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Keynote Lecture & Plenary Session

IA-0212

Imagining the Future of Anatomy Education: Innovation through Collaboration

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Abstract: As we look towards the future of anatomy education, we have to acknowledge that the integration of technology into anatomy education has already transformed our discipline with lasting effect. Emerging visualization technologies, including the use of AI, are accelerating at a breathtaking pace and as anatomy educators we need to define our role in navigating this changing landscape. While anatomy will remain at the core of medical and health professional education, how we educate the next generation is likely to change over time. It is critical to ensure that anatomy content experts, anatomy educators and researchers remain at the forefront of developing new pedagogical and technological approaches to learning. This type of transformative innovation can only develop from a collaborative, interdisciplinary environment, which promotes effective development of educational apps and interventions based on the convergence of a plurality of perspectives and opinions. The mindful, research-based determination of what is an effective technological intervention will benefit our learners everywhere. This presentation will showcase some examples of how innovations were developed and implemented through collaboration across disciplinary boundaries.

Keywords: Anatomy Education

IA-0067

Comprehensive Anatomical Research of the Face and Neck: Clinical Implications and Insights

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Abstract: Anatomy serves as the cornerstone of both medical and dental practice, exerting its influence across various scientific domain throughout human history. As clinical procedures evolve with scientific advancements, the techniques employed in anatomical research must also evolve. Traditional anatomical studies alone are insufficient to fully support or predict improved clinical results within the context of contemporary medical practices. The rapid advancement of medical technologies and the desire for innovative clinical and surgical procedures are driving substantial advancements in clinical anatomy. The clinical anatomy of the head and neck is particularly significant due to the complexity and vital functions of these regions. Modern anatomical investigations have transcended conventional cadaveric dissections, incorporating a range of advanced imaging modalities and innovative research techniques. This comprehensive approach is essential for understanding the intricate anatomical structures and variations that are crucial for successful clinical and surgical interventions. This presentation aims to highlight the critical insights gained from comprehensive anatomical research of the head and neck, focusing on the implications for clinical practice. By integrating classical dissection techniques with modern imaging technologies, such as ultrasonography (US) and 3D scanning, clinicians can achieve a more detailed and accurate understanding of the anatomical intricacies. This enhanced knowledge is vital for identifying anatomical variations, planning surgical procedures, and improving patient outcomes. Emphasizing the vital role of clinical anatomy in the head and neck, this presentation underscores how ongoing research and technological advancements are paving the way for more precise and effective medical practices. These developments present new opportunities for improving diagnostic accuracy, refining surgical techniques, and ultimately enhancing patient care.

Keywords: Clinical anatomy, Minimally invasive procedure, Face, Ultrasonography, 3D scanning

IA-0069

Morphological and Developmental Evolution of the Early Vertebrate Cranium

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Abstract: Cyclostomes are the sister group of the living jawed vertebrates, or gnathostomes, and are thought to still retain some of the features possessed by the common ancestor of the entire vertebrates and already lost by the jawed vertebrates. However, it is the lampreys among the cyclostomes that have

been well studied, and the development of the other group, the hagfish, has not been well understood. The laboratory I hosted until last year succeeded for the first time in 2007 in obtaining fertilized eggs of a hagfish species, Eptatretus burgeri, and since then we have been carefully observing the embryonic development of this animal. As a result, it became clear that embryos of both the cyclostome groups show remarkable morphological similarity at the early pharyngeal stage, and that a similar stage does not exist in the gnathostome embryogenesis. Based on the arrangement of craniofacial primordia at this cyclostome-type stage, it became possible to establish homologies of the cartilaginous elements in cyclostome chondrocrania, and to infer cell lineage origins of the cranial cartilages. Based on this, the evolutionary process of the vertebrate neurocranium will be discussed.

Keywords: Vertebrates, Cranium, Evolution, Morphology

IA-0217

Exploring Cellular Heterogeneity in Healthy and Diseased Skin

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Abstract: The advent of single-cell transcriptomics provides an important opportunity to explore the different subpopulations of epidermal cells and fibroblasts present in human skin. Furthermore, the integration of techniques that provide spatial information about these subpopulations is guiding us in the design of studies to explore cell functionality. In my talk I will give an update on our studies of epidermal stem cells and the different types of fibroblasts that are present in fetal and adult skin. I will also summarise changes in cell populations observed in atopic dermatitis, psoriasis and basal cell carcinoma.

Keywords: Cellular Heterogeneity

IA-0101

Efferent Projections from Paraventricular Thalamic Nucleus Related to Chronic Pain Comorbid with Anxiety and Depression

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Abstract: Chronic pain, which always comorbid with negative emotions, such as anxiety and depression, is one of the most challenging clinical problems over the world. Clinical evidence shows that only when chronic pain and negative emotions are simultaneously treated can an effective analgesic effect be achieved. But the neural circuits and underlying mechanisms associated with chronic pain and its comorbidity have not been clarified yet. Neurons in the paraventricular thalamic nucleus (PVT) receive nociceptive information transmitted mainly from lateral parabrachial nucleus (lPBN), and then, in turn, project to extensive cortical and subcortical regions, especially to limbic system, such as prefrontal cortex (PFC), insular cortex (IC) and central amygdaloid nucleus (CeA), but the function of these efferent projections, especially their involvements in the chronic pain and its comorbidity have not been elucidated yet. To reveal these problems, the morphological and functional approaches were used in the present investigation. Morphologically, it had been observed that the neurons in the PVT receiving noxious information from lPBN, sent efferent projections to PFC, IC and CeA in a topographic manner, respectively, and these projections were involved in chronic pain sensation transmission. Functionally, when optogenetic and chemogenetic techniques were used to specifically activate PVT-CeA and PVT-IC pathways, resulted in addition to the pain- promoting effects, the PVT-CeA pathway activation produced pain-related aversion, fear, and anxiety-like behaviours, while activation of the PVT-IC pathway induced anxiety-like behaviour. When these pathways were inhibited with optogenetic and chemogenetic techniques, almost the exact opposite results could be obtained, respectively. Activation of the PVT-PFC pathway could significantly alleviate hyperalgesia and emotional comorbidities induced by chronic pain. These results suggest that PVT-PFC, PVT-CeA and PVT-IC pathways are play different roles in chronic pain and its comorbidity, and these pathways might be potential targets for

pain and negative emotion treatment in clinical work.

Keywords: Chronic Pain, Negative Emotion, Paraventricular Thalamic Nucleus, Efferent Projection, Limbic System

IA-0148

Teaching Anatomical Sciences through the Digital Platform: Changing Perspectives on Instructions

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Abstract: Anatomical education has been undergoing constant changes over recent decades. Pre-COVID-19 approaches in anatomy education were focused on creating relevant and meaningful educational experience that had impact on student's professional identity formation. The emphases were placed on authentic learning that provided medical students with dynamic tools for real-world problem-solving strategies in preparation for clinical clerkships. The other approaches widely introduced to anatomy education included blended learning and self-directed learning constructs, team-based learning, integrated curricula with emphasis on interprofessional learning and humanities, near-peer instructions, and emphasis on development of non-technical skills. During COVID-19 pandemic, a massive amount of anatomical sciences teaching has been rapidly shifted into digital platforms. The development and expansion of virtual environment has enabled students to participate in virtual dissection laboratories, experienced virtual and augmented reality. In addition, various features of artificial intelligence (AI) are being considered for inclusion in anatomical sciences teaching. These changes resulted in the significant decline of traditional dissection experience and loss of face-to-face interactions with pears, anatomy instructors, and clinical mentors. Therefore, the anatomy educators should rely on their experience and practical wisdom (phronesis) to understand the outcomes of proposed interventions. Challenges with utilization of digital platform for anatomy teaching are also related to multimodal assessment of knowledge and non-technical skills. The major question arises how digital approaches in education are changing perspectives on anatomy instructions. Will digital platform be able to maintain authentic learning and be cognisant of ethical issues associated with the digital and artificial intelligence content to assure that anatomy that we teach has high intrinsic and instrumental value.

Keywords: Anatomy education, Digital platforms, Authentic learning, Virtual environment, Phronesis practical wisdom

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Symposium

[Symposium 1: Clinical Anatomy]

IA-0136

Perfect Facial Symmetry or Subtle Asymmetry - What Is More Attractive?

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Abstract: Facial asymmetry is very often sub-clinically presented, and frequently not something others would even notice. It could be anatomical and functional. Modern technologies and social networks, especially among young people, can create unrealistic expectations in relation to the beauty standards. The aim of this study was to analyze the effect of facial symmetry on the attractiveness applying the face-half mirroring technique. This study included 60 subjects (30 males and 30 females), average age 19.26 years, without history of genetic disorders, injuries or any diseases in the region of head and neck. En face photos of included subjects were taken. After that, three versions of pictures were prepared: original face image and a perfectly symmetrical face images made of the right half and left half of the original face. Subjects rated the attractiveness of all three variants of their own images and other examinees images. According to the results, 86.67% of male and 76.67% of female subjects rated their own original face image as the most attractive, while their own left-left face image was the least attractive (63.33% of males and 60.0 % of females). When subjects evaluated images of the other examinees data analysis shown that males rated as the most attractive original face image of the other males in 61.49% and females in 70.46%. Similarly, females rated as the most attractive original face image of the other females in 57.36% and males in 51.03%. In conclusion, right-right and left-left perfectly symmetrical faces have been found less attractive than the original asymmetrical faces. Absolutely perfect symmetry of the face does not have a significantly positive effect on attractiveness. Discreate asymmetries of the original faces were not perceived by the viewers.

Keywords: Facial symmetry, Attractiveness, Beauty

IA-0027

Relationship between the Layered Structure of the Musculature of the Anal Canal and the Mechanism of Hemorrhoidal Fistula Formation

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Abstract: Our studies have tried to clarify the three-dimensional configuration of the skeletal muscles of the pelvic floor and the detailed histological properties of the smooth muscle structures on the pelvic floor by combining the macroscopic, histological, and immunohistochemical examinations. The most distinctive feature of the skeletal muscles of the pelvic floor is that they share muscle bundles and are continuous. The levator ani and the EAS are not separated but are continuous. Additionally, many tiny connecting muscle bundles exist among the skeletal muscles, including the levator ani, the external anal sphincter, the bulbospongiosus, the ischiocavernosus, the superior transverse perineal, and the external urethral sphincter. These continuous skeletal muscles surround the lower end of the rectum and are composed of smooth muscle layers. According to the macroscopic and histological findings of the anal canal, small, circular, low-intensity areas arranged in a row and a high intensity area surrounding them internally and externally in the longitudinal muscle layer were shown. Dense and sparse areas of smooth muscle fibers coexisted in the longitudinal muscle layer. The dense areas formed columnar muscle bundles approximately 1.0–1.5 mm in diameter, and they continued from the longitudinal muscle bundles of the rectum. The columnar muscle bundles of the longitudinal anal muscle were internally and externally surrounded by sparsely arranged smooth muscle fibers that ran longitudinally. These findings have not been adequately explained by conventional anatomical descriptions but were found to be well observed on MRI. At the lower end of the anal canal, the sparse fibers of these longitudinal muscles were located between the internal and external anal sphincters and further penetrated the external anal sphincter. Ultrasonographic findings in patients with hemorrhoids have revealed that abscesses are often found in the area between the internal and external anal sphincters.

Keywords: Clinical Anatomy, Anal Canal, Smooth muscle, Skeletal muscle, Pelvic floor

IA-0215

Ultrasonography Guided Filler Injection on Dorsal Hand

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Abstract: This study aimed to evaluate the anatomical and cosmetic effects of monophasic stabilized hyaluronic acid (mS-HA) filler injections on the dorsal hand using sonography. The primary focus was on assessing soft-tissue thickness, skin roughness, and stratum corneum hydration (SCH). A prospective study was conducted involving 20 female patients with prominent veins and tendons due to soft-tissue loss in their dorsal hands. Each patient received a 1 cc injection of mS-HA filler into the dorsal superficial lamina (DSL) and dorsal intermediate lamina (DIL) using a subdermal scraping fanning injection technique. Sonograms and topographic computer analyses measured changes in soft-tissue thickness, skin roughness, and SCH at intervals of 1 week, and 1, 2, 3, and 6 months post-injection. Soft-Tissue Thickness: The initial baseline thickness of 3.20 mm increased significantly after treatment: Immediately: 4.52 mm 1 week: 5.52 mm 1 month: 4.89 mm 2 months: 4.25 mm 3 months: 4.08 mm 6 months: 3.86 mm Skin Roughness: There was a marked reduction in skin roughness, indicating improved fine wrinkles: 1 month: 16.17% reduction 2 months: 18.12% reduction 3 months: 23.91% reduction 6 months: 38.12% reduction Stratum Corneum Hydration (SCH): SCH levels improved across all follow-up periods, enhancing skin hydration. Anatomical Layers Identification: The study detailed the subdivision of the dorsal hand into nine distinct soft-tissue layers: Epidermis Dermis Dorsal Superficial Lamina (DSL) Dorsal Superficial Fascia (DSF) Dorsal Intermediate Lamina (DIL) Dorsal Intermediate Fascia (DIF) Dorsal Deep Lamina (DDL) Deep Dorsal Fascia (DDF) Interosseous Muscle (IOM) The injection of mS-HA into the DSL and DIL effectively increased soft-tissue thickness and improved hand appearance by reducing the visibility of veins and tendons. The procedure also enhanced skin texture and hydration, leading to a more youthful and smooth appearance. The study confirmed the placement of hyaluronic acid materials within the specific anatomical layers without adverse effects on hand function.

Keywords: Ultrasonography

IA-0066

Ultrasonography Guided Minimally Invasive Procedure

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Abstract: The use of ultrasonography (US) guidance to perform diagnostic and therapeutic injections is increasing rapidly, as is the evidence supporting its use. However, despite the increased popularity of US, there remains a lack of formal standard references, especially for procedures involving the face. Moreover, while there is a considerable amount of information available in the literatures related to US, there is very little information related to US imaging of the face. Recently, the importance on the facial anatomy has been reconsidered as the interest on the facial aesthetics is increasing. In this reason, it is speculated that the utilization of the facial US will be soon broadened to prevent the side effects. Despites wide ranges of cadaveric studies to prevent the side effects, the US-guided injection technique could be the first choice of procedure than other blind techniques. I believe that the procedures under US leads to more accurate injections into the targeted area with less complications. Through my talks, I would like to introduce the US anatomical findings of the face and provide the reference images on each landmark of the face. Therefore, an in-depth morphological study using an US imaging system can yield depth and orientation on the facial muscles, blood vessels, and fascial structures of the facial area that were previously impossible to obtain. This provides crucial anatomical knowledge that can be utilized in various clinical applications such as the US-guided injections with safety and effectiveness.

Keywords: Face, Ultrasonography, Anatomy, Clinical procedures

[Symposium 2: New Anatomical Insights of Anterior Branches of External Carotid Artery: What Do Surgeons Think?]

IA-0064

The Branching Angle of the Lingual Artery with a Focus on Superselective Intraarterial Infusion Therapy

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Abstract: In anatomy textbooks and atlases, the lingual artery is depicted that it originates from the anterior wall of the external carotid artery (ECA) as well as the superior thyroid and the facial arteries. During superselective intra-arterial infusion therapy to the lingual artery, surgeons empirically rotate the catheter medially which is not done for other anterior branches of the ECA. We hypothesized that the precise course of the lingual artery should be more medial than it has been depicted. The origin of the lingual artery and other anterior branches were observed anatomically. After that, The ECA and the origin of the anterior branches were cut in the axial plane. The angle between the sagittal plane of the ECA and the origin of the anterior branch in the axial plane was calculated using Fiji/ImageJ (NIH). The origin of the lingual artery was located more medially than the other anterior branches on all sides. The mean difference in angle between the lingual artery and other anterior branches of ECA was approximately 40 degrees. This might be related to the distribution of each anterior branch of the ECA. The quantitative data in this study have presented the anatomical evidence for the catheter rotation technique to access to the lingual artery during a superselective intra-arterial infusion therapy.

Keywords: Lingual artery, Superselective intraarterial infusion therapy, External carotid artery, Facial artery, Superior thyroid artery

IA-0029

Anticancer Agent Flow Simulation in the External Carotid Artery and Its Branches for Oral Cancer Chemotherapy Using Computational Fluid Dynamics

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Abstract: Surgery is the typical method for treating oral cancer. However, advanced cases may lead to poor oral functions such as speech, swallowing, and mastication. To avoid these adverse events, retrograde super selective intra-arterial chemotherapy (SSIAC) has been developed. SSIAC involves inserting a hook-shaped catheter into the tumor-feeding arteries via the superficial temporal artery or the occipital artery that arises from the External Carotid Artery (ECA). In cases where catheter insertion is difficult, a linear catheter is inserted and placed near the tumor-feeding artery's bifurcation in the ECA's main trunk instead of inserting a hook-shaped catheter. This method is known as conventional IAC. However, clinicians cannot directly observe the flow, so we use Computational Fluid Dynamics (CFD) analysis to simulate the distribution of anticancer agents in the ECA and its branches. CFD is widely used in simulating fluid flow that is impossible to reproduce experimentally. One of the CFD studies showed that the distribution rate of anticancer agents into the tumor-feeding artery tended to increase when the catheter tip was placed below and toward the target artery. Although SSIAC can reliably supply anticancer agents to the target artery, depending on the vessel geometry of the patient, it can lead to high wall shear stress at the target artery, which may cause severe complications during the treatment. Next, we investigated the agent distribution in the SSIAC for patients with the linguofacial trunk. The distribution is determined by the blood flow field, which differs among patients due to the anatomical topology of the vessels. Notably, the blood flow field in the zone within a 2 mm radius from the catheter tip plays a vital role in determining the destination of the anticancer agent.

Keywords: Oral Cancer, External Carotid Artery, Intra-arterial Chemotherapy, Computational Fluid Dynamics, Common Trunk

IA-0036

Intraoral Perspective of the Facial Artery

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[2]Neurosurgery, Ulane University School of Medicine, New Orleans, LA, USA, New Orleans, United States

Abstract: The facial artery (FA) has been well described in previous anatomical and surgical literature. The FA can be identified by using an antegonial notch of the mandible slightly anterior to the angle of the mandible, which is a helpful landmark for head and neck surgeries. A lot of anatomical variations of the FA have been reported, which can cause iatrogenic injury that might lead to severe hemorrhage. However, many anatomical structures, including the facial artery, have not been considered preoperatively or intraoperatively in dental procedures, even though the facial artery can be injured easily during standard dental procedures. In this session, examples of the transoral anatomy of the facial artery are introduced to link the intraoral course of the FA and standard dental procedures, i.e., mandibular third molar extraction and periosteal releasing incision of the mandibular buccal molar area. Intraoral dissection of the FA and computed tomographic images will create a new perspective on the anatomy of the facial artery.

Keywords: Facial artery, Dentistry, Hemorrhage, Mandibular third molar extraction, Computed tomography

[Symposium 3: Advanced Imaging for Neuroanatomy]

IA-0155

In Vivo Two-Photon Imaging of Microglial Dynamics in Neurodegeneration

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Abstract: Microglial cells, the resident macrophages of the brain parenchyma, exhibit highly dynamic processes and less dynamic somas, playing crucial roles in CNS development and post-maturation immune responses, particularly in neurodegeneration. Current understanding of microglia in neurodegenerative disorders is predominantly based on static pathological observations from fixed tissues, lacking insight into their dynamic behavior during disease progression. In this study, we utilize two-photon microscopy and transgenic labeling techniques in mice to track microglial behavior at subcellular resolution during neurodegeneration, induced by cytosolic TDP-43 expression. We have characterized two distinct behaviors of microglial cells. Firstly, phagocytic microglial cells extend processes to wrap around and engulf degenerating neurons. Secondly, ramified microglia exhibit a resting-like state, either attaching to neuronal somas or not. Our observations highlight the cooperative behavior of microglia in response to neurodegeneration, providing new insights into their role in disease dynamics.

Keywords: Microglia, Two-photon imaging, Neurodegeneration, TDP-43

IA-0039

Optogenetic Stimulation of Cortical Microglia Promotes Neuronal Activity and Pain Hypersensitivity

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Abstract: Chronic pain following peripheral nerve injury is accompanied by increased neuronal activity in the somatosensory cortex. However, whether and how cortical microglia contribute to these changes is less understood. To this end, we applied an optogenetic strategy to specifically target cortical microglia and investigate their function in behavioral pain sensitization. We found that optogenetic activation of primary somatosensory cortex (S1) microglia via red-activated channelrodopsin (ReaChR) triggered pain hypersensitivity and spontaneous pain in mice. Remarkably, S1-targeted optogenetic stimulation increased microglial landscape changes and ATP release. In addition, optogenetic stimulation altered the proteomic profile of S1 microglia and up-regulated c-Fos expression and Ca^{2+} elevation in cortical neurons. Our results provide mechanistic evidence linking cortical microglia with neuronal hyperactivity and chronic pain behaviors.

Keywords: Cortical microglia, Optogenetics, ReaChR, Chronic pain, Microglial landscape change

IA-0190

Image-Guided Surgery of Glioblastoma using Biomarker-Responsive Fluorescent Probes

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Abstract: Understanding the molecular interactions in biological systems is of fundamental importance. Various types of assay and imaging tools have been developed to study diverse biological processes. Among these tools, fluorescence-based methods have received significant attention as they enable sensitive detection and imaging by a relatively simple operation. Fluorescent probes with desirable sensing properties (analyte selectivity, sensitivity, bioimaging capability, etc.) are essential for the investigation of molecular interactions and, thus, have been extensively used in biochemical, clinical, and environmental research areas. In this talk, the speaker will present his multidisciplinary research experiences with key results on image-guided surgery of glioblastoma using biothiol-responsive fluorescent probes.

Keywords: Fluorescent probe, Bioimaging, Glioblastoma, Image-guided surgery, Biomarker

[Symposium 4: Developmental Biology - Genesis]

IA-0111

Elucidation of Skeletal Muscle Regulation Mechanisms Using Mouse Space Experiments

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Abstract: The effects of microgravity in space on skeletal muscles have been analyzed by various space experiments, but it has been technically difficult to scientifically analyze the threshold of gravity effects. To solve this problem, a small animal breeding apparatus with a centrifuge that can generate artificial gravity in the space environment was installed on the International Space Station. In collaboration with the Japan Aerospace Exploration Agency (JAXA), we used this device to raise mice under several gravity environments and analyzed the effects of gravity on skeletal muscles. As a result, as expected, soleus atrophy and fast muscle fiber change induced by microgravity were completely suppressed in artificial 1g (terrestrial gravity). On the other hand, 1/6g (lunar gravity) suppressed muscle atrophy but not fast muscle fiber change. These results suggest that there is a threshold for the effect of gravity on skeletal muscle, and that muscle atrophy and muscle fiber type change are independently regulated. Therefore, to analyze the molecular mechanisms of skeletal muscle atrophy and fast muscle fiber change, we analyzed the genes that fluctuated in response to the gravitational environment by gene expression analysis. As a result, we identified Large Maf transcription factors that induces Type IIb fast-twitch muscle fiber, which had not been clarified before. In this talk, I would like to discuss the genes that fluctuate in response to the gravitational environment and the regulatory mechanisms of skeletal muscle revealed from the genes.

Keywords: Mouse, International Space Station, Muscle, Muscle fiber type, Type IIb

IA-0113

Positional Information during Polarization of the Chick Embryo

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Abstract: Cells in the developing embryo should adopt a proper identity at an adequate time to accomplish tissue patterning. One of the main explanations for this is positional information (Wolpert L, 1969) in which cells read a gradient of morphogen diffused from a local source, responding with discrete thresholds, representatively explained by the 'French Flag problem'. Positional information theory has been explaining successfully how a tissue generates spatial patterns in many developing systems, such as patterning of vertebrate neural tubes and limb regeneration, imaginal discs (of wing, leg, and antenna) of fruit flies, anterior-to-posterior patterning in fruit flies, etc. Nevertheless, how cells interpret positional information in the mixture of secreting molecules and how the positional field is scaled in differently-sized systems are largely unknown. Here, using the process of forming the primitive streak in the chick embryo, we explain how cells assess their position while receiving different concentrations

of inducer and inhibitor morphogens. We propose the cells sense the relative, rather than the absolute, amount of signals compared to their neighboring cells (named 'neighbourhood watch' model). Also, we explain how the embryo can set up positional information across the large chick embryo (> 3mm). We show that long-range communication by traveling calcium activity generates positional information to locate the site of primitive streak formation by regulating the activity of the bone morphogenetic protein. Our study shows short and long-range communication to establish embryo polarity. This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (RS-2023-00239555).

Keywords: Chick, Embryo polarity, Positional information, Primitive streak, BMP

IA-0210

Epithelial Plasticity Drives Circumvallate Papilla Regeneration Following Targeted Ablation of Lgr5+ Stem/Progenitor Cells

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Abstract: Taste receptor cells are sensory cells embedded in the papilla of the oral cavity. These cells have a definite life span of 8-12 days and are renewed continuously by a pool of stem/progenitor cells present outside the taste bud. Genetic lineage tracing has identified that Lgr5+ stem/progenitor cells present at the trench of the circumvallate papilla (CVP) give rise to all taste and non-taste epithelial cells during homeostasis, as well as during regeneration. It remains to be identified whether the CVP harbors another pool of stem cells that can regenerate the epithelium in the absence of Lgr5 expressing stem/progenitor cells. Lgr5 expressing cells in the CVP of mice were specifically ablated using $Lgr5^{DTR/+}$ mice that has diphtheria toxin receptor (DTR) gene knocked into the Lgr5 locus. Administration of diphtheria toxin led to the complete loss of Lgr5 expressing cells in the CVP. Ablation of Lgr5 expressing cells led to the degeneration of taste buds and taste receptor cells expressing K8 with degeneration of basal cells and basement membrane within 24 h after DT injection. Interestingly, after 72 h of injection, it was observed that the basal cells and basement membrane had completely regenerated in the CVP, but no taste buds were observed. By 2 weeks after the injection, the taste buds were also regenerated in the CVP. Lineage tracing using $K8^{CreERT2/+}$; $R26R^{Tom/+}$ showed that cells expressing K8 from Von Ebners gland duct participated in the regeneration of taste buds. These data indicate that the differentiated cells from the Von Ebners gland duct participate in the regeneration of taste buds by undergoing dedifferentiation in the absence of a resident Lgr5 expressing stem cell pool. This work was supported by the National Research Foundation of Korea (NRF) Grant funded by the Korea Government (MSIP) (2022R1A2B5B03001627 and NRF-2021R1A2C1005506).

Keywords: Lgr5 ablation, Stem cells, Taste receptor cells, Dedifferentiation, Regeneration

IA-0050

Species-Specific Deployment of Runx2 Isoforms and Differential Regulation of Target Genes During Avian Jaw Development and Evolution

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Abstract: Developmental regulation of bone formation in the vertebrate jaw skeleton is essential for species-specific adaptation. The jaws are derived from neural crest mesenchyme (NCM), an embryonic progenitor population that directs skeletal patterning by exerting temporal and spatial control over molecular and cellular programs for osteogenesis. One important NCM-mediated gene is Runt-related transcription factor 2 (Runx2), which is a transcription factor required for osteoblast differentiation. RUNX2 protein binds many target genes involved in the deposition and resorption of bone. To determine the extent to which changes in Runx2 structure, function, and expression underlie the evolution of the jaw skeleton, we compare Runx2 across vertebrates and within birds. Runx2 contains two alternative promoters, tandem repeats of glutamine and alanine with variable lengths in different species, a conserved DNA-binding domain, an exon that is alternatively

spliced, as well as two possible C-termini. Such alternative splicing produces eight potential isoforms that show distinct stage- and species-specific patterns in the jaw primordia of chick, quail, and duck embryos. We also find that certain isoforms are strongly induced by Transforming growth factor beta (TGFβ) signaling whereas others are not. Overexpressing Runx2 isoforms in NCM reveals that some are transcriptionally activating, while others are repressive; we apply unbiased high-throughput strategies to understand how widespread this phenomenon is across the genome. Moreover, we assess how these differences in isoform function affect jaw morphogenesis. We find that the developmental context of Runx2 isoform expression appears to be critical since species-specific polymorphisms in the promoter of target genes such as Mmp13, can modulate the effects of different isoforms. Overall, our study indicates that the structure and species-specific deployment of Runx2 isoforms affect the transcriptional activity of target genes in ways that may have played a generative and regulatory role in the evolution of the avian jaw skeleton.

Keywords: Jaw bone development, Runx2 isoforms, Neural crest cells, Evolutionary developmental biology, Transcriptional regulation

[Symposium 5: The Defense Mechanism of Our Body with Immunity]

IA-0214

FoxP3+ Regulatory T Cells Safeguard Fetal Neurodevelopment by Suppressing Maternal Immune Activation

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Abstract: To investigate the role of FoxP3-expressing regulatory T cells (Tregs) in controlling maternal immune activation (MIA) and its impact on offspring brain development and behavior. We conducted experiments on pregnant mice, comparing Treg levels and their expression of the Th17 cell transcription factor RORγt in pregnant versus non-pregnant females. We also partially depleted Tregs or removed RORγt/cMAF expression in the Treg compartment of pregnant mice. Additionally, we examined the effects of enhancing Treg function in mothers infected with the H1N1 influenza virus. Pregnant mice exhibited higher levels of RORγt- or cMAF-expressing Tregs compared to non-pregnant females. Partial depletion of Tregs or removal of RORγt/cMAF in pregnant mice resulted in offspring with MIA-associated behavioral abnormalities. Enhancing Treg function prevented the development of these phenotypes in offspring of H1N1-infected mothers. $FoxP^{3+}$ regulatory T cells play a crucial role in suppressing MIA-associated phenotypes. Enhancing Treg function in pregnant women exposed to infection or inflammatory conditions may reduce the risk of inflammation-induced neurodevelopmental disorders in their children.

Keywords: T Cell

IA-0208

Role of Skin Microbiome and Staphylococcus Aureus in Atopic Dermatitis

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Abstract: Atopic dermatitis patients often have Staphylococcus aureus colonizing their affected skin areas, a condition termed "dysbiosis," which is linked to disease exacerbations. Previously, we discovered that the phenol-solble modulin peptides promotes Th2-type skin inflammation and the release of alarmins from keratinocyte. To investigate how S. aureus selectively colonize on AD skin but not on healthy human skin, we performed whole-genome sequencing on S. aureus strains collected from the skin of infants. Comparing strains from infants who developed AD by one year of age to those with healthy skin revealed significant insights. Whole genome sequencing of S. aureus strains isolated from infant skin revealed that loss-of-function mutations in the S. aureus agr loci reduce skin colonization and protect against AD development. This result indicates that the Agr quorum sensing system is essential for S. aureus colonization of infant skin and is associated with AD onset. In an another recent infant intervention cohort study, we analyzed the longitudinal shifts in the skin microbiomes of newborns treated with a topical moisturizer to determine if the intervention could mitigate the skin dysbiosis associated with AD. Through 16S rRNA gene sequencing, we observed that infants who later developed AD at one year old exhibited skin dysbiosis as early as their third day post-birth, characterized by an elevated presence of Streptococcus sp. and

a diminished presence of Cutibacterium acnes compared to healthy counterparts. The volume of moisturizer applied inversely correlated with the abundance of Streptococcus sp. and directly with that of C. acnes. This correlation suggests that C. acnes may proliferate by utilizing essential lipids (cholesterol and ceramides) in the moisturizer as nutrients. Our findings imply that skin dysbiosis in newborns increases the risk of AD by one year of age, which may be mitigated by skincare.

Keywords: Atopic dermatitis, Staphylococcus aureus, Skin microbiome, Infant, Quorum sensing

IA-0058

Endothelin-1 from Endothelial Cells Promotes Tubular Injury, Myofibroblast Formation and Ischemia in Kidney Fibrosis Model in Mice

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Abstract: Kidney fibrosis is a final pathway of chronic kidney disease (CKD) which is characterized by tubular injury, matrix expansion, myofibroblast formation, thus leads to renal ischemia. Endothelin-1 (ET-1) system is profibrotic factor in many conditions, and involves in CKD progression. However clear mechanism in tubular injury, myofibroblast transition and renal ischemia is still unknown. This study elucidated ET-1 from endothelial cells in kidney fibrosis progression. We performed kidney fibrosis model using Unilateral Ureteral Obstruction (UUO) operation in Vascular Endothelial Endothelin-1 Knock-Out (VEETKO, n=7) and WT mice (n=7), then sacrificed in day 14. We observed renal fibrosis, myofibroblast area, and capillary number using by Sirius Red, α-SMA, and CD31 immunostaining. Double αSMA and PDGFR β staining was done to observe interstitial cells expansion. Renal blood flow was observed by laser Doppler imaging. Western blot was done to examine α-SMA, PDGFR β, and TGFβ1 expressions were examined using western blot. Kidney ET-1 system was measured by ELISA and real time PCR. Double PDGFRβ and ET_AR immunostaining was done to observe ET_AR expression in interstitial cells. We found significantly lower fibrosis, tubular injury, myofibroblast area fraction, and TGFβ1 protein expression ($p<0.05$) in VEETKO mice compared WT after UUO. Kidney ET1 and pre-pro ET-1 mRNA levels increased after UUO, however significantly lower in VEETKO mice. VEETKO mice also had significantly higher capillary number and renal blood flow ($p<0.05$) after UUO. We observed ET_AR expression in myofibroblast area and colocalized with PDGFRβ. Endothelial Cells-derived ET-1 deletion attenuates kidney fibrosis via preserving capillary, reducing tubular injury and interstitial cells expansion and myofibroblast formation which associate with ET_AR expression in interstitial cells.

Keywords: Kidney fibrosis, Endothelin-1, Myofibroblast, Ischemia, Tubular injury

[Symposium 6: The Consent Continuum: Ethical Considerations in Enduring Informed Consent for Human Tissue Donation]

IA-0037

Co-Designing Body Donation Consent Processes

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Abstract: It is widely accepted that body donation programs should obtain informed consent from donors during life. Despite the existence of consent guidelines, consent form content varies considerably. Furthermore, consent forms are typically developed by anatomical and legal experts, and may not include details valued by donors or students. Co-design is a form of participatory action research which engages end-users to understand phenomena and inform change. Co-design may therefore be ideal to develop consent processes that better incorporate values of donors, students and educators, alongside ethical and legal considerations. As a first step to developing consent processes for a proposed body donor program at an Australian university, this study aimed to bring together participants from these groups to co-design a consent process. Study participants included 7 prospective donors, 9

anatomy students and 6 anatomy educators. Data were collected through 4 focus groups involving at least one member of each participant group. During focus groups, the facilitator worked with participants to identify priorities relating to consent processes. Thematic analysis was used to develop draft consent principles encompassing perspectives across groups. Draft principles were sent to participants, and feedback on these collected through a survey. Four principles for body donation consent processes were established: 1. Consent processes should be informative, transparent and community-focussed, 2. Consent processed should include personalised and flexible options, 3. Consent processes should be developed on legal and ethical foundations, and 4. Consent processes should be future-focussed. Although some principles addressed aspects within existing consent guidelines (e.g. information adequacy), participants highlighted ways consent processes typical of body donor programs in Australia could be enhanced (e.g. personalised options including naming preferences after death). Participants also expressed how co-design facilitated a deeper understanding of the value of body donation. Ongoing work will now focus on developing consent resources based on these principles.

Keywords: Consent, Willed body donor, Ethics, Co-design

IA-0175

Consent For Use of Human Tissue For Histology From Sources Other Than Body Donation Programmes

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Abstract: In addition to body donation programs, human materials for teaching and research may be obtained from autopsies or from living donors (body parts removed during surgery, biopsies or cytology smears). Many teaching institutions have extensive collections of such materials, gathered over many years. Materials from living donors may be more suitable for histology or pathology than those from body donation programs. They can be preserved more quickly and may last indefinitely. A greater range of normal (and abnormal) tissues from a wider age range may be accessible, and more complete histories can be obtained from living donors. Conversely, some tissues may be rarely available or impossible to obtain from living donors. Legislative requirements for living donor materials may differ notably from body donation programs. In some jurisdictions, body parts are not owned by living donors, once removed. They can be used without consent or knowledge of the donor. Other jurisdictions permit donors more control, including the choice to not permit further use of their tissue. Collecting tissue with informed consent from living donors raises questions which do not apply to body donation or skeletal material programs, such as the actions required if a living donor wishes to withdraw consent for use, and have their tissues returned. These differences are important for donors, and for students, teachers and researchers seeking to use these materials ethically, especially alongside body donation programs that stress informed consent in acquisition and use of human materials. There is a need for an ethical framework for custodianship of existing historical histology collections and for informed consent for collection of samples for histology from living donors.

Keywords: Consent, Histology, Historical, Living Donor

IA-0149

Cadaver Donors as Silent Mentors: A Humanistic Narrative Approach to Informed Consent

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Abstract: Gross anatomy is the fundamental course of basic medicine, and its success relies on the generosity of voluntary donors who are willing to dedicate their bodies to medical education posthumously. In Taiwan, we respectfully call these voluntary donors "Silent Mentors". While many donors personally provide informed consent during their lifetime, a notable number of consents are granted by their family members after the donors have passed away. To help medical students gain a deeper understanding of the "Silent Mentors", we have designed a narrative-oriented consent form. This innovative form encourages the Silent Mentors or their

families to share the donors' life stories, articulate their motivations for body donation, and express their expectations for the medical students. These personal narratives shared by the voluntary donors aim to cultivate humanity within medical students, fostering values such as gratitude, respect, and empathy. Following their engagement with the Silent Mentors' stories, students are required to reflect on their experiences and express their feelings through reflective writing. These reflections are then shared with the donors' families, honoring the profound selflessness of the donors. This ethos highlights the significance of body donation, transforming it from a mere educational tool into a concrete act of altruism. For the Silent Mentors, death is not the cessation or termination of life; through their generous contributions, they facilitate a deeper understanding and respect between future doctors and their patients. This approach lays a foundation for compassionate healthcare, underscoring the enduring impact of Silent Mentors' altruistic legacy.

Keywords: Cadaver Donors, Narrative-oriented, Informed Consent, Empathy, Reflective Writing

IA-0038

From Papers to Bytes: Exploring Electronic Informed Consent for Whole-Body Donation in Türkiye

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Abstract: In Türkiye, a public awareness campaign on body donation has been implemented since 2012 in order to increase the number of donated bodies for anatomical education and research. Despite limited progress, recent research studies have reported several problems that could be affecting this modest progress. In Türkiye, current legislation requires donors to be physically present throughout the registration process, which limits some people's access to institutions. Institutions responsible for body procurement, on the other hand, are reluctant to provide the public with reliable and comprehensive data. The majority of the donors complete the process by themselves without informing their relatives. This lack of next-of-kin involvement renders body donation less inclusive and given the next-of-kin have the right to revoke the donation it makes future donations more difficult to secure. Furthermore, registered body donors express different preferences regarding public display and retention time of specimens, along with the disclosure of personal information. Along with legal, administrative, and social problems encountered, the current informed consent model, broad informed consent model with written consent methodology, might be causing some of the problems. Therefore, changing the informed consent paradigm and methodology might help to overcome existing problems. This study will try to explore the use of electronic informed consent and discuss its advantages and disadvantages, and whether it could be used as an alternative method for the current practice in Türkiye.

Keywords: Body donation, Informed consent, Electronic consent, Ethical practice, Türkiye

[Symposium 7: Functional Anatomy in the Realm of Myology]

IA-0211

Research on The Correlation between Skeletal Muscle Exercise Energy Metabolism And Reversal of Type 2 Diabetes

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Abstract: This study focuses on the skeletal muscle energy metabolism mechanism of people with type 2 diabetes in remission, focusing on the impact of skeletal muscle exercise on the control of blood glucose and glycated hemoglobin 2 hours after a meal. It mainly includes two aspects of research. The first is the impact of skeletal muscle exercise on blood sugar stability 2 hours after a meal. Through 12 weeks of 30 minutes of medium and low-intensity skeletal muscle exercise after lunch and dinner, mainly Baduanjin and walking, the test Blood glucose before a meal and 2 hours after a meal is used to determine the impact of low- and medium-intensity skeletal muscle exercise on blood glucose 2 hours after a meal. The second effect of resistance muscle-building exercise on glycated hemoglobin, especially the relief of type 2 diabetes. Generally, people with type 2 diabetes have low muscle mass. Loss of lean body weight is a typical symptom of type 2 diabetes patients

in the middle and late stages. Muscle building through resistance Exercise to increase skeletal muscle proportion and improve skeletal muscle metabolic capacity. Through resistance muscle-building exercises three times a week, the patient's skeletal muscle ratio was evaluated using bioelectrical impedance equipment, and changes in glycated hemoglobin were analyzed every three months. The overall goal is to analyze the characteristics of energy metabolism and the impact on blood sugar, hemoglobin and insulin levels through skeletal muscle exercise of different intensities and forms, thereby further promoting the long-term remission of type 2 diabetes.

Keywords: Metabolism

IA-0209

Impact on Lower Limb Muscle Coordination and Biomechanics of Functional Footwear or Insoles in Children and Adults

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Abstract: This study investigates the effects of functional footwear and insoles on lower limb biomechanics, with a focus on muscle anatomy and coordination. It includes two main investigations. The first examines child ankle stability by combining children's training shoes with an 8-week foot exercise program, targeting key ankle muscles such as the peroneus longus, tibialis anterior, and peroneus brevis. Using electromyography (EMG) and 3D motion capture, it provides a detailed analysis of muscle coordination and ankle stability in children. The second investigation addresses adult foot pathologies, specifically flat feet and hallux valgus. It compares Dr. Kong's orthotic insoles with regular insoles, focusing on muscles critical for arch support and toe alignment, like the tibialis posterior and flexor hallucis longus. EMG data and plantar pressure platforms are used to evaluate the effectiveness of these insoles in optimizing muscle function, reducing fatigue, and enhancing performance in adults. The overarching goal is to improve sports aid design for better performance, comfort, and injury prevention by integrating ergonomic principles involving anthropometric data, biomechanics, and skeletal muscle coordination. This comprehensive approach aims to deepen understanding of how functional footwear and insoles can enhance lower limb stability and performance, providing valuable insights for the development of more effective rehabilitation and athletic support solutions for both children and adults. Ultimately, the study aspires to significantly advance sports aid design and its practical applications across diverse populations.

Keywords: Muscle Coordination, Functional Footwear, Lower Limb Biomechanics

IA-0197

Nerve Properties Determine Skeletal Muscle Contraction Properties

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Abstract: From an evolutionary perspective, the emergence of the neck began with the separation of the head and trunk of Urodela from amphibians. According to molecular embryonic development, there exist fundamental development differences in the head neural crest and trunk somites, especially in the mesodermal derived muscles and their innervation relationship, namely: general visceral motor (GVE), special visceral motor (SVE), and general somatic motor (GSE). In rehabilitation medicine, when facing patients suffered from dysphagia the SLP is often surprised that the skeletal muscles of the pharynx and larynx do not become paralyzed after nerve injury. Instead, they triggered these muscles to exsert reflexive contractions in response to mechanical and temperature stimulation needed of a normal swallowing reflex. The accessory nerve that is near the junction of head and torso has special phenomena: it innervates two muscles from the head neural crest, and its nerve roots mainly emerge from the rostral spinal cord but contain branches from the vagus nerve. When the cranial multi-modal nerve innervation pattern transits into the typical spinal GSE mode, an intermediate transitional innervation pattern, namely SVE, occurs between the GVE and the GSE due to the appearance of the neck. Visceral motor neurons innervate skeletal muscles with a lower control level, allowing the autonomic contractility like cardiac muscles to suit the needs of visceral reflex behaviors such as sucking, swallowing, breathing, and vocalization of the digestive and respiratory systems. With the evolution of animal limb locomotive ability, the contraction of shoulder and neck skeletal

muscles requires precise voluntary control. The sternocleidomastoid (SCM) and trapezius muscles innervated by the accessory nerve have become the GSE pattern, gradually losing their SVE characteristics, except for the torticollis occasionally seen in the SCM, a sensitive muscle spasm indicates the diminished SVE function.

Keywords: Nerve

[Symposium 8: Embryology and Fetal Specimens: an Underexplored Paradigm in Transdisciplinary Thinking and Research (A FIPAE Seminar)]

IA-0177

Fetal and Embryological Collections: Challenges and Opportunities

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Abstract: The legacy of fetal collections, while once large, continues to dwindle alongside the time in medical education dedicated to embyrology and fetal development. This is largely driven by its deemphasis on licensure examinations. Despite this, many surgical, and non-surgical, specialities benefit from knowledge of embryology and fetal development and add it to their graduate educational curricula. The legacy anatomical collections of human embryoes and fetuses present at many institutions of higher learning provide an incredible resource that could be used not only for teaching of the relevant content, but also about philosophical bases on which healthcare is founded. Unfortunately, in the United States the majority of these collections are quietly being disposed of under the guise of lack of relevance and a need for the physical space these collections occupy. Not only do these efforts permenantly remove these human remains from the historical record without acknowledgment they rob healthcare professionals of learning opportunities without any plan to rectify the situation. Embryology and fetalology are incredibly complex subjects that benefit from myriad resources to represent the process in both space and time, until a viable alternative can be created the legacy anatomical collections are the best option to bridge the gap in learning. Moving forward it is incumbent upon institutions of higher learning to allow a pathway for individuals to consent to donation of embryologic and fetal remains that can be used to create digital repositorys for use in teaching using modern technologies that can be made available across the globe for the purpose of education.

Keywords: Legacy collections, Ethical principles, Consent, Embryology and fetal development

IA-0140

Macroethics and Microethics of Fetal and Embryological Collections: International Perceptions

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Abstract: The ethical intricacies associated with collections containing human fetal and embryological remains are diverse and complex. Ethical challenges can be examined on two fronts: the individual "micro ethics" level, concentrating on the interactions between those supplying and those receiving human remains, and the overarching "macro ethics" level, which involves the collective responsibilities of the field and society. Examining these ethical dilemmas can translate to other issues in medicine around informed consent and the general pillars of medical ethics. Previous studies have investigated the perception of Australian embryology stakeholders towards these collections. However, there remains a paucity in the literature around non-Australian perceptions. Therefore, the aim of this study was to investigate the perceptions of non Australian stakeholders involved in embryology. A survey was distributed via social media, insights were gathered from 49 participants. Majority of participants were academics (55.1%; n= 27). Perceptions around whether human fetal and embryological remains that were obtained before the era of informed consent should be retained for educational and research purposes varied with 59.2% agreeing, and 4.1% disagreed. Differing opinions revolve around whether the potential benefits of utilizing collections outweigh ethical concerns related to obtaining them without informed consent. Notably, this did not differ across all characteristic demographics. A significant majority (53.1%; n= 26) also expressed support for accepting donations from both maternal and paternal sources. The study emphasizes the impor-

tance of considering stakeholder perspectives when formulating policies and guidelines for human fetal and embryological collections. The results underscore a level of societal discomfort regarding collections without informed consent and provide valuable insights for responsibly and inclusively managing the ethical aspects of such collections on a global scale.

Keywords: Ethics, Macro ethics, Micro ethics, Fetal collections, Informed consent

[Symposium 9: Exploring Brain-Body Dynamics in Neurological Disorders: Integrating Advanced Animal Models with Human Pathologies]

IA-0178

Neuropathological Hallmarks of Neurodegenerative Diseases

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Abstract: This lecture will provide an in-depth exploration of the neuropathological features that characterize major neurodegenerative disorders, with a focus on Alzheimer's disease and Parkinson's disease. We will begin by outlining the fundamental neuropathological characteristics of these conditions, including the distinctive protein aggregates and common pathological features that serve as pathological hallmarks. Real-world case studies from post-mortem brain examinations will be reviewed, highlighting the intricate pathological findings and mixed pathologies often observed in clinical settings. Additionally, the latest research and theoretical frameworks that aim to elucidate the mechanisms underlying disease progression in neurodegenerative disorders will be briefly presented. Through this comprehensive overview, attendees will gain a deep appreciation for the complexities of neuropathology in neurodegenerative diseases, laying the foundation for improved diagnostic approaches and the development of targeted therapeutic interventions.

Keywords: Neurodegenerative disease, Neuropathology, Autopsy, Alzheimer's disease, Parkinson's disease

IA-0116

Development of Nonhuman Primate Models and Therapeutic Strategies for Neurodegenerative Disorders

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Abstract: Parkinson's disease (PD) is a debilitating neurodegenerative disorder. Its symptoms are typically treated with levodopa or dopamine receptor agonists, but their action lacks specificity due to the wide distribution of dopamine receptors in the central nervous system and the periphery. Here, we report the development of a gene therapy strategy to selectively manipulate PD-affected circuitry. Targeting striatal D1 medium spiny neurons (MSNs), whose activity is chronically suppressed in PD, we engineered a therapeutic strategy comprised of a highly efficient novel retrograde AAV, promoter elements with strong D1-MSN activity, and a chemogenetic effector to enable precise D1-MSN activation after systemic ligand administration. Application of this therapeutic approach rescues locomotion, tremor, and motor skill defects in both mouse and primate models of PD, supporting the feasibility of targeted circuit modulation tools for the treatment of PD in humans. In a second study, we have generated PSEN1 mutant cynomolgus macaques (PSEN1-ΔE9) through the genomic deletion of PSEN1 exon 9. Whole-genome sequencing and genotyping analyses of somatic cells confirmed the ΔE9 mutation at both the DNA and transcript levels, with minimal off-target effects. Fibroblasts derived from newborns exhibited signatures of familial Alzheimer's disease (AD) pathogenesis, including disrupted PSEN1 endoproteolysis, resulting in the presence of full-length PSEN1 protein and an increased beta-amyloid $(A\beta)_{42/40}$ ratio. Furthermore, blood transcriptome profiling of mutant macaques revealed molecular dysregulation associated with AD.

Keywords: Parkinson's disease, Circuit modulation, Gene therapy, Alzheimer's disease, Nonhuman primate

IA-0193

Body-Brain Interaction in Developing Parkinson's Disease

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Abstract: Parkinson's disease (PD), a neurodegenerative disorder characterized by the degeneration of dopamine-producing neurons and the presence of alpha-synuclein (aSyn) aggregates, exhibits clinical diversity that has led to a proposed classification into two subtypes: body-first and brain-first. Recent evidence links gut microbiome dysbiosis to aSyn aggregation in the gut, prompting a comprehensive study utilizing shotgun metagenomics to explore marker genes of the gut microbiome in these subtypes. Among the genes increased in body-first PD, we found hns encoding DNA-binding protein H-NS, which contribute to the generation of methylglyoxal (MG), a reactive carbonyl compound linked to the formation of advanced glycation end products and various pathologies. The largest proportion of bacteria expressing hns genes were found to belong to the Escherichia coli (E. coli). To investigate the impact of increased MG-producing hns gene on the host, we used Caenorhabditis elegans (C. elegans) fed with Δhns E. coli. We discovered that Δhns E. coli rescues the degeneration of dopaminergic neurons in C. elegans, and this effect is suppressed by MG treatment. We further identified that rig-5, a gene belonging to neuronal adhesion molecules, mediates the rescue effect on dopaminergic neuron degeneration induced by Δhns E. coli. Interestingly, analysis of RNA sequencing data showed that LSAMP, the human ortholog of rig-5, is also decreased in the substantia nigra of PD patients. Additionally, in human neuronal cells overexpressed aSyn, LSAMP expression was decreased by MG treatment and increased again upon MG removal by a scavenger. These results suggest that increased expression of bacterial H-NS in the gut of body-first PD patients causes the increase of MG, which can downregulate LSAMP in the brain of PD patients. These findings suggest the potential of scavenging MG produced by gut bacteria as a promising avenue for the prevention of PD.

Keywords: Parkinson's disease, Microbiome, Methylglyoxal, H-NS, E. coli

IA-0124

Neuron-Macrophage Interaction Sets Pain Sensitivities in Peripheral Tissues

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Abstract: In the course of our experiments, we accidentally discovered a transgenic mouse that was insensitive to mechanical and inflammatory pain. Genomic analysis of this mouse revealed a null mutation in the sorting nexin 25 (SNX25) gene, and the SNX25 knockout mice exhibited a pain insensitivity phenotype similar to that of the above transgenic mouse. Analysis of SNX25 conditional knockout mice revealed the following: SNX25 in peripheral macrophages, but not in dorsal root ganglionic neurons, is important for pain transmission; SNX25 inhibits ubiquitination of Nrf2 in macrophages, and Nrf2 that escapes degradation promotes NGF transcription, thereby enhancing NGF production from macrophages. Macrophage-specific SNX25 knockout mice showed reduced pain perception not only in physiological conditions but also in neuropathic pain models. In addition to this, macrophage-specific SNX25 knockout mice also have reduced tactile sensation, all together indicating that SNX25 regulation functions in a continuum of sensation from normal touch to pathological pain. These results look at the control of tactile-pain sensation in the peripheral skin, with the dorsal root ganglion involved in sensory transmission. The nerves of the dorsal root ganglion are distributed in the viscera, especially in the lower colon, and are responsible for visceral pain. We are going to show some preliminary results of the visceral pain model in the macrophage-specific SNX25 knockout mice.

Keywords: Pain, Macrophage, NGF, SNX25, Neuron

IA-0167

Gut-Immune-Brain Modulation in Neurodevelopmental Disorder

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Abstract: Children diagnosed with Autism Spectrum Disorder (ASD) commonly exhibit dysregulated immune responses. However, the underlying mechanisms contributing to the development of both neurodevelopmental and immunological characteristics remain unclear. Our research revealed that offspring exposed to maternal immune activation (MIA), displaying neurodevelopmental traits, also show increased vulnerability to heightened inflammatory phenotypes upon later immune challenges. Maternally induced IL-17A during MIA contributes to prenatal neurodevelopmental phenotypes but postnatally triggers immune-primed traits in offspring, influenced by alterations in the maternal gut microbiota. Notably, transferring stool samples from pregnant mice with heightened IL-17A responses to germ-free dams was sufficient to enhance offspring's susceptibility to gut inflammation and induce changes in chromatin accessibility of $CD4^+$ T cells. This study offers mechanistic insights into how children exposed to heightened inflammation in the womb, whether due to viral infection or other inflammatory conditions, may face an elevated risk of developing both inflammatory diseases and neurodevelopmental disorders.

Keywords: Neurodevelopment, Neuro-Immune axis, Gut microbiome

[Symposium 10: Anatomical Education Human Morphological Study Based on Digital and Intelligental Technology]

IA-0097

A Study on Mechanism of Cerebrospinal Fluid Circulation in Cranio-Cervical Junction

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Abstract: The Myodural Bridge Complex (MDBC) is a structural and functional unit composed of suboccipital muscles, ligaments, and dense MDB fibers originate from these muscles and ligaments. It has been reported that MDBC can transmit traction force of muscles to spinal dura mater (SDM) during head movement. A significant increase in cranial net CSF flow after head rotation has been confirmed by magnetic resonance imaging studies, providing evidence that MDBC affects CSF circulation. While the changes of local CSF velocity and pressure caused by MDBC pulling on the SDM were not directly demonstrated in the previous studies. In this study, horizontal slices from Korean digital human dataset were used to reconstruct a three- dimensional mode including the MDBC and its adjacent structures at the level of the atlanto-occipital interspace. Based on the biomechanical experiments, relevant parameters were obtained and assigned to the model. The fluid-structure interaction (FSI) module was used to simulate effects on CSF during the process of MDBC traction on SDM. ANSYS Fluent was used to solve the transient changing of CSF during this process. The traction force acting on the SDM was made occurs and disappears within three seconds. Three seconds was made as an action cycle. It was found that during this action cycle, the posterior part of SDM protrude backward. Eddy currents were generated in the dorsal area in this interspace. The flow velocity of CSF in the protrusion space decreased significantly, and the pressure increased. The velocity and pressure of CSF in this interspace showed opposite changes when the posterior part of SDM back to the normal morphology. This study demonstrated the flow characteristics of CSF at the CVJ and the MDBC's effect on its flow. It also provided a direct evidence at the level of finite element analysis for the original theory that MDBC is one of the powers of CSF circulation.

Keywords: Cerebrospinal Fluid Circulation, Myodural Bridge Complex, Computational Fluid Dynamics

IA-0114

Three-Dimensional Morphological Study of Lymphatics during Early Fetal Period

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Abstract: Compare to blood vessels, few morphological studies on lymphatic vessels (LVs) in human development period. We selected five sagittal serial sections of early human embryos and fetuses, using D2-40 immunohistochemical staining to observe LVs and three-dimensional reconstruction technique to reflect the morphological characteristics. All specimens found both side of jugular lymph sac (JLS) located above the lateral side of the left brachiocephalic vein. In crown-rump length 30 mm specimen, we found the LVs direct inflow to the left brachiocephalic vein near the left JLS, not only though the thoracic duct (TD) inflow near the left venous angle. Moreover, a pair of paravertebral longitudinal lymphatics originated near the cisterna chyli, it seems to collect lymphatics that accompanied the posterior intercostal blood vessels and finally flowed into the TD. As our results, the advantage of the left lymphatics had a slightly greater than that of the right lymphatics, such as the volume of the JLS. In contrast, the venous system on the right seems greater advantage than that on the left. In addition, it looks that the paravertebral longitudinal lymphatics development important for the asymmetric evolution of the TD and azygos vein.

Keywords: Lymphatic vessels, D2-40, 3D reconstruction, Human fetal

IA-0192

Intelligent Segmentation and T-Stage Diagnosis of Prostatic Cancer Based on MRI and Deep Learning

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Abstract: Purpose Manual segmentation of prostate lesion on MRI is highly important for 3D visualization, diagnosis and treatment planning but is time-consuming and laborious. We plan to develop a deep learning model for intelligent segmentation of prostate zones, tumors and adjacent structures and for intelligent T-stage diagnosis of prostate cancer (PCa). Methods PCa patients with pathologically confirmed from SX Hospital (April 2018 to June 2020) and XQ Hospital (January 2021 to January 2022) were enrolled in this retrospective study. Other patients from public dataset (Test-A) and XQ Hospital (Test-B) were selected for external testing. We proposed a deep learning approach called PCa T-stage diagnosis with deep learning (PDD). In the first step, the peripheral zone (PZ), transition zone (TZ), central zone (CZ), anterior fibromuscular stroma (AFMS), tumor, rectum, bladder, seminal vesicle (SV) and urethra were intelligently segmented using Vgg16-AttentionGate-Unet model. In the second step, Swin-Transformer (SwinT) model is used for intelligent T-stage diagnosis with intelligently segmented lesions. Results The study included 209 patients (70 years ± 9). PDD achieved DSCs of 0.783, 0.789, 0.392, 0.563, 0.583, 0.824, 0.938, 0.738, and 0.613 for intelligent segmentation of PZ, TZ, CZ, AFMS, tumor, rectum, bladder, SV, and urethra in the internal test cohort (n = 30) and DSCs of 0.787, 0.755, 0.349, 0.587, 0.487, 0.852, 0.931, 0.667, and 0.639 in the external Test-A (n = 27), respectively. Additionally, the PDD achieved an accuracy of 0.733 and an AUC of 0.827 for differentiating between T1-T2 and T3-T4 in the internal test cohort, outperforming the SwinT by 15.80% and 16.81%, and achieved accuracies of 0.814 and 0.867, and AUCs of 0.815 and 0.861 in the external Test-B and resident-PDD, respectively. Conclusion Deep learning was able to accurately segment prostate zones, tumors and adjacent structures, and performed well in T-stage diagnosis of PCa.

Keywords: Deep learning, MRI, Prostate cancer, Segmentation, Artificial intelligence

IA-0068

Whole-Body Mapping of Adult Mouse at Cellular Level Using fMOST

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Abstract: To generate a comprehensive three- dimensional (3D) cellular census of a mouse, and investigate the organization logic of the anatomical structures of whole body including the brain, heart, and bones. The research aims to dissect the cellular composition and the intrinsic logic governing organic connections, which is pivotal for understanding the development, homeostasis, and disease progression. Our lab developed serial techniques named fluorescent micro-optical sectioning tomography (fMOST). fMOST is a sophisticated imaging platform designed for cellular-level brain mapping. It encompasses multi- faceted approaches, starting with sample preparation to specifically label and preserve the fine structures and fluorescent signals of the biological tissues. By employing high-resolution optical sectioning, fMOST achieves volumetric imaging with resolution at 0.3 × 0.3 ×1 μm3 throughout the entire brain. The technology has been instrumental in creating detailed maps of the brain at the single-cell level. We reconstructed the morphology of individual neuron and axons to reveal the organization logic of the hippocampus and cortex. However, extending the application of fMOST to whole-body mapping presents challenges, including the sample preparing for large-volume tissues with the varying hardness such as skin, bone, nerves, blood vessels, and adipose tissue. Achieving homogeneous imaging across these diverse tissues is crucial. Additionally, the technology must address the immense task of processing the vast datasets generated and extracting meaningful anatomical information. Here, we overcome these challenges to provide comprehensive cellular maps of the entire mouse body, significantly advancing our understanding of biological systems. By revealing the intricate cellular interactions within the body, this method will contribute to the fields of pharmacology, and tissue engineering, ultimately enhancing our ability to treat and prevent disease.

Keywords: Whole body, Cytoarchitecture, 3D, Atlas, Neuron

IA-0085

Development of the Cartilaginous Connecting Apparatuses in the Fetal Sphenoid, with a Focus on the Alar Process

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Abstract: The human fetal sphenoid is reported to have a cartilaginous connecting apparatus known as the alar process (AP), which connects the ala temporalis (AT) (angle of the greater wing of the sphenoid) to the basisphenoid (anlage of the sphenoid body). However, how the AP develops in humans is unclear. In addition, although the AP is a common structure of the mammalian chondrocranium, little is known about whether it is really a fundamental feature in mammals. This study clarified fetal developmental changes in the sphenoid in order to determine developmental processes of the AP in humans. In addition, we reconsidered the definition of the AP by comparing humans and rats with mice. This study examined the histological sections of 20 human embryos and fetuses from 6 to 14 weeks of development, of 20 mouse embryos from embryonic days 12–18, and of 4 rats embryos form embryonic days 17 and 20. In humans, the AP was continuous with the basisphenoid but was separated from the AT by a thick perichondrium. Then, the AP–AT connection had a key-and-keyhole structure. Unlike a joint, no cavitation developed in this connection. In mice, there was no boundary between the AT and the basisphenoid, indicating the absence of the AP in the mouse chondrocranium. In rats, the AP was, however, separated from the AT by a thick perichondrium. Therefore, the AP can be defined as follows: the AP is temporally separated from the AT by a thick perichondrium or a key-and-keyhole structure during the fetal period. This is the first study that confirms the absence of the alar process in the mice skull, and its presence in other mammals skull should be further investigated.

Keywords: Sphenoid, Alar process, Ala temporalis, Mammals

[Symposium 11: Development, Regeneration and Disease]

IA-0087

The Study of the Impact of Developmental Microenvironment on Embryonic Development

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Abstract: Epidemiological studies suggest that congenital diseases caused by teratogenic factors in the developmental microenvironment are a substantial factor, yet the underlying mechanisms remain incompletely understood, and effective prevention and treatment strategies are lacking. In this study, chick and mouse embryos were utilized as model organisms, and a range of cellular and molecular biology techniques such as immunofluorescence, Western blotting, PCR, and RNA sequencing were employed to assess gene expression patterns across different stages of embryonic development. This study has found that new teratogenic factors such as nano- plastics induce cellular oxidative stress, autophagy changes, and various forms of cell death (apoptosis, necroptosis, ferroptosis, etc.) through time and dose-dependent effects. However, cellular homeostasis- maintaining proteins such as NRF2 play a dual role in both physiological and pathological states during development. Based on research highlighting the crucial role of embryonic stem cell homeostasis maintenance in the developmental process, natural small molecule compounds can be utilized to influence the levels of cellular autophagy or oxidative stress in embryonic stem cells. By doing so, they can alter the fate of stem cells, thereby exerting protective effects on embryonic development. The process of embryonic development is a delicate progression involving various gene regulations such as precursor cell migration, proliferation, apoptosis, and differentiation. Maintaining homeostasis during embryonic development ensures the orderly progression of cellular behaviors in both spatial and temporal dimensions, thereby safeguarding embryonic development.

Keywords: Development, Microenvironment, Embryo, Autophagy, Oxidative stress

IA-0086

MMP2-Mediated Accumulation of PNNs Modulates Depressive Susceptibility and the Antidepressant Effect of Metformin in High-Fat Diet Mice

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Abstract: The mechanism by which obesity induces mental illness is not fully understood. Studies have shown that PNNs plays an important role in regulating synaptic plasticity, and its aberrant expression has been associated with a variety of psychiatric disorders. The aim of this project is to study the mechanism of MMP2-PNN in obesity-associated depression to find new targets for the treatment of this disease. An obesity model was induced by a chronic high- fat diet (HFD) in order to observe changes in the hippocampus and depression-related behaviors. Viral and pharmacologic interventions on the expression of PNNs and MMP2 to validate their modulation of mental disorders. Finally, the first- line glucose-lowering agent metformin was used to restore the expression of MMP2 and PNNs in the hippocampus, reversing the depressive phenotype while improving blood glucose. Increased expression of hippocampal PNNs (mainly Aggrecan) in HFD mice promotes inhibition of PV+ interneurons, which, in turn, leads to elevated hippocampal Glu levels and induces depression and anxiety-like behaviors. Notable, we found that the MMP2-PNNs pathway is involved in the treatment of metformin antidepressants. These studies reveal the critical role of synaptic plasticity regulated by MMP2-PNNs in HFD- induced mood disorders and reveal an effective mechanism for metformin treatment in a group with obesity-associated depression.

Keywords: MMP2, Perineuronal nets, High-fat diet, Depression, Metformin

[Symposium 12: Comparative Anatomy and Zooarchaeology]

IA-0053

A Study on the Dismantling and Disposal Patterns of Animal Remains Excavated from the Unified Silla Period in the Gyeongju Area

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Abstract: There are rare cases of animal remains analyzed from ruins from the Unified Silla period. Therefore, not much is known about the ways people dismantled and disposed of animals at the time. Recently, animal remains have been discovered in a number of Unified Silla residences in Gyeongju. Through these cases, we would like to examine the pattern of dismantling and disposing of animals by urban people during the Unified Silla Dynasty. Recently, there are many cases of animal remains being excavated from pit remains of ruins investigated in the Gyeongju area. In particular, there are numerous pits around the buildings of the Unified Silla period near the center where the royal palace and royal tombs exist, and various animal remains have been excavated from them. Most of the excavated animal remains are cattle and horses, and a few or many individuals have been identified in one pit. Most bones are often jointed or divided into different parts. There are many reported cases of excavations in an anatomically connected form. There are many forms where one animal is divided into several parts, such as the pelvic area, some of the limbs, and the spinal area. At that time, it is highly likely that it was transported or distributed in a disassembled form, focusing on the limbs and pelvis. The place of slaughter would not have been inside the residential area, but rather it would have been brought into the residential area in cut form. It is presumed that the meat was collected here and discarded in the same anatomical and skeletal state as it was brought in.

Keywords: Unified Silla, Animal remains, Patterns of animal use

IA-0016

Sex Identification of Early Chickens in the Japanese Archipelago and Korean Peninsula

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Abstract: The chicken is a domestic animal that originates from the red junglefowl, thought to have been introduced to the Japanese Archipelago at the latest in the early middle Yayoi period (3rd century BCE). Due to their small number of bones, chickens in the Yayoi period are thought to be have been used as "time-telling birds," and an understanding of their sex ratio was considered important to deduce their role. In this study, an attempt was made to determine the sex of chickens from bones found in Japanese Archipelago and Korean Peninsula. The sex of chickens was determined from bones found in six Yayoi sites in the Japanese Archipelago based the sexual dimorphism of the long bones of modern captive red junglefowl, which resemble those of the chickens in the Yayoi period. In addition, this approach was applied to two reported chicken bones from the Neukdo site (3rd century BCE to 2nd century CE), Sacheon, Korean Peninsula. All four tarsometatarsi had well-developed spur, and were presumed to be male. In addition, most of the other chicken bones were approximately the same size as the male captive red junglefowl, suggesting a significant bias of the sex of chickens during the Yayoi period towards males. On the other hand, of the two chicken bones at the Neukdo site, one was identified as male and one as female. The significant bias towards males suggests that chickens may not have been able to reproduce in most of the Japanese archipelago in the Yayoi period, although evidence of successive breeding was found at Karako-Kagi site, Nara Prefecture. Chickens in the Yayoi period may have had value as a proof of their relationship with China and the Korean Peninsula. Further studies in China and the Korean Peninsula will be required to test these hypotheses.

Keywords: Domestic chicken, Sexual dimorphism, Domestication

IA-0061

Domestication of Pigs in Ancient Japan

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Abstract: In Japan, pig farming began in the Yayoi period and some of them are thought to be introduced from China or Korean peninsula. However, almost of the bone morphological features excavated from the archaeological site make it difficult to clearly distinguish between wild boars and domestic pigs. Therefore, it is unclear to what extent pigs were kept. This study reconsiders the presence of pigs in the Yayoi period. This study compares the bone(mandibles) morphological features of wild boar excavated from Jomon period sites with that of wild boar/ domestic pig mandibles excavated from Yayoi-period sites and combines the results of dietary analysis (stable isotope analysis) clarify the characteristics of wild boar/ domestic pig from the Yayoi period. The bones of wild boar/ domestic pig from the Yayoi period site showed trait characteristics that differed from those of wild boars from the Jomon period site. It is also found that palaeopathological features could be observed in the Yayoi individuals. It is cleared that some Yayoi individuals have different morphological feature from the Jomon individuals. These phenomena indicate human husbandry, but it is not clear whether they were reared generation after generation.

Keywords: Japan, Yayoi period, Wild boar, Pig, Domestication

IA-0196

Zooarchaeological Studies over the Last Decade in the South Korea

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Abstract: From ancient times to the present day, humans have had relationships with various species of animals. Among those animal species, domesticated animals accelerated the development of human civilization and provoked physical changes such as human nutrition improvement. The significance of such relationships between human and domesticated animals in the archaic past has been well established and is commonly highlighted in groundbreaking studies worldwide. In the field of Korean comparative anatomy and zooarchaeology, many related studies have also been performed over the past few decades, as in the other countries. From this perspective, in this presentation, I would like to introduce zooarchaeological researches over the past 10 years using scientific analytical methods in Korea. More specifically, results from comparative anatomical studies using traditional gross anatomical analysis and modern zooarchaeological studies using ancient DNA and stable isotope analysis would be suggested. Also, how these findings were used to understand the lives of ancient peoples who lived in the Korean peninsula will be briefly introduced. This study is supported by the National Research Foundation of Korea (NRF) grant (NRF-2023R1A2C1006785).

Keywords: Zooarchaeology, Korea, East Asia, Domesticated animals, Comparative anatomy

IA-0139

Do Native Horses Represent Past Japanese Horses? Diversity of Limb Bone Proportions in Japanese Ancient and Medieval Horses

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Abstract: Equine whole-body skeletons excavated from ancient and medieval archaeological sites in the Japanese archipelago were investigated to reveal the diversity of equine limb bone proportions and discuss the differences underlying their uses. There are eight species of Japanese native horses in the Japanese archipelago. These have been considered to retain the characteristics of horses bred in the archipelago before the modern era, as they have been largely unaffected by crossbreeding with foreign breeds for the purpose of improvement promoted after the modern era. Indeed, in terms of height, most horses excavated from archaeological site are small to medium-sized horse, showing characteristics in common with native horses. However, a more detailed analysis reveals that in terms of limb bone proportions, there was greater diversity in the past. The limbs of horses excavated from ancient local government areas and the medieval city of Kamakura have relatively long distal limb bones compared to those of native horses. On the other hand, some horses excavated from inland medieval fortresses have shorter distal limb bones. These dif-

ferences suggest that the former type of horse was adapted to traveling and running on flat terrain, while the latter was adapted to traveling on slopes such as those in mountainous areas. The characteristics of native horses are closer to the latter, and it has become clear that they have only transmitted some of the diverse equine traits that once existed in the archipelago. It can be concluded that horses with more diverse traits were used in the Japanese archipelago in the past for a variety of uses and purposes.

Keywords: Zooarchaeology, Horse, Limb bone proportion, Japanses native horses

[Symposium 13: Challenges of New Body Donation Programs in the 21st century]

IA-0033

Facilities, Difficulties and Strategies for the Creation and Development of the Body Donation Program at the National University of Cordoba - Argentina

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Abstract: To develope a Body Donation Program in Argentina was not easy. The country population had never heart about this possibily and our university authorities were not interested in. The National University of Cordoba is one of the oldest universities in the continent and has been a historical leader in many activities and aspects, but was very conservative on this topic. After 10 years trying the Faculty of Medicine to create a program for body donors, in 2018 I proposed a research project to consider the willingness of different groups to donate their bodies. The Project was approved by the University Secretary on Sciences and Technology and carried on by medical and dental anatomists. Willingness was evaluated by an anonymous survey addressed to medical students, medical and dental doctors (without including anatomists) and general population of Cordoba city and surroundings. Results were better than expected and after two years' work, they were approved and supported the request to create the Body Donation Program. The proposal clearly stated its objectives, all steps and conditions, based on the IFAA ethical guidelines and within the framework of national and regional laws. The Program was created in April 2021 and, since then, we are working hard to manage its objectives. It is based on supervising the due respect to these bodies and the voluntary, generous and supportive donation from the population of Cordoba city and surroundings. These altruistic caracteristics determined the general acceptance or, at least, not negative reactions. We have managed to consolidate a committed working group, to organize an effective and transparent system, and to give visibility to the issue by offering a new option after death and using different media. Certainly we have not got the expected number of bequests and bodies yet, but we need to increase people's information.

Keywords: Body donation, Argentina, National University of Cordoba, Body donation program, Anatomy resources

IA-0046

From Unclaimed Bodies to Voluntary Body Donations: A Paradigm Shift in Urban India

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Abstract: Background Cadavers are the best teachers at infancy of medical career. In India as elsewhere in the world disposal of dead body is a sacred, religious, traditional and cultural practice that the next of kin (NOK) executes as essential social obligation. Altruism as a concept has often evaded larger section of our population due to lack of awareness. Challenges Our institute routinely received unclaimed bodies in liaison with the local police authority Strategies Awareness drive: A large section of our population is not aware about whole body donation. Awareness programmes and voluntary body donation pledge by politicians and medical fraternity promoted awareness. Improved digital visibility of Body Donation Program: Institute website revamped to include body donation link on home page. Availability of 24X7 Body Donation Helpline number: Continuously monitored by faculty and

manned by PG Resident. Demise to disposal a hassle free journey: It is our endeavor to ensure a hassle free handing/ taking over of the body from the NOK. All documents are processed on same day and handed over to NOK (Next of Kin) within 60min of wait time. Build sustainable ecosystem to nurture altruism: In order to recognize the act of altruism we issue a certificate of gratitude and appreciation to the NOK. Such certificates are shared back home with family and friends which in turn motivates elderly group to embrace the noble act of body donation for medical and research purpose. Outcome In last 4-5 years our institute has stopped using unclaimed bodies for cadaveric dissection. The supply of cadavers is consistent and in such huge numbers that we are able to conduct frequent cadaveric workshops on soft embalmed bodies in addition to Formalin preserved cadavers routinely used for UG training.

Keywords: Cadavers, Altruism, Dissection, Unclaimed bodies

IA-0091

Challenges and Achievements of the Body Donation Program of the School of Medicine of the University of Costa Rica

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Abstract: Introduction PRODOCU emerged in 2018, after assessing the need not to depend on the General Health Law, which in article 79 says that bodies that are not claimed can be donated to educational health institutions. Previously, the number of bodies that entered the School each year did not exceed 10 to 15 bodies, limiting the use of biological material only for teaching anatomy in undergraduate courses. Methodology The project that represents the body donation program is registered as part of social action with the objective of creating a culture of body donation at the national level, which transforms the program into an entity that ensures the ethical use and worthy of human material for teaching and research and not just an entity that receives bodies. **Results:** In 2018, the first year of the program, 114 donation forms were signed, unlike other years where only 10-15 forms were signed per year. During the COVID-19 pandemic, the program did not close, but rather the way in which donations were made was rethought and the process was virtualized, allowing people outside the capital to easily access the program, which has increased the number of donors from areas far from the capital. Before the donation program, most of the bodies that entered the School of Medicine were donated from hospitals by the general health law, in the year 2023 the majority of the bodies that entered the School belonged to the body donation program, allowed the development of research and biological simulation courses. Conclusions The program has not only managed to create a culture of body donation at a national and international level, but has also made it possible to develop research projects, social action, improve teaching and carry out biological simulation courses unique in Latin America.

Keywords: PRODOCU, Body donation program, Biological simulation, Latin America

[Symposium 14: Anatomists United – A Symposium-Workshop to Initiate Global Anatomy Faculty Exchanges to Promote "Science Diplomacy"]

IA-0075

Session Introduction

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Abstract: [This is the united abstract of this symposium] Anatomy education is ubiquitously present in all medical schools globally. However, teaching is conducted very differently around the world. Minimal exchange occurs worldwide and teaching in other countries remains an enigma. At a time of increasing globalization, conflicts and forthcoming changes in medical education, medical educators need to join forces and work collaboratively. International collaboration via sharing of teaching material and faculty exchanges can support learning and cultural understanding and lead to efficiency. In addition, global collaboration can promote "Science Diplomacy" by connecting scientists and anatomists around the world. In this symposium-workshop we present examples that showcase global differences in anatomy teaching to inspire diversification in anatomy via internationalization and global exchange of teaching modalities and faculty. Three speakers

from diverse regions of the world (i.e., Kenya, a low resource country in Africa; Taiwan, a small country in East Asia; and Ukraine, a war-torn country) will showcase differences in their teaching methods along with challenges they are facing. Each will describe how anatomy is currently taught in their respective schools and countries, and the impact of current teaching challenges. The above will be followed by a guided brainstorming discussion with the audience regarding global multilateral exchanges of anatomy faculty. The diversification of anatomy faculty can enhance equitable education around the world – while promoting "Science Diplomacy" globally.

Keywords: Internationalization of Medical Education, Science Diplomacy, Faculty Exchange, Anatomy teaching

IA-0076

Anatomy Education at the University of Nairobi

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[4]Anatomy and Physiology, University of Nairobi, Nairobi, Kenya

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Keywords: Internationalization of Medical Education, Science Diplomacy, Faculty Exchange, Anatomy teaching

IA-0077

Challenges of Anatomy Teaching in Ukraine in 2023

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multilateral exchanges of anatomy faculty. The diversification of anatomy faculty can enhance equitable education around the world – while promoting "Science Diplomacy" globally.

Keywords: Internationalization of Medical Education, Science Diplomacy, Faculty Exchange, Faculty Exchange

IA-0078

Humanism and Anatomy - The Silent Mentor in Anatomy Education in Taiwan

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Abstract: [This is the united abstract of this symposium] Anatomy education is ubiquitously present in all medical schools globally. However, teaching is conducted very differently around the world. Minimal exchange occurs worldwide and teaching in other countries remains an enigma. At a time of increasing globalization, conflicts and forthcoming changes in medical education, medical educators need to join forces and work collaboratively. International collaboration via sharing of teaching material and faculty exchanges can support learning and cultural understanding and lead to efficiency. In addition, global collaboration can promote “Science Diplomacy” by connecting scientists and anatomists around the world. In this symposium-workshop we present examples that showcase global differences in anatomy teaching to inspire diversification in anatomy via internationalization and global exchange of teaching modalities and faculty. Three speakers from diverse regions of the world (i.e., Kenya, a low resource country in Africa; Taiwan, a small country in East Asia; and Ukraine, a war-torn country) will showcase differences in their teaching methods along with challenges they are facing. Each will describe how anatomy is currently taught in their respective schools and countries, and the impact of current teaching challenges. The above will be followed by a guided brainstorming discussion with the audience regarding global multilateral exchanges of anatomy faculty. The diversification of anatomy faculty can enhance equitable education around the world – while promoting "Science Diplomacy" globally.

Keywords: Internationalization of Medical Education, Science Diplomacy, Faculty Exchange, Anatomy teaching

[Symposium 15: Are You for or against Public Dissection? An Open Debate]

IA-0109

Public Dissection: Education or Edutainment?

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Abstract: Background Human dissection began thousands of years ago and was popular as a public event between the 16thto 18th Centuries. During the Renaissance, the act of dissection extended beyond the ambit of anatomists to include artists. In this time too, religious authorities embraced human dissection and changed their attitude from rigid denial to benevolent support which encouraged the robust engagement of society with public dissection. In the early 19th Century, following violations of body sourcing and unethical practices by anatomists, society disengaged from these public events which then became confined to the anatomy laboratory. Recently, public dissections have increasingly found their way back into society, with some of these verging on the realm of edutainment. As we function in a global anatomy village, we should consider the impact of these public dissections on all societies. While public dissections may be more acceptable to certain societies, it is yet to be established whether they are appropriate in all cultures, such as those in Africa. Thus, this presentation will explore the possible impact of public dissection in relation to ethical, religious and cultural concerns. Methods Historical and current information on professional, societal, cultural and religious beliefs regarding public dissection will be considered. Results As societal recognition and trust in the discipline of anatomy is of great importance, the tension between the educational value of public dissection and its marriage to entertainment will be explored. The presentation will also pose questions on the motivation behind returning to the public domain. Conclusion In navigating the complex terrain of public engagement in anatomy, and public dissection in particular, the union of education and entertainment verging on the macabre, must be carefully considered. The anatomical integrity of these events must contemplate the values of ethical

relativism, consent, dignity, respect, cultural and religious sensitivities and societal mores.

Keywords: Public dissection, Ethics, Societal mores

IA-0121

Does Public Dissection Bridge Anatomy Education and Community Engagement?

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Abstract: Research shows that the public often struggles to communicate with healthcare providers due to a lack of anatomical knowledge, suggesting that anatomy education outreach is critical to public health initiatives. Anatomy is often taught through dissection. Public dissection of human tissues has a controversial history, raising ethical concerns about respect, dignity, and educational purposes. Historically, public dissections date back to the Renaissance, serving both educational and entertainment purposes. These events attracted large audiences, often using the bodies of criminals or unclaimed individuals, raising issues of consent and exploitation. Today, the ethical implications of public dissection of human tissues are even more pronounced. Conducting dissections for a public audience is ethically problematic. The public does not need this exposure to understand basic human anatomy. Dissection of human tissues should be reserved for educational contexts involving participants with vested interests and foundational knowledge, such as anatomy students and health-related professionals. Public dissection of human tissues risks sensationalizing and trivializing the human body, potentially undermining the dignity and respect due to human remains. Educational outreach can be conducted through animal dissections, which impart fundamental anatomical principles and address a practical need. However, animal dissections may not be culturally appropriate for all audiences, particularly those who hold animals in high regard. Sensitivity to cultural perspectives is essential in planning these activities. While dissection is valuable for teaching anatomy, it is not the only method; models, body painting, and other teaching modalities can be effective. Given that this symposium focuses on public dissection, animal dissection, where culturally appropriate, is a more ethical alternative. The study of anatomy must be approached with ethical mindfulness. Public dissection of human tissues should be reserved for those with clear educational needs, while animal dissections, conducted with cultural sensitivity, can serve as an ethical tool for broader public education.

Keywords: Outreach, Animal, Dissection

IA-0089

Do We Need Public Dissection? History and Future of a Very Special Anatomical Practice

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Abstract: Today, anatomical dissection is usually practised in restricted spaces that limit access to certain groups of professionals, like health sciences students or postgraduate medical trainees. This is based on notions of dignity and privacy of the deceased, and of protection of vulnerable individuals like children. Public dissection is thus dissection with less limited access, or presented on media where access is difficult to control. More specifically, it includes the observation of the act of dissection and is not just the demonstration of dissected bodies. In this sense, it has a long history in Europe, where dissections in 18th century anatomical theatres were a public event for health professionals and a (mostly paying) public. The purpose of dissection in these theatres was diverse and included "enlightenment" of the public, representation of scholars, praise of God and his creation, memento of death, and extended public punishment of wrongdoers. In the 19th century, dissection became less representational and more scientific, education of the public was realised with anatomical museums rather than public dissections. Events in recent times, like Gunther von Hagens' public and televised dissection of a male donor in London 2002 or the dissection of a donor at a hotel in Oregon in 2021, both for paying audiences, officially had an educational purpose, but were also commercial and may have catered for morbid rather than scientific curiosity. Regarding today's ethical appraisal, informed consent is a necessary, but not a sufficient condition for public dissection. It is important to have a dignified context for the dissection and above all a dignified purpose that excludes commercialisation and showmanship. Education of laypeople is often taken as a pretext for other purposes and should be approached with scepticism as it usually takes a lot of training to see relevant structures in a freshly dissected anatomical specimen.

Keywords: Anatomical theatre, Commercialisation, Education, Morbid curiosity, Dignity

IA-0032

We Must Remove the 'Closed Doors' of Anatomy

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Abstract: The documentary titled 'My Dead Body' has been a huge success in the United Kingdom, with over 1.5 million viewers. It has received critical acclaim and garnered numerous award nominations. The documentary revolves around the story of a donor named 'Toni', a 30-year-old woman who had a rare adenocarcinoma of the lacrimal gland. Toni had given consent during her lifetime for anatomical examination and public display, including the use of her images and disclosing her identity. With the support of her family and following a not-for-profit approach, this documentary was created to raise awareness about cancer and body donation. The team of anatomists involved in the project strongly believes that with fully informed consent, there is a valuable role for anatomists and institutions to engage in activities that educate individuals- regardless of their background or qualifications about the human body in both its healthy and diseased states. The fundamental principle underlying the use of human material is informed consent. By conducting a wide range of educational activities that treat human material with dignity and respect, enlightening and myth-busting messages can be delivered, helping individuals understand their own bodies and supporting others in matters of health and disease. It is crucial to remove the 'closed doors' and break down barriers in order to support broader public health initiatives. Otherwise, there is a risk that demand will be met by alternative activities, such as 'edutainment' or even illicit 'black market' practices.

Keywords: My dead body, Public dissection, Public display, Documentary

[Symposium 16: The Art of Indulging in Anatomy]

IA-0142

The Most Efficient Anatomy Education for Medical Artists

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Abstract: Understanding human anatomy in three dimensions is the most fundamental and crucial skill in medical illustration. Therefore, almost all educational programs that train medical illustrator currently include anatomy as an essential component. In the case of the BioMedical Art program at Incheon Catholic University Graduate School, in the theoretical courses such as Understanding Biomedical Science and Human Anatomy, we sequentially teach subjects like medical terminology, surface anatomy, systematic anatomy, and regional anatomy, as well as parts of neuroanatomy, embryology, histology, and dental morphology. In practical courses such as Scientific Visualization, Illustrating Anatomy, and Surgical Observation & Sketching, students explore methods to filter out unnecessary anatomical information and express important structures in a way that makes them clearly memorable. They also undertake tasks to reconstruct CT or MRI cross-sections into 3D using relevant software, and reconstruct cross-sections and 3D structures from new perspectives based on existing atlases, photographic materials, etc. In summary, to facilitate effective anatomical learning for medical illustrator students, we gradually increase the difficulty step by step, teach theory and art skills in parallel, and induce repeated learning and self-directed deep learning through applied courses.

Keywords: Medical Illustrator, Anatomy Education, Gross Anatomy, Anatomy Practice, Biomedical Art

IA-0092

Surgical Anatomy and Visual Narratives

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Abstract: Comprehending Surgical Anatomy stands as a cornerstone for medical illustrators. Crafting a visual narrative to educate surgeons necessitates a profound grasp of Gross Anatomy and the pertinent surgical field. This presentation will

explore the nuances of Facial Anatomy, illuminating how recent insights into facial structures empower medical illustrators to educate plastic and aesthetic surgeons effectively. This presentation will explore the nuances of Facial Anatomy, illuminating how recent insights into facial structures empower medical illustrators to educate plastic and aesthetic surgeons effectively.

Keywords: Medical illustration, Medical visuals, Surgical anatomy, Facial anatomy, Aesthetic surgery

[Symposium 17: Deciphering the Cancer Progression

IA-0170

The IFIT Protein Family in Breast Cancer

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Abstract: Breast carcinoma is the most frequently occurring malignancy amongst women worldwide, and a leading cause of cancer mortality. There are four known members in the interferon induced protein with tetratricopeptide repeats (IFIT) family. In resting cells, these molecules are usually minimally expressed or absent. In contrast, their biosynthesis is upregulated by interferon or other stimuli. The biological functions of IFIT proteins have been well investigated with regard to the antiviral response to infection. Additionally, recent reports have highlighted that these molecules have fundamental importance in different types of cancer. In this presentation, the usefulness of different IFITs as biomarkers of various cancer types will be reviewed. Recently obtained results that demonstrate the biological roles of these proteins in breast carcinoma will be shown. The use of IFITs in prognostication of patients with breast cancer will also be discussed.

Keywords: Biomarker, Breast cancer, Interferon induced protein with tetratricopeptide repeats, Prognostic factor

IA-0187

Complement Regulatory Protein CD46 Promotes Bladder Cancer Metastasis through Activation of MMP9

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Abstract: CD46, a transmembrane protein known for protecting cells from complement-mediated damage, is frequently dysregulated in various types of cancer. Its overexpression in bladder cancers safeguards the cancer cells against both complement and antibody-mediated cytotoxicity. The present study explored a new role of CD46 in facilitating cancer cell invasion and metastasis, examining its regulatory effect on matrix metalloproteases (MMPs) and their effect on the metastatic capability of bladder cancer cells. Specifically, CD46 alteration positively influenced MMP9 expression, but not MMP2, in several bladder cancer cell lines. Furthermore, CD46 overexpression triggered phosphorylation of p38 MAPK and protein kinase B (AKT), leading to enhanced activator protein 1 (AP-1) activity via c-Jun upregulation. The inhibition of p38 or AKT pathways attenuated the CD46-induced MMP9 and AP-1 upregulation, indicating that the promotion of MMP9 by CD46 involved activating both p38 MAPK and AKT. Functionally, the upregulation of MMP9 by CD46 translated to increased migratory and invasive capabilities of bladder cancer cells, as well as enhanced in vivo metastasis. Overall, the present study revealed a novel role for CD46 as a metastasis promoter through MMP9 activation in bladder cancers and highlighted the regulatory mechanism of CD46-mediated MMP9 promotion via p38 MAPK and AKT activation.

Keywords: CD46, Bladder cancer, Matrix metalloproteinase 9, Metastasis

IA-0141

Effects of Epstein-Barr Virus Infection on Various Cancer Cells

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Abstract: Epstein-Barr virus (EBV)-encoded latent membrane protein 1 (LMP1) is an oncoviral protein that plays a

pivotal role in EBV-induced oncogenic transformation. The function of LMP1 in EBV-induced oncogenesis has been well studied. However, the molecular mechanisms underlying LMP1 protein stability remain poorly understood. In this study, we found that EBV infection and LMP1 regulates Cancer stemness in multiple myeloma cells. Moreover, both EBV infection and LMP1 transfection increased cell proliferation and induced the up-regulation of α9-nAChR expression. Additionally, nicotine treatment induced tumorigenic activity in both EBV-infected and LMP1-transfected MDA-MB-231 breast cancer cells. Western blot and inhibitor assays showed that the nicotine-induced signaling was mediated through MAPK/ERK and AKT signaling pathways in EBV-infected and LMP1-transfected breast cancer cells, respectively. And olaparib treatment led to different cellular responses depending on EBV infection in gastric cancer cell lines. These results provide new insights into the mechanism of olaparib-induced apoptosis in gastric cancer cells and suggest that EBV infection should be considered when developing new potential therapeutic agents for gastric cancer. These results suggest that EBV infection and EBV-related LMP1 may act as potential molecular targets for various cancers, and provide a novel insight into the mechanism of anti-cancer therapeutic development in EBV-positive cancer cells.

Keywords: Epstein-Barr virus, Multiple myeloma, Gastric cancer, Breast cancer

IA-0127

The Impact of Peristalsis-Mimicking Culture on Human Colon Tumor Organoids

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Abstract: Human colon tumor organoids provide a useful in vitro model to study the biology of colon tumors, test potential drug treatments, and personalize treatment options for individual patients. Peristalsis in the digestive tract is crucial to maintaining physiological functions. It remains challenging to mimic the peristaltic microenvironment in colon organoid culture. Here, we present a method to model the peristalsis for human colon tumor organoids on a microfluidic chip. The chip contains hundreds of lateral microwells and a surrounding pressure channel. Human colon tumor organoids growing in the microwell were cyclically contracted by pressure channel, mimicking the in vivo mechano-stimulus by intestinal muscles. The chip allows the control of peristalsis amplitude and rhythm and the high throughput culture of organoids simultaneously. By applying 8% amplitude with 8~10 times min–1, we observed the enhanced expression of Lgr5 and Ki67. Moreover, ellipticine-loaded polymeric micelles showed reduced uptake in the organoids under peristalsis, which resulted in compromised anti-tumor efficacy. The results indicate the importance of mechanical stimuli mimicking the physiological environment when using in vitro models to evaluate nanoparticles. This work provides a method for attaining more reliable and representative organoid models in nanomedicine.

Keywords: Colon tumor organiod, Peristalsis, Organoid-on-chip, Nanomedicine

[Symposium 18: Multidisciplinary Training Requirements in Craniofacial Identification Expertise]

IA-0102

Multidisciplinary Training Requirements in Craniofacial Identification Expertise: Part 1: Anatomy and Photography

Nicholas BACCI
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Abstract: Craniofacial anatomy is crucial for identification both as a social tool and in more nuanced applications, including forensics and security. Facial comparison, using analysis of the facial morphology to identify individuals, is a recently validated method that is often employed in a forensic or government setting. This involves training-based expertise and is guided by international guidelines and recommendations from standard-setting bodies like the Facial Identification Scientific working Group. In order to provide the best possible practice, with the strong reliance of facial comparison on expertise, training is paramount. Training in anatomy is often overlooked as the assumption of prior knowledge is made. Knowledge of the intricate facial morphology details that even most anatomists tend to consider as overly specialised is vital to facial comparison expertise. Although the current preferred method for facial comparison is descriptive and intrinsically subjective, new approaches focusing on classification schemes

are being tested to attempt quantification and enforce statistical testability. Incorporating these techniques even if only in the training setting can be of benefit to establish anatomical knowledge and instil terminology to non-anatomist practitioners. Another aspect that is often neglected, not only in training, is the quality of captured images used in facial comparison, and recent research has demonstrated the severity of its impact on facial identification accuracy, with images of low facial resolution and poor lighting conditions increasing the likelihood of false positive outcomes. Inclusion of these overlooked yet foundational pillars in facial comparison training and practice are instrumental to ensuring its success, legal defensibility, and ethical practice. Ethical practice in any high-stakes application of anatomical knowledge is essential as misuse of forensic techniques can lead to severe consequences for everyone involved.

Keywords: Facial identification, Morphological analysis, Image quality, Facial morphology, Training

IA-0128

Training and Troubles in Facial Image Comparison and Facial Approximation

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Abstract: The rise of CCTV surveillance and increased security measures has bolstered the adoption of both manual and automated recognition methods. Furthermore, catastrophic events have highlighted the complexities and obstacles inherent in contemporary approaches to disaster victim identification. The interpersonal and intrinsic value of the human face underscores its importance in human identification efforts. Characterized by genetics, environment, lifestyle, developmental factors, and mechanical function, the craniofacial complex is inherently dynamic. Craniofacial identification draws from numerous specialties including image science, anatomy, biological anthropology, and forensic psychology. Standards and guidelines aimed at ensuring consistency and quality assurance across craniofacial identification disciplines are continuously developing. The multidisciplinary nature of the field and the evolving nature of protocol design present inevitable challenges in achieving optimal training and performance goals. Facial image comparison (FIC) and facial approximation (FA) are two significant sub-disciplines within craniofacial identification. FIC heavily relies on the quality standards framework established by the Facial Identification Scientific Working Group (FISWG), which has gained significant international recognition. Challenges with taxonomy, reporting methods, image integrity preservation, and bias prevention, however, persist. In FA, the Scientific Working Group for Forensic Anthropology (SWGANTH) emphasizes the need for practitioners to limit subjectivity, utilize scientifically tested methods, and transparently communicate method weaknesses and limitations. Appropriate protocol selection and visual face prediction are the independent responsibilities of the practitioner. This paper examines current teaching practices within the UK and identifies ongoing concerns in FIC and FA that require attention to bolster confidence in future practice.

Keywords: Facial image comparison, Facial approximation, Craniofacial identification, Human identification, Education

IA-0099

Development of Anatomy-Based Craniofacial Identification : Focusing on Craniofacial Reconstruction/Approximation and Superimposition

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Abstract: Symposium title : Multidisciplinary Training Requirements in Craniofacial Identification Expertise Craniofacial identification is a method that uses two- or three-dimensional images of the skull and face from an unidentified decedent to promote a positive identification. Typical methods of craniofacial identification include craniofacial reconstruction/approximation, which predicts an antemortem facial appearance from the skull of an unknown skull, and superimposition, which analyzes the skull against an antemortem facial photograph of an individual whose identity is believed to be the skull. Both are based on collecting and analyzing data on the correlation of anatomical structures between the skull and face of the same person, and the changes caused by age and various environmental factors. Therefore, it is essential to acquire basic knowledge of anatomy and to educate and un-

derstand the process of skull-head/face evolution and change. To improve the accuracy of craniofacial identification, it is necessary to investigate the measurement values between the skull, head, and face of subjects according to various population groups, sex, and biological characteristics. Typical studies include the measurement of corresponding landmarks on the skull, head, and face and the correlation of facial component morphologies and positions in relation to the skull. Of course, these studies also require an understanding and application of the anatomy of the craniofacial complex. The anatomy of the craniofacial region is the foundation of craniofacial identification techniques and is essential to the development of the field. Therefore, most craniofacial identification research and practice is based on anatomy. In this symposium, the relevant research on craniofacial identification in South Korea will be reviewed and its application to forensic practice will be discussed. Finally, the future development direction of anatomy-based craniofacial identification will be explored. This work was supported by National Forensic Service (NFS2024MED03), Ministry of the Interior and Safety, Republic of Korea.

Keywords: Craniofacial, Identification, Anatomy, Multidisciplinary, Training

IA-0183

Facial Recognition Psychology in Craniofacial Identification Training

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Purpose: This talk is part of the symposium on "Multidisciplinary training requirements in craniofacial identification expertise". Eyewitnesses are requested by police to create the face of a person they have seen commit a crime. The normal forensic process requires these eyewitnesses to recall the appearance of the offender's face and create a facial composite using either manual hand-drawn sketching or one of the facial-composite production (software) systems. The overall procedure requires specialist training to enable a police practitioner to conduct an appropriate cognitive interview, and work with eyewitnesses to create the best likeness possible, without cognitive bias. Consideration of maintenance of skills and competencies is of particular relevance given continual changes to best practice for interviewing witnesses and production systems.

Methods: I will outline the main face-production systems available to police practitioners, along with guidelines (produced in the UK) in that specify standards in the discipline. I will then consider routes undertaken by police practitioners for obtaining initial and then subsequent training in these production systems as well as training in cognitive interviewing.

Results: It is clearly evident that practitioners receive initial training in various ways, but (in spite of standards) there is a lack of assessment in the discipline to establish competency and attempt to reduce bias, and no requirement for ongoing Continuing Professional Development, itself likely to impact on maintenance of skills.

Conclusion: While the discipline has changed considerably over the years, the lack of formal training, both initially and at regular intervals, remains an issue, one which there are efforts to overcome in the UK.

Keywords: Facial composite

[Symposium 19: Artificial Intelligence (AI) @IFAA: Scope for Cross-Disciplinary International Collaboration in Clinical Anatomy]

IA-0153

Artificial Intelligence (AI) in Anatomical Education and Clinical Practice: A Cross-Disciplinary Symposium

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[2]Health & Life Sciences, Northumbria University, Newcastle-upon-Tyne, United Kingdom
[3]AI, AIATELLA, Helsinki, Finland

Purpose: The symposium identified and evaluated best practices in incorporating AI in clinical anatomy education, outlined the future horizon, and fostered cross-disciplinary collaboration acromedical and dental education through shared insights and methodologies.

Methods: A comprehensive literature review was performed prior to the symposium to gather information on current best practices and the scope of AI in medical/dental education and clinical practice. Key academic databases, including PubMed, Scopus, and Google Scholar, were searched for relevant articles published within the last five years. The studies included were systematically analyzed to extract data on the implementation of AI technologies, their educational impact, and recommend-

ed best practices.

Results: The initial literature review highlighted opportunities for interdisciplinary collaboration between the medical and dental fields, setting the stage for our symposium. We shared and learned from each other's experiences on this collaborative platform. The potential impact of AI is evident across the student journey and the patient journey beyond. AI tools have consistently demonstrated improved knowledge retention, higher student engagement, and better practical skills among learners. There is a clear potential for significant cross-disciplinary collaboration with shared AI resources and joint educational programs benefiting medical and dental practice.

Conclusion: The potential of AI in enhancing clinical anatomical education is not just a possibility but a promising reality. AI can afford innovative, personalized, and interactive learning experiences that could surpass traditional educational methods for our students. By sharing knowledge across education, clinical practice, and industry, institutions can maximize the benefits of AI, leading to improved learning outcomes and student engagement. Furthermore, fostering cross-disciplinary collaboration through shared AI resources and joint initiatives will enhance the overall educational impact across medicine and dentistry. Future research should focus on the long-term effects of AI integration on clinical skills and professional practice.

Keywords: Artificial Intelligence, Clinical Anatomy, Evidence based medical education, Cross-Disciplinary Collaboration

IA-0169

AIATELLA: Case Study on a Start-Up Automating Cardiovascular Disease Detection and Quantification

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Purpose: This case study aims to demonstrate the effectiveness of AIATELLA's AI in automating the detection and quantification of cardiovascular diseases. It also highlights the value of multi-modal solutions and discusses the necessity for training data that is diverse in demographics, not just in quantity. The study uses patient data from multiple sites, including the UK, US, India, and Europe, across various imaging modalities.

Methods: A retrospective imaging dataset was gathered, focusing on quantity, quality, and diversity, representing different demographics from the UK, US, India, and Europe. The dataset utilised modalities, across ultrasound, MRI, and CT scans. Investigators from each participating site evaluated the 'ground truth' and subsequently assessed the AI's performance on a testbed dataset, which included outliers and particularly challenging cases. A validation study was conducted to compare the AI's performance to that of the investigators at each site on unseen data, measuring accuracy, speed, and observer variability.

Results: Initial findings from the training phase indicate that models trained with international datasets of varying quality significantly outperform those trained on specific cohorts, as expected. Notably, the amount of data required to reach comparable performances was lower in the diverse model than the specific model, which was unexpected. The model demonstrated comparable performance across different imaging modalities, including CT, MRI, and ultrasound, which holds high clinical value. Furthermore, the model showed comparable performance in both contrast-enhanced and non-contrast-enhanced imaging, which was not expected.

Conclusion: The case study highlights the potential of AI in revolutionizing the detection and quantification of cardiovascular diseases. It underscores the importance of global partnerships in training AI on diverse datasets, leading to robust and reliable results across multiple imaging modalities. AIATELLA sets a new standard in the use of AI in healthcare, demonstrating the transformative potential of AI technology in clinical practice.

Keywords: Artificial Intelligence, Clinical Anatomy, Cardiovascular Disease, Radiology

IA-0025

Artificial Intelligence for Dental Malocclusion Identification

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Abstract: Artificial intelligence (AI) has been used in various area of dentistry including orthodontics which mainly deal with malocclusion. Conventionally, the procedures for diagnosing malocclusion are tedious as experts do landmarking manually and can lead to bias in judgement. However, the facial shape is difficult to extract due to the quality of lateral cephalogram images which contain much noise area. This research proposed a pre-processing framework to transform lateral cephalogram images into contour images that extract facial shapes from the lateral cephalogram images. Shape Classification Network (SCN) is used to classify skeletal malocclusion using transformed contour images. The proposed pre-processing framework achieves better classification results in terms of accuracy compared to the classification performed with the original images. In conclusion, this study introduces a pre-processing framework for skeletal malocclusion detection in lateral cephalogram images, transforming them into contour images for easier facial shape extraction and improved classification accuracy.

Keywords: Skeletal malocclusion, Lateral cephalogram images, Contour images, Shape Classification Network (SCN)

IA-0094

Utilization of Artificial Intelligence for Anatomical Assessment of Tooth Root Resorption

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Abstract: In the past, various subjective or linear methods have been used to assess root changes in orthodontics and orthognathic surgeries using two-dimensional (2D) and three-dimensional (3D) imaging techniques. Artificial intelligence (AI) in dentistry is an emerging field that combines the power of advanced technologies and dental expertise to improve dental care and diagnosis. This can assist dentists in making accurate diagnoses and designing appropriate treatment plans. The steps of the root assessment protocol consisted of segmentation, registration and 3D analysis, details of which are covered in the following sub-sections: 1. Segmentation: The DICOM images at each time-point were individually uploaded onto a CNN-based online cloud tool, 'Virtual Patient Creator'. The segmentation outcome was generation of a virtual 3D model of each tooth in Standard Tessellation Language file format. 2. Registration and 3D analysis. The segmented dentition was imported to 3-matic software. A script was incorporated into the 3-matic software for the quantification of root changes based on root length and volumetric. In this study, we included 110 patients who met the inclusion criteria. Of these patients, 30 underwent one-piece Le Fort I, fifteen underwent two-pieces Le Fort I, fifteen underwent three-pieces Le Fort I, and twenty underwent SARPE by using tooth-borne device. We also included 30 patients who underwent BSSO and only orthodontic treatment in the upper jaw that is called orthodontic group. The findings indicate that root resorption during orthodontic treatment, whether conducted alone or combined with maxillary surgery, remained minimal, with rates ranging from 4% to 7%. However, caution is advised when planning procedures like surgically assisted rapid palatal expansion or extensive maxillary advancement through Le Fort I osteotomies, as they were found to be associated with increased root remodeling. These findings have important implications for clinical practice and can help to optimize treatment outcomes and minimize risks.

Keywords: Artificial intelligence, Root resorption, CBCT, 3D

IA-0093

Artificial Intelligence as Supporting Identification Methods in Forensic Odontology: A Literature Review

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Abstract: Forensic dental identification stands at the forefront of medico-legal investigations as an essential tool for resolving complex cases. Recent technological advancements, particularly the integration of artificial intelligence (AI), have brought about a paradigm shift in this field. This paper presents a literature study of the role of AI as a supporting method in forensic dental identification, aiming to elucidate its profound impact on accuracy, efficiency, and collaborative potential. This article provides an in-depth overview of AI applications in forensic odontology contexts through a thorough search of existing academic literature in PubMed databases. It highlights the contributions of AI in streamlining identification processes and enhancing precision, thereby improving the efficacy of forensic investigations. In addition to online literature searches, reference lists from the included articles were manually examined for further discussion. Artificial intelligence technology holds vast potential for application in forensic odontology, particularly in three key areas: human bite marks, sex determination, and age estimation. Through the utilization of sufficiently large datasets, optimal algorithm architecture, and precise assignment of hyperparameters, this advanced tool can address complex challenges with remarkable accuracy, thus offering promising solutions to pressing issues in the field. Integrating AI into forensic dental identification presents a compelling opportunity to augment the precision and efficacy of the identification process. However, further research and practical implementation are essential to fully realizing the benefits of AI in this field. By embracing and harnessing AI technology and its capabilities, forensic dentists can enhance their investigative proficiency, thereby advancing the effectiveness and efficiency of forensic practices.

Keywords: Artificial intelligence, Forensic odontology, Human rights, Identification, Legal identity

[Symposium 20: Innovations in Anatomy Education: Navigating the Confluence of Tradition, Technologies and Games!]

IA-0168

The Evolving Landscape: Unveiling the Fate of Cadaver-Centric Anatomy Education

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Abstract: The human anatomy education, a cornerstone in the medical curriculum, is undergoing a significant transformation. Advancements such as virtual reality (VR), augmented reality (AR), digital anatomy tables, and 3D atlases are changing the landscape of cadaveric-based anatomy education. This integration of digital tools has sparked a debate about whether digital resources are the future of anatomy labs or if cadavers should remain as silent teachers in the labs. Students can learn anatomy from anywhere and at any time using digital resources due to their undeniable advantages of accessibility. VR allows for immersive 3D exploration of the body, offering unparalleled views of fine structures. Cost reduction is another potential benefit, as cadaver procurement and maintenance can be expensive. It is obvious that digital advancements shouldn't completely replace cadaveric-based education. Dissection provides a unique, hands-on learning experience that fosters a consolidated understanding of the human body's structures. Learning by using wet specimens enables students to understand the variations in human anatomy that they may experience in clinical practice. A hybrid model would be the ideal approach for the future of anatomy education in medical schools. This approach would leverage the strengths of both cadaveric-based and digital methods. Cadaver dissection could serve as the foundation, providing a tangible learning experience, supplemented with digital tools for enhanced visualization, targeted practice, and remote learning during unforeseen circumstances like pandemics.

Keywords: Cadaver, Education, Anatomy, Technology, Digital

IA-0023

A Plethora of Choices: Designing a Digital Anatomy Curriculum

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Abstract: Digital technologies are changing the landscape of higher education. How human topographic anatomy is taught and assessed has been dramatically influenced by the adoption of digital resources over the last twenty years. In Australia and around the world, there is a consistent increase in the adoption of digital modalities in anatomy education across all health disciplines in both undergraduate and postgraduate courses, particularly applied or advanced anatomy curricula. Moreover, there was a steep increase in virtual reality anatomy combining digital simulation for surgical anatomy training. Despite the wide adoption of digital technologies in anatomy teaching, however, still little comprehensive information is known on the selection and implementation of these digital resources when designing an anatomy curriculum. This talk will describe how combining multimodal digital resources supports blended and interactive learning in anatomy course design at Swinburne University of Technology, Australia. The author will also discuss the advantages and limitations encountered during course design and their recommendations for using these current digital technologies to further advance anatomy education, moving medical education further away from its didactic history.

Keywords: Digital anatomy, Virtual anatomy, Digital technologies, Augmented reality

IA-0040

Is Virtual Reality the New Norm for Teaching Gross Anatomy?

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Introduction: Virtual reality (VR) complements traditional anatomy classrooms. By paralleling synchronised traditional with virtual environments, VR aims to improve learner outcomes. Application of VR in anatomy classrooms may mitigate obstacles, such as the shortage of anatomists, increasing student numbers, and escalating maintenance costs of cadaveric labs. VR can facilitate autonomous learning environments, which catalyses active learning. Enhanced student engagement in VR classrooms and improved understanding of less-demonstrable body systems, such as the lymphatic system (LS), warrants further investigation into the effectiveness of VR as a complementary educational tool.

Materials and methods: In a mixed-methods study, the effectiveness of VR to examine the lymphatic system (LS) was evaluated. Thirty-five (n=35; M:F = 17:18) participants reviewed LS in VR during a one-hour session using an Oculus Quest Headset, running 3dOrganon software. A questionnaire comprising three open-ended and four closed-ended (7-point Likert scale) questions was used to conduct qualitative comparisons between VR and traditional classrooms methods (plastic model). Quantitative data were obtained via a combination of multiple-choice and viva-style anatomy quizzes, before and after the one-hour sessions.

Results: Initial results indicate that 85% of participants thought that the primary benefit of using VR in labs would be to provide learners with a deeper understanding of content, increased retention, and enhanced learning experiences. In this study, 92% of participants chose VR as a preferred distance education method for demonstrating organ-specific information in 3D. The results of this analysis indicated there is justification to blend VR with traditional pedagogy rather than plastic models.

Conclusions: The results of this work support the idea that VR may be an effective tool to complement traditional anatomy laboratories. This work also suggests that VR provides a highly engaging user-centred platform without compromising learners' ability to understand complex body structures and their anatomical relationships.

Keywords: Anatomy, Cadavers, Virtual reality, Distance learning, Active learning

IA-0115

A Blended Pedagogical Approach: Incorporating Prosections and Digital Technology

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Abstract: Anatomy education has undergone a significant transformation in recent years, embracing blended learning approaches that combine traditional approaches with digital technologies. This study is conducted at the University of Sydney, comparing the pedagogical approaches employed at its main campus and School of Rural Health (SRH) in Dubbo, focusing on Year-1 medicine students. While the main campus predominantly utilizes prosections during practical sessions, the SRH campus, adopts a blended approach, incorporating plastic models, the digital anatomy lab, and occasional hands-on prosection sessions. These digital resources include 3D virtual reality, 3D Complete anatomy, Sectra Table. The study evaluates the efficacy of these approaches in enhancing learning outcomes. Notable, both campuses offer identical curricula, with lecture material accessible synchronously via Zoom and recorded for later review. Moreover, students on the main campus could attend the lectures in-person. Summative assessments indicate higher scores of Anatomy and Histology Competitive Tests among SRH students, albeit with slightly lower Knowledge Applied Tests grades compared to the main campus. The benefits of the blended approach are multifaceted. Digital tools enhance the learning experience by providing dynamic visualizations and interactive content, while direct manipulation of cadaveric specimens deepens understanding of anatomical structures. Moreover, the flexibility of digital resources enables students to reinforce their knowledge outside of scheduled lab sessions at their own pace. Despite its advantages, challenges persist, including faculty training, technical support, and the development of high-quality digital content. Additionally, ethical considerations related to the use of cadaveric material in digital formats must be addressed. In conclusion, blending prosections with digital technology holds promise for enhancing anatomy education. As educators continue to explore innovative teaching methods, this model offers a pathway to more effective and accessible learning experiences for future healthcare professionals. Addressing challenges through ongoing development and support will be crucial in realizing its full potential.

Keywords: Anatomy Education, Blended Learning, Digital Technologies, Prosections

IA-0195

Levelling up Your Game!: A Scholarly Evaluation of Game-Based Learning

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Background: Game-based learning requires the same scholarly evaluation as any other educational method in order to understand both if and why they work. This presentation proposes a mixed-methods approach to evaluation, using first-person perspective video derived from wearable technology, together with traditional quantitative measures. It will use the example of escape room games for anatomy education, for which we conducted a mixed-methods study triangulating participant-generated video with pre-post testing and survey data to better understand how escape rooms may facilitate learning.

Methods: A student-teacher team was formed and undertook a formal co-design process to generate a novel and engaging escape room for students based on a dystopian future ruled by a rogue AI. The pedagogical design included challenges using anatomy models, histology slides and digital tools. Participants undertook a maximum of 45 minutes of escape room learning, followed by a 25 minute debrief. Each student group undertook a pre-test and post-test multiple choice quiz and were fitted with a single wearable camera (GoPro) on a chest mount. Thematic analysis of video data was undertaken in qualitative research software (Nvivo 14) and themes generated.

Results: 81 students have participated in the educational escape room, generating 550 minutes of video footage. Qualitative analysis revealed four themes: group problem solving, knowledge sharing, metacognitive behaviours and negative learning processes. Pre and post-test scores support the putative role of the escape room in enhancing participant's knowledge acquisition, and survey data further triangulates the positive reception and value of group learning.

Discussion: First-person perspective video, combined

with other triangulating data, can shed significant insight on the learning processes which occur between students in escape rooms. It allows teachers to evaluate whether students responded to the pedagogical design of individual puzzles as expected, and can additionally lead to further fine-tuning of the learning design.

Keywords: Game-based, Escape room, Mixed-methods, Qualitative

IA-0125

Reaching the Boss Level: Overcoming Obstacles in Game-Based Learning

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Abstract: Game-based learning can be defined as a teaching approach in which a game object is used to support the achievement of learning outcomes. An example of a game object is a serious game. Serious games are games which can be either digital or non-digital that are primarily used for education, training and healthcare, and entertainment being made secondary. In anatomy education, although game-based learning is recognised as a method for delivering teaching and learning while fostering students' engagement, it is not free from challenges and obstacles. The literature shows that educators face barriers and obstacles when using game-based learning methods. For example, a congested curriculum that limits the time available to learn and use gaming methods, unfamiliarity with using these techniques, the significant time required to master them, and the traditional attitudes of stakeholders that stigmatise gaming approaches as frivolous. A step to overcoming the obstacles is understanding the needs of the stakeholders, which include the anatomy educators, and gaining their perspectives on the concept of game-based learning using digital serious games. This presentation will discuss a qualitative inquiry study using reflexive thematic analysis to explore the perspectives of anatomy educators from a single institutional study in terms of their understanding of serious games regarding the utility, opportunities and challenges of using them. Following that, drawing from the anatomy educators' perspectives, a framework of implementation is proposed that should prescriptively overcome the common obstacles of game-based learning. This framework will be grounded in four areas, which include the anatomy curriculum, the educators, the students, and the game object in terms of learning, game, and ethical designs. During this presentation, the audience will also gain a high-level understanding of games including what is and what is not a game and the differences between game-based learning and gamification.

Keywords: Game-based Learning, Serious Games, Games

[Symposium 21: Anatomy as It Relates to the Clinic in Research and Teaching]

IA-0107

The Importance of Anatomy Training for Vertical Integration in Clinical Rotation

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Abstract: Learning and remembering basic sciences is essential in pre-graduate medical education. Requests and suggestions from clinicians and students to organize the existing anatomical education and add a clinical anatomy course to internships were evaluated, and clinical anatomy training was added to the curriculum at the beginning of some internships within the scope of vertical integration. It has continued to include various internships since 2016. This study evaluated the clinical anatomy education given to students in Gynecology and Obstetrics, Ear, Nose and Throat Diseases, Neurology and Orthopedics and Traumatology internships. In our study, for which ethics committee and administrative permissions were obtained, questions were asked to all students who received term 5 internships in the 2022-2023 and 2023-2024 academic years, on a 5-point Likert scale, via the Google Form Survey. Statistical analysis was performed, presenting the results as averages and percentages. Students' opinions about clinical anatomy were evaluated with an independent sample t-test. Of the 213 students who participated in the survey, 125 (58.7%) were in term 5 and 88 (41.3%) were in term 6. A significant difference was found between periods for the statement that clinical anatomy is required in vertical integration. Those who think that clinical anatomy training is necessary were found to be 70%. The desire to add anatomy practical training (65%) and support it using materials (55%) was determined. Regardless

of the period and gender, there was no significant difference in which internships clinical anatomy training would be added, and the desire to add clinical anatomy training was mainly detected in General Surgery, Cardiology and Ophthalmology internships, respectively. Vertical integration aims to integrate pre-clinical sciences with clinical internships. Our study also supported the view that clinical anatomy education effectively ensures understanding basic sciences, remembering its relationship with the clinic, and encouraging lifelong learning.

Keywords: Anatomy, Education, Curriculum, Internship, Survey

IA-0150

Morphometric and Morphologic Examination of Opponens Digiti Minimi in Human Fetuses

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Abstract: Opponens digiti minimi (ODM) is a hypothenar muscle that lies deep in abductor and flexor digiti minimi. Its functions are flexion of fifth digit on metacarpophalangeal joint, lateral rotation, and opposition of fifth digit during fine motor movements. Such actions are important for a strong, hand grip. Ulnar nerve compression at Guyon's canal can be caused by variant hypothenar muscles. Due to hidden location of ODM, it mostly lacks variations and is sometimes missing. In this context, this study aimed to examine origin, insertion, morphometric features, and variations of ODM in human fetuses. Twenty-six sides of 32 fetuses (mean age: 23.63±4.13weeks, 11 boys, 21 girls) in laboratory of Gaziantep University Anatomy Department, were dissected. Dissection was performed using a surgical microscope (CarlZeissMeditecAG, OpmiPicaModelS100, Germany) at x10 magnification and photographed. ODM's origin and insertion were determined. The length, width, and area of ODM were measured. The study was conducted following ethical rules of Declaration of Helsinki. Results of the literature review and our dissection of 2 types have been detected for the ODP according to its origin and insertion. It was found that ODM started from the hamate bone-flexor retinaculum and ended at the ulnar side of the fifth metacarpal bone in all fetuses. The mean ODM width, length, and area were 2.25±0.81mm, 7.04±3.21mm, and 13.32±8.70mm2 respectively. Linear function was calculated as y =-0.754+0.330xweeks (p<0.001) for ODM-Length, as y =-0.040+0.096xweeks (p<0.001) for ODM-Width, and as y =-13.236+1.124xweeks (p<0.001) for ODM-Area. It is thought that ODM, which is often neglected due to its deep location and small size, may be important in the differential diagnosis of ulnar neuropathies. In this study, the growth pattern of ODM was examined and the developmental dynamics were determined according to fetal weeks. In addition, the typing of the muscle according to origin and insertion is the first and may contribute to future.

Keywords: Fetus, Dissection, Opponens digiti minimi, Hypothenar region

IA-0052

Reflection of the Anatomical Perspective in Clinical Practice

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Abstract: The field of clinical anatomy forms the basis for the practice of medicine and healthcare. This topic explores the intricate interplay between anatomical knowledge and its application in a clinical context. It examines the essential role of anatomy in understanding the structure and function of the human body and emphasizes its importance in the diagnosis and treatment of disease. It provides a comprehensive overview of the various systems of the human body, including the musculoskeletal system, the cardiovascular system, the nervous system and the gastrointestinal system, and emphasizes their clinical relevance. In addition, clinical anatomy discusses modern imaging techniques and technological advances that allow medical professionals to visualize and understand anatomical structures with greater precision. Clinical case studies and real-world examples illustrate how a deep understanding of anatomy improves clinical decision-making and surgical procedures. By bridging the gap between theoretical anatomical knowledge and its practical application, this clinical anatomy aims to equip healthcare professionals with the tools

they need to provide competent, compassionate, and effective patient care. In summary, this "Clinical Anatomy" theme is a foundational exploration of the synergistic relationship between anatomy and clinical practice and illuminates the central role of anatomical knowledge in shaping the future of healthcare. It serves as an invaluable resource for medical students, physicians, and anyone wishing to gain a deeper understanding of the vital link between anatomy and clinical excellence.

Keywords: Clinic, Anatomy, Education

IA-0161

The Relationship of the Optic Nerve and the Ophthalmic Artery in the Optic Canal: An Anatomical View with an Endonasal Endoscopical Approach

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Abstract: Optic nerve and optic canal, which were surrounded by important neurovascular structures, can be affected by many pathologies such as tumors, traumas, vascular pathologies and inflammatory processes. In the presence of these pathologies, surgery was performed for resection and decompression. In this study, optic nerve decompression via endonasal endoscopic approach was perfomed on 10 head cadavers. Anatomical landmarks used during endoscopic approach to the opticocarotid region and located on the roof of the sphenoid sinus were evaluated. The relationships of the the opthalmic artery and the optic nerve and the opthalmic artery and the internal carotid artery were evaluated. The diameter of the opthalmic artery was measured in all of the cadavers. Optic prominence, carotid prominence and lateral opticocarotid recess were prominent bilaterally in all cadavers. The amount of decompression applied to the optic nerve was measured averagely as 6.60±0.69 mm on the right side and 7.00±1.33 mm on the left side. The origin of the opthalmic artery was inferior to the optic nerve in 50% of the cadavers, inferomedial to the optic nerve in 35% of the cadavers and inferolateral to the optic nerve in 15% of the cadavers. The origin of the opthalmic artery was superomedial to the internal carotid artery in 60% of the cadavers, superolateral to the internal carotid artery in 35% of the cadavers and superior to the internal carotid artery in 5% of the cadavers. The diameter of the opthalmic artery was measured as 1.03±0.06 mm on the right side and 1.14±0.2 mm on the left side. Despite the developing technology, advanced imaging methods, and surgical techniques, it is extremely important to know the anatomy to reduce the risk of neurovascular damage and to reveal safe surgical margins.

Keywords: Optic nerve, Endoscopy, Endonasal, Decompression, Anatomy

IA-0151

Measurement Reliability in Terms of Base of Cranium

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Abstract: Any aspect of physiological function is determined by the underlying morphology, and measurement is the most objective method of evaluating and comparing morphology. Morphometrics, often known as morphometry, is the quantitative study of an organism's or organ's size and shape based on measurements. Morphometric data are an invaluable source of information for comprehending many phenomena in biology. Thus, morphometric measurements should be performed in a standardized manner. As with any quantitative biological measurement, it is critical to minimize error and understand the various approaches for estimating and assessing it. The acceptability of measured variables for subsequent analyses in the main study cannot be determined without quantification of measurement error. Therefore, an estimate of measurement error is required as part of each investigation. The most frequently used metrics of this are the technical error of measurement (TEM), relative technical error of measurement (rTEM) and coefficient of reliability (R). TEM provides a standard deviation-like measure of the magnitude of error, and it is in the original units of measurement. rTEM represents an estimate of error magnitude relative to the size of the measurement and expressed as a percentage. R represents the proportion of between-subject variance free from measurement error. The aim of this presentation is to give estimates of intra-observer precision for various measures collected at the base of the skull. Thus, precision estimates of several studies

are presented. The findings indicate that each study's morphometric measures had an adequate level of intra-observer reliability. The magnitude of measurement error is critical for interpreting morphometric data because large measurement errors might have a negative impact on statistical results.

Keywords: Morphometry, Measurement, Error, Reliability, Base of cranium

IA-0059

Extracranial Transport of Brain Lymphatics in Human

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Introduction: Extracranial transport of waste, macromolecules, and immune cells from the brain to lymph nodes is not extensively understood. The present study aims to show the role of dural sinuses, cranial nerves, and meningeal arteries in the extracranial transport of brain lymphatics vessels (LVs).

Methods: Sections were obtained from 6 autopsies and 3 cadavers were stained with Podoplanin (PDPN) and CD31 immunohistochemistry, and Western blotting was applied to samples.

Results: The IHC staining showed the presence of mLVs accompanying both dorsal and basal dural sinuses. The mLVs accompanying the dorsal had a larger dimension compared to the basal dural sinuses. However, the number of mLVs along the basal dural sinuses was more than the mLVs along the dorsal ones. Furthermore, the LVs were observed along the olfactory, optic, oculomotor, trigeminal, facial, glossopharyngeal, vagus, and accessory nerves. However, no LVs were present along the trochlear, abducens, vestibulocochlear, and hypoglossal nerves. The LVs were predominantly localized at the endoneurium of the cranial nerve that has motor components, and LVs along the cranial nerves that had sensory components were present in all 3 layers. The largest diameter of LVs was in the epineurium and the smallest was in the endoneurium. Moreover, we observed the presence of the LVs along the main trunk of MMA and its two branches, AMA, and PMA. The LVs along the MMA (main trunk) had a larger average diameter than its branches and the AMA and PMA. The mean diameter of LVs accompanying the PMA was larger than AMA. The Western Blotting supported the IHC data.

Conclusion: The knowledge of the presence of LVs accompanying dural sinuses, specific cranial nerves, and meningeal arteries in humans can increase the understanding of how LV contributes to the brain lymphatic circulation and may help understand the neuropathophysiological processes of various neurological diseases.

Keywords: Lymphatic system, Dural sinus, Cranial nerve, Meningeal artery, Human

IA-0095

Contributions of Neuroanatomy to Artificial Intelligence and Automation

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Abstract: In this paper, the structure and function of the human nervous system from the viewpoint of artificial intelligence and automation are discussed by the author's self-experiences. As a third element in the human-interface-machine triad, intelligent interfaces serve as translational mediators between people and machines. They aim to optimize the cooperative potential of humans and machines by exchanging reciprocal questions and actions in the most appropriate symbols for each participating entity. Improving the mutual adaptation capacity of the human-interface-machine triad's individual members or the triad as a supraordinate unit is the best way to achieve these aims. By doing function allocation, the designers take into consideration the role of humans, integration of human and automation systems, fatigue, hazards, costs and human values. Investigation of the human nervous system from an integrative perspective provides a better understanding of the basis of automation, designing a better function allocation. The nervous system includes four steps to perform a motor action, sensory processing, perception, decision-making and response. There is both structural and functional hierarchy in the human nervous system. Therefore, the nervous system executes a response from the basic reflex activity to the complex fine movements depending on at which level this four-step process is completed. This is a magnificent example of hierarchical task analysis. In most parts of the human nervous system, the steps are also organized in a cyclic way or a serial order. The human nervous system is the best model for the distribution of authority, sharing responsibil-

ity and controlling ways for designing function allocation in the human-interface-machine triad. High cognitive demands in the human-interface-machine triad also can influence the function allocation in the new man-machine systems. It is expected that this paper will offer an overview of this emerging area and the new and future areas of artificial intelligence applications.

Keywords: Human nervous system, Automation, Artificial intelligence, Function allocation

[Symposium 22: 3D Printing in Anatomy: from Undergraduate Training to Translational Research and Clinical Applications]

IA-0203

Structural, Physical, and Biological Features of Materials Useful for Implantable 3D Printable Medical Devices for Anatomical Reconstruction

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Abstract: There has been great interest in 3D printed devices for potentially personalized anatomical reconstruction of various tissues and organs. There has been a plethora of studies in this field, making it difficult to navigate the existing information. In this presentation, the authors will review and summarize the most recent literature on 3D printable materials potentially useful for bone, fascia, nerve, and vascular reconstruction. Their structural, physical, and biological features will be discussed, as well as their biological properties. Moreover, the issue of device biofunctionalization will be discussed. Finally, the authors will address the various techniques available for device sterilization before implantation. The authors will draw on their experience with several experiments in this field to provide a personal view of this subject. When developing implantable 3D printable medical devices, a comprehensive understanding of these structural, physical, and biological features is essential. The choice of materials and printing technologies should align with the specific clinical application, ensuring that the final product is safe, effective, and capable of promoting tissue regeneration and integration, and eventually anatomical restoration. Further multidisciplinary studies are warranted to answer numerous lingering questions, and obtain the incontrovertible evidence of safety and efficacy required to certification before clinical use.

Keywords: 3D Printing, Medical Devices, Biocompatibility, Biodegradation, Sterilization

IA-0204

Digital 3D Evaluation of Surface Topology and Clinical Applications

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Abstract: Digital representations of anatomical structures lend them amenable to sophisticated 3D evaluation using topological analysis software. This analysis is invaluable in the clinical setting, facilitating the decision-making process in a personalized and non-invasive manner. 3D anatomical representations of individual patients can be rendered by commonly used image tests, such as CT or MRI scans. Recently, more affordable 3D scanners have been used. Brachial plexus lesions have an important deleterious impact on the lives of those affected. One of the main culprits is the precocious manifestation of glenohumeral joint dysplasia whose effects tend to be permanent. The authors produced digital representations of the shoulder joint surfaces of pediatric and adult patients with brachial plexus injuries. Both surfaces were evaluated for congruency with resort to a dedicated software. The data lend numerical support to the empirical clinical observation that the joint surfaces rapidly become incongruent after a brachial plexus lesion. This information seems promising for tailoring nerve and tendon transfers for individual patients. Another clinical problem concerns defects of the proximal interphalangeal joint of the fingers. These are common and difficult to treat. Recently, some authors have proposed to use part of the dorsal and distal aspect of the hamate for reconstructing the base of the middle phalanx. Subsequently, Cavadas proposed to use the base of the fifth metacarpal bone to reconstruct individual condyles of the proximal phalanx. However, the anatomical studies supporting these options are scarce and present conflicting data. We analyzed the 3D surface congruency

of the mentioned surfaces using 3D virtual representations derived from hand CT scans of patients presenting no injuries in these regions. Our data support the use of the mentioned donor areas for reconstructing the proximal interphalangeal joint of the fingers.

Keywords: 3D Printing, Medical Devices, Anatomy, Anatomical variations, Medical Imaging

IA-0207

3D Printed Devices in Vertebral Reconstruction

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Abstract: Current guidelines used in the treatment of burst vertebral fractures are controversial and sometimes fail to predict progression to necrosis. There is high variability between surgeons in how to treat this type of fractures, which can go from conservative treatment to invasive corpectomies and reconstructions. There is a need to stratify and define the best treatments for these particular type of fractures. 3D printing has been able to increasingly faithfully replicate various types of natural tissues, of which bone is no exception. The goal of our experiment procedure is to assess the efficacy of 3D printed medical devices with different biological materials (combinations of polylactic acid or polycopraquetone scaffolds functionalized with glutamide or chitosan or both) in replacing the L1 vertebral body in 40 Wistar rats, in order to allow a biological reconstruction of spine that can replace a compromised vertebral body, affected for exemple by post-traumatic vertebral necrosis. In 40 Wistar rats, first by an anterior retroperitoneal approach was performed in order to identify the L1 vertebral body. After this, a complete removal of the vertebral body was carried out and this was replaced by a biological implant and fixed to the adjacent vertebral bodies by sutures. Then, the animals were sequentially sacrificed after 3 weeks, the vertebrae were resected and analyzed macroscopically and in histological terms, evaluating their state of vascular invasion, osseointegration and consolidation. The objective is, in situations of fractures in which it is assumed that the intraosseous arterial microvascularization is compromised to the point of not allowing bone healing, to have options for biological replacement of the vertebral body, in order to obtain a vertebra as close as possible to the native one in anatomical and biomechanical terms. We present the preliminary results of this ongoing experiment and the potential importance of its clinical application.

Keywords: 3D Printing, Medical Devices, Orthopaedics, Surgery, Bone

IA-0206

3D Printed Devices for Fascial and Uterine Reconstruction

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Abstract: There has been a recent interest in 3D printing for anatomical reconstruction in Gynaecology and Obstetrics. In fact, fascial defects after laparotomy, perineal prolapses due to pelvic floor weakening, and uterine wall thinning due to previous surgeries are common problems with frequently faulty reconstructive options. Personalized 3D printed devices for fascial and uterine reconstruction represent a promising advancement in personalized medicine. The authors provide a synopsis of the literature in this field, drawing on their previous experimental results to give a more personalized insight. The materials used require the ability to withstand significant intra-abdominal pressure in fascial reconstructions and contractions in uterine repairs. However, they also need to be flexible in order to mimic natural tissue behavior. Porous scaffolds allow for tissue ingrowth and vascularization, providing the additional advantages of facilitating fluid exchange and nutrient delivery. They should be non-immunogenic, to avoid a host versus graft reaction. Ideally, they would have a controlled degradation, matching the tissue healing process to support temporary scaffolding which is gradually replaced by natural tissue. Polylactic Acid (PLA), Polycaprolactone (PCL), and Polyurethane (PU) are amongst the materials most frequently used in this field. The authors have used the first two materials in a rodent model of fascial defects with promising results. By focusing on the structural, physical, and biological features, as well as leveraging appropriate materials and printing technologies, these devices can significantly improve patient outcomes

in complex anatomical repairs. Collaboration between material scientists, biomedical engineers, and clinicians is essential to ensure the successful development and implementation of these innovative medical devices.

Keywords: 3D Printing, Medical Devices, Gynaecology and Obstetrics, Fascia, Surgery

IA-0205

Anatomical 3D Printing: Teaching and Clinal Applications from the Newborn to the Elderly Person

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Abstract: In this presentation, the authors describe their experience with the use of 3D printing in the teaching and clinical settings for over a decade. At the undergraduate level, the authors have been using anatomical replicas of various anatomical structures, either as entire organs or sectioned ones, providing students with hands-on experience, and enhancing their understanding of complex anatomical structures. Models of anatomical variants, some of them very rare, have been used to illustrate morphological variability. Additionally, representations of phylogenetic ancestors' bones, obtained from CT scans of fossil registries, create an intuitive first approach to paleontology and to compared anatomy. This would hardly be possible without the resort to 3D printing, given the scarcity of original fossils. Finally, 3D representations of anatomical structures at scale allows the creation of miniature organs that can be easily carried and manipulated. At the postgraduate level, the authors have been using 3D representations of relevant anatomical structures, for surgical residents' training. This approach has been especially useful for complex and rare surgical procedures. The trainees can repeat the procedures as many times as they want in a stress-free environment and under supervision or by their own. Finally, the authors have been using 3D printed anatomical models in the clinical setting to explain diseases to patients and health care personnel, as well as to prepare to perform complex surgeries. Various techniques can be simulated in different replicas of the pertinent anatomical structures. Anatomical 3D printing has revolutionized both medical education and clinical practice. This technology allows for the creation of precise anatomical models that can be used for a variety of educational and clinical purposes.

Keywords: 3D Printing, Medical Devices, Plastic and Reconstructive Surgery, Surgery, Reconstruction

[Symposium 23: Innovative Imaging Technologies: Unveiling the Ultrastructure of Cell Organelles]

IA-0034

Seeing is Believing: An Ultrastructural Perspective and Insight into the Process of Autophagy

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Abstract: The word "autophagy" (first coined by Nobel Laureate Christian de Duve in 1963) means "self devouring" or "self eating". Autophagy is a process that degrades intracellular components such as organelles, proteins, lipids, and nucleic acids via the lysosomal pathway. Autophagy is classified into non-selective autophagy, for instance macroautophagy (non-specific engulfment of cytoplasmic components), and selective autophagy where there is sequestration and degradation of specific targets, such as damaged mitochondria (mitophagy). The transmission electron microscope is a useful tool to directly visualize the dynamic autophagic compartments viz., pre-autophagosomal phagophore, autophagosome and autolysosome. The ultrastructrural features of gold nanoparticle-induced macroautophagy in lung cells in vitro will be demonstrated using Conventional Transmission Electron Microscopy (TEM), Focused Ion Beam Scanning Electron Microscopy (FIB-SEM) and 3D reconstruction of EM images. To further illustrate the autophagic process in an in vivo model, TEM images of the liver of mice fed with caffeine would be shown. Additionally, an example of mitophagy such as that in liver cells induced by thyroid hormone will also be presented. EM complemented with other biochemical and genetic assays could provide valuable information and verification of the process of autophagy.

Keywords: Transmission electron microscopy, Autophagosomes, Lysosomes, Mitophagy, Cell culture

IA-0105

Regulation of Autophagy by the Intracellular Ca2+ Channel TRPML3

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Abstract: Autophagy progresses through Ca^{2+}-dependent multiple fusion events. Recently, we reported that the intracellular Ca^{2+} channel TRPML3 provides Ca^{2+} for autophagosome formation as a downstream effector of PI3P. However, the molecular mechanism of Ca^{2+} signaling in the late stage of autophagy remains unknown. Here, we show that TRPML1/3 heteromer is the Ca^{2+} provider for autophagosome-lysosome fusion. TRPML1/3 functions downstream of PI4P to increase autophagosome-lysosome fusion and the Ca^{2+} signal via PI4P-TRPML1/3 is decoded by synaptotagmin 5 (SYT5) Ca^{2+} sensor. The binding of Ca^{2+} and PI4P to SYT5 is critical for autophagosome-lysosome fusion by forming a fusion complex. Collectively, these results reveal that PI4P-TRPML1/3-SYT5 constitute the Ca^{2+} signaling complex in autophagosome-lysosome fusion and that TRPML3 also regulates late stage of autophagy by heteromerization with TRPML1 in a phosphoinositide-dependent manner.

Keywords: Autophagy, Ca2+ channel, TRPML1/3, SYT5, PI4P

IA-0159

Unraveling the Role of Non-Neuronal Cells in Brain Pathology

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Abstract: In acute central nervous system (CNS) injuries, such as ischemic stroke, non-neuronal cells, including astrocytes, microglia, monocytes, lymphocytes, fibroblasts, and endothelial cells, play crucial roles in injury-specific responses, including neuroinflammation and scar formation. We comprehensively analyzed the contributions of these cells using various immunolabelling techniques and microscopy at different scales. First, the involvement of glial cells in delayed neuronal death and their role in microcalcification and corpora amaylacea formation was investigated. Immunoelectron microscopy and correlative light and electron microscopy revealed that osteopontin, a cytokine synthesized and secreted by microglia and astrocytes in the striatum and hippocampus after brain injury, serves as a marker for corpora amylacea and microcalcification. Additionally, astrocytes were found to function as immune cells alongside microglia, participating in phagocytosis. Second, we investigated fibrotic scar-forming cells following CNS injury. Recent studies have shown the presence of fibrotic scars, which significantly impede axon regeneration, in addition to the well-recognized astrocytic glial scars. Immunolabeling techniques demonstrated that cells expressing platelet-derived growth factor receptor beta are major contributors to CNS fibrosis. The ultrastructural features of these cells were characterized, revealing their presence in the perivascular region and leptomeninges, as well as differences in activation status based on their anatomical location. Three-dimensional reconstruction of serial sections uncovered the unique lamellar morphology of the cell processes, emphasizing the importance of this technique in capturing cellular architecture complexity. In conclusion, this study presents a methodology utilizing immunolabeling techniques observable under various scales of microscopy to analyze the distinct biological functions of non-neuronal cells following brain injury, providing valuable insights into their roles in neuroinflammation and scar formation.

Keywords: Osteopontin, Microcalcification, Corpora amylacea, Fibrotic scar, Platelet-derived growth factor receptor beta

IA-0062

Hepatoprotective Effect of Polygonum Munus Flavonoid-Rich Fractions Against Cisplatin-Induced Hepatocyte Injury: An Electron Microscopic Study

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Background: Cisplatin (CP) is a chemotherapeutic drug for various cancers. However, it has cytotoxic effect to liver, kidney, and nervous system, which limit its therapeutic usage. Its toxicity occurs due to oxidative stress, inflammation, and DNA damages. Natural products with flavonoids possess potent antioxidant and anti-inflammatory properties. Polygonum minus (P. minus), a local traditional plant known as 'kesum' with high antioxidant level was used in this study.

Objective: It was aimed to observe the hepatoprotective effect of P. minus-flavonoid rich fractions (P. minus-FRF) via electron microscope (EM) study.

Method: P. minus leaves were naturally dried and extracted to obtain the crude extract and further proceeded with fractionation to acquire its flavonoid-rich fractions prior to in vivo study. Forty healthy male rats were divided into 5 groups: Groups A and B were administered with distilled water, Group C was given quercetin, and Groups D and E were administered with P. minus-FRF 100mg/kg and 200mg/kg respectively for 14 days. At day 15, Group A was injected with normal saline whereas other groups were administrated with CP and all rats were sacrificed on day 18. Liver samples were harvested and kept in 3% glutaraldehyde for further EM analysis.

Results: The rats injected with CP exhibited ultrastructural alterations including oval pyknotic nuclei with marginated heterochromatin and irregular nuclear membrane. The cytoplasm contained vesiculated rough endoplasmic reticulum and atrophic mitochondria. Some mitochondria exhibited swollen with degenerated cristae. The Pm-FRF treated groups demonstrated protective effect such as normal chromatin distribution and prominent nucleoli. Pm-FRF also preserved the mitochondria with normal endoplasmic reticulum and glycogen. Therefore, we conclude that flavonoid-rich fractions of P. minus are potential hepatoprotective agent against CP-induced liver injury.

Keywords: Polygonum minus, Flavonoids, Cisplatin, Ultrastructure, Hepatotoxicity

[Symposium 24: Paleopathology and Biological Anthropology]

IA-0186

Paleopatholgy in Korea from the Perspective of Parasitology

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Abstract: It has been about 30 years since the intensive growth of paleoparasitological research in Korea. During the time, lots of parasitological studies have been carried out in various archaeological sites like moats, tombs and ancient toilets. And we have conducted paleopathological studies on people who lived in previous eras based on these findings. Typical parasites were nematodes and trematodes. It was estimated that the infection rate of these parasites decreased from the past to the present, and probably assumed that the improvement in public health, the development of agricultural technology, and the use of drugs such as anthelmintics after industrialization had a significant impact. However, until recently, studies on ancient parasites have been based on the presence of their eggs in human organic matter under a microscope or the application of molecular biological techniques such as PCR for only a few target species, making it difficult to analyze species such as protozoa, which may be small in number or decomposed and not easy to identify morphologically. Therefore, to obtain accurate information about parasites from previous eras, it is recommended to use NGS technique on all samples. Obviously, the further accumulation of the NGS data on ancient parasites will further enrich paleopathological inshights. This research was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea gov-

ernment (MSIT; No. 2022R1C1C1013540).

Keywords: Paleopathology, Parasitology

IA-0129

Prevalence and Possible Causes of Vertebral Compression Fracture in the Human Remains from Okhotsk Culture Archaeological Sites in Hokkaido, Japan

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Purpose: The Okhotsk culture people were maritime foragers who inhabited Hokkaido, Sakhalin, and Kuril Islands in the late first millennium AD. A few case reports indicate that the vertebral compression fractures (VCFs) on the thoracolumbar junction prevailed in the Okhotsk people. The aim of this study is to evaluate the prevalence of the VCFs in the Okhotsk human remains excavated from the Moyoro shell mound site, the settlement, enshrinement and trading center of the period in eastern Hokkaido, and to discuss the possible causes.

Methods: A total of the 259 thoracolumbar (Th1 to L5, and two anomalous L6) vertebral bodies of the 21 individual skeletons from the Moyoro site (10 young adults, probably 40> age, and 11 middle and old adults, probably >40 age) were examined. We first qualitatively identified fractured vertebrae, and then quantitatively evaluated the vertebral deformity by deviations of anterior-to-posterior and middle-to-posterior height ratios of the vertebral body from those of the non-fractured vertebrae.

Results: VCF was found in 6.9% (18/259) of the Th1–L6 vertebrae and 11.1% (13/117) of the Th11–L6 vertebrae, respectively. While fracture was not found in the young adults, about a half of the middle and old adult skeletons (6/11 or 54.5%) had at least one fractured vertebra. Of the vertebrae which were qualitatively regarded as fractured, significant deformity was also detected quantitatively (z-scores < -3.0) in all but one of them.

Conclusion: High prevalence of VCFs on the lower thoracolumbar region was found in the Moyoro population of the Okhotsk culture. Considering a recent study showing that exposure to warm temperature can reduce the risk of osteoporosis through polyamine production by gut microbiota, the prevalent vertebral deformity of the Okhotsk people might be partly attributable to their subsistence in cold environment as well as mechanical stress associated with daily activities such as boating.

Keywords: Vertebral compression fracture, Okhotsk culture, Osteoporosis, Marine foragers, Cold environment

IA-0126

Exostoses of the External Auditory Canal in Ancient Human Bones Excavated from the Kyushu Region of Japan

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Abstract: Bony prominences of the temporal bone, which constitutes the external ear, are called exostosis. In modern people, it tends to be observed in surfers and divers who spend much time underwater, and cold-water stimulation is thought to be a contributing factor. We investigated the occurrence of the exostoses on the temporal bones of archaeological human bones excavated in the Kyushu area, Japan (49 sides of an Okinawa Jomon-Yayoi equivalent, 490 sides of a Yayoi period human bone, and 230 sides of a Kofun period human bone) in Nagasaki University's collection. We compared the results to clarify the differences in frequency of occurrence between populations. The frequency of occurrence among Yayoi period people was 31.8% for males and 0% for females from Okinawa Jomon-Yayoi equivalent, 5.0% for males and 1.3% for females from Northern Kyushu Yayoi, and 29.3% for males and 3.5% for females from Western North Kyushu Yayoi. The high frequency of occurrence among the Northwest Kyushu Yayoi, whose occupation might be fishing in coastal areas, and the low frequency among the North Kyushu Yayoi, whose occupation might be farming in the plains, are consistent with the cold-water stimulation hypothesis. On the other hand, the frequency of Kofun period people was 29.1% for males and 25.7% for females living in the mountains of Southern Kyushu, 30.0% for males and 0% for females living in the plains of Southern Kyushu, and 27.3% for males and 27.3% for females living in the inland areas of Kumamoto Prefecture. These results sug-

gest that some factor other than cold-water stimulation induces it. The frequent exostoses on Kofun period human bones excavated from the same tomb suggest that genetic factors may also contribute. We will discuss the above data with observations of human bones equivalent to those of the Jomon period.

Keywords: Exostosis, Paleopathology

IA-0144

Anthropological Research of Post-Mortem Investigation Records in Jeungsu Muwonrok Eonhae of Joseon Dynasty Period

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Abstract: Jeungsu Muwonrok played a crucial role in shaping traditional forensic investigation methods in pre-modern East Asian societies. Documents from the Joseon period, based on Muwonrok, are referred to as Geoman and contain post-mortem examination records and interrogation reports of individuals connected to incidents. By examining these documents through a medical lens, we can gain significant insights into the cause of death and the circumstances surrounding the events. However, a significant challenge has been the lack of anatomical analysis of the terminology for various body parts, which hampers precise understanding of the records. This study aims to support researchers investigating Joseon Dynasty post-mortem records by accurately identifying the anatomical locations of the body parts mentioned. The review shows that translating the terms used for body parts in these documents into modern anatomical language is generally straightforward. Nevertheless, the descriptions of head positions are less clear and require more detailed examination. The findings from this study are expected to enhance the accuracy of interpreting crime scenes as described in the post-mortem records from the Joseon period. This study was supported by the Convergence Research Support Program of Seoul National University (800-20220548) and the Education and Research Encouragement Fund of Seoul National University Hospital (2023-2024).

Keywords: Geoman, Muwonrok, Forensic medicine, Anatomy, Post-mortem investigation record

IA-0079

Caries, Wear, Periodontal Disease-Points of Research on Oral Health of Ancient People

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Abstract: The presentation will also discuss how caries, dental wear and periodontal disease were related to each other to determine the oral hygiene of prehistoric and ancient peoples. This presentation will discuss how caries, dental wear, and periodontal disease were related to determining oral hygiene in prehistoric and ancient peoples, based on the presenter's years of accumulated data and experience. Prehistoric and Ancient dental caries rarely occurred on flattened occlusal surfaces due to their severe dental wear, and were most seen on cemented root surfaces' caries all over the world below the CEJ, which were exposed by periodontal disease. However, occlusal surface caries is also seen in younger individuals with non-severe dental wear, suggesting that severe dental wear may have obliterated the initial caries. In addition, as these results of observations of archaic human remains from around the world, alveolar recession and periodontal diseases occur even in populations where caries is not found. To discuss oral hygiene from the perspective of paleohealth, a comprehensive viewpoint is necessary. In other words, dental caries, periodontal disease, and dental wear are epidemiological factors that closely influence each other. The presenter, who has studied the teeth of many ancient human remains not only in Japan but also in many foreign countries, understood that it is impossible to discuss oral diseases from the viewpoint of paleohealth and paleopathology in a comprehensive and in-depth manner by simply separating caries, periodontal disease, and dental wear. The presentation will also discuss how caries, dental wear and periodontal disease were related to each other to determine the oral hygiene of prehistoric and ancient peoples. And I strongly suggest how the future of dental paleopathology must incorporate a multidisciplinary viewpoint such as that presented in this oral presentation and the results of modern dental medicine.

Keywords: Dental caries, Dental wear, Periodontal disease, Paleopathology, Paleohealth

[Symposium 25: Biomechanics in Clinical Anatomy]

IA-0030

Large-Scale Modeling of the Relationship Between Auricular Surface Morphology and Sacroiliac Joint Mechanics

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Abstract: Large variation has been reported in sacroiliac joint (SIJ) morphology, especially concerning the auricular surface. This variation does influence the morpho-mechanical link of the sacroiliac joint, which is a core node for energy transmission between the trunk and lower limbs. The impact of auricular surface morphology on stress and deformation in the SIJ remains the subject of contemporary research. Pelvic ring geometries were extracted from 281 clinical CT scans. The auricular surface, SIJ thickness, and total volume were identified. From these reconstructions, 281 finite element models were created to simulate SIJ mechanical loading and stress distribution patterns. It was found that SIJ thickness weakly depended on age and laterality but strongly depended on sex. Auricular surface area and SIJ volume depended weakly on age and peaked around menopause in females, but with no laterality effect. Principal stress and strains, as well as total SIJ deformation energy, remained uninfluenced by SIJ thickness. SIJ stress and total deformation energy decrease exponentially if the auricular area and SIJ volume decrease. Furthermore, SIJs with larger auricular surfaces were exposed to less stress and strain under similar loads. Larger SIJs may therefore be capable of bearing larger loads.

Keywords: Sacroiliac joint, Biomechanics, Finite Elements Simulation, Auricular Surface

IA-0123

Dynamic Studies of the Human Thoracic Duct and Lymphovenous Junction Using Heavily Weighted T2 Magnetic Resonance Imaging: A Pilot Study

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Introduction: One third of patients admitted to the Emergency Department die due to organ failure. Understanding the lymphatic flow and the impact of venous circulation, arterial circulation and respiration will help clinicians to understand the pathophysiology of organ failure. This pilot study is to use of non-contrast heavily-weighted T2 MRI to visualise the anatomy of the lymphovenous junction and central lymphatic system, including the thoracic duct, cisterna chyli and lymphovenous junction, and its potential to calculate dynamic physiological quantities such as thoracic duct lymph flow.

Methods: Magnetic resonance imaging was used to visualize major lymphatic vessels and the blood vessels in vivo in two human torsos. All scanning was conducted on a 3T GE Medical Systems MRI scanner. Heavily weighted T2 imaging was conducted to highlight the slow-moving fluid within the major draining lymphatic vessels in a region of interest that covers the torso. Phase contrast flow imaging was conducted in the same regions of interest, with the same image resolution as anatomic images to enable quantification of volumetric lymph flow in the major lymphatics.

Results: The central lymphatic system (thoracic duct, cisterna chyli and major lymphatic tributaries) were successfully demonstrated. Venous structures were also visualized as dark pixel intensities. A set of axial cross-sectional images with resolution 0.6x0.6x1.6mm, and 600-700 slices per participant were produced.

Conclusion: Non-contrast heavily weighted T2 MRI can be used to characterize the structural and functional anatomy of the thoracic duct.

Keywords: Lymphovenous junction, Lumphatics, MRI, Lymphatic flow

IA-0096

Biomechanical Study on Pedicle-Legthering Osteotomy, a Potental New Sugical Operation for Lumbar Stenosis

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Abstract: Pedicle-lengthening osteotomy is a new percutaneous minimally invasive surgical procedure for lumbar spinal stenosis that enlarges the dimensions of the spinal canal and neural foramen through bilateral lengthening of the lumbar pedicles. This new technique increases the volume of the lumbar vertebral canal, maintaining normal spinal kinematics and reducing the risk of blood loss and muscle damage. Three-dimensional reconstructions of CT images were performed for 69 patients (33 men and 36 women) (mean age 49.96 years; 24 to 81). Simulated pedicle- lengthening osteotomies and disc bulge and spinal canal volume calculations were performed using Mimics software. The mean spinal canal volumes of the two groups, L4 and L5, were 14,646.81 mm3 (5,918.60 to 22,717.77) and 16,408.47 mm3 (8,678.21 to 31,204.79), respectively. The mean lengthening distance was 2.17 mm (0.5 to 4.8) and the mean bulge-canal volume ratio was 0.23 (0.05 to 0.48). The pedicle- lengthening distance of the two groups was very strongly correlated with disc bulge volume and bulge-canal volume ratio ($p < 0.001$); the predictive equation was established as $L = 0.06 + 9.06R$ (where L equals the pedicle-lengthening distance and R represents the bulge- canal volume ratio). Our findings indicated that lumbar pedicle- lengthening distance strongly correlates with bulge-canal volume ratio, which can be estimated before surgery from CT images.

Keywords: Pedicle-lengthening osteotomy, 3-D reconstruction, Spinal stenosis, Digital anatomy, Biomechanics

IA-0057

Impact of Hallux Valgus Deformity on the Contact Properties of Foot Joints

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Background: Hallux valgus is a common foot deformity that arises from an altered distribution of foot load, with a specific focus on the distribution of intra- articular pressure.

Methods: We employed fresh cadaveric below- knee specimens, both without hallux valgus (n=4) and with pre- existing hallux valgus (n=12). We evaluated the peak intra-articular pressure, contact force, and contact area across various joints (including the first and second metatarsophalangeal joints, the first and second tarsometatarsal joints, the medial and intermediate cuneonavicular joints, the talonavicular joint, the calcaneocuboid joint, the subtalar joint, and the tibiotalar joint) in all specimens. These measurements were conducted under varying loading states, from ankle plantar flexion to dorsiflexion, using a weight-bearing model.

Results: In the forefoot region, the contact force, peak pressure, and contact area of the first and second metatarsophalangeal and tarsometatarsal joints in hallux valgus feet surpassed those in normal feet when the ankle joint's range of motion was between 20° plantar flexion and 20° dorsiflexion. In the midfoot region, the contact force and peak pressure of the medial and intermediate cuneonavicular joint in hallux valgus feet were lower than in normal feet, but the difference was not statistically significant. In the hindfoot region, the peak pressure of the subtalar joint in normal feet was significantly higher than in hallux valgus feet at 10° plantar flexion. However, no significant differences were observed in the contact force, peak pressure, and contact area between normal and hallux valgus feet in the remaining subtalar and tibiotalar joints.

Conclusion: Our results suggest that hallux valgus deformity significantly alters the contact properties of foot joints, particularly in the forefoot region. The contact force, peak pressure, and contact area are notably affected.

Keywords: Hallux valgus, Contact force, Peak pressure, Contact area

[Symposium 26: Global Trends in Anatomy Curriculum in Medical Specialty Programs]

IA-0213

Trends in Anatomy Education in Australia and New Zealand

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Abstract: Anatomy education in Australia and New Zealand has undergone significant changes in recent years, reflecting global shifts in medical education and technological advancements. This presentation aims to provide a comprehensive overview of current trends and innovations in anatomy teaching across medical schools in these two countries, and is based on a narrative review. A summary of the key trends includes: A widespread shift towards integrated curricula, with anatomy increasingly taught in clinical contexts rather than as a standalone subject. Growing adoption of 3D visualisation technologies and virtual/augmented reality platforms to supplement laboratory and classroom teaching. Increased emphasis on surface and living anatomy, reflecting modern clinical practice. Diversification of assessment methods, moving away from traditional spot tests towards more applied and clinically-oriented evaluations. Challenges in balancing reduced contact hours with the need to maintain comprehensive anatomical knowledge. Innovative approaches to address the shortage of qualified anatomy educators, including inter-institutional collaborations and professional development programs. Embedding anatomy in the assessment of essential skills such as ethical practice, professionalism and critical thinking. Emerging focus on cultural sensitivity in anatomy education, particularly regarding Indigenous perspectives and practices. The study demonstrates a thriving practice characterised by innovation and adaptation to changing educational paradigms and technology. While there is a clear trend towards technology-enhanced learning and clinical integration, more traditional methods like cadaveric dissection continue to play a crucial role, albeit in modified forms. Challenges remain, particularly in resource allocation and maintaining the depth of anatomical knowledge within integrated curricula. However, the collaborative nature of the anatomy education community in Australia and New Zealand is fostering creative solutions and shared best practices. This research provides valuable insights for curriculum designers, anatomy educators, and medical education policymakers.

Keywords: Anatomy Education

IA-0074

The Role of Clinical Anatomy Education in Surgical Specialty Residency Programs: Lessons Learned from Mayo Clinic

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Introduction: In a time of rapidly evolving surgical needs and medical education approaches, the anatomy curriculum must adapt to prepare residents for the demands of modern surgical specialties. This presentation aims to highlight the innovative approaches undertaken by the Department of Clinical Anatomy at Mayo Clinic to advance anatomy education in surgical residency programs.

Aim: The aim is to provide insights into the progressive strategies implemented at the Mayo Clinic, which aligns clinical anatomy education with the latest advancements in surgical practice.

Initiatives: Several key initiatives were implemented including the integration of state-of-the-art imaging technologies like photogrammetry into the anatomy curriculum, the use of fresh frozen cadaveric tissue material to enhance surgical skills, and collaboration with skilled video and image capture specialists to provide realistic and high-quality views of dissection.

Impact: These initiatives have led to a more authentic learning environment, equipping residents with the knowledge and skills necessary for successful surgical careers. Feedback from residents and faculty has been overwhelmingly positive, indicating a significant enhancement in both educational satisfaction and clinical competency.

Conclusion: The Mayo Clinic's proactive approach to updating its clinical anatomy curriculum serves as a pilot that blends authentic learning with the Mayo legacy of teamwork. This is directed at one goal of putting the patient first.

Keywords: Clinical Anatomy, Surgical Education, Mayo Clinic, Residency Training, Postgraduate Education

IA-0173

Advancing the Relevance of Cadaveric Anatomical Training in Medical Specialization through Innovations

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Abstract: Cadaveric anatomical training remains a cornerstone of medical education, essential for the development of specialized skills and knowledge among medical professionals. This paper examines how innovative techniques and technologies are enhancing the efficacy and applicability of cadaveric training in medical specialization. Traditional cadaveric dissection has been augmented by new embalment methods, including light embalming. This modern approach to cadaver preservation ensures anatomical fidelity while minimizing tissue distortion, thus extending the usability of cadavers and enhancing the quality of training. Prefabricated specimens, crafted using advanced preservation methods, offer tailored training opportunities for specific medical disciplines. These specimens provide intricate anatomical details and pathologies, allowing specialists to refine their skills in a controlled environment before encountering similar scenarios in clinical practice. Moreover, technology plays a vital role in augmenting cadaveric training through simulated experiences. Virtual reality, augmented reality, and anatomical modeling software provide immersive platforms for trainees to interact with anatomical structures and simulate complex procedures. These technological innovations complement traditional cadaveric training, offering additional avenues for skill development and knowledge acquisition. In conclusion, the relevance of cadaveric anatomical training in medical specialization is being advanced through innovations in embalment techniques and technology. These advancements not only enrich the educational experience but also better prepare medical professionals for the complexities of specialized practice. Efforts to integrate these innovations into medical education must continue to ensure that cadaveric training remains a vital component of specialized medical training.

Keywords: Educaation, Simulation, Cadaveric

IA-0172

Anatomical Cadaveric Training for Exploratory Procedures and Surgical Accesses, Based on Remote, Asynchronous Feedback, as a Learning Tool for Residents of Traumatology and Orthopedics. Experience in Chile

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Objective: To evaluate the efficacy of a cadaveric anatomical training program in exploratory and surgical skills with remote and asynchronous feedback as a learning tool for first-year residents in Traumatology and Orthopedics.

Materials and Methods: Experimental study. Learning was compared between two cohorts of first-year Traumatology and Orthopedics residents. The intervention assessed the progression of a control group (theoretical training; n=9) and an experimental group (theoretical-practical training; n=9). The students participated in three courses (1: Anatomical Knowledge, 2: Anatomical Exploration, and 3: Anatomical Dissection). At the end of each training course, both groups took the same evaluations. The statistical analysis assessed normality with the Shapiro-Wilk test, and the inferential analysis used the Mann-Whitney test for independent samples, considering p-values <0.05 as statistically significant. The study was approved by the scientific ethics committee (221123001).

Results: When comparing the scores obtained in the evaluations at the end of each course, significant differences were observed between the experimental and control groups in all evaluated courses. In course one on anatomical knowledge, the median score of the experimental group was 79 points (range 64-105) versus a median of 63 points (range 50-79) in the control group (p=0.02). In course two on anatomical exploration, the median score of the experimental group was 109 points (range 103-113) versus 97 points (range 76-112) in the control group (p=0.04). Finally, the median score obtained in the evaluation of course three on anatomical dissection in the experimental group was 104 points (range 76-116) versus 82 points (range 63-96) in the control group (p=0.02).

Conclusions: This study's findings indicate the practical benefits of implementing a cadaveric anatomical training

program with remote and asynchronous feedback. This innovative approach was found to be an effective learning tool for first-year residents in Traumatology and Orthopedics, potentially enhancing their exploratory procedures and surgical approaches.

Keywords: Gross Anatomy, Traumatology, Intervention, Medical Education, Medical Specialists

[Symposium 27: Neurobiology of Neurodegenerative Diseases]

IA-0199

Cerebellar Patterning and Volume Changes in Health and Disease

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Abstract: The complexity of cerebellar compartmentation is revealed through differential expression of several genes, afferent and efferent connections, and the birth dating of neurons such as Purkinje cells (PCs). PCs, the sole output neurons of the cerebellar cortex, are primarily responsible for the intricate topography that results in a set of zones and stripes within the cerebellum. The mouse cerebellum is divided into four transverse zones: the anterior zone (AZ; lobules I-V), the central zone (CZ; lobules VI-VII), the posterior zone (PZ; lobules VIII-dorsal IX), and the nodular zone (NZ; ventral lobule IX and lobule X). The selective gene expression in different regions and the patterning of PCs serve as indicators of compartmentation and differential vulnerability to insults. The cerebellum's anatomical subdivisions, including transverse zones and lobules, exhibit distinct structural and functional connectivity profiles, reflecting their roles in cognitive and motor functions. This study examines the impact of age and sex on the volumes of the total cerebellum, cerebellar transverse zones, and lobules using magnetic resonance imaging (MRI) scans from six neuroimaging datasets. Our results show that cerebellar regional volumes decrease with age, with significant age-dependent volume reductions in the CZ, which is associated with emotion and cognitive functions, compared to other transverse zones in both males and females. In both healthy and neurodegenerative conditions, males exhibited smaller adjusted cerebellar volumes and faster volume reduction with age compared to females. Conversely, in mental disorders, females showed faster volume reduction with age. These findings reveal atrophy along functional gradients, varying by disease, and suggest that MRI-based detection of cerebellar volume changes could potentially serve as biomarkers for monitoring various neurological disorders.

Keywords: Cerebellar Patterning

IA-0098

Impairment by Mutant Polyglutamine Proteins of Herp E3 Ligase Activity and the Neuropathology of Polyglutamine Diseases

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Abstract: This investigation aims to elucidate the biological roles of Herp, particularly in modulating the aggregation and degradation of mutant polyglutamine (poly-Q) proteins, and to analyze the adverse impacts of these proteins on the structural and functional integrity of Herp. The E3 ubiquitin ligase activity of Herp was evaluated using in vitro ubiquitination assays. The types of ubiquitin linkages and the specific attachment sites catalyzed by Herp were determined via ubiquitin modification mass spectrometry. Co-immunoprecipitation and pull-down assays were implemented to investigate the mechanisms of protein-protein interactions. Caspase cleavage patterns and specific sites on Herp were delineated through in vitro proteolytic cleavage experiments. Herp interacts with mutant huntingtin (mHtt), providing a cytoprotective effect by mitigating mHtt aggregation and facilitating its degradation. Herp exhibits E3 ubiquitin ligase activity, primarily catalyzing the polyubiquitination of mHtt through K48 and K63 linkages. The UBL domain of Herp directly interacts with the poly-Q domains of various mutant poly-Q proteins, effectively inhibiting aggregate formation. Mutant poly-Q proteins trigger caspase-7-mediated cleavage at the C-terminus of Herp, resulting in a truncated variant. This modification transitions Herp's enzymatic function from polyubiquitination to monoubiquitination, thereby increasing the stability of substrate proteins. Herp serves as a novel E3 ubiquitin ligase that promotes the ubiquitination and subsequent degradation

of mHtt. The UBL domain of Herp effectively binds to and inhibits the aggregation of mutant poly-Q proteins. The caspase-7-mediated cleavage of Herp's C-terminus by mutant poly-Q proteins shifts its ubiquitin ligase activity from polyubiquitination to monoubiquitination, resulting in the accumulation of pathogenic proteins due to impaired degradation via the ubiquitin-proteasome pathway. This research was supported by the National Natural Science Foundation of China (Grant No. 31971114).

Keywords: Herp, E3 ubiquitin ligase, Ubiquitination, Mutant huntingtin, Polyglutamine protein

IA-0108

ABI3BP Participates in Alzheimer's Disease by Affecting the Phagocytic Function of Astrocytes on Synapses

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Objective: To elucidate the role and mechanism of Abi3bp in the development of AD mediated by astrocyte phagocytosis of Aβ sedimentation and synaptic loss.

Methods: Morris water maze and novel object recognition tests, Western Blot, immunofluorescence staining, Nissl staining, Thioflavin S staining, electron microscope and RNAseq were performed in Wild-type (WT) mice, Abi3bp-/- mice, 5xFAD mice, and Abi3bp-/-5xFAD mice.

Results: Abi3bp was mainly expressed and colocalized in astrocytes,and the levels of Abi3bp proteins in the hippocampus of WT mice were obviously decreased after 7 days of birth. The Abi3bp proteins levels were obviously increased in the hippocampus of 5xFAD mice while it were mainly expressed and colocalized in A1 type astrocytes marked by with C3, and β- Amyloid (1-42) induced Abi3bp expression in astrocytes. Abi3bp knockout increased the levels of NeuN and synapsin 1/2 proteins in the hippocampus of 18- month-old mice. The number of plaques, and the levels of NeuN, synapsin 1/2, Megf10, Intgerinbeta1, iba1 and GFAP proteins in the hippocampus of Abi3bp-/-5xFAD mice were markedly reduced. Meanwhile, in Abi3bp-/-5xFAD mice, Thioflavin S staining showed that the number of plaques in the cerebral cortex and hippocampus were obviously decreased while Nissl staining showed that the increased number of neurons in hippocampus compared with 5xFAD mice. Furthermore, electron microscope showed the increased number of synaptic vesicles of presynaptic neurons in CA1 and CA3 regions of hippocampus of Abi3bp-/-5xFAD mice, consistent with the results that immunofluorescence double staining of synapsin 1/2 with Homer1, VGLUT1 with PSD95, or VGAT with Gephyrin. Morris water maze and novel object recognition tests showed that Abi3bp knockout improved the the abilities of learning and memory of elderly and 5xFAD mice.

Conclusion: Knockout of Abi3bp improved the learning and cognitive abilities of 5xFAD dementia mice, which were associated with the reduced Megf10, hippocampal Aβ protein amyloid deposition, neuronal loss, and synaptic loss mediated by astrocyte phagocytosis.

Keywords: Abi3bp, Alzheimer's disease, Astrocyte, B-amyloid deposition, Synapse

IA-0112

ANGPTL8 Mediates the Liver-Brain Axis to Promote Neuroinflammation by Activating Microglial Pyroptosis and Contributes to Alzheimer's Disease Pathology

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Abstract: Alzheimer's disease (AD) is caused by a complex interaction between peripheral organs and the central nervous system. Recent studies have shown that microglial hyperactivity is closely related to immune system disorders, and the peripheral blood microenvironment can regulate the disorders of brain immune function, which is an important reason for the abnormal activation of microglia to promote AD, but the specific regulatory mechanism is not completely clear. Here we identified a liver-derived secreted protein, ANGPTL8, which enters the blood stream as a proinflammatory factor and crosses the blood-brain barrier to abnormally activate

microglia and promote AD progression. First, ANGPTL8-/- mice were crossed with 5×FAD mice to obtain WT, 5×FAD, ANGPTL8-/-, and ANGPTL8-/- 5×FAD mice. The Morris water maze (MWM) test and novel object recognition task were used to evaluate recognition ability in 5×FAD transgenic and ANGPTL8-/- 5×FAD mice. Thioflavin-S (Tio-S), Neru-N and Nissl staining were used to analyze amyloid β (Aβ) deposition and neuron loss. The phagocytic capacity of microglia was determined by FITC- latex beads and transmission electron microscopy. Then, the mechanisms by which ANGPTL8 regulates AD progression were studied with NLRP3 siRNA, PIRB siRNA and ANGTPL8 knockout. Finally, we found that liver-derived ANGPTL8 could pass through the blood-brain barrier and interact with the microglial membrane receptor PIRB/LILRB2 to activate the downstream NILRP3 inflammasome, causing microglial pyroptosis and aggravating the Aβ-induced release of inflammatory factors, leading to AD progression, Metformin, an ANGPTL8 inhibitor, improved the learning and memory of 5xFAD mice. Collectively, ANGPTL8 is a novel peripheral inflammatory trigger that regulates the liver-brain axis and aggravates microglial pyroptosis via the PIRB/NLRP3 pathway to accelerate the pathogenesis of AD.

Keywords: ANGPTL8, Neuroinflammation, Liver-brain axis, Microglial pyroptosis, Alzheimer's disease

[Symposium 28: Innovative Contrast with Novel Cadaver Preparation Using Specialised MicroCT and MRI Imaging Revealing Unseen Human Anatomy]

IA-0179

MircoCT Angiograms of the Wrist/Hand Reveal Extraordinary Detailed Vascular Anatomy from Novel Prepared Donor Cadavers with Innovative Contrast and Minimal Structure Distortion

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Purpose: Estimated annual number of hand/wrist injuries presenting to USA Emergency Departments was 2.6 million. Most common presenting age group was 18-39, which could render an individual with a debilitated hand over half one's life and more worrying if it's the dominant hand. Most common injuries were lacerations and fractures. Forearm/wrist/hand region commonly has variations and/or anomalies regarding neurovascular and muscular structures. Generalizations regarding dominant blood supply/drainage can be dangerous for clinicians and disastrous for patients. Studies vary between deep or superficial arches providing majority blood flow to minimum of three digits, and some reveal equal. Such studies ignore ligating ulnar or radial artery at the wrist, rarely results in digit(s) loss from trauma. Detailed vascular mapping of wrist/hand studies is warranted. This study objective conducted MicroCT arteriograms of the wrist/hand region from novel donor-cadaver preparation with contrast rendering minimum tissue distortion providing detailed lifelike anatomy.

Methods: Literature search was conducted regarding novel donor-cadaver preparation techniques with innovative vascular contrast resulting in minimal tissue distortion providing quality detailed cross-sectional imaging. GAX-specimen preparations (n=6,12-sides) with BriteVu contrast received CT and MicroCT imaging, joint movement and surgical dissection assessment compared with formalin-fixed cadavers (FFC) n=15,30-sides.

Results: GAX-specimen prepared donor-cadaver studies have been conducted by Benninger infusing BriteVu contrast for CT/MRI, radiographic and ultrasound imaging. GAX-specimen with BriteVu (12/12 sides) demonstrated exceptional CT and MicroCT imaging of vasculature and osteology of wrist/hand region. GAX-specimens with BriteVu received excellent scores comparing lifelike palpation, complete joint range-of-motion, quality surgical plane dissections versus FFC which consistently received poor ratings.

Conclusions: This study of GAX-specimen prepared donor-cadavers with infused BriteVu contrast successfully revealed extraordinary vascular and osteology imaging of the wrist/hand region from CT/MicroCT scans for assessing detailed anatomy and accuracy. Additionally, lifelike, minimally distorted tissue, enabled free joint movement and surgical plane dissection.

Keywords: MicroCT, Innovative, GAX specimen, BriteVu, Vascular anatomy

IA-0181

Human MicroCT Angiograms of the Ankle/Foot Region from a Novel Donor Cadaver Preparation with Innovative Contrast Continues to Improve, Fascinate and Nurture the Quest for Anatomy Detail and Accuracy

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Purpose: Macro anatomy can be an endless vacuum of variants, anomalies, calculated norms, with static and dynamic entities consisting of ratios, angles, compartments, connections which are unique and similar amounst human races. Though it appears much studied, it is not fully detailed or perhaps even understood. Contemporary anatomy texts/atlasses have improved the description and sensory overload phenomena associated with such literature from the past three centuries. However, the pendulum has swung towards over simplification. From a conceptual view, texts/atlasses and computer generated software are impressive, but from a detalied accurate representation of in vivo anatomy essential for invasive procedures, diagnosis, treatment, monitoring recovery, still need improved. Cross-sectional imaging allows one to create 3D anatomy structures from humans. The study objective was to identify body preparation procedure with contrast rendering human donor cadavers with the least amount of tissue distortion while providing detailed lifelike anatomy for cross-sectional imaging demonstrating anatomy not previously viewed.

Methods: Literature search was conducted regarding novel cadaver body preparation techniques which could receive innovative vascular contrast with minimal distortion providing quality detailed cross-sectional imaging. GAX-specimen preparations (n=6,12 sides) with innovative contrast had CT/MRI and MicroCT imaging compared to formalin-fixed cadavers (FFC) n=15,30 sides.

Results: Literature search revealed GAX-specimen prepared cadaver studies receiving BriteVu contrast for CT/microCT/MRI images. GAX-specimens allowed palpable bony landmarks, compliant soft tissue, lifelike surgical plane dissections versus FFC. MicroCT revealed detailed vasculature of the ankle/foot region. Gax-specimen tissues were notably compliant and lifelike vs FFC. GAX-specimens with BriteVu (12/12 sides) revealed exceptional CT vascular networks and extraordinary microCT vascular networks.

Conclusions: This study revealed GAX-specimen prepared donor cadavers with BriteVu contrast demonstrated detailed vascularity of the ankle/foot region from CT and microCT imaging not previously viewed with lifelike palpation, movement, and dissection accompanied by minimal tissue distortion.

Keywords: MicroCT, Innovative, Ankle/Foot vessels, GAX specimen, BriteVu

IA-0180

Can a Donor Cadaver be Prepared and Preserved Using a Novel Medium with Innovative Contrast for Conventional Knee CT-Arteriograms, Lifelike Movement and Surgical Dissection Within 24-Hours and Beyond

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Purpose: Several sources report 41% of sports injuries occur to the knee. Successful conservative and invasive treatment decisions and/or healing expectations to injured or diseased structures of the knee rely on the understanding of the delivery of oxygen and nutrients to knee structures. Therefore, a thorough knowledge of the vascularity of knee structures is important regarding injury assessment, recovery, and vascular protection from mechanisms of injury and/or invasive instruments. Cross-sectional imaging can be organized to create 3D vascular structures from human knees. Vascular contrast provides useful cross-sectional imaging identifying large, medium and some small-sized vessels. CTscans of donor cadavers reveals collapsed vessels. The objective of this study was to identify donor cadaver preparation technique for immediate and long term dissection, have synovial joint full range-of-motion (JFROM), receive vascular contrast enabling whole body conventional CT-arteriograms (CCTA) and subsequently dissection within 24-hours post preparation demonstrating detailed knee vasculature compared to formalin-fixed cadavers (F-FC).

Methods: Literature search was conducted regarding donor cadaver preparation techniques enabling JFROM, vascular contrast, immediate CCTA with dissection within 24-hours. GAX-specimen preparations (n=6,12-sides) with BriteVu innovative contrast received CCTA compared to F-FC (n=27,54-sides).

Results: All 6 (12-sides) novel GAX-specimen were successfully prepared donor cadavers, receiving innovative BriteVu contrast for CCTA and dissection within 24 hours of original preparation. GAX-specimens allowed palpable bony landmarks, lifelike soft tissue, JFROM at all synovial joints, surgical plane dissections and viewing patent small vessels versus F-FC. Detailed vasculature of the knee was acquired successfully from CCTA. Gax-specimen cadavers were dissected for several months following initial 24-hour dissection. GAX-specimens with BriteVu (n=6,12/12-sides) revealed exceptional CT vascular networks and extraordinary CCTA images of knee vessels.

Conclusions: Within 24-hours, this study demonstrated donor cadavers can be successfully prepared, produce exceptional detailed CCTA images, provide lifelike surgical dissection of the knee from GAX-specimen preparations with BriteVu contrast and continue to dissect for several months.

Keywords: Knee vascularity, Innovation, GAX specimen, Novel, Clinical anatomy

[Symposium 29: Brain Development and Regeneration]

IA-0047

Longitudinal Single-Cell Tracking in Live Animals with Advanced 2-Photon Microscopy

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Abstract: Visualizing and tracking cells over time in a living organism was only a dream before the invention of intravital microscopy. However, the opaque nature of tissues, especially the brain is a major hurdle that was overcome by the invention of multiphoton microscopy. With the advancement of optical imaging and fluorescent labeling tools, intravital 2-photon microscopy has become increasingly accessible over the past few years. We advocate the concept of functional longitudinal tracking of individual cells (fLoTIC) under 2-photon microscopy and its application in stem cell therapy. It is a power tool to gain insight into the longitudinal changes in the morphology, migration, or function of endogenous or exogenously transplanted neural stem cells or subcellular structures in live animals. It is particularly suitable for studying slow-evolving cellular and molecular events during development, regeneration, or disease progression, without losing the opportunity of catching fast events such as calcium signals. In this talk, I will present the principles of fLoTIC and its applications for studying the behaviors of endogenous NSCs and transplanted NSCs for stroke therapy. It is expected that fLoTIC will have huge impact in the coming decades to reveal essential molecular and cellular events in health and disease.

Keywords: 2-photon microscopy, Intravital imaging, Single-cell tracking, Stem cells, Fluorescence indicators

IA-0100

UHRF1 Mediates Maternal Immune Activation Induced Autism-Like Phenotype in Offspring by Regulating the Proliferation of Neural Stem Cells

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Abstract: Previous studies showed that maternal immune activation (MIA) is a high-risk environmental factor for autism spectrum disorders (ASD), and neural stem cells may play an important role in the process of MIA- induced ASD. However, there is a lack of systematic research on how MIA affects the development of neural stem cells and thus induces ASD. We aim to study the role of embryonic neural stem cell development in MIA-induced ASD and the related molecular regulatory mechanisms using the mouse model. We first detected the proliferation of embryonic neural stem cells in MIA offspring by morphology, then used Nestin-GFP mouse specific sorting to isolate neural stem cells, analyzed the changes in gene expression and DNA methylation modification of embryonic neural stem cells in MIA offspring by multi-omics technology, compared them with the autism risk gene pool, screened im-

portant target genes, and finally verified the function of candidate genes in regulating the development of neural stem cells and their role in MIA-induced ASD. After MIA, the increase of maternal inflammation level leads to the increase of the expression level of UHRF1, an epigenetic regulatory molecule in offspring neural stem cells, which promotes the proliferation of neural stem cells, affects the subsequent nervous system development process, and then induces ASD. Those results will prove that abnormal neural stem cell development is an important cause of ASD pathogenesis, clarify the epigenetic regulatory signaling pathways, deepen the understanding of the environment-gene interaction mechanism in the pathogenic factors of ASD.

Keywords: Autism spectrum disorders, Maternal immune activation, Neural stem cell, Cell Proliferation, Epigenetic regulation

IA-0056

Sirt6 Regulates the Proliferation of Neural Precursor Cells and Cortical Neurogenesis in Mice

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Abstract: Sirt6, a member of the class III histone deacetylases (HDACs), functions in the regulation of genomic stability, DNA repair, cancer, metabolism and aging. Sirt6 deficiency is lethal, and newborn SIRT6-null cynomolgus monkeys show unfinished brain development. After the generation of a cortex- specific Sirt6 conditional knockout mouse model, we investigated the specific deletion of Sirt6 in NPCs at E10.5. This study found that Sirt6 deficiency causes excessive proliferation of neural precursor cells (NPCs) and retards differentiation. The results suggest that endogenous Sirt6 in NPCs regulates histone acetylation and limits stemness-related genes, including Notch1, in order to participate in NPC fate determination. These findings help elucidate Sirt6's role in brain development and in NPC fate determination while providing data on species generality and differentiation.

Keywords: Sirt6, proliferation, Neural precursor cells, Cortical neurogenesis, mice

IA-0145

Autism-Risk Factor Foxp1, an Endochondral Ossification Inhibitor Regulates the Neurogenesis in Brain Development

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Abstract: Foxp1 as an endochondral ossification inhibitor, mutation or deletion of its allele can lead to neurodevelopment disorders such as autism spectrum disorder (ASD). Previous studies have revealed that Foxp1 is highly expressed in the cortex, hippocampus, and striatum during brain development, highlighting its essential role in neurocognitive functions. Nonetheless, there is a need to further elucidate the role and mechanism of Foxp1 in the development of the central nervous system (CNS). In this study, the expression pattern of Foxp1 in early brain development, along with the cell types expressing Foxp1, was examined. A nervous- specific Cre-Loxp system was used to delete Foxp1 in vivo. Neural stem cells (NSCs) were isolated from embryonic cerebral cortex, and primary astrocytes were obtained from newborn mouse brain. Interestingly, we detected the expression of Foxp1 not only in neural stem cells and neurons, but also in astrocytes. Notably, the cerebral cortex thickness was significantly reduced, especially in layers V and IV, in Foxp1 knockout mice. Furthermore, the knockout of Foxp1 resulted in an increased number of astrocytes in the prefrontal cortex, striatum, and hippocampal formation of these mice. Furthermore, Foxp1 knockout led to an increase in the number of astrocytes in the prefrontal cortex, striatum, and hippocampal formation of mice. Additionally, overexpression of Foxp1 in neural stem cells (NSCs) promoted neuron differentiation and inhibited astrocyte production, achieving this by regulating the Jak/Stat signaling pathway. Transcriptome sequencing analysis revealed differential expression of factors related to immunoregulation signal pathways in primary astrocytes isolated from Foxp1 knockout mice. In conclusion, our data indicate that Foxp1 can promote neurogenesis in brain development.

Keywords: Foxp1, Neural stem cells, Neurogenesis, Differentiation

[Symposium 30: Mastering Manuscript Writing in Anatomy Journals: Best Practices and Pitfalls]

IA-0184

Publishing about Anatomical Variations

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Abstract: Anatomical variations (AV) are discussed in the activity editorial activity. Should we publish manuscripts about anatomical variations? Our aims were to consider AV through anatomical and clinical aspects. - The anatomical knowledge needs to be enriched by new cases. - The clinical relevance of AV takes place at the step of diagnosis, but also in the risk of iatrogenous injuries due to the variant anatomy. It is strong in medical imaging. - Education relevance is encountered in both the anatomical and clinical fields. This supports the role in education: learning how to prepare, how to submit, how to track a submission, how to improve it through the reviewers' suggestions. The phase of preparation goes through the collection of articles, but also implies reading the greatest texbooks about variations. - Which journals are interested in publishing AV? Some journals of Anatomy decided not to publish case reports. Some others, as Surg Radiol Anat, remain open to the submissions about AV, according different forms: case report, unusual or new aspect of imaging, reviews, meta-analysis. The quality and pertinence must be assessed by a peer-reviewing. The articles about AV are not frequently cited, and not during the two years following their publications. This is not a positive point for the journal because this will not contribute to increase the impact factor. This is an editorial choice. Some clinical journals are interested in publishing articles about applied anatomy, and could be more attractive when they have a better impact factor. The journals are now facing a new difficulty: the using of artificial intelligence that can edit a well-constructed article about AV, case report, review and meta-analysis. The publishers have included specific tools for detecting these types of manuscript. **Conclusion:** All these aspects, anatomical, clinical, educational and editorial, support the publishing of anatomical variations.

Keywords: Anatomical variations, publications, anatomy, education

IA-0200

Effective Literature Review Strategies in Anatomy Manuscripts: Synthesizing Past and Present Knowledge

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Abstract: Increasingly, manuscripts are being submitted to anatomical journals with inadequate literature research. The authors of such manuscripts are virtually rediscovering anatomy, even though much or all of it has been known for well over 100 years. These "new" discoveries are based on the fact that only an Internet search was carried out. What cannot be found on the Internet therefore does not exist. On the one hand, the talk is intended to show what can be found in relation to macroscopic anatomy with a good internet search and, on the other hand, to draw attention to the fact that anatomy has been researched for many centuries and that the subject of anatomy has systematically generated data on the structure of the human body, the musculoskeletal system, the vascular system, embryology etc. since around 1860, which has since been filed in books and journals. Many of these anatomical articles were not written in English and must therefore not only be found but also translated during a literature search. A truly valuable publication contains data with novelty value and this involves an intensive literature search to uncover what is already known. Anyone embarking on macroscopic and histological examinations of anatomy is entering a scientific field in which research has been conducted for many decades. It is not easy to contribute something new here, as the anatomists of old have already carried out their examinations on a much larger number of objects of all ages than is the case today.

Keywords: Anatomy Manuscripts

IA-0104

Publication Ethics: The Role and Responsibilities of Authors

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Abstract: Publishing plays a crucial role in disseminating knowledge, fostering recognition, advancing scientific progress, facilitating collaboration, and fostering networking. Moreover, it significantly contributes to determining academic excellence within the profession. As the number of manuscripts being published worldwide continues to surge, ensuring authors' adherence to publishing ethics and regulations becomes paramount. Authors' violations of ethics and responsibilities not only tarnish the reputation of the journal but also incur significant penalties in terms of indexation for scientific journals. This discussion thus centers on the essential considerations authors must bear in mind regarding publication ethics in academic and research publications. Key areas include ensuring the research or publication's originality, fulfilling authorship obligations, preventing plagiarism, maintaining data integrity, managing conflicts of interest, addressing ethical issues, adhering to journal guidelines, promoting transparency and scientific content validity, preventing misconduct, and upholding post-publication ethics. It is imperative to adopt a rigorous approach in these areas to preserve the integrity, credibility, reputation, and trustworthiness of research publications. There is a growing trend of scientific papers being retracted from reputable journals due to publication misconduct, which may occur with or without authors' awareness. Educating individuals about these matters is crucial to upholding the standards of research publications. It is worth noting that such misconduct not only affects the authors' reputations and the journals' integrity but also disrupts the integrity of the scientific community and healthcare as a whole.

Keywords: Plagiarism, Authorship, Conflict of Interest, Publishing, Delivery of Health Care

[Symposium 31: Trends in Embalming of Human Bodies for Teaching Anatomy]

IA-0162

Are We Using the Best Methods and Chemicals in Embalming

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Abstract: Embalming of the human body is essential for disinfection and preservation to support the teaching and research in anatomy. The quality of the preservation of human remains is important for studying detailed morphology. The preserved human body has thus provided an excellent teaching and research platform for the development of our modern curricula in the health sciences. While the embalming of the human body is critical to anatomists, there is generally little agreement on the best methods and chemicals that should be used. This may be because conditions are linked to legal requirements, local costs and other challenges. Methods and chemicals used for embalming have improved the pliability and durability of the body over time. However, there is a need to better understand advances in embalming techniques, particularly for those countries where formaldehyde is still in use. Unavailability of certain embalming chemicals due to finances in certain countries may result in anatomists being confined to using whatever chemicals are available. Poor embalming and local conditions may have a negative impact on the health of staff and students, as well as on the training of students who will not have an opportunity of exploring a well-preserved human body. Long term preservation requires different techniques, such as using stronger preservative chemicals, multiple injection sites to ensure thorough saturation of body tissues and in case of a body to be used for anatomical dissection. The aim of this Symposium will be to reflect on the global trends in embalming techniques with a focus on best practice for teaching, research and occupational health. Research is needed in this field, to achieve best methods to use, as this will have a negative impact on Medical students and researchers who will not have an opportunity of exploring and contributing towards scientific research in a long run.

Keywords: Embalming, Dissection, Anatomists, Research, Law

IA-0063

An Overview of the Embalming Process for Anatomical Studies

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Abstract: The purpose for successful embalming of cadavers for dissection includes but limited to, long term structural preservation of organs and tissues, maintaining flexibility and suppleness of internal organs, reduction of hazardous chemicals in the environment to comply with health and safety regulations. All the cadavers are from persons who have consented to body donation for anatomical science education and research. The cadavers reach Anatomy department mortuary within 72 hours of death. Our embalming solution consists of chemicals that were supplied by Mazwell group (Exclusive manufacturer of Dodge products): these products include Metaflow, Rectificant, Introfiant, Dis-Spray, Restorative, Proflow in their respective constituents. The cadaver is placed on the embalming table lying flat in an anatomical position. Following our SOP the cadaver is disinfected topically using disinfectant and germicidal solution and left to stand for 5-10mins. The embalming fluid is perfused via the femoral artery using a mechanical pressure pump at 150/160 psi. To avoid introducing air into the cadaver, the rubber tube linking the tank and the two cannulae must be filled with the embalming fluid before the cannulae are inserted into the femoral artery. The two cannulae are inserted into the femoral artery at the incision made pointing opposite directions tied up with twine and the embalming fluid begins to enter the femoral artery. As the embalming fluid circulates, the skin becomes pallid. The extent of this change indicates the extent at which the fixatives have circulated. The cadaver is then placed in an airtight polythene bag at 18 degrees for at least 3months. Before opening the bodies for dissection, the excess embalming fluid is removed, and the cadavers are left to dry There is more muscle flexibility and bending of limbs. Further, good flexibility and plasticity preservation in internal organs and tissues are remarkable characteristics as well.

Keywords: Embalming, Cadavers, Cannulae, Hazardous, Techniques

IA-0182

Travelling with Thiel

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Abstract: The Thiel soft-fix embalming method was developed by Professor Walther Thiel in Graz, Austria, with his first paper on the technique published in 1982. The Centre of Anatomy and Human Identification (CAHID) at the University of Dundee adopted the method in 2009 and have become the UK's leading experts in this method, developing a solid international reputation. The embalming technique has been gaining popularity over several years due to its advantageous properties, including a high level of flexibility, maintenance of fascial layers, very limited formalin content and robust longevity, making the cadavers ideal for surgical training, where the same body can be used many times for different procedures, or for medical device testing. This talk will explore various applications of the Thiel method, giving examples of how it has been used in Dundee and how its use has been spreading to other parts of the world, including Sri Lanka, Israel, India and more recently Peru. Additionally, a longstanding and mutually beneficial relationship with the anatomists of Thailand has resulted in the method being taken up there, with a consortium of local universities adapting the method and modifying the solutions to suit their purposes.

Keywords: Embalming, Thiel, Soft-fix, Surgical training

IA-0198

The Utility of Soft Preservation in Anatomy Education, Research and Clinical Training

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Abstract: Formaldehyde has long served as the primary preservative for human body donors in anatomy education. However, recent decades have seen a growing interest in alternative preservation techniques. This shift is driven by the need for safer solutions that maintain tissue quality, meeting the rising demand for highly realistic models for clinical training. Various soft preservation techniques have been explored, including Thiel, Imperial College London-soft preservation

(ICL-SP), saturated salt, and Genelyn, among others. A recent study compared ICL-SP with Genelyn, Thiel, and formaldehyde, revealing that ICL-SP provides the most realistic preservation of the body. In educational settings, ICL-SP was evaluated against formaldehyde for teaching DPT and DOT students. Results demonstrated that using ICL-SP facilitates the integration of clinical skills, enhancing student learning and motivation. Furthermore, this technique was applied in the training of general surgery and orthopedic residents. General surgery residents preferred ICL-SP-preserved donors over porcine models, while orthopedic residents favored ICL-SP donors over those embalmed with formalin. Both groups highlighted the advantages of working with soft-preserved donors for training purposes. In contrast, training with unembalmed donors, commonly used for clinical training, limits the extended practice opportunities desired by donors. Therefore, there is a pressing need to prioritize research on alternative preservation techniques and raise awareness of their benefits.

Keywords: Anatomy Education

[Symposium 32: Anatomical Education: Multiple Disciplines, Teaching Methods and Training in Medical Curriculum]

IA-0019

Students as Near-Peer Anatomy Teachers - A Nourishing Program for Fledging Medical Educators

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Abstract: Throughout their careers, medical students will transition from learners to educators, taking on the role of teaching and guiding future generations of medical professionals. Recognising this inevitable transformation, the LKS Faculty of Medicine of the University of Hong Kong (HKUMed) has implemented a near-peer anatomy teacher (N-PAT) programme, which provides a unique opportunity for aspiring medical student-educators to gain hands-on experience by serving as co-instructors during dissection sessions. The N-PAT programme has grown significantly, with over 200 registered N-PATs participating in 200+ dissection sessions, enriching the learning experience for numerous medical students. This innovative approach enhances understanding of complex anatomical concepts and fosters a collaborative learning environment, benefiting both near-peer teachers and students. The N-PAT programme is an invaluable resource for future medical educators, with many participants continuing their involvement over the years. This creates a continuous improvement cycle as former students-turned-N-PATs contribute unique insights to refine the program. This talk will introduce the N-PAT training program and discuss its win-win-win nature. We will explore the benefits and challenges faced by N-PATs, as well as the programme's effectiveness in preparing medical students for future educator roles. We will also examine the potential long-term impacts on the medical education landscape, including fostering a culture of mentorship and collaboration among medical professionals. In summary, the N-PAT programme significantly impacts medical education by providing student-educators with necessary knowledge, skills, hands-on experience, fostering a collaborative learning environment for junior students, and enhancing the teacher-student ratio and teaching efficiency for educators. As the program evolves and expands, it will shape the future of medical education and enhance the overall quality of health services in Hong Kong.

Keywords: Near-Peer Teaching, Anatomy Education, Student As Partners

IA-0022

Implementation of Virtual Teaching and Core Syllabus into Anatomical Curriculum

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Abstract: Traditional teaching emphasizes direct interaction and face-to-face learning via lectures and textbooks. Virtual teaching is more flexible because it can be accomplished via virtual platforms, virtual eBooks, online meetings, and video lectures. In this talk, we will review traditional teaching methods, provide examples of virtual teaching methods and platforms, demonstrate how to implement these virtual teaching methods, and compare and contrast the advantages and disadvantages of traditional and virtual teaching methods. Traditional microscopic anatomy (histology) has been cen-

tered around using microscopy to examine histological slides and teaching students how to use microscopy to identify structures and cells on the slides. Virtual microscopy has become a popular form of education in many schools worldwide in recent years. For much of the current twenty-first century, anatomical education has been managed through the use of online learning management platforms like Blackboard and Canvas. They allow students to access course materials both inside and outside of the classroom synchronously and asynchronously, depending on the instructors' preferences. Virtual meeting platforms, such as BigBlue Button and Microsoft Teams, enable teachers to teach students remotely, but synchronously. Nevertheless, recording options in these platforms also allow instructors to post recorded lectures that can be viewed by students later in an asynchronous fashion. In this talk, we will also discuss recommendations for educators and textbook authors regarding updating and improving their course contents to flexibly suite both the needs of the newest generations of health science professional students and the current modern curriculum based on the results of the Core Syllabus for histology within the medical curriculum from the International Federation of Associations of Anatomists (IFAA).

Keywords: Virtual teaching, Core Syllabus, Virtual platform, Canvas, Histology

IA-0028

Enhancing Anatomy Education: Integrating Medical Humanities, History of Medicine, and Ambiguity Tolerance Training

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Purpose: Introducing humanities and history content into an existing medical curriculum requires a strategic approach and should ideally commence in the gross and developmental anatomy course. Besides incorporating aspects of medical humanities and the history of medicine, including an element of ambiguity tolerance training is beneficial. It is important in the context of anatomy, as anomalies, non-symmetrical anatomical findings, and the presence of multiple names for one structure can often perplex students early in their training.

Methods: Eponyms during lectures, commonly held beliefs, and intricate anatomical details are opportunities to elaborate, question, and debate by delivering short, engaging narratives and introducing challenging concepts. These narratives aim to provoke thought and connect anatomy content with art, history, ethical dilemmas, elements of Diversity, Equity, and Inclusion (DEI), as well as ambiguity.

Results: The above strategy enabled students to anchor information, reflect, contemplate, generate discussion, and learn how to navigate through seemingly perplexing information. Assessment in the short term included multiple-choice questions at the end of the lecture, in exams, and through course evaluations. Illustration of the implementation of this concept is demonstrated by providing examples that show how this approach is introduced and allows members of the audience to observe their reactions and emotions in response to the content.

Conclusion: Introducing elements of medical humanities and the history of medicine into an anatomy course is effective. Evaluation gauges the impact of content on students. Ambiguity tolerance training in the anatomy course eases anxiety and benefits students' understanding and engagement with the material.

Keywords: Anatomy Education, Medical Humanities, History of Medicine, Ambiguity Tolerance Training

IA-0131

Enhancing Understanding of Collateral Circulation and Clinical Correlation in Anatomy Education by Using SMA and IMA

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Abstract: The superior mesenteric artery (SMA) and the inferior mesenteric artery (IMA) communicate via the marginal artery of the middle colic artery and the left colic artery of the inferior mesenteric artery, and the meandering mesenteric artery. The middle and left colic artery branches, located within the mesocolon, are the primary means of communication. Collateralization between the IMA and systemic circulation occurs in the rectum as the superior rectal vessels merge with the middle rectal vessels from the internal iliac arteries. The superior mesenteric artery is much bigger in diameter than the

inferior mesenteric artery. A unique case of superior mesenteric arterial blockage, followed by enlargement of the inferior mesenteric artery, serves as a good example of collateral circulation. A radiographic image was chosen to show students that when the superior mesenteric artery is blocked, the inferior mesenteric artery increases its size to accommodate the deficiency of blood supply to the SMA. Intestinal ischemia, which can affect the small or large intestine, can be caused by arterial occlusion, venous occlusion, or arterial vasospasm. Atherosclerosis is the major cause of chronic mesenteric ischemia. The narrowing of the arteries occurs more in the origins of the celiac or superior mesenteric arteries. A rapid diagnosis is crucial for patients with acute symptoms because ischemia can result in sepsis, bowel infarction, and death. Although atherosclerosis of the mesenteric vessels is common, clinical manifestations caused by mesenteric arterial disease are rare. The diameter of IMA is wider for patients with rectal cancer and left colon cancer compared to those without colorectal cancer. IMA diameter can be a potential marker for locoregional staging of rectal cancer.

Keywords: Collateral circulation, Superior mesenteric artery, Inferior mesenteric artery, Anatomy education, Cadaver study

[Symposium 33: "Ethical Anatomy in Practice: Contemporary Oversight and Management of Anatomical Programmes and Collections" for Stream]

IA-0024

Recommendations for the Management of Legacy Anatomical Collections

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Abstract: Collections of human remains in scientific and private institutions are globally ubiquitous. Throughout history, there has often been variable regard for the respect and dignity that these tissues demand or receive. Recent public scandals around the use of human remains, coupled with an increasing community awareness around accountability in such instances, has forced scholars to confront the ethical and moral concerns associated with these collections. This includes specific focus on the acquisition, storage, use, and disposition of these remains, which were often collected with no consent and with little knowledge, or concern, about the individual or their respective practices and culture surrounding death and postmortem treatment. In 2021 the American Association for Anatomy convened a Legacy Anatomical Collections Task Force to consider these issues and to develop recommendations to assist those working with these tissues in education, research, and museum collections. This has culminated with the development of Recommendations for the Management of Legacy Anatomical Collections which have since been endorsed by the American Association for Anatomy. The Recommendations provide both an ethical foundation and practical considerations for the use, storage, and disposition of legacy collections of human tissues, and deliver guidance establishing appropriate management and oversight, investigating provenance, and engaging with communities of care. These Recommendations have recently been published and represent current 'best practice' that can guide researchers, teachers, and museum associates as they consider the future of legacy anatomical collections in their care. They are also considered a living document which will change over time as ethical principles concerning the management of human tissue evolve.

Keywords: Legacy collection, Anatomy collection, Ethics, Recommendations, Guidelines

IA-0054

Human Body Donation Programs: Recommendations for Consistent Policies and Procedures

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Abstract: Over the past fifty years, the use of altruistically donated bodies for anatomy education and surgical skills training has increased worldwide with a significant increase in

their use in the United States. This increased use in the United States paralleled an increase in body donation programs – both non-profit academic programs as well as for-profit businesses. As these programs were established, they developed their own unique operational policies and procedures as there was little legislation to guide them. Consequently, there are markedly different ways that donation programs run their operations including how donations are solicited, the types of forms and information that are provided to the donors, the ways the donors are utilized and the processes around the donor's disposition. To improve benchmarks and standards, anatomical societies and other organizations have called for more consistent policies and procedures in body donation programs. The American Association for Anatomy (AAA) has recently released "best practices" guidelines for body donation programs. These guidelines provide a path for programs to follow to maintain consistent ethical, procedural and financial policies. They provide detailed information about best practices in the field for both those with established programs as well as those who are developing new programs. Many of these policies can also be applicable internationally with the goal for all body donation programs to have the same ethical foundations in the respectful and dignified treatment of those that altruistically provided their bodies for education and research.

Keywords: Body Donation, Ethics, Best Practices, Policies

IA-0080

Management and Transition of Physical Collections into the Digital Realm: A South African Experience

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Abstract: Human skeletal repositories are shifting from physical to digital platforms for a variety of reasons which include restrictions on space, preservation of human remains, and limitations on international access. Technological advancements, exemplified by a variety of modalities such as computer tomography, 3-D surface scanning, and photogrammetry that facilitate high-resolution scans, have enabled acquisition of digital renderings that retain the integrity and original morphology of anatomical structures. These digital technologies enable non-invasive preservation and non-destructive analysis, promote global access of digital data to researchers, and provide benefits around storage capacity for physical specimens. However, such benefits are attached to challenges that extend from data privacy and security to cultural sensitivities that require unique, region specific solutions. This work provides a comprehensive account of the challenges and interventions addressing the digital transition of human skeletal collections in a South African context. This includes a revision of specific digital curatorial practices with a focus on data management, legislation, and ethical considerations. Solutions for the creation of digital repositories are described, including variations from less resourced frameworks through to those that are fully funded digital repositories. Key features for consideration are the development of management policies guided by data security, international collaboration, local indigenous perspectives, and ethical stewardship to enable democratising access to African human skeletal remains. Digital anatomical repositories have the potential to revolutionise teaching and research landscapes, however their establishment and management demands unique innovations specific to regional contexts and needs.

Keywords: Digital repositories, Skeletal collections, Ethics

IA-0084

Defining Contemporary Consent Practices for Body Donation (for the Symposium: Ethical Anatomy in Practice: Contemporary Oversight and Management of Anatomical Programmes and Collections)

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Abstract: Body donors and anatomical specimens play a crucial role in teaching and research. Upholding the highest standards of professionalism and ethical management of anatomical collections, from legacy and contemporary sources, is critical to ensure access to these valuable resources now and for future generations of students and researchers. The anatomy community is increasingly aware of the ethical issues associated with the practice of anatomy and the importance

of compliance. Yet, relatively few best practices exist to guide anatomical program management and fewer still lend guidance to, or contain specific recommendations for, consent of body donors. Relevant research on donor consent practices in the US and beyond highlight opportunities for body donor programs throughout the global community to reflect on contemporary perspectives and promote ethical consent concepts that are salient for anatomical programs and donors alike. An assessment of available guidance and standards that underscore consent will be presented alongside "best practices" for the acquisition, storage, tracking, utilization, and disposition of anatomical specimens and collections used for the practice of anatomy. Research in the US shows significant variety of information presented during consent practices. Best practices specificity for consent form content is sparse but contain vital ethical concepts for the oversight and management of body donation programs and anatomical collections that can be leveraged for developing ethical consent procedures throughout the anatomy community.

Keywords: Anatomical collections management, Body donation oversight, Consent practices, Ethics, Policies and Procedures

[Symposium 34: New Dimensions in Applied Anatomy (Forensics and Clinical Anatomy)]

IA-0018

The Role of Artificial Intelligence in Forensic Osteology Research in Thailand

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Abstract: Identifying human remains is fundamental to the humanitarian, legal, and natural rights of all individuals. The methods are classified into non-scientific and scientific approaches. Even though DNA is the most precise technique, it is often inaccessible in many cases. Consequently, in Thailand, we developed a method of human genomic extraction from metacarpal bone using gelatin-coated magnetic particles. We applied the four principles of biological identification—sex, age, stature, and ancestry—in the discovery of each bone remains. The most significant factor is sex, since it could promote the other principles. We have studied sexual dimorphism in numerous Thai bones. However, the most challenging principle is age estimation, which has limited studies conducted in Thailand. Furthermore, we thoroughly studied stature identification in both complete and incomplete long bones, which is a crucial step in the identification process. Additionally, we have published a study on identifying ancestry between Thais and Japanese populations. We have also conducted a promising study on identifying ancestry between Thais and Indonesian populations. To enhance the precision of all determinations, we have determined to utilize artificial intelligence, which will play an important role in forensic osteology.

Keywords: Biological identification, Human remains, Artificial intelligence

IA-0132

The Importance of the Biological Profile in Commingled Human Remains Analysis: A DPAA Perspective

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Abstract: Forensic anthropological analysis of human remains in human rights and disaster victim identification contexts commonly involves the sorting of commingled skeletal elements to aid in the personal identification of individuals. The Defense Prisoner of War/Missing in Action Accounting Agency (DPAA), the United States government agency responsible for the search, recovery, and identification of service members from past U.S. conflicts, is often tasked with resolving commingled assemblages ranging in complexity from small aircraft crashes to large mass graves. It has collaborated on several tools to improve the efficacy of commingled remains sorting utilizing biological profile data. A variety of methodological strategies are available to analyze commingled assemblages. Each impacts the techniques employed by forensic practitioners, including the technological advances to help streamline and automate processes. However, fundamental to all the technological and methodological advances for laboratory-based sorting is the application of the biological profile criteria (i.e., age, ancestry, sex, stature, etc.). Three case examples highlight how forensic practitioners must

solidly understand the anthropological techniques to estimate the biological profile prior to implementing technologies that automate processes to 1) assure programs are trained properly and 2) assess the validity of generated recommendations. Case 1 highlights the utility of the OsteoSort program, which compares metric data of skeletal elements to generate shortlists of those that potentially pair match or articulate. Case 2 highlights how the Commingled Remains Analytics program, a specimen level information management system, integrates disparate biological criteria to suggest linkage of skeletal elements. Case 3 utilizes a combination of biochemical and age data to support the association and/or segregation of elements. Although the biological profile is typically associated with personal identification (i.e., comparison to missing person records), these case examples demonstrate how essential it is to sorting commingled remains and, thus, must remain an educational focus in training programs.

Keywords: Forensic Anthropology, Commingling, Biological Profile, DPAA

IA-0106

From Bones to Bytes: Advancing Forensic Anthropology through Geometric Morphometrics and AI in Malaysia

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Abstract: The advancement of technology has revolutionized the field of forensic anthropology, ushering in a new era characterized by the integration of digital methodologies. In Malaysia, the absence of an osteological centre has necessitated a shift towards innovative solution in forensic anthropology research. The transition to imaging techniques marked a significant milestone, enabling forensic anthropology researchers to conduct detailed skeletal examinations specific to Malaysian population without the need for extensive osteological collections. Radiographic imaging modalities such as X-rays and computed tomography (CT) scans became indispensable tools in forensic anthropology, allowing for two- and three-dimensional visualization of skeletal structures and precise measurements. With radio-imaging, geometric morphometric (GM) method is adopted as a sophisticated approach to skeletal analysis. Unlike traditional linear measurements that focused on length and index, GM focuses on capturing shape variations through the use of Cartesian landmark and advanced statistical analysis, offering a more nuanced understanding of skeletal morphology. We then delve into the evolution towards cutting-edge artificial intelligence (AI)-driven approaches for predictive modelling and classification tasks. The application of AI algorithms will facilitate the rapid identification and classification of skeletal remains from large datasets, which is crucial for both legal and humanitarian efforts. In conclusion, the convergence of GM and AI marks the digital revolution of forensic anthropology. As Malaysia continues to develop its forensic capabilities, the adoption of these cutting-edge methodologies, from "bones to bytes" will play a pivotal role in elevating the standards and outcomes of forensic anthropology practices. The insights gleaned from this research not only enrich our understanding of human skeletal morphology but also hold profound implications for forensic science practice and policy in Malaysia and beyond.

Keywords: Forensic Anthropology, Geometric Morphometric, Artificial Intelligence, Malaysia, Digital Revolution

IA-0117

The Present and Future of Forensic Anthropological Studies Using Korea CT Data

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Abstract: The computed tomography (CT) data have become one of the key research materials the field of forensic anthropology and its applicability has expanded to encompass various topics, including personal identification. As a result, since 2000, there has been a significant increase in CT-related articles, particularly in the field of forensic anthropology. In this regard, the presentation aims to examine the current state of forensic anthropological research in Korea using CT data, focusing on recent studies, and to anticipate future research directions. Since the late 2000s, numerous studies utilizing CT data of Koreans have been published in domestic and interna-

tional forensic anthropology journals. The primary focus of these studies is on the development of sex estimation specific to Koreans and facial reconstruction for personal identification. Additionally, research continues to utilize CT data for developing methods to estimate age-at-death and stature among Koreans. Considering that a sufficient database of CT data from Koreans, which is usable for forensic anthropological research, has not yet been fully established, these research outcomes can be considered highly promising. Currently, the most actively utilized research data in studies are CT scans of autopsy bodies accumulated by the National Forensic Service of Korea since 2013. These are being employed for large-scale forensic anthropological research on the Korean population. Based on this research trend, various aspects of skeletal variation in Koreans are currently being analyzed using artificial intelligence-based deep learning techniques and 3D statistical shape modeling methods. Therefore, it is anticipated that in the future, not only will the development of biological profiling methods using skeletal variation in Koreans advance, but also comparisons among diverse populations will become feasible.

Keywords: Computed tomography, Personal identification, Biological profiling, Forensic anthropology, Korean

IA-0026

Dental Age Estimation Using the London Atlas in a Select South African Population

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Background: A crucial aspect of clinical dentistry, forensic science, and medico-legal cases is dental age estimation in the living and deceased. Consequently, this study aimed to determine the accuracy and reproducibility of the London Atlas in a select sample in KwaZulu-Natal, South Africa.

Methodology: This cross-sectional retrospective study reviewed 760 digital panoramic radiographs (n = 760) aged between 5.00 and 23.99 years using consecutive sampling. The radiographs were reviewed, and the dental age was assigned using the London Atlas of Human Tooth Development and Eruption by AlQahtani et al. (2010).

Results: The London Atlas over-estimated age in the selected South African sample and a statistically significant difference between the chronological and estimated dental ages were recorded. The over-estimation of age was higher in the South African Black and Indian males in comparison to their female counterparts. The South African Indian population had a less over-estimation in age when compared to the South African Black population.

Conclusion: Subsequently, this study created the KZN population- and sex-specific atlases for the selected population groups of KwaZulu-Natal. The KZN Atlases were more accurate in the prediction of age in the selected sample, with a mean absolute error of 0.57 years and there were no statistically significant differences between the chronological and estimated dental ages.

Keywords: Dental age estimation, Digital panoramic radiographs, Forensic dentistry, London Atlas, Population-specific data

IA-0083

The Domino Effect: Spinal Variations Associated with Lumbosacral Transitional Vertebrae

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Aim: This study investigated the co-occurrence of lumbosacral transitional vertebra (LSTV) and spinal variations, analysing prevalence, morphology, demographic factors, side and spinal location.

Methodology: An ex-situ anatomical study of cadaveric spinal columns from a South African skeletal population were examined at the Raymond A. Dart Collection of Modern Human Skeletons. Eleven spinal variations were considered within two cohorts: an LSTV cohort (n=100) and a control cohort (n=60).

Results: LSTV primarily displayed Type IIB morphology and sacralisation, with fewer spinal variations per skeleton compared to controls (4.03 vs. 5.05). When including LSTV as a variation, both cohorts averaged five variations per spinal column. Accessory transverse foramen (ATF) was the most common variation, affecting upper and lower cervical regions bilaterally for both groups. Males in both cohorts showed a

higher incidence of spina bifida occulta (SBO), sacral spinal region (SSR), and midline variations (p=0.001, p=0.002, p<0.01). Conversely, females were more likely to exhibit lateral ponticle, retrotransverse foramen, and left-sided variations (p=0.03, p=0.033, p=0.021). Significant associations were observed between LSTV and arcuate foramen (AF) (p=0.048), while the control cohort demonstrated statically significant associations with partial retro-transverse foramen, partial accessory transverse foramen (PAF), bipartite superior facet of atlas, upper cervical spinal region, lower cervical spinal region, as well as left and right-sided variations (p=0.041, p<0.001, p=0.018, p=0.02, p=0.011, left p=0.026, right p=0.027). The predominant side of spinal variations in both cohorts was bilateral occurrence.

Conclusion: The LSTV and control cohorts demonstrated similar prevalences for spinal variations. Sex-specific differences were noted with males demonstrating a higher incidence of SBO in the SSR, with midline dominance. Females exhibited greater prevalence for LP, RTF, and left-sided dominance. Overall, these findings contribute the understanding of spinal variation patterns, emphasizing the importance of considering sex-specific differences and their clinical implications for back pain and treatment.

Keywords: Lumbosacral transitional vertebra, Lumbarization, Sacralization, Spinal variation, Anomaly

IA-0041

Vertebra C1 - A True Vertebral Enigma

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Abstract: The Cervical Vertebra C1 (or Atlas) have been studied in the most detail because of its critical location. It is an atypical vertebra of the cervical region of the vertebral column, exhibiting unique features that substantiate its critical role in the functionality of the vertebral column. Providing attachment for the smallest vertebral muscles, its location is at a crucial interface between cranial and vertebral elements of the skeleton. Not only is it supportive and weight-bearing of the skull, but it is also an important partner in two significant joints of the cervical region, namely the atlanto-occipital and the atlanto-axial joints. Its special morphology and diminutive size underplay the importance of its role and enigmatic nature. Its embryonic derivation of being derived from the fourth occipital sclerotome that has merged with the first cervical sclerotome makes it most vulnerable to multiple anomalies and variations. These range from missing vertebral elements, such as having unfused transverse foramina, to exhibiting the addition of extraosseous elements, such as the anterior, lateral and posterior particles, the formation of an arcuate foramen or accessory transverse foramina. These, in turn, impact or are impacted by the neurovascular structures related to this bone, which then exhibit the associated clinical implications.

Keywords: Cervical Vertebrae, Atlas vertebra, Clinical Anatomy, Cerevical movement, Variations

[Symposium 35: Intersection of Cell Biology, Tissue Engineering and Precision Medicine]

IA-0055

Semisynthetic Extracellular Matrix-Inspired Systems for Therapeutic Delivery and Tissue Repair

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Abstract: The extracellular matrix (ECM) is a highly dynamic structure that plays a critical role in disease and regeneration. Engineered matrices, or synthetic ECM (sECM) offer great promise for the treatment and regeneration of damaged or diseased tissue. The biophysical and biochemical properties of sECM, including mechanical properties, degradation kinetics, cell adhesion and growth factor retention, can be tailored to promote tissue regeneration and functional repair. With these considerations in mind, we describe the development of ECM-inspired systems to promote tissue repair. Hyaluronic acid (HyA) is a major component of the native ECM, and has been widely use in the development of biomaterials owing to its biodegradable and biocompatible nature. Addition of an acrylate group to HyA (AcHyA) allows for the formation of a crosslinked HyA hydrogel using dithiol-terminated crosslinkers, as well as conjugation of a range of bioactive moieties. With AcHyA as the polymeric backbone, HyA-based hydrogels are engineered to embody critical ECM features including ma-

trix metalloproteinase (MMP)-sensitive degradation, adhesion ligand presentation and growth factor retention. This system demonstrates great promise to support vascularisation and tissue repair, and reduce fibrosis in clinically-relevant in vivo models of volumetric muscle loss (VML). While this AcHyA shows great promise for the treatment of VML, key properties of this HyA-based sECM may also be tailored for alternative tissue types. This may include modification of biophysical properties including mechanical properties, degradation kinetics or the adhesion peptide sequences, or the addition of therapeutic molecules to adapt to the properties or disease-states of other tissues. For example, further functionalisation of this AcHyA-based hydrogel system by the conjugation of antimicrobial peptides (AMPs) will be demonstrated. AMPs can be conjugated without otherwise altering the AcHyA-based hydrogel properties, making this system suitable for the repair of infected skin wounds.

Keywords: Hyaluronic acid, Hydrogels, Muscle regeneration, Wound healing, Tissue Engineering

IA-0070

Painful Intervertebral Disc Degeneration: Hydrogel System and Disc-on-a-Chip through Precision Medicine

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Abstract: Intervertebral disc (IVD) degeneration is one of the etiological factors of LBP, affecting 42% of the population globally. Our study advances a hydrogel technology and organ-on-chip for disease model tailored to the patient-specific pathogenesis of painful IVD degeneration. We developed a hydrogel system that has been shown to alleviate pain phenotype and promote disc hydration and disc height for tissue repair in IVD injury of rat models. Using a precision medicine approach, we conducted a multicentre prospective study to determine molecular markers of neuroinflammation and nociception in LBP patients diagnosed with degenerative disc disease (DDD) across severity stages by RNA sequencing analysis. Demographic analysis revealed that ageing patients were most impacted by severe degenerative disc stages of Pfirrmann grades IV and V. Transcriptomic profiling mapped the upregulation of pro-inflammatory and nociceptive markers. To mimic the 3D inflammatory and nociceptive niche of the IVD, we developed the disc-on-a-chip model, a disease model-oriented microfluidic and hydrogel system using 3D (bio) printing. It comprised the nucleus pulposus (NP), annulus fibrosus (AF) and sensory regions. Computational simulation determined shear stress and fluid velocity as increasing pressure. The viability and phenotypic markers of AF, NP and sensory neurite were informed. Our results imply a human "on-chip" model to investigate the patient-specific pathogenesis of painful IVD degeneration, allowing for rapid prototyping and a high-precision platform for pharmacological testing and tissue regeneration.

Keywords: Intervertebral disc degeneration, Nociception, Organ-on-a-chip, Neuroinflammation, Tissue regeneration

IA-0134

Protective and Anabolic Effect of Tocotrienol on Differentiation and Proliferation of MC3T3-E1 Osteoblast via Induction the Wnt/β-catenin Signalling Pathway and Inhibition of RhoA Activation

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Abstract: Bone remodelling is regulated by osteoblast-mediated bone formation and osteoclast-mediated bone resorption. Osteoporosis is characterized by low bone mass and deterioration of skeletal microarchitecture, leading to bone fragility. Osteoporosis is caused by osteoblast apoptosis and osteoclast proliferation in the body, which leads to bone loss. The imbalance of these two processes causes abnormalities in bone remodelling, which can produce a variety of bone disorders including osteoporosis. Wnt signaling is a key molecule that determines the directional differentiation of MSCs into osteoblasts and participates in bone formation, development, and remodelling. Wnt3a promotes the formation and deposition of bone matrix by activating Runx2 through synergistic action with BMP-9. The current therapies for osteoporosis include anti-resorptive agents (bisphosphonates, calcitonin,

denosumab, oestrogen+ progesterone) and anabolic agents (teriparatide). These agents are effective against osteoporosis but they come with adverse side effects. The preventive agents for osteoporosis are limited to calcium with or without vitamin D, has been the target of drug intervention for osteoporosis. Statins, traditionally known as cholesterol-lowering agents, have been found to promote bone formation in vitro and in vivo. Statins regulate the mevalonate pathway by inhibiting the 3-hydroxy-3- methyl-glutaryl coenzyme-A (HMG-CoA) reductase (HMGR) enzyme. Rho, a type of G protein is involved in statin- induced osteogenesis. Rho-Rho kinase inhibition stimulated differentiation and calcium nodule formation. Inhibition of Rho kinase was shown to increase bone morphogenetic protein- 2 (BMP-2) gene expression. Tocotrienol and tocopherol are members of the vitamin E family, can be found in palm oil. Tocotrienol exerts powerful antioxidant properties, have been reported to protect bone in various animal models of osteoporosis. It enhances the expression of bone formation-related genes such as OSN, OCN, and OPN through the Wnt/β-catenin signaling pathway. From its effects on the related pathways, tocotrienol has the potential to be used as a treatment for osteoporosis.

Keywords: Osteoporosis, Tocotrienol, Wnt/β-catenin, Osteoblast, Osteoclast

[Symposium 36: A Tale of Three Continents: Innovations in Anatomical Sciences in the New Medical Education Landscape]

IA-0082

Weaving and Interleaving Anatomical and Clinical Sciences to Enhance Adaptive Competence

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Abstract: The initiative to redesign medical education resulted in many US medical schools adopting more clinically relevant, systems-based curricula. The curricular innovation at CU facilitated adaptive competence in students from the first day of medical school with a three-pillar curricular design integrating the medical sciences, health and society, and clinical skills. The medical sciences pillar incorporated anatomical sciences within the discipline and the clinical sciences. Students acquired scientific knowledge, clinical reasoning skills, and professional competencies through the spiraled presentation of content and robust opportunities for self-reflection, coaching, and feedback. In year one, each week is oriented around a chief concern covering relevant basic sciences, applicable clinical conditions and patient presentations, and addressing health and societal considerations. This ambitious curriculum required innovative pedagogical approaches to reduce extraneous and germane cognitive load for learners. Extraneous load was reduced by streamlining learning objectives and incremental increase in content depth. Germane load was reduced by deliberately reinforcing concepts from basic, clinical, and societal sciences forcing students to interleave all three pillars. Learning events such as bedside anatomy, basic sciences dry labs, case-based application, and weekly concept checks were implemented with metacognitive check-ins to promote authentic learning and adaptive competence. Formative and summative assessments including standardized exams, and perceptions on student competency improved compared to the traditional curricula. Clinical faculty deemed students more knowledgeable and better prepared for clinical phases while students self-report inadequacy and under preparedness. Metacognition analyses reveal that incoming medical students are unable to accurately predict their learning outcomes on assessments. Results suggest facilitating adaptive competence in early medical training is possible through deliberate multidimensional integration of basic, clinical, and societal sciences, and professional development. The implication of these data suggests that reimagining Miller's Pyramid as a geometrically fluid shape is essential in the new medical education landscape.

Keywords: Adaptive competence, Metacognition, Longitudinal medical curriculum, Interleaving, Cognitive load

IA-0216

Anatomy Education Embedded in Multidisciplinary Training and Clinical Skills

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Abstract: In the current landscape of artificial intelligence and rapidly advancing medical education, a critical challenge in anatomy education is distinguishing between essential knowledge that medical graduates should retain in long-term memory and information that can be efficiently accessed through technology at the point of care. This distinction is crucial for optimizing medical training and ensuring that healthcare providers safe and effective, while leveraging technology effectively. This presentation explores an approach to anatomy education embedded in multidisciplinary case-based learning, clinical skills training, and non-technical skills development such as professionalism and critical thinking. The approach is grounded in the pedagogical principles of contextual application, knowledge integration, and reasoning. By presenting anatomy through the lens of medical disciplines, students develop a holistic understanding of clinically relevant anatomy. This method enhances knowledge retention, promotes critical thinking and enables students to develop skills for the future AI-augmented workplace. A comprehensive framework for this approach using practical examples drawn from integrating anatomy into clinical skills training, surgery, radiology and internal medical will be outlined. This approach is particularly relevant in the context of AI and machine learning advancements. While AI can provide quick access to anatomical information, the ability to apply this knowledge in clinical contexts remains a uniquely human skill. By focusing on the integration and application of anatomical knowledge, this method prepares students for a future were understanding the "why" behind structure and relations is as important as knowing the "what".

Keywords: Anatomy Education

IA-0081

Development of Modified Autopsy Prosection Protocol and a New Anatomy Lab Practical Assessment Modeled on the OSCE for Clinically Authentic Anatomy Education in a Systems-Based Curriculum

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Abstract: Promoting adaptive competence for gross anatomy in the new era of medical education requires deliberate design to enhance clinical authenticity from the first day of training. Gross anatomy in the new medical curriculum at CU has evolved from a 10-week immersive dissection course to year-long integration with 10 systems-based courses. Prosection labs begin with a full external body inspection akin to autopsy. Clinical authenticity is further reinforced through a novel modified en masse autopsy protocol (AP) prosection preserving anatomic relationships across organ systems. To promote adaptive competency with flipped lab, students were prompted to manipulate organ blocs to identify anatomy, synthesize clinical relevance, and interact with donors as their first patients. For assessments, a novel performance-based lab exam was created, modeled on the Objective Structured Clinical Examination for anatomy (OSCE-A). OSCE-A assesses higher levels of Bloom's Taxonomy by having students interpret physical exam, imaging, and lab results, navigate variation or pathology, and manipulate the donor to tag accurate anatomic structures relevant to diagnosis and therapeutic intervention. Evaluation on the efficacy of the new anatomy curriculum reveal positive student perceptions from the full body inspection, and significantly higher learning outcomes in labs using AP (n=172, 84.2% vs 78.6%, $p<0.01$, Glass' $\delta=0.29$). Appraisal of OSCE-A revealed that it is a valid and reliable 20-item assessment tool (KR-20 range 0.43-0.54), consistent with board style exams when scaled using the Spearman-Brown prophecy formula (0.82), with good discrimination

(average 0.31). Students perceived the OSCE-A as a clinically relevant and authentic assessment well aligned with the curriculum. These results indicate that full body inspection, AP, flipped lab, and OSCE-A promote clinical authenticity in gross anatomy curriculum and support a systems-based, integrated medical education. Innovative approaches with tangible educational toolkits can enhance student experiences while promoting adaptive competence, ultimately transforming patient care starting with gross anatomy education.

Keywords: Practical Exams, Gross Anatomy, Autopsy, Prosection, Clinical authenticity

[Symposium 37: Synchronicity of Artificial Intelligence with Digital Dissection- A Tool for Better Future of Anatomy]

IA-0119

Harnessing Artificial Intelligence to Revolutionize Anatomy Education

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Abstract: The advent of Artificial Intelligence (AI) has initiated a paradigm shift in anatomy education, offering innovative solutions to longstanding challenges and significantly enhancing learning experience. AI has transformative impact of AI on anatomy education, focusing on the development and implementation of AI-driven tools and methodologies that are redefining how anatomical knowledge is taught and absorbed. Interactive 3D Anatomical Models: AI technologies are facilitating creation of highly detailed and manipulable 3D models of human anatomy. These models allow students to visualize and interact with anatomical structures in a dynamic way, providing a deeper and more intuitive understanding compared to traditional static images or physical models. Virtual Dissection and Simulation: Leveraging the power of AI, virtual reality (VR) and augmented reality (AR) applications are offering realistic dissection simulations. These virtual dissections enable students to practice surgical techniques and explore anatomical relationships in a safe, controlled, and repeatable environment, thereby enhancing their practical skills without the ethical and logistical issues associated with cadaver-based learning. Personalized Learning Platforms: AI-driven adaptive learning systems tailor educational content to the individual needs of each student. Automated Assessment and Feedback: AI algorithms can automate the grading of assignments and practical exams, offering instant and objective feedback. Enhanced Accessibility: AI can bridge gaps in accessibility by translating complex anatomical terminology and concepts into simpler language, making them comprehensible to a wider range of learners. Integration with Big Data for Research: AI's ability to analyze large datasets of medical images and clinical information is uncovering new insights into human anatomy, informing both research and development of educational materials. In conclusion, AI is poised to significantly transform anatomy education by providing interactive, personalized, and efficient learning tools & has potential of AI to enhance educational experience and prepare future healthcare professionals with a deeper and more comprehensive understanding of human anatomy.

Keywords: Artificial Intelligence, Deep Learning, Human Anatomy, Simulation, Virtual Dissection

IA-0160

Advancements in AI-Assisted Surgical Planning and Practice

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Abstract: The field of surgery has witnessed remarkable advancements in recent years, driven in part by the integration of artificial intelligence (AI) technologies. This presentation aims to explore recent applications of AI in surgical planning and practice, highlighting anatomical aspects and implications. AI-assisted surgical planning has revolutionized the preoperative phase, enabling surgeons to leverage advanced computational models and data analysis techniques. Examples include virtual surgical planning, rapid prototyping techniques, through to aAugmented rReality surgical planning and automated detection of breast cancer and diagnosis of appendicitis. We are at the cusp of using AI-powered decision support systems during surgical procedures. AI algorithms provide actionable insights and guidance to surgeons through rReal-time analysis of intraoperative data, such as vital signs, imaging, and surgical instrument tracking, allows AI algorithms to provide actionable insights and guidance to surgeons. These systems can enhance

precision, reduce human error, and facilitate more informed decision-making throughout the surgical process. The role of AI in training surgeons extends from acting as a mentor to test knowledge and decision making,through to analysis of performance within Virtual Reality environments. Additionally, the role of AI in postoperative care and rehabilitation will be explored, showcasing how intelligent monitoring and personalized treatment plans can optimize patient recovery and reduce complications. By highlighting real-world case studies and cutting-edge research, this presentation will illustrate the transformative potential of AI in surgical planning and practice. It will also address the ethical considerations, regulatory challenges, and future directions in this rapidly evolving field.

Keywords: Artificial Intelligence, Surgery

IA-0088

Employing Artificial Intelligence for Enhanced Anatomy Dissection and Surgical Training

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Abstract: Artificial intelligence (AI) is rapidly transforming the landscape of anatomy and surgical training. AI's capabilities transcend the limitations of human vision in anatomy dissection and surgical planning, unveiling a multitude of possibilities by offering innovative solutions to longstanding challenges. In anatomy education, AI is facilitating the development of 3D anatomical models for virtual dissections. These advancements address the dearth of cadavers for dissection. They provide a unique advantage of virtual dissection remotely during free time without visiting the dissection hall. Using the human anatomy data from CT and MRI of different individuals AI tools like 3D slicer, Tempus radiology, etc. can also give an experience of the anatomical variations that are come across during dissection. This is one of the most important advantage that cadaveric dissection gives over any virtual dissection tables. AI-assisted assessment tools like Moodle with AI plugins, and Gradescope by Turnitin streamline evaluation processes, providing personalized feedback and adaptive testing to cater to individual learning needs. It makes evaluation faster and easier especially when evaluating large groups of students. In surgical practice, AI-driven technologies such as VR-based surgical planning tools and handheld portable ultrasound systems integrated with AI are transforming preoperative planning and diagnostic imaging. It is employed in online simulations of surgeries and autopsies, offering trainees opportunities to enhance their practical skills in a controlled environment. While embracing the potential of AI it is essential to recognize the importance of maintaining human-centric approaches as this enhances personalised learning based on students' learning styles and pace. In conclusion, the integration of AI, holds immense promise in advancing anatomical education and surgical practice. Harnessing the potential of AI tools to integrate the variability and uncertainty of human anatomy will pave way for development of effective dissection and surgical planning software.

Keywords: Virtual Dissection, Anatomy education, Surgical planning, Virtual Reality, AI tool

IA-0118

Ethical Implications and Challenges of Digital Dissection

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Abstract: Advancements in technology, particularly AI and digital imaging, have introduced digital dissection tools as a virtual alternative to traditional cadaver-based learning in medical education. These tools offer significant benefits such as enhanced accessibility, safety, customization, and sustainability. However, they also pose notable ethical concerns, including respect for the deceased, loss of tangible learning experiences, equity in education, and the validity of learning outcomes. Additionally, practical challenges arise, such as technology reliability, educational standardization, and the need for regulatory oversight. The ethical implications are multifaceted, involving issues of informed consent, privacy and data security, algorithmic bias, and the impact on cadaver donation programs. To harness the potential of AI-assisted digital dissection while upholding ethical principles, it is crucial to maintain transparency, accountability, and

ethical governance. Integrating ethics education into medical curricula and fostering ongoing dialogue among stakeholders will be essential in navigating these challenges effectively. The responsible implementation of digital dissection technologies can advance anatomical education and research while safeguarding individual rights and ensuring equitable access. By addressing the ethical challenges associated with AI-assisted digital dissection, we can harness the benefits of this technology while upholding ethical principles and safeguarding the rights of individuals whose anatomical data is utilized. Ethical awareness, regulatory oversight, and transparent practices are essential for the responsible integration of AI into anatomical education and research.

Keywords: Ethics, Artificial Intelligence, Challenges, Digital dissection, Algorithmic bias

[Symposium 38: Gross Anatomy]

IA-0138

Gross Anatomy: Ligamentous and Vascular Relations in the Radial Wrist

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Introduction: Clear and detailed understanding of the anatomy of the human wrist remains elusive, moreso when looking for clear application of such anatomy in a clinical setting. The anatomical "template" of each individual could be anywhere along a broad spectrum of variations, and these only increase in difference with ageing and degeneration. Understandably, most wrist anatomy studies focus on specific tissues, such as ligaments, and rarely look at the associations between tissues. Could combining investigations into multiple tissue types provide clearer answers? This study combines ligamentous and vascular approaches to explore this possibility on the radial side of the wrist.

Methods: Body Donor wrists (n=22) were dissected, with particular focus on the dorsal and palmar sides of the scaphoid. Any superficially observed vessels were traced into these regions and excluded when diverted elsewhere. At the wrist capsule a fascicular dissection approach was used to observe and maintain tissues likely to be of direct mechanical importance.

Results: Where ligament attachments to the scaphoid were minimal (principally to the trapezium dorsally and the capitate palmarly), much of the dorsal scaphoid waist was occupied by a longitudinal array of small blood vessels entering the scaphoid via nutrient foramina along this length. Conversely, when the equivalent ligaments were predominately attached to the scaphoid, the expanse of waist area was obstructed, forcing a smaller number of vessels to enter a small number of more distal foramina.

Conclusion: Ligament arrangements at the scaphoid influence the course of vasculature into the scaphoid. Given the difficulty in imaging these ligaments clinically, vascular imaging may provide an alternate route to typing wrists. This may allow for more accurate treatment design, individualised for each patient and, in turn, improve clinical outcomes for wrist disorders.

Keywords: Anatomy, Wrist, Ligaments, Scaphoid

IA-0176

Clinical Anatomy as the Core of Both Anatomy Education and Research

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Abstract: Nowadays, following the development of cellular research in medicine, anatomy is facing an important decision if the anatomists should become molecular biology researchers to keep the pace of the current science but to lose their deep knowledge in the gross anatomy, or to adhere to clinical anatomy, the applied research related to surgical medical fields. As anatomy is still considered one of the cornerstones of the medical curriculum for future physicians, it is inevitable to assure deep and qualitative anatomical knowledge of its teachers. The contents and amount of anatomical structures taught to the first-year student is one of the also a point of discussion which differs across the world. Reasonable seems to have a pyramidal way of anatomical education, with basis coming in the first year, extended throughout the clinical years and crowned during the specialisation after graduating from a medical school. Especially the last steps should comprise very detailed anatomy of the specific regions including thorough variant anatomy and development defects. The first and second step should be

made up as applied knowledge, combining radiological, surgical, endoscopical, topographical and surface anatomy, using a complex method of teaching, comprising anatomical models/plastinated specimens, dissections, imaging including active ultrasound and 3D/virtual tools. Also, combination with embryology and histology into one subject is a useful approach integrating the knowledge and understanding of the human body morphology.

Keywords: Anatomy, Education, Reserach, Clinical

IA-0110

Exploring Microanatomy: Integrating Microdissection, Histology, Micro-CT, and Numerical Simulations

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Abstract: This presentation demonstrates new discoveries in the microanatomical structures through an integrative methodology that includes microdissection, histology, Micro-CT, and numerical simulations. Our research focuses on detailed anatomical studies of specific facial muscles—including the zygomaticus minor, mentalis, corrugator supercilii, depressor septi nasi, and facial muscles affecting the nasolabial fold—as well as the stomach, prostate, and iliotibial tract. By utilizing advanced imaging techniques, microdissection, and computational analysis, we reveal new facts about these structures that enhance our understanding of their functional and clinical relevance. These findings not only contribute to anatomical knowledge but also have practical implications for surgical and diagnostic procedures.

Keywords: Microdissection, Histology, Micro-CT, Numerical Simulation, Microanatomy

[Symposium 39: What is a 'Good' Anatomical Picture? Historical and Ethical Considerations in 2024 and Beyond; Stream]

IA-0060

Subjection and Power in Biomedical Visualization: Past, Present, and Future

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Abstract: As educators and researchers, as those who create visualizations, we often find ourselves with the opportunity and the means to create the "perfect image". Many of the images that we use in our educational practice have their origin from nefarious sources. The Pernkopf atlas is one such example: it was developed in Vienna during the Nazi period and many of the persons depicted were the victims of Nazi terror. The anatomical gaze from this atlas has informed modern atlases, that have emulated these depictions, and in some cases blatantly copied them. We need to explore the ethical implications of the past in the present: How can we deal with the discovery and multiplication of images that come from unethical sources? How do we deal with the "anatomical gaze" that comes from centuries of eurocentric illustrations? Pernkopf was not the only anatomist who exploited the availability of executed bodies for his own ambition: Rudolf Spanner was appointed Director of the Anatomy Institute in Danzig (Gdańsk) from 1939-45. During this time he worked on a new edition of the Spalteholz anatomy atlas and for this project he created hundreds of new illustrations. The bodies of the persons depicted were brought to the anatomy institute from surrounding Nazi executions sites, the Konradstein psychiatric institution, and some from the Stutthof concentration camp. Ambition, opportunity, and means came together and led to ethical transgressions. Using the ledgers of persons brought to the department and various historical archives, we have been able to identify some of the victims depicted in the atlas. What is our role as a modern viewer of these illustrations? How do we move forward into a future where illustrations, whether copied, created by AI, or from the historical archive, proliferate quickly and the origins can be forgotten?

Keywords: History of Anatomy, Atlas, Visualization, Nazism

IA-0043

Representation and Inclusion in Anatomical Images

Kelly HARRELL
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Abstract: Anatomical science education is fundamentally rooted in the visual image. Whether microscopic or macroscopic, anatomy education struggles to fully exist without visual supplementation. Historically, anatomical images have significantly lacked a breadth and depth of representation across categories of race, ethnicity, gender, body habitus, age, physical ability and accessibility. Rather, popular anatomy textbooks consistently overrepresented light-skinned, mesomorphic, young, male subjects as the physical gold standard. This ongoing disparity in representation in anatomical instructional materials perpetuates dangerous stereotypes of what is "healthy" and "normal", thereby failing to prepare our students to effectively engage with diverse populations. Simultaneously, a lack of visual representation in instructional materials disregards the diversity of our learners, thereby limiting the level of inclusion experienced in the learning environment. More recently, educators and students alike have put forward initiatives to advocate for the inclusion of anatomical images that display representation across a broad range of demographic categories. These efforts have been seen at the grassroots, institutional, Associational, and commercial levels with varying degrees of reach and success. At the Associational level, the American Association for Anatomy has funded the ongoing POP-AART (Portfolios of People-Advancing Anatomical Representation Together) project. The goal of POP-AART is to increase anatomical representation in photographic and illustrated images through the creation of an accessible repository of visual supplements for anatomical and health science educators. Two important elements of achieving this goal have been to include creative partners with diverse lived-experiences and to ensure ethical use of these materials as they are made available to users. Through initiatives like POP-AART, educators will be better equipped with images that display the diversity that is representative of society. Furthermore, the impact transcends beyond just the visual, allowing learners to also feel seen and included in their educational endeavors.

Keywords: Anatomy, Representation, Inclusion, Images, Diversity

IA-0021

Making the History and Ethics of Anatomy Transparent

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Abstract: The history of the Pernkopf atlas is an example for the continuities and legacies of past unethical practices in anatomy and medicine in general that reach into the present and inform ethical questions about the origin of and respect for human bodies in anatomy, and their representations in education. From 1933 on, most anatomists in Nazi Germany and its territories collaborated with the regime in body procurement for purposes of education and research. Austrian anatomist Eduard Pernkopf was among the many of his colleagues, who used bodies of executed Nazi victims for his work, in his case the creation of a topographical atlas of anatomy. These victims included a great number of young healthy persons who had been executed following civilian and military trials based on a Nazi legislation that was imbued with antisemitic and racist ideology. Pernkopf eagerly seized the opportunities presented to him by the Nazi regime in the steady availability of these bodies, with funding from his publisher to employ a team of talented illustrators and profiting from a new color-printing technique. In hundreds of high-quality illustrations, which have long been conceived as unique by anatomists and surgeons, he produced the "perfect image" through at the time legal and accepted means - means that are rightfully condemned as unethical today. When in 2019 the author visited the major publishing house that held the copyright and remaining original paintings of the atlas, there was no one who was aware of the book's history. After learning about the historical details, the publishers changed their practice of dealing with the legacy of their repository of illustrations. This included making the origins of copies of Pernkopf images in the new editions of the Sobotta atlas transparent in a historical-critical foreword.

Keywords: Anatomical image, History, Ethics, Pernkopf, Legacies

[Symposium 40: Neural Control of Feeding and Social Behaviors]

IA-0045

Neuroregulation of Feeding and Immunity: Understanding the Interactions

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Abstract: Eating is a fundamental behavior with a potent influence on health. Dietary fasting has a significant impact on the distribution and function of immune cells, exerting strong immunosuppressive effects. Through the utilization of techniques such as optogenetics/chemogenetics, behavioral studies, flow cytometry, and neural tracing, we have investigated the neuronal mechanisms by which dietary restriction affects immune functions in the context of autoimmune diseases. Our findings indicate that hunger neurons in the brainstem possess the capability to suppress autoimmune diseases and excessive inflammatory responses. Furthermore, we have elucidated the corresponding neural circuits and molecular mechanisms involved.

Keywords: Neuroimmune interactions, Eating behavior, Catecholaminergic neurons, Solitary nucleus, Ventrolateral medulla

IA-0188

Translational Neuroscience Research for Eating Behavior and Obesity: Mouse - Monkey - Patient

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Abstract: I will present the orchestration of food-seeking behavior by lateral hypothalamus (LH) GABAergic/leptin receptor (LepR), and dorsomedial hypothalamus (DMH) GLP-1R neurons. Two distinct LH LepR neurons encode food-seeking and food-consummatory behaviors, respectively. The role of LH GABAergic neurons in eating is investigated in three macaques by chemogenetics, PET, MRS, and rs-fMRI. LH GABA neuron activation increased naturalistic goal-directed behaviors and food motivation. GLP-1 treatment in humans increased cognitive satiation. Since DMH is a well-known satiation center, the role of DMH GLP-1R neurons is investigated using optogenetics, fiber photometry, miniscope, and GLP-1R agonist treatment. Results demonstrated that DMH GLP-1R neurons encode cognitive satiation.

Keywords: Eating, Obesity, Hypothalamus

[Symposium 41: Assessment in Anatomy Education: From Utility to Authenticity]

IA-0143

Unlocking the Power of Assessment Utility in Medical Education: Nurturing Master of Adaptive Learners

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Abstract: Master Adaptive Learners (MALs) are those who can modify their learning processes and habits to overcome new challenges. They have a growth mindset, critical thinking abilities, and the ability to self-manage their learning. Nurturing MALs in medical school is crucial for preparing practitioners to navigate the complexities and uncertainties of clinical practice. unlocking the potential of assessment utility in medical education is crucial for producing Master Adaptive Learners. Educators may create a learning environment that actively promotes student growth and development by designing and implementing high-utility evaluations. Assessment utility is an assessment's overall contribution to the learning process. This includes not only evaluating knowledge and abilities, but also encouraging learning and growth. High-utility assessments provide valuable feedback, guide future learning, and encourage mindful conduct. High-Utility Assessments have several critical qualities. The evaluation should follow an integrated assessment plan that prioritizes formative assessments during the learning process and summative assessments to validate competencies. The assessment must contain constructive, timely, and precise feedback, which is essential for guiding students' learning processes. The assessment should be structured to inspire students to think about their performance and learning habits in order to improve their adaptive learning abilities. The use of technology may assist in the provision of immediate feedback, progress tracking, tailored assessment,

and learning tools.

Keywords: Master of Adaptive Learners, Authentic Assessment

IA-0035

Beyond the Textbook: Authentic Assessment in Anatomy–Bridging the Gap to Safe Clinical Practice

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Abstract: Bridging anatomy knowledge with practical application is essential for clinical practice. Authentic assessment methods in anatomy education serve to cultivate not only a deep understanding of anatomical concepts but also to foster skills essential for safe clinical practice. Authentic assessment in anatomy refers to evaluation methods that assess students' abilities to apply their anatomical knowledge and skills in real-world contexts, such as clinical scenarios or practical applications, as opposed to traditional assessments that focus solely on factual recall or theoretical understanding. Through authentic assessment in anatomy, educators can create immersive learning experiences that mirror real-world clinical challenges. By moving beyond traditional textbook- based assessments, students are encouraged to apply their knowledge in contextually relevant scenarios, thereby better preparing them for the complexities of clinical practice. Authentic assessment in anatomy should align with competency-based education frameworks, emphasizing the importance of assessing not only factual recall but also clinical reasoning, communication skills, and professionalism. By adopting a multifaceted approach to assessment, educators can accurately evaluate students' readiness for clinical practice and identify areas for further development. Nevertheless, practical considerations and challenges associated with implementing authentic assessment methods in anatomy education, including resource allocation, faculty training, and logistical constraints, should be taken into account. By sharing evidence-based practices and innovative approaches, this symposium aims to empower educators to overcome these challenges and embrace authentic assessment as a cornerstone of effective anatomy education.

Keywords: Authentic assessment, Anatomy assessment, Safe clinical practice, Competency-based education, Medical education

IA-0147

Navigating the Threats to Validity of Authentic Anatomy Assessment

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Abstract: In anatomy education, a persistent challenge has been creating authentic assessments that accurately evaluate the intended skills for students to learn. Traditional methods like Objective Structured Practical Examinations (OSPEs), Objective Structured Clinical Examinations (OSCEs), and spotters have faced different obstacles. Firstly, a clear distinction between these assessment tools is necessary, as literature and practice reveal discrepancies in their application and interpretation. This ambiguity represents the first issue. The second issue is that when it comes to assessing skills within the cognitive domain, there is a risk of solely assessing factual recall rather than evaluating higher cognitive levels. This suboptimal utilisation of various cognitive domains of learning represents the primary issue. These two issues threaten the validity of test score interpretation and undermine the use of authentic assessments. Addressing these challenges is crucial to ensuring that anatomy assessments accurately measure the intended skills and cognitive levels, promoting effective learning and evaluation in the field. The key to addressing the two issues raised above is distinguishing between the cognitive and psychomotor domains. Cognitive assessments evaluate a student's understanding of the underlying principles, starting at the lowest level of the mental process, recall. All the way up to the creation of a hypothesis or an idea. While psychomotor assessments evaluate a student's ability to perform a task physically. It is imperative to relate our understanding of those two domains to understanding each assessment tool's nature to eliminate threats to validity.

Keywords: Assessment, Validity, OSCE, OSPE, Spotter

[Symposium 42: Ion Channel-Transcriptomics in Development, Fertilization, and Embryogenesis of Human Body]

IA-0202

Sperm Ca2+ Channels: Advocacy for Fertility and Contraception

Jean-Ju CHUNG
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Abstract: The sperm flagellar-specific Ca2+ channel CatSper is the predominant Ca2+ entry site in mammalian spermatozoa. CatSper-mediated Ca2+ signaling affects nearly every event that regulates sperm to acquire fertilizing ability. This talk will summarize some of the key findings in CatSper research and will highlight recent progress & perspectives.

Keywords: Ca2+ Channel

IA-0071

Role of Two-Pore Domain K+ Channels in Reproductive Tissues

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Abstract: The complex oocyte maturation, fertilization, and early embryonic development processes in mammals demand precise cellular control mechanisms. Central to these processes is the modulation of membrane potential, critically maintained by two-pore domain potassium (K_{2P}) channels. These channels are influenced by pH, temperature, mechanical stress, and biochemical signals. Despite their crucial role, the specific functions of K_{2P} channels in reproductive tissues are not yet fully understood. This presentation will provide a comprehensive overview of K_{2P} channels, emphasizing their established functions and regulatory mechanisms, and will detail our research findings on their expression and roles within reproductive tissues. Additionally, I will explore the potential interactions between K_{2P} channels and the platelet-derived growth factor receptor alpha (PDGFRα), which is highly expressed in the ovary, testis, and uterus. These interactions may uncover novel regulatory pathways critical to reproductive physiology. This discussion aims to deepen our understanding of K_{2P} channels' pivotal roles in reproductive physiology, their importance in health, and their potential implications in managing reproductive diseases.

Keywords: Germ cells, Ovary, PDGFRa, Testis, Two-pore domain K+ channel

IA-0049

V-ATPase a3 Subunit Contributes to Transport of Enamel Matrix Protein to Basolateral Membrane Using Lysosomal Exocytosis and Ruffled Border Formation

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Objectives: Maturation stage ameloblasts play an important role in calcification during amelogenesis, and express vacuolar proton-ATPase (V-ATPase) -a3 subunit in the lysosome and ruffled-border membrane specifically. Although the role of V-ATPase in creating the acidic microenvironment of the enamel matrix surface is well known, recently a3-subunit has recently been found to be closely associated with the secretion of enamel matrix protein at the maturation stage. Our aim is to elucidate the role of a3 subunit in secretion and ruffled border formation.

Methods: We examined the localization of a3 and rab27a, lamp1, some enamel proteins in ameloblasts, immunochemically. The teeth of epithelium-specific a3 deficient mice were analyzed as loss-of- function experiments. NGS was used to examine differences in gene expression patterns between a mouse ameloblast cell line and an a3 KO cell line.

Results: The a3-subunit co-localized with several enamel proteins, rab27b, lamp1 and tubulin in the cells. Furthermore, mice lacking the epithelial-specific a3 subunit showed dental epithelial cysts and disruption of ruffled border membrane. a3 isoform KO cell lines showed deregulation of several enamel proteins, and consequently lost the ability to attach to apatite.

Conclusion: V-ATPase a3-subunit contributes to the transport of lysosome containing enamel matrix proteins to basolateral membrane and the formation of ruffled border membrane.

Keywords: Lysosome, V-ATPase, Exocytosis, Enamel, Ameloblast

[Symposium 43: Promoting Inclusive Practices in Anatomy Education]

IA-0103

Inclusive Research Practice in Anatomy Education

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Abstract: Globally, anatomists are making changes to ensure their teaching and research prepares students for the fascinating wealth of anatomical diversity. As a community we have a responsibility to represent variation, but how is this best achieved and what barriers do we face? Our research 'Inclusivity in Anatomy Education: What is it and how do we achieve it?', explores anatomists' views on inclusive anatomy education, highlight existing good practice and identifying how we can work together, as a community, to make anatomy education more inclusive. Our study reached 263 participants from 24 countries, through a combination of questionnaires and focus groups. Of the participants surveyed, 28% of anatomists and 33% of students did not feel represented by their anatomy curricula, suggesting that there is still work to be done. This presentation will candidly share our experiences of the research process and advocate for a more inclusive approach to anatomy education research. We will describe how aspects of co-creation and community-based participatory research informed the study; collaborating with the Anatomy Collective for Equality (ACE) action group, and stakeholders to develop the questions, analyse the results and translate the study into other languages. We also used reflexivity as a powerful tool to critically reflect on our own biases, assumptions, and positionalities, and collected completely qualitative demographic data to allow participants to describe themselves in their own words. During the talk, the audience will be invited to reflect privately on their own positionality and consider how this can influence the stages of a research process. There will be discussion around good practice in inclusive research, the challenges to conducting it and how the audience can apply these principles to their own research. By building a community of practice for anatomists interested in improving representation in their curricula and research, we can make change together.

Keywords: Inclusivity, Inclusive research, EDI, Anatomy education, Research

IA-0090

Challenges for Inclusive Anatomy and How to Keep Moving Forward

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Abstract: Within the anatomy community, there is motivation to make our teaching practices and learning material more inclusive and representative of the diverse society in which we live and work. However, barriers faced by educators means that these good intentions do not always follow through into commitments and tangible improvements to inclusion. In this study, we aimed to understand what barriers are limiting the promotion of inclusive practice in anatomy education. Anatomy educators were invited to complete the Inclusivity in Anatomy Education survey, promoted internationally by the IFAA. Two questions asked for details of barriers (encountered or perceived) that have prevented individuals and institutions from implementing inclusive initiatives related to anatomy education. The authors conducted reflexive thematic analysis on the responses to these two questions. In total, 137 anatomists completed the survey, and 61% responded to the barriers questions. The source of barriers were multifold. In the first instance, there were significant barriers at an individual-level, including basic awareness of issues, and a fear of getting it wrong. Barriers were also present within groups and at institutional-level, including motivation within leadership to drive inclusive change, and an overarching confusion as to who is responsible for inclusion. Access and availability of inclusive teaching and learning resources were also notable barriers specific to inclusivity in anatomy education. This included resources that demonstrate diversity in anatomy, but also resources for educators to expand their awareness of inclusivity which could address some of the aforementioned personal barriers. For our discipline to keep moving forward and to sustainably enhance inclusivity in anatomy education, it is imperative that we all overcome these barriers. Pragmatic approaches to navigating these challenges will be presented, supporting attendees to identify where and how they

might further their inclusive practice and take action.

Keywords: Inclusion, Anatomy education

IA-0135

Inclusive Anatomy-A Showcase

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Abstract: The discipline of anatomy is criticised for offering limited diversity in its teaching and research practices. Without critical and deep reflection on the current practice, anatomy and anatomists risk becoming detached and disconnected from real-world problems and challenges. Consequently, this detachment affects how anatomy contributes to solving these challenges and issues. Anatomy educators struggle with the paucity of resources and literature that discuss inclusion within the remit of anatomy education. This work aims to provide a concise summary of key points with actionable and achievable steps that can guide anatomy educators as they work toward inclusive practice. In this work, a reflection of what we teach, how we teach and who is at the centre of the teaching in an anatomy classroom are considered. Challenges faced by anatomy educators are analysed, and opportunities are explored to create strategies that anatomy educators can use to make their practice more inclusive. Inclusive teaching involves constructing an environment where all students feel valued, respected, and able to participate regardless of their abilities, backgrounds, or identities. It requires anatomy educators to diversify their teaching materials and approach, be aware of their own personal biases, and constantly reflect and learn. In order to aid anatomy educators, a list of key considerations and questions are presented. The talk will highlight examples and case studies from the presenters' practical experience. Our list can serve as a starting point to actively make positive changes towards diversification, inclusion, and meaningful representation in an anatomy classroom. Embracing inclusion in education is a strategic investment in building a brighter and more inclusive future for all.

Keywords: Inclusivity, Anatomy Education, Inclusive research design

IA-0133

The Anatomy Collective for Equality: Taking Action

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Abstract: As a discipline, anatomy faces ongoing challenges related to equality, diversity and inclusion (EDI) with a gap identified in discipline-specific guidance. To address these concerns, the Anatomy Collective for Equality (ACE) was founded, with the aims to embrace, champion, and celebrate equality, diversity, and inclusion in anatomy. On April, 3rd 2023, ACE held its first event titled "Taking Action" with the aim to : 1) facilitate a safe space to establish a network of individuals who are interested and/or committed to EDI in the field of anatomy; 2) support and empower individuals to take action across their own practice and institutions; 3) nurture a shared understanding of inclusive practice in the field of anatomy; and 4) disseminate best practice and inclusive anatomy education following the principles of EDI. ACE's inaugural "Taking Action" hackathon event was held in April 2023. The event brought together 35 delegates from higher education institutions and industry bodies across England, Scotland and Wales. The aim was to collaboratively problem-solve issues of inclusivity in four key areas: assessment, research, education, and barriers to inclusivity in an attempt to answer the question 'What can we do to make anatomy more inclusive?'. The event format intentionally diverged from traditional academic conferences. Instead of unidirectional hierarchical information flow, the hackathon emphasized multi-directional information sharing and team-based co-creation of solutions. Three working-groups examined case studies on the four topics from varying perspectives over three intensive and progressive working sessions. Event organiser's reflections and participant feedback suggest that this event and format enabled timely exploration of pressing EDI issues in anatomy by aggregating otherwise siloed conversations. The collaborative problem-

solving generated constructive dialogue and tangible solutions. Next steps entail sharing outputs to engage wider stakeholder groups in engendering systemic change towards equality, diversity and inclusion in anatomy education and research.

Keywords: Anatomy, Inclusivity, Equality, Hackathon

[Symposium 44: It's Legal, but is it Ethical and Practical: Anatomists as Stakeholders in Legislation and Governance]

IA-0130

Comparative Law and Body Donation from Across the Globe: Similarities, Differences, and Paths Forward

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Abstract: In the past, whole-body donation programs have been mainly operated within countries in accordance with specific local social and cultural needs. More recently, technological advances have led to the increasing interconnectedness of regions across the globe through telecommunications and sophisticated shipping capabilities. To operate ethically, whole-body donation programs must first abide by the laws and regulations of their jurisdiction. These recent technological and logistical advances may create a need for updating laws and regulations. In working together as a global anatomical community, we can learn from each other with an understanding of context-dependent differences in our societies and cultures. As the subject matter experts, anatomists can see themselves as stakeholders in the law to advocate for ethical rules of society. This descriptive talk will introduce these topics to an anatomical audience by covering a history of Western legal traditions as contrasted with others across the globe. In the past several centuries, geopolitical forces (e.g., colonialism and globalization) have caused almost all countries to have legal frameworks based on some principles of Western law. However, the processes and procedures behind what is allowed to become law and laws are abided by can and do differ. Case studies of select countries with legislation will be used to relate these traditions to body donation. Some things may be permissible and lauded in one region that are illegal or unethical in others: i.e. public display or the anonymization of the donor. The process of navigating these differences – especially as they impact each other through their differentiated representation in media – requires input from the anatomical profession. From this, anatomists can aid those across the globe in developing new and/or updating legislation to be ethical and practical.

Keywords: Law, Ethics, Body donation, Anatomy education

IA-0158

Body Donation Laws and African Societies. Are Anatomists Equipped to Bridge the Gap?

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Abstract: Current IFAA practice recommendations stipulate that body donation programs be regulated through national or state legislative laws. Among African countries with such legislative frameworks, apart from South Africa, voluntary body donation programs are typically unsuccessful, as evidenced by the heavy reliance on unclaimed bodies for anatomy education. Cultural/religious beliefs are typically cited as a key factor impacting on success without examining deeper relationships between body donation laws and societal norms and values. This omission is significant given that colonial legacies have inevitably underpinned these laws. This qualitative case study explored the alignment between body donation legislation and societal norms and values in four African countries: Ghana, Kenya, Malawi, and Zimbabwe. Data were analysed from two sources: (1) the legislative body donation act of each country (content analysis); and (2) individual semi-structured interviews with anatomists in each country (n=12) (thematic analysis). Data collection and analysis are currently underway. Preliminary findings suggest there is misalignment

between body donation legislation and societal norms and values. The acts could be considered colonial artefacts, each underpinned by a tacit assumption of individualism, which is at odds with the collectivist societies in which these legislations operate. This legislative/societal dissonance is also evident in the preliminary analysis of interview data wherein collectivist decision-making associated with voluntary body donation is limited. Additionally, anatomists perceive that they themselves also lack power to influence and facilitate legislative change. Strengthening alignment between societal norms and legislation is critical to establishing a successful, sustainable voluntary body donation program. Achieving this requires a review of historical legislation to ensure it remains contemporary and responsive to societal values and ensuring that all key stakeholders have a voice in enacting change.

Keywords: Body donation laws, African societies, Anatomists, Alignment, Norms and values

IA-0174

Anatomists as Stakeholders in Developing Legislation Governing Anatomical Examination

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Abstract: Great Britain was the first country to introduce legislation governing Anatomical Examination, in response to the illegal supply of bodies to Anatomy Schools that proliferated towards the end of the 18th century. Although the Anatomy Act 1832 legalised the supply of bodies for Anatomical Examination, it did this by the use of 'unclaimed' bodies. With growing awareness of the ethical importance of consent, the 1832 Act was replaced in England and Wales by the Anatomy Act 1984 that enabled individuals to donate their own bodies. However, although most Institutions only accepted bodies with donor consent, the law still allowed the use of 'unclaimed' bodies and those donated by a donor's next of kin. The UK government subsequently developed legislation to regulate all use of human tissue in England, Wales and Northern Ireland, based on donor consent. Stakeholder groups were consulted and the Human Tissue Act 2004 was passed. A regulatory body was constituted including stakeholder representatives and one of its first tasks was to develop Codes of Practice for the regulated sectors, These Codes are living documents and are amended in response to changing conditions and stakeholder feedback. The Scottish government passed the Human Tissue Act Scotland (2006) and more recently the Irish government passed the Human Tissue Act (2024), both of which encompass Anatomical Examination. In all jurisdictions of the UK and Ireland, inspectorates can impose penalties for contravention of the law governing Anatomical Examination, including prohibiting it taking place at an Institution and imprisonment of individuals. Stakeholder views informed the drafting of all of the current legislation governing Anatomical Examination in the UK and Ireland and have been critical for its success. Although the regulatory frameworks involved differ, the ethics underpinning them are similar, demonstrating the possible universality of ethics relating to body donation and Anatomical Examination.

Keywords: Anatomical examination, Body donation, Ethics, Law, Consent

[Symposium 45: Application of Neural Organoids for Neurological/Psychiatric Disease Research and for Regenerative Medicine]

IA-0201

Deciphering the Dawn of Alzheimer's Disease: Unveiling Early Neuronal Transformation in Brain Organoids

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Abstract: Focusing on the early stages of Alzheimer's disease (AD) offers significant promise. However, the specific events in neural cells leading up to the onset of AD have remained unclear. To clarify these events, we utilized isogenic human-induced pluripotent stem cells (hiPSCs) with an introduced APPswe mutation. This enabled us to investigate the initial changes in AD progression. We studied the differentiation of neural progenitor cells (NPCs) in cerebral organoids or 2D culture with and without the APPswe mutation into neurons, analyzing variations in levels of neuronal and progenitor markers. Our findings revealed early neuronal differentiation in APPswe NPCs. Transcriptomic analysis further confirmed

alterations in neurogenesis-related gene expression in APPswe NPCs. We also discovered that the upregulation of reactive oxygen species (ROS) in APPswe NPCs is necessary for early neuronal differentiation. Finally, we demonstrate that APPswe neurons remain immature during early differentiation and are more susceptible to toxicity, providing valuable insights into the premature exit from the neural progenitor state and increased vulnerability in AD.

Keywords: Alzheimer

IA-0051

Analysis of Mitochondrial Function and Morphology in GFP-Labelled Patient Dopaminergic Neurons: from 2D to 3D Midbrain Organoid

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Objective: Mitochondria have different morphologies and properties between in the dendrites and axons of neurons. Dysfunction of mitochondria is partially or mainly involved in the development of Parkinson's disease (PD), which manifests as the loss of dopaminergic neurons in the substantia nigra. It has been reported that the accumulation of damaged mitochondria in the neurites of iPSC-derived dopaminergic neurons from PD patients. However, axonal mitochondrial function in iPSC-derived dopaminergic neurons have been poorly analyzed. To define axonal mitochondrial function and morphology in iPSC-derived dopaminergic neurons, we differentiated iPSCs into dopaminergic neurons in monolayer or midbrain organoids and analyzed them.

Methods: We have previously generated tyrosine hydroxylase reporter (TH-GFP) iPSC lines from two control and one PD patient lines. In addition to those, we newly generated TH-GFP iPSC lines from different control and PD patient lines using CRISPR/Cas9 system. We differentiated TH-GFP iPSCs into dopaminergic neurons in monolayer or midbrain organoids. The differentiated cells or organoids were stained with antibodies against MAP2 and Tau, markers of dendrites and axons, respectively. The differentiated cells or organoids were then stained with TMRM to measure mitochondrial membrane potential in GFP-positive dopaminergic neurons.

Results: We have successfully established two new TH-GFP iPSC lines. The immunostaining of the TH-GFP iPSC-derived monolayer neurons showed a colocalization of MAP2 and Tau. In contrast, the peripheral area of midbrain organoids had little expression of MAP2 and high expression of Tau, indicating the axonal maturation in midbrain organoids. The staining with TMRM indicated that the mitochondrial membrane potential of GFP-positive axons was lower than that of GFP-negative axons.

Conclusion: The midbrain organoids are an effective tool to distinguish and analyze axonal mitochondria from dendritic mitochondria. The analysis of axonal mitochondrial function would provide insights on the mechanisms of dopaminergic neuron degeneration in PD patients.

Keywords: Pluripotent stem cells, Dopaminergic neurons, Organoids, Mitochondria

IA-0156

Application of Nerve Organoids for Regenerative Medicine through Medical-Engineering Collaboration

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Abstract: The novel nerve organoid culture device with the excellent patented technology was utilized in various projects including nerve regeneration. Our peripheral nerve research team has been conducting collaborative research for many years, trying the several challenging tasks by taking advantage of each other's advanced technologies as surgeon, imaging specialists, and engineering experts for novel microfluidics device development. In recent several years, we have been working on

developing a new culture device with human iPS cell derived nerve organoids for detecting pain and for peripheral nerve deficits treatment with transplantation. We tried to develop a novel artificial nerve organoid for nerve transplantation as a substitution of the self-nerve. Human iPS cells were induced to differentiate into motor and sensory neurons and were cultured using a newly developed specialized culture device. The novel artificial nerve was transplanted into the peripheral nerve defect of rodents with optimized transplantation surgery, the motor function was evaluated over time, and the condition of peripheral nerve regeneration by transplantation was evaluated for several weeks (12 weeks) after transplantation. The histological evaluation was performed in detail by using immunostaining and an electron microscope to evaluate the effect of this novel transplantation therapy. For elucidating the mechanisms, multidimensional gene expression profiling was carried out mRNA sequencing. As a result, the neurite bundle-derived artificial nerves exerted significant therapeutic effects, both functionally and histologically after transplantation without immunosuppression, even in xenotransplantation. The transplanted neurite bundles fully dissolved after several weeks, with no tumor formation or cell proliferation, confirming their biosafety. Gene expression profiling demonstrated the importance of immune system for recovery. We hope new artificial nerve prepared in advance will be transplanted if a major peripheral nerve is damaged due to traumatic injury or surgical operation of cancer, without any loss of patient's own peripheral nerve in near future.

Keywords: Human iPSC-derived nerve organoid, Peripheral nerve injury, Specialized microfluidic device, Nerve regeneration, Artificial nerve transplantation

IA-0189

Establishment of Pipeline for Developmental Neurotoxicology Tests with Neural Organoid Technology

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Abstract: Neural organoids have been increasingly used for disease modeling, which will be potentially useful for drug screening. However, achieving this goal has been hampered by the considerably high level of variation within and among the experimental batches. We recently established a new protocol for the production of various neural organoids representing different domains of the central nervous system along the anteroposterior and dorsoventral axes. This protocol allows for precise control of the size and shape of organoids, and these optimization improved the reproducibility and reduced batch variation. Especially, we were able to produce large quantity of sufficiently small organoids that were virtually free from the formation of necrotic core, which made protocol especially suitable for the mid-to high throughput drug screening. Using this new protocol, we established pipelines for screening drugs that prevent neural hypoxia and promote nerve regeneration. In this short talk, I will share our successes and challenges in our journey with neural organoids.

Keywords: Organoids, Drug screening, Hypoxia

[Symposium 46: Integration of Innovative Educational Technologies in Anatomy Teaching and Curriculum: New Normal in Anatomy Education]

IA-0120

Integration Of Innovative Technology In Anatomy Education Curriculum: Students and Anatomy Educators Perception

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Abstract: Anatomy is an important basic medical science subject in medical education due to its relevance as a prerequisite for safe clinical practice. Before now, the anatomy education curriculum involves application of traditional methods of teaching such as classroom teaching, cadaveric dissection, and textbook-based learning. In recent years, medical schools have transformed the curriculum by integrating innovative educational technologies, such as virtual and augmented reality, virtual dissection, and other computer-based programs into the anatomy education curricula. This transformation has garnered increasing attention as educators seek to enhance learning outcome to prepare students for clinical application in healthcare practice. The integration of innovative technology in anatomy education curricula has revolutionized the

teaching and learning process, offering an enhanced visualization and interactive learning experiences for students, and to overcome challenges associated with the traditional methods of teaching. This discourse explores the perceptions of students and anatomy educators regarding the incorporation or integration of innovative technologies into the anatomy education curriculum. This will demonstrate continuous evaluation and adaptation to innovative technologies directed to improve students' engagement and self-directed learning to foster deeper comprehension of anatomical structures and clinical applications. Regardless of the success stories there are a few constraints associated with the acceptance of innovative educational technologies in the anatomy curriculum such as technical issues, human resource resistance due to long- term adaption to traditional educational paradigms, limitations of virtual simulations compared to hands-on dissection, and the need for support and professional development for educators navigating the digital landscape. However, students and anatomy educators perceived benefits in virtual dissection technology as a teaching tool in the anatomy medical education curriculum is associated with the ability to enhance the learning experience and educational outcomes.

Keywords: Anatomy education, Cadaveric dissection, Learning outcomes, Virtual dissection, Innovative technology

IA-0065

Creation and Incorporation of an Online Illustrated Neuroanatomy Glossary to Enhance Neuroanatomy Teaching

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Background: Medical students struggle with neuroanatomical terminology. To help address these struggles and to assist students in learning this new language, the authors developed an illustrated neuroanatomical glossary hosted on Google Sites. While there are multimedia resources available to aid in teaching and learning neuroanatomy, the authors were not able to find a freely accessible illustrated neuroanatomy glossary for students. Developing this resource in house allowed the authors to tailor it specifically to the needs of the students at Idaho College of Osteopathic Medicine (Meridian, ID, USA).

Methods: The Neurosensory course is a multidisciplinary, team-taught course. The anatomy faculty that teaches in the Neurosensory course compiled the initial list of terms, which included approximately 430 terms. The authors then used lecture materials and other resources to determine the definitions and illustrations. Two of the authors were students in the Neurosensory course in the Spring of 2023; student involvement was critical to the success of this project because they provided a much-needed perspective to ensure the glossary will be useful for the intended audience. The neuroanatomical illustrated glossary content was manually input and uploaded to the Google Site. The website was launched at the start of the Neurosensory course in January 2024. In addition to glossary content, included on the webpage are embedded Google Forms to allow users to provide feedback on the glossary, including any terms they would like added.

Conclusion: This resource was created in collaboration with several medical students to ensure its usefulness and preliminary student feedback indicates this tool was helpful. The goal is to continue to build and expand on this resource to include interactive elements and practice questions. In the future, we would also like to gather student perspectives on how this resource is used and can be improved.

Keywords: Neuroanatomy, Educational resource, Medical education

IA-0137

Re-Conceptualization of Inquiry-Based and Case-Based Review Sessions in an Integrated Anatomy Curriculum

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Background: Review sessions are an integral part of active learning and have been shown to be useful in consolidating critical information, recognizing learning gaps, and developing the critical thinking skills needed to tackle examinations. Since the introduction of the integrated medical curriculum, the concentration has mostly been on developing creative instructional and assessment strategies as core of curriculum design. However, the role of review sessions in the undergraduate medical curriculum has not been fully recognized.

Method: We grouped our pedagogical approaches to active review sessions in the structure curriculum of the Zucker School of Medicine into two categories: case-based faculty-driven and inquiry-based student-driven review sessions. To assess students' perception of and satisfaction with these active review sessions, the second-year medical students participating in the Human Condition course were given an anonymous electronic survey at the end of the course. A focus group was also organized to determine how these review sessions impacted their learning and preparation for assessment.

Results: 82.35% of the respondents preferred the case-based faculty-driven review sessions while 17.65% preferred the inquiry-based student-driven review sessions. There were statistically significant differences in their evaluation of increased problem-solving skills ($p \leq 0.001$) and enhanced peer collaboration ($p \leq 0.05$) during case-based faculty-driven review sessions compared to inquiry-based student-driven review sessions. There was however no significant different in their evaluation of increased student engagement, closing knowledge gaps and consolidation of existing knowledge for both review sessions.

Conclusion: Effort needs to be put into designing active review sessions as it is put into instructional and assessment design to drive learning. The feedback from students indicate that both types of review sessions were helpful, albeit for different purposes. The goal is to improve these sessions to enhance their learning experience.

Keywords: Anatomy Education, Review, Integrated Curriculum, Medical Education, Learning

IA-0122

Innovative Anatomy Education is an Approach to Bridge the Gap in Traditional Methods of Teaching Anatomy

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Abstract: The anatomy course is an integral part of medical education that enables students to acquire knowledge about the intricacies of the human body which is the basis for understanding pathological and clinical problems in clinical settings. Traditional methods of teaching the anatomy course includes didactic lectures, cadaver dissection and textbook-based learning. Over the last decade, there has been an increase in the use of innovative teaching methods involving computer-based learning, virtual dissection technology, and interactive digital platforms. These innovative methods prove useful in alleviating several constraints associated with traditional teaching methods. For example, use of cadavers to study the three-dimensional structure of the human body is often constrained by limited access to cadavers due unwillingness to donate bodies for medical education in various cultures, high cost of maintaining wet dissection laboratories and poor adherence to ethical considerations involving cadaver sourcing, handling and disposal. Innovative anatomy teaching methods apart from being expensive they present with added advantages to traditional methods that include being dynamic, interactive, self-directed and self-paced. This enables students' engagement in an interactive and dynamic learning environment ensuring their interest in self-directed learning at their own pace and according to their individual learning or comprehension styles. The integration of these innovative approaches into anatomy education has demonstrated several benefits such as promotion of active learning, increased student engagement, improved understanding of complex anatomical concepts, and greater retention of knowledge as judged by the assessment of learning outcomes via formative and summative assessments and feedback mechanisms. In conclusion, innovative anatomy education offers a comprehensive solution to the limitations of traditional methods resulting in an effective, inclusive, and accessible anatomy education that ultimately enhances anatomy education in medical training aimed at clinical application and patient care.

Keywords: Anatomy, Cadaver dissection, Computer-based learning, Virtual dissection, Student engagement

[Symposium 47: 3D Cell Culture and Organoid Models and Applications in Biomedical Research]

IA-0073

Stem Cell-Derived Intestinal Avatars: Unveiling Mechanisms of Gastrointestinal Disorders

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Abstract: The primary aim of this study is to develop intestinal barrier integrity and plastic intestinal homeostasis, which involves interactions between immunocompetent cells and the epithelial cells themselves. We developed a novel intestinal organoid called "mini-gut," derived from human pluripotent stem cells. The mini-gut replicates various physiological functions of the human small intestine, including peristalsis, absorption, and secretion, as observed in vitro. It comprises multiple cell types such as Lgr5-positive intestinal epithelial stem cells, absorptive epithelial cells, goblet cells, Paneth cells, and enteroendocrine cells. Additionally, it features a complex tissue structure with elements like Cajal interneurons, enteric plexus, and smooth muscle cells within the submucosal region. To address the challenge of evaluating human gastrointestinal immunological functions using in vitro models, we integrated tissue macrophages derived from iPS cells into the mini-gut to enhance its immunocompetence. The min-gut demonstrated an ability to recapitulate the dynamics of viral infections and host responses similarly to in vivo conditions. The inclusion of macrophages has enabled the mini-gut to function as a command post for antigen recognition, significantly enhancing its utility in studying human immunological responses. The mini-gut organoid represents an innovative human tissue system with high potential for advancing research in viral pathogenesis and host immune responses. Its capability to mimic the human small intestine's structure and function makes it an invaluable tool for novel drug discovery research. The novel organoid model further emphasizes its potential as a comprehensive model for studying gastrointestinal diseases and therapies.

Keywords: Mini-gut, Organoid, Gastrointestine, IPS cells

IA-0044

Three-Dimensional Coculture System to Mimic Epithelial Tissue Containing Immune Cell

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Abstract: Epithelial tissue consists of primary epithelial and stromal cells, including fibroblasts, endothelial cells, and immune cells. It is essential to coculture different types of cells derived from epithelial tissue to develop epithelial tissue in vitro. However, direct contact between various types of cells induces activation of cells such as immune cells. An indirect coculture system was developed using a nanofiber-based culture of epithelial cells, fibroblasts, and immune cells. MLE-12, lung epithelial cells, and primary hepatocytes were cultured on laminin- and fibronectin-derived peptide-blended poly (vinyl alcohol) nanofiber membrane as a multilayer rather than spheroid structure. Coculture of fibroblasts in different layers of nanofibrous membrane stabilized long-term culture of epithelial cells. Direct coculture of dendritic cells (DC) and fibroblasts on a culture plate and polycaprolactone nanofiber membrane induced DC activation. Coculture of DCs and fibroblast in collagen gel partially blocked the activation of DCs. We confirmed that soluble factor(s) released from fibroblasts up-regulated DC activation. Based on the coculture system, epithelial cell-derived organoids can be used for precision medicine.

Keywords: Three-dimensional culture, Dendritic cell, Coculture, Nanofibers

IA-0072

3D Model of Cancer Progression to Recapitulate Cancer Stem Cell Niche and Chemoresistance for Anti-Cancer Drug Discovery

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Abstract: Recent attention has focused on the development of an effective three-dimensional (3D) cell culture system enabling the rapid enrichment of cancer stem cells (CSCs) that are resistant to therapies and serving as a useful in vitro tumor model that accurately reflects the in vivo behaviors of cancer cells. We aimed to establish an effective 3D in vitro human cancer model that can imitate the in vivo tumor microenvironment. We fabricated a biomimetic hydrogel for use in 3D cancer cell cultures. Then the hydrogel was assessed by phase contrast microscopy, cell proliferation assay, colony forming assay, cell migration and invasion assay, chemosensitivity assay, confocal microscopy, flow cytometry, western blot analysis, and RT-PCR analysis. Remarkably, human tumor cells grown in this hydrogel exhibited biochemical and physiological features, including (1) enhanced cell proliferation, migration and invasion, colony formation, and chemoresistance; (2) suppressed apoptosis with altered expression levels of apoptosis-regulating molecules; (3) upregulated expression of crucial multidrug resistance-related genes; (4) accentuated expression of key molecules associated with malignant progressions, such as epithelial-mesenchymal transition transcription factors, Notch, and pluripotency biomarkers; and (5) robust enrichment of CSCs. Furthermore, the advantages of our in vitro tumor model include simplicity, efficiency, bioactivity, and low cost. The findings indicate the potential of our 3D in vitro human cancer model as an in vitro research platform to study CSC biology and to screen novel therapies targeting human cancers as well as CSCs.

Keywords: Cancer, 3D cell culture, Hydrogel, In vitro tumor model, Tissue engineering

[Symposium 48: The ABCs and 123s of Anatomical Science Outreach: Ideation, Planning, Execution and Sustainability]

IA-0164

Anatomy Outreach Programs: From Ideas to Execution

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Abstract: Anatomy outreach programs are powerful tools for inspiring curiosity, dispelling misconceptions, and nurturing the next generation of healthcare professionals. This symposium explores the lifecycle of designing and executing impactful anatomy outreach initiatives. Attendees will gain insights into identifying target audiences, developing interactive activities that resonate, securing resources, and overcoming logistical hurdles. Effective strategies for fostering community partnerships, evaluating program outcomes, and ensuring sustainability will be highlighted. Through a case study of Science Advocacy Program for Youngsters organized by LifePorté Educational Project, Nigeria and interactive discussions, participants will learn about our experience, best practices, and how to embrace the mission of enhancing anatomy education and public engagement beyond classroom walls.

Keywords: Anatomy, Outreach, Ideas, Execution

IA-0163

Adapting Outreach Programs for the Underrepresented and Underprivileged Population

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Abstract: This symposium will address the critical need for inclusive and effective community outreach initiatives. The discussion will include identifying access barriers and developing culturally sensitive and contextually relevant programs. This includes understanding the unique needs and preferences of diverse communities, incorporating local knowledge and practices, and ensuring that programmes respect and reflect the cultural identities of the target populations. With the increasing role of technology in society, the symposium will examine how digital tools and platforms can enhance outreach

efforts among the underprivileged or underserved population. This will include discussions on how to better reach and engage them through mobile applications, social media, and other digital innovations. The session will focus on strategies for fostering genuine community engagement, empowering local leaders, and building trust between service providers and community members. The symposium will also emphasise the importance of community engagement, collaboration among stakeholders, and sustainable funding models to ensure the long-term impact and scalability of these programs. The speaker will discuss how to create and sustain effective collaborations that leverage the strengths and resources of all partners and highlight best practices for monitoring and evaluating programmes, including the use of qualitative and quantitative metrics to assess outcomes and inform future strategies. The speaker will explore best practices and successful case studies that demonstrate how tailored outreach programmes can significantly improve the quality of life for underrepresented and underprivileged populations.

Keywords: Outreach, Anatomy, Underprivileged, Equity, Adaptation

IA-0171

Your Program Is Up and Running! Now, How Do You Keep It Going?

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Abstract: While the anatomy outreach programme (AOP) is up and running, this project still needs to be managed well. It should be understood that AOP is not a one-off activity but an ongoing process that requires governance and a desire to improve with wider community acceptance. It is necessary to continue to learn from both our own and other people's experiences, to stay aware of the newest trend and to carry out best practices within the community. This article aims to provide an overview and shared experiences of how to keep anatomy outreach programmes going for the wider community. The strategies for maintaining AOP sustainability consist of internal and external ways. The internal ways include: 1) strengthening the team through internal management discussions; 2) improving information systems and promotional facilities; 3) updating topic trends; and 4) strengthening regulations. Meanwhile, the externals are: 1) greeting the collaborators and participants regularly at special events, as well as prospective clients who have been recorded previously. To look after existing collaborators, we evaluate our program by conducting satisfaction surveys; collecting input from stakeholders, and being responsive to their needs and expectations; 2) providing information when special programmes (e.g., training for teachers) are released; 3) offering AOP to agencies that are already regular school partners; and 4) providing certain discounts.

Keywords: Anatomy, Outreach programme, Sustainability

Free Paper_Oral Presentation

[A. Gross Anatomy]

A-0021

Triphallia: The First Cadaveric Case Report of Internal Penile Triplication

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Purpose: Triphallia, a rare congenital anomaly describing the presence of three distinct penile shafts, has been reported only once in the literature (Jabali and Mohammed, 2020). This case report, based on an extensive literature review, describes the serendipitous discovery during cadaveric dissection of the second reported human case of triphallia, distinctly morphologically different from the previous case.

Methods: Discoveries were made during routine full body cadaveric dissection.

Results: Despite the normal appearance of external genitalia on examination, the dissection of a 78-year-old male revealed a remarkable anatomical variation: two small supernumerary penises stacked in a sagittal orientation posteroinferiorly to the primary penis. Each penile shaft displayed its own corpora cavernosa and glans penis. The primary penis and largest and most superficial of the supernumerary penises shared a single urethra, which coursed through the secondary penis prior to its passage through the primary penis. A urethra-like structure was absent from the smallest supernumerary penis. This case report provides a comprehensive description of the anatomical features of triphallia in a cadaver, shedding light on the morphology, embryology, and clinical implications of this anomaly. Without dissection, this anatomical variation would have remained undiscovered, suggesting the prevalence of polyphallia may be greater than expected. The single tortuous urethra present in this case, as well as the supernumerary and blind ending urethras present in many cases of penile duplication, may pose significant risk of infection, sexual dysfunction, subfertility and traumatic catheterisation.

Conclusion: These findings underscore the importance of meticulous anatomical dissections and may act as a resource for anatomists and those studying genitourinary anomalies. Although we can only speculate which functional implications this gentleman may have experienced, understanding such anatomical variations contributes to both knowledge of human anatomy and clinical management should the condition be encountered in living individuals.

Keywords: Triphallia, Polyphallia, Cadaveric, Dissection, Diphallia

A-0031

Presence of the Sternalis Muscle in an Iranian Male Cadaver: A Case Report

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Purpose: Sternalis muscle is an infrequent, non-pathological anatomical variant of the anterior thoracic wall located deep into the subcutaneous layer and superficial to the pectoral fascia. According to the previous cadaveric studies, the presence of sternalis muscle is between 3 to 8%. The muscles were identified during a routine cadaver prosection at the Department of Anatomical Sciences, Kashan University of Medical Sciences.

Methods: Anterior thoracic wall dissection on an Iranian male cadaver exposed the unilateral sternalis muscles. The Snosek et al. classification system was used to describe the variant types.

Results: During dissection of the thoracic region of a 60-year-old male, we observed a distinct muscular mass about 13.5 cm long in the right hemithorax, covered by superficial fascia and located anterior obliquely to the pectoralis major muscle. This muscle presented with two muscle bellies, where cranial end blends with fibers of the sternochondrocostal portion of the right pectoralis major muscle and caudal end blends with fascia covering pectoralis major and aponeurosis of external oblique muscle of the abdomen.

Conclusion: Clinically, the sternalis muscle may be misinterpreted as a pathological mass or lesion, thus accurate knowledge regarding its variations and prevalence is of importance.

Keywords: Sternalis muscle, Anterior thorax, Anatomic variation, Classification

A-0035

Experience of Using a Variable Educational Trajectory in Clinical Anatomy with Elements of Immersion Technologies

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Purpose: The "gold standard" in teaching clinical anatomy is the dissection course. However, in a number of countries there is a tendency to reduce or completely exclude work with anatomical material from the educational trajectory. This is facilitated, in our opinion, by the following reasons: the legislative and regulatory framework that does not allow a body donation program; moral, ethical and religious aspects and etc. Therefore, it is necessary to develop educational trajectories that include several stages of access to anatomical material.

Methods: A study of the effectiveness of a dissection course with VR/AR with the participation of 400 students is being conducted in the period 2022-2023 at the Department of Operative Surgery and Topographic Anatomy of Sechenov University. We have proposed an educational trajectory that includes 1) preliminary theoretical course through public broadcasting of seminars and lectures; 2) practicing dissection skills in the digital anatomical table (Pirogov) and MCQ 3) Practicing operational access on a VR simulator in order to acquire the skill of correctly selecting a tool, the sequence of its use and choosing the area of ??operation with MCQ 4) Admission to the dissection course on anatomical material. The students were divided into 2 groups of 200 people each, so that one group had the classical teaching method "theory + dissection", and the second "theory-digital dissection-virtual simulator-anatomical preparation".

Results: The results of the study on the Likert scale showed an increase in motivation in the control group by 49% compared to the main group. At the same time, 98% attendance was noted versus 73% in the main group. The average score in the main group was 3.98 out of 5, and in the control group 4.89 out of 5.

Conclusion: Thus, it becomes obvious that the use of VR/AR is a useful intermediate level in student learning.

Keywords: Education, Cadaver, Dissection, VR, AR

A-0036

Investigation of the Effect of Posterior Spinal Fusion Surgery on the Increase in Pelvic Incidence in Individuals with Adolescent Idiopathic Scoliosis

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Purpose: Investigate the preoperative pelvic incidence's growth during adolescence in a population of adolescent idiopathic scoliosis (AIS), and analyze how it alters after posterior correction surgery.

Methods: The radiological data of 30 AIS patients who underwent a posterior spinal fusion (PSF) surgery were analyzed by an independent observer to compare to changes in the pelvic incidences (PI), pelvic tilt (PT) and sacral slope (SS) at preoperative, early postoperative, 6 months, 1 year, and 2 years follow-up after correction surgery. "Friedman Test" and "Repeated Measures ANOVA" were used to compare the means between dependent groups according to their normality status to determine the difference between the two groups of dependent groups studied. Pearson Correlation was used to determine the direction and degree of the relationship between the variables, and 'Frequency Analysis' was used to determine demographic characteristics.

Results: Multiple comparisons of spinopelvic parameters' measurements from the preoperative period to the final follow-up at 2 years (preoperative, early postoperative, 6th month, 1st year and 2nd year) were carried out. As the results were analyzed, it was determined that PI and SS parameters increased significantly ($R=3.026$; $p<0.05$) in each measurement in relation to the previous measurement value. However, PT variable no significant difference was found in the same comparison.

Conclusion: We observed an increase mean PI value. The peak velocity is between early post-operative and 6th month follow-up, and it is still increasing to the last follow-up. This increase may be a response of the sacroiliac joint to change in spinal balance due to correction with PSF. Our results suggested that the PI growth may be associated with changes in sacroiliac morphology during adolescence, as well as PSF and altered spinal balance in the post-operative period.

Keywords: Scoliosis, Pelvic incidence, Adolescent, Sacral slope, Pelvic tilt

A-0055

Myodural Bridge and Chronic Headache

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Purpose: The Myodural Bridge (MDB) is known as a fibrous connective structure that connects the suboccipital muscle to the cervical spinal dura mater via the atlanto-occipital and atlanto-axial interspace. The MDB exists universally in mammals, many of birds and other tetrapods, indicating that it is highly conserved. Clinicians have found that the pathologic MDB might cause a cervicogenic or chronic headache, but the role that the MDB may play in headache production is uncertain. We aimed to investigate the potential correlation and mechanism of action between chronic headaches and the MDB.

Methods: In clinical practice, magnetic resonance imaging (MRI) and Mimics software were used to collect images of RCPmi for comparison between chronic headaches patients and healthy adult volunteers. In addition, cervical manipulation therapy was performed on patients with chronic primary headaches to further assess their headache-related scores and symptoms. According to the proliferative effect of bleomycin on collagen fibers, bleomycin solution was directly injected into the MDB fibers in the posterior atlanto-occipital interspace of rats, and subsequently headache-related changes were further observed.

Results: Patients with chronic headaches suffered from more obvious hypertrophy than those of the control group. It might indicate that chronic headaches were correlated with the RCPmi. Furthermore, after the application of cervical manipulation therapy on patients with chronic primary headaches, there was a significant improvement in the headache-related scores and headache-related symptoms post-treatment in comparison to pre-treatment. Rats with fibrosis of MDB exhibit headache-related behavioral changes and high expression levels of headache-related neurotransmitters in the brain.

Conclusion: In conclusion, MDB can provide novel anatomical and physiological insights into the underlying etiology of chronic primary headaches, and will further lay a foundation for the diagnosis and treatment of some unexplained chronic primary headaches in clinical practice.

Funding: Natural Science Foundation of China (Grant numbers: NSFC32071184 and NSFC32100928).

Keywords: Myodural Bridge Complex, Chronic Headache, Rectus capitis posterior minor muscle, Manipulation therapy

A-0081

A Topographic Study of the Extracranial Middle Meningeal Artery for Endovascular Therapy

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Purpose: Middle meningeal artery (MMA) is a key vessel in MMA embolization (MMAE), but little is known with respect to the extracranial MMA (exMMA).

Methods: A total 5 heads from anatomical specimens, 300 human dry skulls, and 162 head & neck CT angiographies (CTA) were adapted. The overall features of exMMA were obtained from body dissection, and the distal features of exMMA were determined via recording the outer osseous grooves of the foramen spinosum on the skulls. Measurements of the exMMA were taken from CTA.

Results: Most of the exMMA were off from the maxillary, but a 9.6 % percentage of exMMA (n = 324) sprung off from the external carotid artery (ECA). The angle between the maxillary artery and the exMMA was 109.5° ± 32.5° (left) and 117.1° ± 34.3° (right) ($p < 0.05$). Thereafter, the angle between the exMMA and the skull base was greater in the left side (79.24° ± 4.21°, $p = 0.0017$). And the diameter of exMMA was 1.45 ± 0.12 mm (left) and 1.44 ± 0.13 mm (right) ($p = 0.82$). The length of exMMA was 16.03 ± 3.75 mm (left) and 16.52 ± 3.82 mm (right). There were five types of the outer openings grooves of foramen spinosum locating in the four quadrants and the origin point, and multiple types of accessorial foramen spinosum provided the path for the accessorial MMA.

Conclusion: The exMMA has five main types with interventional difficulty may gradually increase from type A to type E. More careful preoperative evaluation shall be taken during MMAE when encountering type B to type E.

Keywords: Middle meningeal artery, Anatomical specimen,

CTA, Foramen spinosum, Endovascular therapy

A-0084

Anatomical Study about Stabilizing Structures in the Trapeziometacarpal Joint

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Purpose: Joint instability leads to trapeziometacarpal (TMC) osteoarthritis, which results in pain, dysfunction of the joint, and dorsoradial subluxation of the 1st metacarpal bone. To determine the pathology of TMC joint instability, which leads to osteoarthritis, we anatomically analyzed the relationships among the surrounding ligaments, muscles, and joint capsule.

Methods: We examined the bone morphology and cortical bone thickening in 25 cadaveric thumbs using micro-computed tomography and macroscopically and histologically investigated TMC joint and surrounding muscles including the first dorsal interosseous (FDI) and opponens pollicis (OPP).

Results: The dorsal trapezium had a unique tubercle with cortical bone thickening visualized using micro-CT imaging. This tubercle on the dorsal trapezium corresponded to the attachment of the FDI aponeurosis, which intermingled with the joint capsule. On the radial side of TMC joint, the thin joint capsule was observed, and the muscular part of OPP without aponeurosis overlay it.

Conclusion: The dorsal ligaments (dorsoradial or posterior oblique ligaments), which have been previously assumed as static stabilizers, could be interpreted as parts of the capsuloaponeurotic complex, which consisted of the FDI aponeurosis and TMC joint capsule. In the radial aspect of TMC joint, functional activation of OPP muscle activation may be essential for TMC joint stabilization during the pinching motion. Obtained findings in the current study could contribute to the appropriate management for prevention of TMC osteoarthritis.

Funding: This study was funded by the JA Kyosai Research Institute (Agricultural Cooperative Insurance Research Institute).

Keywords: Trapeziometacarpal joint, Firstdorsal interosseous muscle, Opponens pollisis muscle

A-0094

Is the Mona Lisa a Celebration of Human Reproduction? An Anatomical Analysis of the Painting Answers "Yes"

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Purpose: In 1492, Leonardo drew "Coition of a hemisected man and woman", an anatomical study of figures having sexual intercourse. In 1503, he began painting the portrait of Mona Lisa, which became the most famous painting in the world. Her husband wanted to pay tribute to her motherhood. However, the background landscape remains misunderstood by arts historians: a landscape in two parts which do not connect; the surface of the upper lake is oblique; the lower lake does not connect with the dry river, etc.

Methods: We compared the landscape in the painting with the drawing, element by element.

Results: Left side. A penis is openly visible behind ML's shoulder, pointing leftward. Below, a reddish rectangle corresponds to the rectum. Above, the cervix then the cervical canal with the palmate folds, bounded by rocks. The lake silhouette outlines a calf fetus in the amniotic fluid. ?Right side. The lake with two depressions (left temporal / occipital fossae) represents the base of the skull (BS) where the sperm collected. Its surface is inclined 2.5° below the horizontal. Why? In Leonardo's skull drawings, the BS follows a line from the internal occipital protuberance to the nasion, inclined 23° below the horizontal. The male figure in the drawing tilts his head 20.5°. Its skull base is therefore 2.5° below the horizontal, the value displayed by the lake. This cannot be a coincidence. The sperm then descended with the CSF along the spinal cord to the sacrum. Interestingly, the river has four curvatures, comparable to spinal curvatures. Finally, the rock at the bottom is aligned with the penis and clearly looks like testicles.

Conclusion: The drawing is the matrix of the ML landscape; left side, the female pelvis, right side the male. Therefore, the ML should be viewed as a celebration of reproduction. Immense audacity for Leonardo!

Keywords: Mona Lisa, Leonardo, Reproduction, Renaissance

A-0095

Beyond Traditional Methods: A Geometric Approach to Age and Sex Determination in Permanent Mandibular First Molars

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Purpose: In forensic odontology, determining the age and sex of an individual from teeth remains is crucial. Geometric morphometric (GM) is a quantitative technique used in biological and anthropological sciences to analyse and study the shape and form variations in biological structures. The study aimed to determine the size and shape of the permanent mandibular first molar (PMFM) measurements using GM methods.

Methods: 400 orthopantomography, (OPG) images of the PMFM in the adult's Malay population of different sex (male and female) and age groups (Group 1: 18-22 years old and Group 2: 23-30 years old) were collected retrospectively. 22 landmarks were applied to the OPGs. Two-dimensional reconstruction of the PMFM was performed using tpsDig2, MorphoJ software, and the OPG images. tpsDig2 and MorphoJ software were used for landmarking and analysis in GM analysis.

Results: In principal component analysis (PCA), PC1 to PC9 represents 70% of the shapes. Procrustes ANOVA, discriminant analysis and canonical variate analysis showed significant differences between two age groups of Malay adults in the size and shape of PMFM ($p < 0.05$). Discriminant function analysis showed that 93% and 92%, after cross-validation, of the PMFM can differentiate between the two age groups. Incorporating morphological analysis of PMFM proves precise age determination and, to lesser extent, sex in forensic odontology and anthropological investigations.

Conclusion: This approach showcases potential as a valuable tool for accurately estimating age and sex in individuals based on dental remains.

Keywords: Age determination, Sex determination, Permanent mandibular first molars, Forensic Odontology, Geometric morphometrics

A-0118

Freeing and Stretching the Palatine Vessels from the Greater Palatine Foramen in Palatoplasty

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Purpose: The aim of this paper is to present how to free and stretch the palatine vessels from the greater palatine foramen in palatoplasty.

Methods: After a mucoperiosteal flap is raised, periosteal elevator is passed behind the palatine vessels to detach the periosteum around the vessels. Then, a blunt right-angle instrument is placed behind the palatine vessels, and the vessels are pulled from the foramen in the superior aspect, slightly forward (63°) and medially (19°) according to the direction to the greater palatine canal (GPC). The nasal mucosa is also released from the hard palate and from the lateral pharyngeal wall. After dividing the palatal aponeurosis and elevating the anterior flap, the first suture is inserted through the nasal layer of the mucosa at the level of the posterior border of the hard palate (A suture). The nasal layer is approximated and sutured. After closure of the buccal layer, the 2 posterior flaps are joined to the small anterior flap. Finally, A suture is tied.

Results: In 60 cases of pushback palatoplasty, the palatine vessels were stretched from the greater palatine foramen.

Conclusion: In literatures, the length of GPC is 26.97mm. Anteroposterior diameter of the upper opening of GPC is 3.88mm. The angle between the vertical plane and the axis of GPC is 19.09°. The angle between the transverse plane and the axis of GPC is 62.63°. Probably this information is the values obtained in adults. As a matter of fact, similar values were obtained in our study on this subject.

Funding: This study was funded by the JA Kyosai Research Institute (Agricultural Cooperative Insurance Research Institute).

Keywords: Cleft Palate, Anatomy, Regional

A-0127

Abnormalities in Cerebellar Subregions' Volume and Cerebellocerebral Structural Covariance in Autism Spectrum Disorder

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Purpose: The cerebellum plays a crucial role in functions including sensory-motor coordination, cognition, and emotional processing. In comparison with the neocortex, the human cerebellum exhibits a protracted developmental trajectory. This delayed developmental timeline may lead to increased sensitivity of the cerebellum to external influences, potentially extending the vulnerability period for neurological disorders. Abnormal cerebellar development in patients with autism spectrum disorder (ASD) has been confirmed, and these atypical cerebellar changes may affect the development of the neocortex. However, due to the heterogeneity of ASD, the regional changes in the cerebellum and cerebellocerebral structural relationship remain unknown.

Methods: We used imaging methods optimized for the cerebellum and cerebrum on 877 individuals aged 5-18 years in the ABIDE II dataset to address these issues.

Results: Results showed that the volume of total cerebellum and the Right Crus II/lobule VIIB were reduced in ASD patients relative to healthy controls (HCs). Conversely, an increase was observed in the volume of vermis VI-VII in ASD. This cerebellar regional disparity persists in male ASD patients, but not in females with autism. Structural covariance analysis revealed an enhanced structural covariance in ASD patients between the cerebellum and parahippocampal gyrus, parsopercularis, and transverse temporal gyrus in the right hemisphere.

Conclusion: This suggests that the underlying pathological processes of ASD might concurrently affect the cerebellum and parahippocampal gyrus, cerebellum and parsopercularis, cerebellum and transverse temporal gyrus. Furthermore, this structural covariance varies across genders. These findings indicate diverse alterations in cerebellar-cerebral structural connectivity, and offer insights into the potential of cerebellocerebral pathways as therapeutic targets for ASD.

Keywords: Cerebellocerebral structural covariance, ASD, Cerebellar regional disparity

A-0181

A Comparative Study of the Outcomes of Surgically versus Non-Surgically Treated Spinal Disease in Patients with Multiple Myeloma: Northern Ireland's Experience

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Purpose: The aim was to compare the outcomes of treatment between patients managed surgically vs non-surgically with spinal myelomatous disease with regards to pain reduction, neurological function and survival duration.

Methods: A retrospective evaluation of the outcomes of patients who have received treatment for myelomatous spinal disease in Northern Ireland (2010-2023) was performed. To compare patients' outcomes when treated surgically versus non-surgically, two cohorts were required. The 1st cohort contains patients who underwent surgery. Patients who were managed conservatively were selected as the Non-surgical Cohort. The comparison was based on pain, neurological status, and survival outcomes in each group. To quantify any neurological impairments, spinal cord injuries were classified using the Frankel grading system. MRI was performed prior to treatment to assess the extent of spinal pathology.

Results: The mean age of diagnosis in the surgical group was 59, compared to 71 in the non-surgical group. The mean duration of survival was significantly longer in the surgical cohort. The most commonly affected vertebral level in the surgical cohort was T12. In the non-surgical cohort, T11, T12 and L4 were the most commonly affected vertebrae (35%). The percentage reduction in pain at the 3-month follow-up period was greater in the surgical group (60% reduction vs 54.8%). In the surgical group, 18 patients presented with Frankel Grade E, 4 patients were Frankel Grade D, 5 were Frankel Grade C, and 2 patients were Frankel Grade A. Postoperatively, 16 patients' Frankel Grade remained stable, 7 patients' neurological status improved Frankel grades, and 2 patients' Frankel Grade deteriorated. In comparison, the non-surgical group displayed no significant changes in neurological status post treatment.

Conclusion: Surgical intervention successfully prevented the deterioration of neurological function in patients presenting with neurological impairment and those patients had a significantly longer mean duration of survival than the non-

surgical cohort.

Keywords: Multiple Myeloma, Lytic Spinal Lesions, Treatment Outcomes, Vertebral column, Neurological impairment

A-0215

Landmarks and Safety Surgical Position for a Novel 3D-Printed Guider in Treating Humeral Greater Tuberosity Split Fracture (Liu-Gang Type I & II): An Anatomic Study

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Purpose: In order to fix the innovative 3D-printed guider for a better stabilization of the greater tuberosity (GT) fracture, this cadaveric study investigated the anatomic relationships between the axillary nerve and artery and the acromion and GT facets.

Methods: Twenty-six fresh-frozen shoulders (thirteen whole-body) were dissected and measured in three surgical positions: the modified anatomic position (group A), arm 30° abduction (group B) and 45°abduction with 15°forward flexion (group C). Then, facets of GT (landmarks for fixing 3D-guider) were measured including five points (A-E), three superficial landmarks(anterior, middle and posterior point) on the acromion (F-H) and one at insert point of deltoid (K) and six intersection points (vertical distance) from acromion and GT facets to axillary nerve and artery (I,J, L-O).

Results: There were elven males and two female cadavers averaged age at 68.24 ± 9.64 years (range: 61-78). The mean distance FA, FB, GA, GB, GC and GD measured 36.25 ±6.00, 39.50 ± 6.94, 41.47 ± 4.69, 35.74 ± 6.13, 41.90 ± 5.16 and 54.24 ± 6.55mm respectively(group A), while the mean distance KI and KL measured 116.82 ± 13.45 and 121.99 ± 14.37mm respectively (group A). Measurements from middle point of acromion (G) to the axillary nerve and artery (I, J) showed a progressive decrease in group A, B and C (GI, GJ), measuring 62.16 ± 5.62, 65.30 ± 7.33; 58.26 ± 4.81, 61.09 ± 6.61 and 55.58 ± 6.10, 58.97 ± 7.87mm respectively (group A vs B, P<0.05, group A vs C, P<0.05).

Conclusion: The distance from anterior, middle and posterior point of acromion to each facet of GT can be used to guide the placement of 3D-printed guider. Additionally, in order to evaluate surgical safety, the modified anatomical position is suggested.

Funding: The scientific research project of Southwest Medical University (2022QN048).

Keywords: Landmarks, Anatomy, Greater tuberosity fracture, Surgical positions, 3D-printed guider

A-0222

Association between Anatomical Variants of Musculoskeletal Structures and Nerve Compressions of the Lower Limb: Systematic Review and Meta-Analysis

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Purpose: The aim of this study was to describe the main anatomical variants and morphofunctional alterations of the lower limb, which compress surrounding nervous structures in the gluteal region, thigh region, and the leg and foot region.

Methods: We searched the Medline, Scopus, Web of Science, Google Scholar, CINAHL, and LILACS databases from their inception up to October 2023. An assurance tool for anatomical studies (AQUA) was evaluated for methodological quality, and an assurance tool for anatomical studies (AQUA) was also used. the Joanna Briggs Institute assessment tool for case reports. Forest plots were performed to assess the prevalence of the variants; of the gluteal region, thighs and leg.

Results: For the forest plot of the gluteal region, the prevalence was 0.18 (0.14-0.23) with a heterogeneity of 93.52%. For the thigh region, the forest plot presented a prevalence of 0.10 (0.03-0.17) and a heterogeneity of 91.18%. The forest plot of the leg region was based on seven studies, which presented a prevalence of 0.01 (0.01-0.01) and a heterogeneity of 96.18%.

Conclusion: This review and meta-analysis showed that in the studies that analyzed nerve compressions, the prevalence was low in the thigh and leg region, while in the gluteal region it was slightly higher. This is mainly due to the PM region and the different variants of the same. We believe that it is important to analyze all the variant regions defined in this study and that the surgeons treating the lower limb should be attentive to these possible scenarios so that they can anticipate possible surgical situations and thus avoid surgical complications.

Keywords: Nervous compresion, Anatomical Variation, Nerve compression syndrome

A-0235

Sex Differences and the Role of Anthropometrics in Predicting Long Jump Distance of Elite Athletes during National Championships

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Purpose: The aims of the study were to analyze differences in anthropometrics between female and male long jumpers and to investigate the relationship between anthropometrics and long jump distance.

Methods: Body height, weight, segment lengths and circumferences of 39 male and 22 female competitors at the national championships were obtained via the direct standard anthropometric approach. Officials measured jump distance during competition. ANOVA, correlation, and stepwise-forward regression analysis were conducted at a significance level of $p<0.05$ (*). The final regression model was cross-validated using the half-split method.

Results: Sex differences were observed in height, weight, and over 50% of the measured segment lengths and circumferences. Correlation with jump distance was documented for sex (r=0.686*), weight (r=0.338*), height (r=0.375*), arm span (r=0.318*), shank (r=0.300*) and leg length (r=0.264*), and upper arm (r=0.301*) and chest circumference (r=0.353*). A final regression model predicted jump distance based on sex and chest circumference (adjusted R^2=0.519*).

Conclusion: The study contributes to the theoretical understanding of a specific set of anthropometric features playing an integral role in achieving great long jump distance at high levels. Understanding the importance of specific anthropometrics may find practical implications in talent scouting, physical assessment of athletes, and training regimes for long jumpers.

Keywords: Anthropometry, Gender, Human body, Regression analysis, Sports performance

A-0244

Optimal Proximal Tibial Placement for Intraosseous Access in Paediatric Patients: A Computed Topographical Evaluation

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Purpose: Intraosseous access is a safe and efficient method to administer medications to patients who require advanced life support when intravenous access is not readily available. Therefore, this study was conducted to narrow down the ideal insertion site for intraosseous access in paediatric patients.

Methods: This study utilised computed tomography scans that were retrospectively collected from Steve Biko Academic Hospital, in South Africa, of which five infant patients were between four weeks and two years old, seven young children between two years and six years old, and ten children between six years and twelve years of age. The analysis of the scans started at 10mm and extended to 50mm distally to the tibial tuberosity at 10mm increments.

Results: The study found that the most desirable cortical thickness to anteromedial border ratio and the most negligible cortical thickness to medullary space ratio across all three groups were identified at 10mm. Meanwhile, the most significant medullary space to anteromedial border ratio for the infants and young child groups was 10mm and 30mm for the child group.

Conclusion: Based on this study the ideal needle insertion site to gain vascular access for an intraosseous infusion procedure in the proximal tibial is 10mm distal to the tibial tuberosity. This anatomical investigation confirms the practice of gaining vascular access 10 to 20mm inferior to the tibial

tuberosity. These findings can help improve the efficiency and safety of administering medications to paediatric patients who require advanced life support when intravenous access is not available.

Keywords: Infant, Child, Infusions, Intraosseous, Vascular access

A-0247

The Micro Reconstruction of Three-Dimensional Model of Gall Bladder

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Purpose: We conducted continuous slices of gall bladder to get the micro reconstruction three-dimensional (3D) model of gall bladder to reveal the internal structure, and the distribution and location of artery, veins, lymphatic vessels, and nerves of gall bladder.

Methods: Continuous tissue sections of human gall bladder were prepared, with each group consisting of four layers. Each group was subjected to hematoxylin-eosin, and anti-LYVE1, anti-tyrosine hydroxylase-neuronal marker, or anti-choline acetylase immunohistochemistry staining. And fine rectification was performed using software Photoshop. Software Mimics 21.0 was used to overlap 4 groups of sections for 3D reconstruction. And the 3D structure was segmented, zoned, and labeled. The course and anastomosis of micro vessels, nerves, and lymphatic vessels were analyzed by tissue sections and reconstruction.

Results: More than 500 longitudinal paraffin slices of human gall bladder with a thickness of 2 μm were obtained. The arteries after entering the gallbladder from the neck of the gall bladder, the gallbladder artery is divided into 2 branches, which walk along both sides of the gall bladder to the fundus of gall bladder, and finally anastomosis at the fundus of gallbladder. The nerves in gall bladder had abundant anastomotic grids. Lymphatic vessels were abundant, which cling to blood vessels.

Conclusion: After micro reconstruction the three-dimensional model of human gall bladder, we can observe the branches of blood vessels, nerves, and the distribution and course of lymphatic vessels in gall bladder. It is a solution to problems related to interventional treatment of gall bladder diseases. Our results provided corresponding anatomical basis for gall bladder surgery.

Funding: This study was financially supported by National Key R&D Program of China (2022YFF1202600).

Keywords: Micro reconstruction, Three-dimensional (3D) model, Gall bladder, Internal structure

A-0255

Intelligent Segmentation and T-Stage Diagnosis of Prostatic Cancer Based on MRI and Deep Learning

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Purpose: Manual segmentation of prostate lesion on MRI is highly important for 3D visualization, diagnosis and treatment planning but is time-consuming and laborious. We plan to develop a deep learning model for intelligent segmentation of prostate zones, tumors and adjacent structures and for intelligent T-stage diagnosis of prostate cancer (PCa).

Methods: PCa patients with pathologically confirmed from SX Hospital (April 2018 to June 2020) and XQ Hospital (January 2021 to January 2022) were enrolled in this retrospective study. Other patients from public dataset (Test-A) and XQ Hospital (Test-B) were selected for external testing. We proposed a deep learning approach called PCa T-stage diagnosis with deep learning (PDD). In the first step, the peripheral zone (PZ), transition zone (TZ), central zone (CZ), anterior fibromuscular stroma (AFMS), tumor, rectum, bladder, seminal vesicle (SV) and urethra were intelligently segmented using Vgg16-AttentionGate-Unet model. In the second step, Swin-Transformer (SwinT) model is used for intelligent T-stage diagnosis with intelligently segmented lesions.

Results: The study included 209 patients (70 years ± 9). PDD achieved DSCs of 0.783, 0.789, 0.392, 0.563, 0.583, 0.824, 0.938, 0.738, and 0.613 for intelligent segmentation of PZ, TZ, CZ, AFMS, tumor, rectum, bladder, SV, and urethra in the internal test cohort (n = 30) and DSCs of 0.787, 0.755, 0.349,

0.587, 0.487, 0.852, 0.931, 0.667, and 0.639 in the external Test-A (n = 27), respectively. Additionally, the PDD achieved an accuracy of 0.733 and an AUC of 0.827 for differentiating between T1-T2 and T3-T4 in the internal test cohort, outperforming the SwinT by 15.80% and 16.81%, and achieved accuracies of 0.814 and 0.867, and AUCs of 0.815 and 0.861 in the external Test-B and resident-PDD, respectively.

Conclusion: Deep learning was able to accurately segment prostate zones, tumors and adjacent structures, and performed well in T-stage diagnosis of PCa.

Funding: This study received funding from the National Natural Science Foundation of China (31971113), the Chongqing Science and Technology Talent Project (CQYC201905037), the Army Science and Technology Talent Project (91003201901973), and the Qingbo Project of the Second Affiliated Hospital, Army Medical University (2022YQB043).

Keywords: Artificial intelligence, Prostate cancer, Segmentation, Deep learning, MR imaging

A-0273

Correlation between the Diameter of the Main Trunk of Facial Artery and Its Distribution Pattern in the Face

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Purpose: The facial artery (FA) is the most important artery in the face, and it enters the facial area passing through the antegonial notch (AG). The diameter, symmetry, and number of branches of the FA vary from person to person, so they are important factors to consider during minimally invasive anti-aging procedures. The purpose of this study was to determine the relationship between the diameter of MT at the AG (MT; main trunk of FA) and the course or the branching patterns of FA.

Methods: In this study, 72 sides of FA were dissected from 36 cadavers (16 women, 20 men), and the average age was 73 years old. The diameter of MT and each branches of FA was measured. And the branching pattern of major branches of FA was confirmed.

Results: The diameter of MT was 3.05 ± 0.67 mm of all cases. The FA was classified into five types. The textbook-shaped FA (type D) was only 11.11%, and the MT diameter of type D was 3.47 ± 0.59 mm. Type E with detoured branches was 9.72% and had the largest MT diameter of 3.85 ± 0.43 mm. The most common type of FA was type C, which had no angular branches. The FA was right-dominant in 47.2% and left-dominant in 16.7% of all cases. The diameter of MT had a close positive correlation with the number of branches of FA.

Conclusion: The most common side effects from minimally invasive anti-aging procedures are vascular-related. Because the pattern of FA varies from person to person, it is not easy to prevent these side effects with uniform treatment methods. Based on the results of this study, the distribution pattern of the FA can be predicted just by checking the diameter of MT before treatment, and it will be helpful in minimizing side effects during treatment.

Keywords: Facial artery, Diameter, Distribution pattern, Minimally invasive procedure

A-0286

Anatomical Relationship between Profunda Brachii Artery and Radial Nerve at the Entrance of Sulcus Radialis

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Purpose: In examination of the literature, it is seen that the anatomical studies concerning profunda brachii artery (PBA) are rare, and most are related to the origin of PBA. There are no studies that examine the relationship between PBA and radial nerve. Thus, in this study, we aimed to examine the relationship between PBA and radial nerve in the entrance of sulcus radialis.

Methods: Dissections were carried out on 44 (21 right and 23 left) upper extremities of 24 fixed cadavers used for medical education purposes at Istanbul University, Istanbul Faculty of Medicine, Department of Anatomy.

Results: It was observed that PBA is a single artery in 39 extremities, and a double artery in 5 extremities. In 27 cases with single PBA, the nerve was located superolateral of PBA (Type

A) and in 8 cases the nerve was located inferomedial of PBA (Type B). All of 5 extremities with double PBA had superolateral extension of proximal branch (Type A) and inferomedial extension of distal branch (Type B).

Conclusion: Our study, which examines the relationship between PBA and radial nerve, will contribute the literature anatomically and radiologically regarding the treatment of humerus fractures and lateral arm flap practices carried out by surgeons.

Keywords: Profunda brachii artery, Radial nerve, Cadaver

A-0293

Anatomical Variants of the Renal Veins and Their Clinical Implication in the Management of Kidney Transplants. A Systematic Review and Meta-Analysis of Prevalence

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Purpose: The objective of this review was to know the characteristics and prevalence of anatomical variants of RV and to associate them with possible clinical complications in the presence of these variants.

Methods: A systematic search was conducted in the Medline, Scopus, Web of Science, Google Scholar, CINAHL, and LILACS databases from their inception until January 2024. Two authors independently carried out the search, study selection, and data extraction, and assessed methodological quality using a quality assurance tool for anatomical studies (AQUA). Ultimately, consolidated prevalence was estimated using a random-effects model. In total, 91 studies meeting the eligibility criteria were identified. This study included 91 investigations with a total of 46,664 subjects; the meta-analysis encompassed 64 studies.

Results: The overall prevalence of multiple renal veins was 5%, with a confidence interval (CI) of 4% to 5%. The prevalence of the renal vein trajectory was 5%, with a CI of 4% to 5%. The prevalence of renal vein branching was 3%, with a CI of 0% to 6%. Lastly, the prevalence of unusual renal vein origin was 2%, with a CI of 1% to 4%.

Conclusion: These patients undergo various surgeries that are often necessary for the continuity of their lives. A lack of knowledge could lead to the reconstruction of the normal anatomy in the face of an asymptomatic variant, thus altering the functionality of the kidney and neighboring structures. Therefore, new studies that relate these variants with kidney transplant and hemodialysis are essential.

Keywords: Variations renal vein, Renal failure, Kidney vascularization, Clinical anatomy, Kidney Transplant

A-0302

The Morphological and Quantitative Analysis of Individual Footprints of the Common Extensor Origin of the Elbow

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Purpose: The primary cause of lateral epicondylitis (tennis elbow), which is one of the most common diseases, is the common extensor origin (CEO). The attachment site of the CEO, known as the footprint, is a point of muscle movement and is closely associated with the pathophysiology of lateral epicondylitis. Recently, a selective approach that targets each CEO has been tried to minimize unnecessary damage. However, the anatomy of the footprints of the CEO has not yet been clearly identified. This study aims to analyze the footprint of each CEO and their anatomical relationships.

Methods: A total of 15 fixed cadavers (29 upper extremities, mean age 83.25 years old; 9 females and 6 males) were dissected. 3D scanning (Space Spider, Artec 3D, CA, United States) was utilized. Analyzing the footprint was performed utilizing 3D software (3-matic, Materialise, Belgium). This study was approved by the Institutional Review Board (IRB) of Ewha Womans University (ewha-202308-0023-01).

Results: The morphology of the footprint of the CEO was arranged longitudinally in a stratified manner. In particular, there were two forms according to the extensor carpi radialis

brevis (ECRB), the main target of treatment for lateral epicondylitis. The majority, 82%, of ECRB was separated and located in the inferio-anteromedial aspect of the extensor carpi radialis longus (ECRL), and only 18% was located inferior to the ECRL. The ECRL was located in the most proximal, and the extensor carpi ulnaris (ECU) was located in the most distal. There was a significant difference between the surface area (mm^2) and the calculated 2D area (mm^2) based on the outline of the footprint.

Conclusion: This study provides morphological and quantitative information that can be applied to the clinical field. Our study suggests that the clinical approach to the CEO should consider the anatomy of the footprint.

Funding: This research was supported by a grant of the MD-PhD/Medical Scientist Training Program through the Korea Health Industry Development Institute (KHIDI), funded by the Ministry of Health & Welfare, Republic of Korea. This research was supported by a grant from the Korea Health Technology R&D Project (HI23C0170) through the Korea Health Industry Development Institute (KHIDI), funded by the Ministry of Health& Welfare, Republic of Korea.

Keywords: Elbow, Lateral epicondylitis, Common extensor origin, Footprint

A-0314

Anatomic Study Suggests that the Morphology of the Planters Tendon May Be Related to Mid-Portion Achilles Tendinopathy

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Purpose: The plantaris muscle has a great clinical significance. The tendon may have a role in procedures such as grafting. However, recent reports suggest its potential involvement in the tendinopathy of the midportion of the Achilles tendon. The aim of the study is therefore to evaluate morphological variation of the PM with regard to its potential conflict with the Achilles tendon.

Methods: Classical anatomical dissection was performed on 200 lower limbs (100 right, 100 left) fixed in 10% formalin solution. The morphology of the PM was assessed regarding the relationship between the course of the plantaris tendon and the calcaneal tendon.

Results: The plantaris muscle was present in 95.5 % of cases. Six types of insertion were foubnd plantaris tendon into the calcaneal tuberosity based on its shape, its relation to calcaneal tendon and the exact point of insertion in the calcaneal tuberosity. The most common type was Type I, which was characterized by a wide, fan-shaped insertion to the calcaneal tuberosity on the medial side of the Achilles tendon. It was observed in 81 lower limbs (42.4 %). On the other hand, the rarest two types were Type IV and VI. Type IV was characterized by insertion not being located on the calcaneal tuberosity but rather in the deep fascia of the leg. This type was found in 6 lower limbs (3.1 %). Type VI – distal attachment was located at the point near to the tarsal canal flexor retinaculum of the leg. This type was observed in 6 limbs (3.1 %).

Conclusion: The anatomical variation of the plantaris tendon morphology may create a potential conflict with the Achilles tendon and the tibialis posterior tendon, thus increasing the possibility of tendinopathy.

Keywords: Plantairs tendon, Achilles tendon, Midportion Achilles Tendinopathy, Achilles tendinopathy

A-0315

Analyzing the Indication, Time Factor and Early Postoperative Outcome on Free Tissue Transfer - A Single Centre Tertiary Care Experience in a Developing Asian Country

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Purpose: Free tissue transfer is the gold standard for reconstruction of soft tissue defects following trauma, cancer and brachial plexus injury. It is technically demanding due to complex anatomy of the transferring as well as the donor tissue. We aimed to evaluate indications, site of defect, type of flap, early postoperative outcome and factors associated with outcome of free tissue transfers in a resource limited develop-

ing country.

Methods: A prospective follow up study with a sample of 21 patients underwent free tissue transfer at plastic surgical unit, NHSL, Colombo for 6 months duration.

Results: Mean age of the population was 40.38±14.1. Majority [71.4% (n=15)] were males. Considering the indications, RTA accounted for 66.7% (n=14) followed by malignancy (14.3%,n=3) and burn (9.5%,n=2). Considering the site, lower extremity accounted for 57.1% (n=12) followed by upper extremity (23.8%,n=5) and face (19%,n=4). Majority [47.6% (n=10)] were anterolateral thigh flaps. Free functional muscle transfers and fibular bone flaps accounted for19% (n=4) and9.5% (n=2) respectively. All the flaps (n=21) had one artery while 9 flaps (42.9%) had 2 veins anastomosed. Mean surgery duration was 351.43±68.5 minutes. Mean flap dissection time, mean ischemia time and mean anastomosis time were 97.14±41.2, 97.14±36.6 and 87.8±34.3 minutes respectively. Considering the early post operative complications, majority (81%, n=17) had no complications. There was no statistically significant association of complication with site of flap, type of injury, surgical, flap dissection, ischemic or anastomosis time, age or number of vessels anastomosed (p>0.05).

Conclusion: Free tissue transfer has demonstrated high success rate in our setting emphasizing its preference for optimal reconstruction. Choice of flap depends on the anatomical location of the tissue defect. Surgeons should possess a thorough understanding of tissue anatomy and vascular anatomy to ensure successful outcomes. The introduction of innovative flaps can be guided by a comprehensive understanding of both the macroscopic and microscopic anatomical features of the tissues involved.

Keywords: Free tissue transfer, Microsurgery, Vascular anatomy, Tissue anatomy

A-0332

Topographic and Morphometric Anatomy of the Buccal Nerve: A Cadaveric Investigation

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Purpose: Recent bichectomy and face lift operations that prefer an intraoral approach to the region, which puts the buccal nerve at risk. This study aimed to investigate the anatomy of the buccal nerve with an intraoral approach.

Methods: Hemi-faces of 8 cadavers were dissected at Koç University School of Medicine. The heads were cut sagittally with a band saw and dissections were done with a medial approach. The course of the nerve in the pterygomandibular and buccal spaces, its relationship with the temporalis muscle, opening of the parotid duct, and buccal fat pad were evaluated. Nerve's horizontal and vertical distance to the parotid duct opening, distances of the nerve as it turned anteriorly into the buccal space to the coronoid tip and retromolar trigone, and the horizontal distance between the nerve and the lateral pterygoid plate was measured.

Results: Buccal nerve coursed parallel to the temporalis tendon vertically within the temporalis fascia and pierced the muscle/tendon in 2 specimens. In buccal space it had an antero-inferior course and stayed below the linea alba in all specimens. As it entered buccal space, it gave off numerous branches posterior to the parotid duct opening. Nerve remained lateral to the temporal expansion of the buccal fat pad in pterygomandibular space and medial to the anterior lobe of buccal fat pad in buccal space. Distance of the nerve was 14.1±1.2 mm to the lateral pterygoid lamina, 25.2±2.8 mm to the coronoid tip, and 15±2.2 mm to the retromolar trigone. Horizontal and vertical distances of the nerve to the parotid duct opening were 18.9± 2.4 mm and 16.6± 2.4 mm, respectively.

Conclusion: The buccal nerve had a more close relationship to the temporalis muscle than previously reported. Its antero-inferior course in buccal space and relationships with buccal fat pad are reported for the first time.

Keywords: Buccal nerve, Buccal fat pad, Buccal fat extraction, Bichectomy, Rhytidoplasty

A-0347

Protocol of Cadaveric Spine Dissection on Body Donors for Harvesting Lumbar Intervertebral Discs

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Purpose: In spine research, degenerative discs are often procured from patients undergoing spinal surgeries. Nevertheless, obtaining healthy discs to serve as an age-match control for the degenerative cohort is strictly limited. This study established a protocol designed to dissect the spine of body donors, aiming to harvest the intact lumbar discs for research purposes.

Methods: Five body donors without a history of spine diseases were identified through a public institution. Utilising a standard midline laparotomy, cadaveric dissection was performed to access the lumbar spine via an anterior retroperitoneal approach, facilitating the extraction of intact discs.

Results: The fresh, frozen body was fully thawed and placed in a supine position. Anatomical landmarks, including the xiphoid process and pubic symphysis, guided the length of the anterior incision that was made down the middle of the abdomen along the linea alba. The subcutaneous fat and superficial fascial layers down to the rectus sheath were dissected. The peritoneum was left intact without injuring any underlying structures as blunt dissection was performed to gently reposition it to the inner aspect of the abdominal wall. With the aid of a handheld retractor, the retroperitoneal cavity was exposed, revealing the aorta, inferior vena cava and spine. The surrounding tissues, including ligaments, were dissected to expose the discs sandwiched between vertebrae. Using an osteotome, both pedicles of the vertebrae at L1-L5 were cut before removing the discs with endplates intact from the spine. The discs were wrapped in gauze soaked with the phosphate-buffered solution for further analysis. In total, twenty discs were successfully harvested within an average duration of 40 minutes per body.

Conclusion: This protocol is simply efficient for harvesting intact discs with endplates preserved, offering promising prospects for age-match healthy control in research.

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Keywords: Lumbar spine, Cadaveric dissection, Intervertebral Discs, Protocol, Retroperitoneal approach

A-0363

Three-Dimensional Analysis of the Distribution of Smooth and Skeletal Muscle Tissue around the Female Urethra

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Purpose: Understanding the anatomy of the urethral sphincter is crucial for evaluating urinary function in female. It is generally known that the urethra is surrounded by layers of smooth muscle, including inner longitudinal and outer circler muscles, as well as the skeletal muscle of the external urethral sphincter. However, the extent of these muscles and their relationship to the levator ani are still unclear. The aim of this study was to clarify the composition of the muscle layers around the female urethra and their three-dimensional arrangement.

Methods: The pelvises of five female cadavers (mean age: 78.8 years) were collected for histological analysis. The tissue around the urethra was serially sectioned and stained with Elastica van Gieson, to identify the connective and muscular tissues. To confirm the distribution of smooth and skeletal muscles, immunohistological staining with anti-smooth muscle antibody was performed. Thereafter, the muscle layers were three-dimensionally reconstructed based on the serial histological sections.

Results: The female urethra was surrounded by four muscle layers arranged in the following order from inner to outer layers: longitudinal smooth muscle, the circular smooth muscle, external urethral sphincter, and the outermost smooth muscle layer. These muscles not only simply surrounded the urethra, but also partially extended anteriorly. The outermost smooth muscle extended to the vaginal muscle layer, and the external urethral sphincter and the levator ani were connected each other.

Conclusion: This study clarified the distribution of muscle

tissue surrounding the female urethra and the relationship between the external urethral sphincter and the levator ani. These findings suggest that the control of urination involves not only the sphincteric action of the external urethral sphincter, but also the elevating action of the levator ani. This study provides an anatomical basis for the clinical management of urinary incontinence and the development of surgical techniques.

Keywords: Anatomy, Female urethra, Urinary function, Skeletal muscle, Pelvic floor muscle

A-0367

Operative Approach to the Articulatio Carpometacarpalis Pollicis in Relation to the Course of the Ramus Superficialis Nervi Radialis: An Anatomical Study with Clinical Applications

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Purpose: Despite high caution during surgical interventions, perioperative damage of the ramus superficialis nervi radialis (RSNR) during various procedures, resulting in postoperative neuritis and sensory loss, is repeatedly described, and description of its course and variations in the literature is limited to a few selected clinical applications. Especially during direct surgical approach to the articulatio carpometacarpalis pollicis (ACMP) is often completely neglected. The aim of the work was to determine the safest operational approach to the ACMP due to the course of the RSNR branches.

Methods: We dissected 165 cadaveric limbs of donors of Central European origin (79 left, 86 right). We documented topographical conditions in the area of approach to the ACMP, attached transparent films to the limbs and drew orientation points - the tendons of the abductor pollicis longus muscle (MAPL), the extensor pollicis brevis muscle (MEPB) and the extensor pollicis longus muscle (MEPL), as well as the processus styloideus radii, the edge of the first metacarpal, and the RSNS branching. We transferred these diagrams to graph paper and compared the appropriateness of the cut in three places (along MAPL and MEPB tendons, along MEPL tendon and in the middle between them). We assumed the incision to be 2 cm proximal and distal to the joint cleft.

Results: In 107 of 165 cases (65%) the incision is safe along the parallel MAPL and MEPB tendons, in 54 of 151 (36%) in the midline, and in 13 of 165 (8%) along the MEPL tendon.

Conclusion: From the established distribution of RSNR branching variations, a reduction in postoperative complications can be assumed in case of using a direct straight cut along the MEPB tendon. Compared to other possible incision sites, this has a significantly lower probability of nerve branches, and we consider its use to be the method of choice.

Keywords: Superficial branch or radial nerve, Ramus superficialis nervi radialis, Articulatio carpometacarpalis pollicis, Carpometacarpal joint of thumb, Injury

A-0387

A Proposal for a New Morphological Classification of the Popliteus Muscle Tendon

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Purpose: The purpose of this study was to characterize the morphological variations in the proximal attachments and create an accurate classification of the popliteus muscle for use in planning surgical procedures in this area, for evaluating radiological imaging and rehabilitation.

Methods: Two hundred lower limbs of body donors fixed in 10% formalin solution were examined.

Results: The popliteus muscle was present in all 200 limbs. Four main types were identified with subtypes. The most common type was Type I (76 lower limbs), characterized by a single tendon in the popliteus sulcus. Type II (57 limbs) characterized by a main tendon in the popliteus sulcus and accessory bands. This type was divided into five subtypes (A–E) based on presence of specific accessory bands. Type III (30 limbs) was characterized by two tendons in the popliteal sulcus. Type IV (37

lower limbs) was characterized by two tendons in the popliteus sulcus and additional bands. This type was also divided into five subtypes (A–E) based on presence of specific accessory bands. The popliteofibular ligament was present in 182 lower limbs.

Conclusion: A new classification based on a proximal attachment is proposed. The popliteus tendon is characterized by a very high morphological variability, which can affect posterolateral knee stability and the natural rotation of the tibia. Such a classification system may be useful for clinicians performing medical procedures within the knee joint, including orthopedic surgeons.

Keywords: Popliteus tendon, Popliteus muscle, Popliteofibular ligament, New classification

A-0389

Ultrasound Protocol to Visualize the Suprascapular Notch Anatomy: A Diagnostic Algorithm in Detecting Suprascapular Notch Stenosis

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Purpose: Visualizing the suprascapular notch on radiographic images is challenging. Ultrasound of the suprascapular notch had been performed only from a superior shoulder approach projecting a posterior view. Ultrasound anterior view has not been presented in the clinical practice and has been believed not to be possible. We provide a shoulder maneuver giving anterior ultrasound visibility of the suprascapular notch with a protocol to evaluate the suprascapular notch space.

Methods: The study was performed on 100 volunteers (50 males, 50 females, age ±21). The suprascapular canal was first scanned by placing the transducer in a diagonal orientation along the shoulder sagittal plan. This allowed observation of the pre- and post-suprascapular notch spaces. Then, the suprascapular notch vicinity was captured by the posterior and the anterior approaches. The depth, upper width, and middle width of the suprascapular notch were measured as well as the vertical and horizontal diameters of the residing suprascapular nerve.

Results: Ultrasound anterior view of the suprascapular notch was achieved by four step maneuver: 1) Arm abduction in approximately 45° degrees lifting up the supraspinatus muscle and clavicle. 2) Arm external rotation with flexed forearm lowering the subscapularis muscle. 3) The probe was placed under the clavicle on the palpable base of the coracoid process, which is the lateral border of the suprascapular notch. 4) The medial border of the suprascapular notch was identified by locating the omohyoid muscle which was confirmed by neck rotation to the opposite side until visibly stretched on the screen. The average obtained parameters were: suprascapular notch depth = 10.0 mm, upper width = 13.0 mm, middle width = 7.5 mm, and the suprascapular nerve diameter = 2.5 x 2.0 mm.

Conclusion: We have provided an algorithm to assess the suprascapular notch stenosis in cases of suspected suprascapular nerve entrapment.

Funding: Grant agency of Charles University (Grant number: GAUK no.266222).

Keywords: Suprascapular notch, Suprascapular nerve, Suprascapular notch stenosis, Suprascapular nerve entrapment, Suprascapular notch ultrasound

A-0397

Intra-Individual Comparative Assessment between Magnetic Resonance Image Segmentation and Physical Dissection of the Muscles of Facial Expression in Cadaveric Donors

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Purpose: The muscles of facial expression (MOFE) are small highly variable structures that are responsible for movements of the face. Understanding the variable form of these muscles is important for inferring function, the effects of normative muscle variations on function, the effects of disease and injury on function and the evolution of universal systems of

facial communication. The gold-standard for studying MOFE form is dissection. However, this does not allow for the large human samples needed to establish normative ranges of variation, nor does it align well with clinical practice. Whilst MRI does allow for large samples from open repositories and aligns well with clinical practice, we know little about how MOFE are visualised with MR as directly compared with dissection. This work aims to validate analysis of face muscles between ex-situ cadaveric and in-situ cadaveric MRI.

Methods: Head MR images (DESS and T1 sequences) were taken of 8 cadaveric donors (4 male: 4 female; 60-100yrs, mean 82yrs). The donors were equally split between formalin-embalmed and Thiel-embalmed. After imaging, four were dissected using the Anterior-Posterior method and the remaining four were dissected using the Posterior-Anterior mask method. To visualise the MRI, 3D models of MOFE were created using 3D slicer. Each individual muscle was compared to evaluate the anatomy between dissection and M

Results: Consistent with previous literature, the visibility of individual MOFE was variable on MRI, however in the DESS sequences these were more obvious. Unnatural positioning of the jaw and magnified effects of gravity were seen in the Thiel-embalmed donors in the MRI. Variations such as bifid zygomaticus major were present and visible in the MRI.

Conclusion: This work validates analysis of certain facial muscles between ex-situ cadaveric and in-situ cadaveric MRI. A follow up study will evaluate the use of the digital technique for extrapolation to in-situ in-vivo volumetric analysis.

Funding: This work was funded by the European Research Council (ERC) Consolidator Grant FACEDIFF (864694) to BW. Ethical approval for the work was given by the University of Liverpool's ethics committee (Number 12311), and is concurrently conducted under the HTA license held by HARC. Consent for research as well as anatomical examination was provided by the donors.

Keywords: Muscles of Facial Expression, Cadaveric, Dissection, Magnetic Resonance Imaging

A-0398

Evaluation of a Multi-Modal AI System in Clinical Anatomy: An International Multi-Centered Study

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Purpose: To demonstrate the application of novel Artificial Intelligence (AI) tool in anatomy, radiology and clinical practice. With a focus on cardiovascular anatomy, our initial study built on a proof-of-concept study conducted with NHS colleagues in the UK to compare the 'AIATELLA' AI with Consultant Cardiologists' assessment of aortic root and valve planimetry. This multi-site investigation has since obtained over 50,000 ultrasound, CT, and MRI scans from clinical sites in three continents to further inform the AIATELLA AI across different anatomical sites.

Methods: The study compares clinicians' appraisal of normal vascular anatomy and pathology with that of the AI. Accuracy, speed of analysis, and reproducibility were the focus along with the inter and intra-operator variability paramount to clinical practice. Three NHS Consultant Cardiologists and the 'AIATELLA' AI algorithm—trained on 35 patients' DICOM images—conducted 15 measurements per patient dataset using cvi42®software. Statistical analyses, including descriptive and ANOVA, were performed using IBM SPSS to compare group measurements.

Results: AIATELLA demonstrated statically significant (ANOVA) superiority when compared with manual methods. Analysis of Interclass Correlation Coefficient (ICC) metrics indicates high concordance across all measurements (overall ICC: 0.98), with AI matching the accuracy of cardiologists while delivering results more than 100 times faster. Notably, average measurement time of 2.6 seconds significantly outpaced human observers, enhancing workflow efficiency and potentially reducing time from diagnosis to treatment.

Conclusion: Variability in human measurements, attributed to factors like experience and fatigue, contrasts with AI's uniform standard. Statistical analysis has confirmed AIATELLA precision and speed, with a large effect size indicating a substantial variance in measurement times attributable to inter and intra-operator variability. This suggests AI's role in standardising measurements, reducing error margins, and of-

fering consistent output quality. AI tools such as AIATELLA can improve diagnostic accuracy, efficiency, and patient care standardisation, complementing but not replacing cardiologist expertise.

Keywords: Clinical Anatomy, Artificial Intelligence, Radiological Anatomy/Imaging, Anatomical Research, Clinical Medicine

A-0407

Mesoscopic Anatomy of the Tectorial Complex and Deep Ligaments of the Craniocervical Junction

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Purpose: A cervicogenic headache is thought to be referred pain arising from irritation of C1-C3 spinal nerves, which innervate the tectorial ligament (TL) and/or membrane (TM) at the craniocervical junction (CCJ). Grey's Anatomy defines the TL as the superior-ward prolongation of the posterior longitudinal ligament (PLL). However, the precise anatomy of the TL-PLL junction is inconsistently reported. The purpose of this study was to define the TL and its relationship with surrounding structures.

Methods: Sixteen cadavers were prepared as 5 transverse, 8 sagittal and 3 coronal sets of epoxy plastinated slices and examined using stereoscopic and confocal microscopy.

Results: (1) The TL consists of a median and two lateral fibrous bundles which are sandwiched in-between the TM and neurovascular networks. (2) Superiorly, the TL originates from the inner occiput at the level of the jugular foramen. (3) Inferiorly, the median TL intermingles with the cruciate ligament and inserts at the mid C2 body. On both the lateral sides of this termination site, the PLL begins its origin, thus marking this level as the TL-PLL junction. (4) The lateral TL merges and continues with the perineurovascular sheath of the vertebral artery, internal vertebral venous plexus and C1-C2 spinal nerves.

Conclusion: The TL and TM form a peridural complex which is immediately exterior to the dura proper, attached to the cruciate ligament and terminates at the C2 level. These results may contribute to clinical management of the CCJ injuries as well as the understanding of the pathogenesis of cervicogenic headache.

Keywords: Tectorial membrane, Craniocervical junction, Mesoscopic anatomy, Cervicogenic headache

A-0455

Evaluation of Masseter Thickness in Individuals with Class I Skeleton by Ultrasonography during Teeth Clenching and Resting

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Purpose: The most important indicator of a healthy dentofacial complex is the harmonious functioning of the orofacial structures and the temporomandibular joint. For a healthy occlusion, not only the bone structure but also the activity of the chewing muscles is important. Our study aims to analyze the possible relationship between the ultrasonographic evaluation of the muscle thickness of the masseter during teeth clenching and rest and the Class I skeletal structure.

Methods: This research was conducted at Ankara Medipol University. Individuals between the ages of 20 and 30 who applied to the Faculty of Dentistry Hospital for various reasons, and who did not receive orthodontic treatment, were included in the study voluntarily (n: 49). Earaches and headaches were evaluated during the clinical examination of the individuals. Muscle pain resulting from palpation of the masticatory muscles was noted. The muscle thickness of the masseter was analyzed by ultrasonography by measuring it from three separate points during teeth clenching and rest.

Results: 32.65% (n:16) of the people included in the study had headache. No temporalis pain was detected during the palpation examination. It was determined that the muscle thickness of the masseter at the insertion level increased during teeth clenching and decreased during rest (right 43.715 mm, 38.426 mm; left 42.335 mm, 36.315 mm, respectively). In the measurements taken from the origin and middle level of the masseter, it was determined that there was statistical significance in its thickness according to the teeth clenching and loosening positions ($p < 0.05$).

Conclusion: The intensity of teeth clenching causes hypertrophy in the masseter over time. This situation leads to disruption of normal occlusion and temporomandibular joint degeneration. Evaluation of the masseter in individuals with Class I skeleton without showing any symptoms will contribute to the protection of jaw joint health.

Funding: The vertebral artery (VA) is a branch of the subclavian artery that runs through the transverse foramina of the cervical vertebrae. One of the conditions that VA can present as a variant is vertebral artery hypoplasia (VAH). This condition has various definitions and there is still no definitive consensus on it to be able to master it, but in simple words it is a decrease in the lumen of the vertebral artery.

Keywords: Ultrasonography, Masseter, Muscle thickness, Class I

A-0473

A Rare Presentation of Multi-Organ Hydatid Disease: Reflections on the Importance of Anatomy Training in Improving Clinical Diagnosis in Resource Scarce Settings

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Purpose: Hydatid disease involving multiple organs is rare in clinical practice. It is caused by the larval stages of cestodes (tapeworms) belonging to the genus Echinococcus and the most commonly affected organs in adults include the liver and lungs.

Methods: We describe the rare presentation of multi-organ hydatid disease at a South African Specialist Respiratory Clinic where a referral from a local clinic was made for the assessment of 'multiple round cystic opacities varying in size' noted on chest radiograph.

Results: A 54-year-old woman presented with multiple cystic lesions in the liver, lung and spleen. The general examination was normal while the respiratory examination revealed a trachea deviated to the right and dullness in the right upper and lower zones, with decreased breath sounds in the right lower zone. The abdomen was soft on palpation with mild hepatomegaly and an 8 - 10 cm firm mass in the left upper quadrant. A CT scan of the chest revealed a large right lower-lobe cyst (8 × 8 cm), with significant right middle- and upper-lobe scarring, traction bronchiectasis/bronchiolectasis and lung cavities containing low-density material with gas locules, in keeping with aspergillomas. The left lung had a small well circumscribed superior lingual cyst (19 mm), while the upper abdomen revealed two large cysts in the liver (9.5 × 7.0 cm) and spleen (15 × 10 cm).

Conclusion: The final diagnosis of hydatid disease of the lungs, and liver with a rare giant splenic hydatid was made, while the right upper and middle-lobe disease was possibly due to post-TB lung disease with aspergillomas and/or bronchiectasis. The surgical removal of the cysts was recommended. The case highlights the importance of sound surface and gross anatomy competence in medical students and residents in the detection of important clinical signs that are key in making clinical diagnoses in resource scarce setting.

Keywords: Anatomy education, Hydatid cysts, Multi-organ hydatid disease, South Africa

A-0522

Revisiting the Foramen of the Thyrohyoid Membrane: Insights from Dissection and Morphological Analysis

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Purpose: The depiction of the foramen of the thyrohyoid membrane in textbooks suggests a confined opening within a robust membrane. However, dissection reveals a passage through multiple fascial layers for the internal laryngeal nerve (ILN) and its accompanying vessels. What constitutes the layers that contribute to what is commonly known as the thyrohyoid membrane and its foramen?

Methods: Ten human specimens were dissected from superficial to deep and five from deep outwards, tracing the ILN between the thyroid cartilage and the hyoid bone (IRB exemption 06014). A discernible pattern emerged, illustrating how the nerve traverses through various layers. Images and pen drawings were generated to visually document the course of the ILN.

Results: Antero-medially to the ILN lies the thyrohyoid muscle and a fascial layer continuous with the median thyro-

hyoid ligament. This fascial layer envelops an almost rectangular fat pad. Antero-laterally to the ILN, the inferior pharyngeal constrictor muscle attaches to the superior-lateral border of the thyroid cartilage, proceeding anteriorly to the lateral thyrohyoid ligament. Postero-laterally, a fascial layer continuous with the lateral thyrohyoid ligament serves as the posterior layer before the ILN enters the laryngopharynx. The anterior fascial layer forms a bridge over the ILN, creating a sliding passage through the fascial layers.

Conclusion: The ILN and accompanying vessels traverse through fascial layers between the thyroid cartilage and hyoid bone. The location of the passage, situated between the thyroid and hyoid cartilage, varies based on the extent of pharyngeal muscles attached to the thyroid cartilage. The passage lacks a distinct demarcation of a true foramen.

Keywords: Anatomy, Internal laryngeal nerve, Thyrohyoid membrane, Foramen

A-0551

Bridging the Gap between Available and Accessible Information in Research

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Purpose: In the field of systematic research in biomedicine, the primary source of data acquisition is platforms like PubMed and Google Search. These sources predominantly index English-language abstracts, thereby limiting the scope of accessible literature. Furthermore, the exclusion of doctoral theses housed in national libraries narrows the spectrum of potential insights. This raises the pertinent question: What invaluable knowledge might remain obscured by these constraints?

Methods: Multilingual proficiency, expertise in country-specific information gathering, and on-the-ground access are methods for obtaining data from PH. D. theses.

Results: Three theses defended between 1975-1983, conducted in an anatomical institute, were made available from the library of a Dutch anatomist. The 'Venous drainage of the human knee joint' is highlighting two main systems of draining veins: an anterior- and a posterior system. These systems communicate at the posterior horns of the menisci and the posterior part of the infrapatellar fat pad. Another thesis, "Venae Communicantes van het Onderbeen," explores perforating veins in the leg, detailing their morphology and role in connecting the superficial and deep venous systems by perforating the crural fascia. These veins generally lack valves in their superficial course and have a longer, deeper course, often running double with one to four valves, facilitating blood flow from superficial to deep. Deeper course veins are classified into three groups based on their outlets. Finally, "Het lymfevaatstelsel in de wand van het thoracale deel van de aorta descendens" delves into the lymphatic vascularization of the wall of the thoracic aorta, noting a uniform pattern in humans within specific layers. There is no relation to areas primarily affected by atherosclerosis.

Conclusion: The breadth and depth of available research data expand when exploration methods transcend mere electronic data retrieval. Accessing this information requires persistence. Once accomplished, it validates the researchers and widens the base of knowledge.

Keywords: Anatomy, PH.D. thesis, Non-English abstract, Multilingual

A-0555

Anatomy of Vertebral Artery Hypoplasia and Their Relationship with Clinical Implication. A Systematic Review and Meta-Analysis of Prevalence

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Purpose: This systematic review and meta-analysis aims to report the anatomical characteristics and prevalence of vertebral artery hypoplasia (HAV), as well as its association with pathologies in the brain and cervical region or, in some special cases, other surrounding structures.

Methods: The databases Medline, Scopus, Web of Science, Google Scholar, CINAHL and LILACS were researched until January 2024. Two authors independently performed the search, study selection and data extraction. Methodological quality was evaluated with an assurance tool for anatomical studies (AQUA). Pooled prevalence was estimated using a ran-

dom effects model.

Results: A total of 24 studies met the established selection criteria. In this study, 6 articles were included for the meta-analysis with a total of subjects. For the prevalence of the VAH, it was 11% (CI = 10% to 12%), a heterogeneity of 41 based on the funnel plot and with a low risk of bias.

Conclusion: It is important to know that in the presence of a VAH, complications can occur that could even be lethal to the health of patients with this condition. The most classic clinical relationship being cerebrovascular accidents of the posterior cerebral circulation, therefore the knowledge of this condition by health professionals becomes crucial.

Funding: The vertebral artery (VA) is a branch of the subclavian artery that runs through the transverse foramina of the cervical vertebrae. One of the conditions that VA can present as a variant is vertebral artery hypoplasia (VAH). This condition has various definitions and there is still no definitive consensus on it to be able to master it, but in simple words it is a decrease in the lumen of the vertebral artery.

Keywords: Vertebral artery, Encephalic irrigation, Vertebral artery hypoplasia, Variation anatomical, Clinical anatomy

A-0557

Identification of the Third Belly of Opponens Pollicis Muscle: Association with Trapezio-Metacarpal Joint Arthritis

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Purpose: We have recently identified fatty infiltration (FI) in patients with Trapezio-metacarpal Joint (TMJ) arthritis. This FI is found in a focal area of the opponens which we hypothesize to be an independent and undescribed unit of the opponens muscle which we have provisionally called the "the third belly". The purpose of this study was: 1) to demonstrate the existence of the OPP third belly and its prevalence in cadaveric hands; 2) to describe its insertion on the trapezium and first metacarpal; and 3) to investigate its independent character inside the OPP.

Methods: Ten cadaveric hands were dissected. Each OPP muscle belly, its connection with (APL) and its nerve branch were photographed. Then the OPP insertions were identified and described. In three hands, a CT scan and MRI were performed prior to dissection. After dissection in these three hands, the OPP insertions were digitized. A 3D model of the OPP insertions was created to summurize the findings.

Results: The OPP third belly was found in all 10 cadavers. It is the thinnest OPP belly. It completely covers the TMJ palmar capsule, with fibers oriented transversely, which is different than the other two bellies. The trapezial insertion of the third belly included the entire trapezium palmar facet and the palmar TMJ capsule. The metacarpal insertion is adjacent to TMJ capsule insertion. We identified a slip of APL tendon attaching to the third belly. The third belly innervation is directly from the motor branch of median nerve (MBMN).

Conclusion: This study identified and described what we believe is a previously unnoticed OPP third belly with its insertion, innervation and imaging characteristic. The identification of the third belly explained why fatty infiltration could be limited to a specific focal area of the OPP as described recently in association with TMJ osteoarthritis.

Keywords: Thenar eminence anatomy, Opponens pollicis third belly, Opponens fatty infiltration, Thumb carpometacarpal osteoarthritis, Opponens 3D model

A-0571

Digital Assessment of Prosthesis Position after Hip Replacement in Inner Mongolia and Development of an Artificial Intelligence Measurement System

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Purpose: To develop an artificial intelligence model, which can automatically measure implant position parameters on anteroposterior X-ray images of postoperative hip replacements.

Methods: These X-ray images (anteroposterior) of postoperative hip replacements were collected from four hospitals (BTSH, IMMUH, IMMUSH, USH) from January 1, 2021, to February 28, 2023, and divided into training and validation sets for model training (This model is divided into three modules for training, the left replacement module, the right replacement module, and the bilateral replacement module). The X-ray images (anteroposterior) of postoperative hip replacements were collected from another hospital (BTFH) for

independent external validation from May 1, 2023, to June 30, 2023. Statistical software Python (version 3.8) and SPSS (version 25.0) was used to describe the data in terms of quantity and distribution and to analyze the consistency of image annotations among different physicians, the accuracy of key point detection by the model, and the accuracy of model measurements.

Results: These X-ray images (anteroposterior) of postoperative hip replacements were collected from four hospitals (BTSH, IMMUH, IMMUSH, USH) from January 1, 2021, to February 28, 2023, and divided into training and validation sets for model training (This model is divided into three modules for training, the left replacement module, the right replacement module, and the bilateral replacement module). The X-ray images (anteroposterior) of postoperative hip replacements were collected from another hospital (BTFH) for independent external validation from May 1, 2023, to June 30, 2023. Statistical software Python (version 3.8) and SPSS (version 25.0) was used to describe the data in terms of quantity and distribution and to analyze the consistency of image annotations among different physicians, the accuracy of key point detection by the model, and the accuracy of model measurements.

Conclusion: We have successfully established an automatic measurement model for postoperative pelvic X- ray (anteroposterior) images of hip replacements.

Funding: Key Research Project of Inner Mongolia Medical University in 2021 (YKD2021ZD001); Innovation Center of Inner Mongolia Autonomous Region (MYYXTYB202104)

Keywords: Yolov7, Total hip arthroplasty, Anteroposterior (AP) pelvic X-ray, Landmark identification, AI

A-0572

A Cadaveric Study of the Distal Biceps Femoris Muscle in Relation to the Normal and Variant Course of the Common Peroneal Nerve: A Possible Cause of Common Peroneal Entrapment Neuropathy

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Purpose: The aim of this cadaveric study was to evaluate the relationship between morphologic variations of the distal biceps femoris muscle (BFM) and the course of the common peroneal nerve (CPN) and to investigate the incidence and morphological characteristics of anatomical variations in the BFM associated with common peroneal nerve entrapment neuropathy (CPNe).

Methods: The popliteal region and the thigh were dissected in 115 formalin-fixed lower limbs. We evaluated consensus for (1) normal anatomy of the distal BFM, (2) anatomic variations of this muscle, and (3) the relationship of the muscle to the CPN. Measurements of the distal extents of the short and long heads of the BFM from insertion (fibular head) were performed.

Results: Two anatomic patterns were seen. First, in 93 knees (80.8%), the CPN ran obliquely along the lateral side of the BFM and then superficial to the lateral head of the gastrocnemius muscle. Second, in 22 cases (19.2%), the CPN coursed within a tunnel between the biceps femoris and lateral head of the gastrocnemius muscle (LGCM). There was a positive correlation between the distal extents of the short heads of the biceps femoris muscle (SHBFM) and the presence of the tunnel. The "popliteal intermuscular tunnel" in which the CPN travels can be produced between the more distal extension variant of the SHBFM and the LGCM.

Conclusion: The common peroneal nerve courses through the "popliteal intermuscular tunnel" formed between the more posterior or distal extension of the SHBFM and the LGCM in about 20% of the population. This anatomical variation of BFM may have a clinical significance as an entrapment area

of the CPN in the patients in which the mechanism of CPNe around the fibula head and neck is not understood.

Keywords: Biceps femoris muscle, Common peroneal nerve, Variation, Cadaveric study

A-0580

An Anatomical Investigation of the Anterior Choroidal Artery: Branching Patterns and Regional Distribution in Human Brains

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Purpose: The anterior choroideal artery (AChA), one of the branches of the internal carotid artery, is a critical artery in terms of the number of branches it gives throughout its course and the cortical areas and structures that it supplies through these branches. The study aimed to investigate the number of branches of the AChA and the regions reached by these branches.

Methods: A total of 62 fresh brains, 10 females and 52 males from Department of Morgue, the Council of Forensic Medicine in Istanbul, Turkey between 2021-2023 years, were included in the study (date:17/02/2023; number:2023/320). The number of branches arising from AChA and the regions they reached were determined and recorded.

Results: In our study, there were no branches originating from AChA in 4 (2 right, 2 left) of 124 hemispheres of 62 cadavers. A total of 594 branches were observed to arise from the AChA in 120 hemispheres. The number of these branches varied between 0-10. The mean number of AChA branches was found to be 4.79 (between 0-10). The frequency of occurrence of only one, 2, 3, 4, 5, 6, 7, 8, 9, 10 AChA branches was 7/120, 11/120, 14/120, 21/120, 22/120, 14/120, 11/120, 14/120, 4/120, 2/120 in the 120 cerebral hemispheres examined, respectively. It was observed that 587 branches of AChA reached the optic tract (220/594), cerebral peduncle (214/594), uncus (130/594), and subtantia perforata anterior (23/594). Variative morphological branches of 7/594 AChA were found.

Conclusion: Considering the important cortical areas, visual and motor pathways supplied by the AChA, knowledge of the vascular anatomy and variations of the AChA is important in the treatment of intracranial diseases and in the planning of surgical procedures.

Keywords: Anterior choroidal artery, Variation, Optic tract, Uncus, Cerebral peduncle

A-0606

I Can't Believe It's Not Human: Lessons Learned in the Design of Procedural Skills Trainers

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Purpose: Over the last two decades, there has been a growing interest in utilizing physical simulations for teaching procedural skills to physicians. Specifically, the focus has intensified on designing synthetic simulations to substitute traditional cadaver-based methods. Whilst it is widely acknowledged that maintaining a certain level of biomechanical fidelity is essential, the extent of fidelity necessary for effective transfer of procedural skills remains uncertain. This study delves into the crucial aspects of biomechanics and haptics in the design of procedural skills trainers, aiming to shed light on their roles in enhancing the learning experience.

Methods: A simulation mimicking trocar entry in laparoscopy was developed by incorporating biomechanical data obtained from human tissues in the anterior abdominal wall. Puncture force testing was executed to quantitatively assess and compare forces, torques, velocities, and insertion angles between the physical simulation and cadavers. Additionally, qualitative insights were gathered from surgeons inserting trocars into both the simulation and cadaver.

Results: Data collection is in progress, and results will be available at the time of presentation.

Conclusion: This study is currently underway, with data collection in progress. While definitive findings are pending, we anticipate that the results will provide valuable insights into the role of biomechanics and haptic fidelity. This work underscores the importance of qualitative and quantitative measures in the design of simulations and lays the groundwork for further exploration.

Keywords: Laparoscopy Simulation, Medical education, Haptic Fidelity, Biomechanics

A-0616

Anatomical Variation Explored: U.S. Case Study and Literature Review of the Aberrant Right Subclavian Artery, Spotlighting Worldwide Rate Variations

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Purpose: This study aims to delve into the aberrant right subclavian artery (ARSA), a relatively uncommon anatomical variation within the vascular system. Through the synthesis of findings from both a case study and a comprehensive literature review, our objective is to provide insights into the prevalence, anatomical characteristics, and clinical implications associated with ARSA. Additionally, we aim to underscore potential regional disparities in ARSA incidence rates by comparing global data.

Methods: A rigorous literature review was conducted using PubMed, focusing on articles detailing disorders and diseases linked with ARSA. Additionally, insights obtained from a cadaveric dissection conducted during the summer of 2023 augment our understanding of this anatomical variation. Global incidence rates of ARSA were derived from a systematic search of international literature sources.

Results: Our review of nine articles published between 2013 and 2023 unveiled a wide range of ARSA incidence, spanning from 0.16% to 4.4%. Noteworthy among the findings were investigations into the potential association between ARSA and conditions such as Down's syndrome, as well as its correlation with Kommerell's diverticulum. Moreover, our case report documented the identification of ARSA in a male cadaver with a history of vascular issues, highlighting the clinical relevance of this anatomical anomaly. Comparison of global ARSA incidence rates revealed notable disparities, with frequencies ranging from 0.11% in Great Britain to 0.8% in New Zealand. However, regional variations in detection methods may contribute to these differences.

Conclusion: While the occurrence of ARSA is relatively rare, its identification holds significant implications for clinical practice. A thorough understanding of ARSA is crucial for accurate diagnosis and surgical planning, as misinterpretations in imaging and procedural maneuvers may arise without proper recognition of this anatomical variation. By integrating insights from both case studies and literature reviews, healthcare professionals can enhance patient care by anticipating and addressing potential challenges associated with ARSA.

Keywords: Aberrant right subclavian artery (ARSA), Anatomical variation, Clinical implications, Global incidence, Regional differences

A-0647

Fasciology Open the New Era of Anatomy

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Purpose: Professor Lin Yuan's proposal of fasciology accomplish the biological theory about the differences structure between the life spans of different species. That is to make up for the biological research axis on time (life span).

Methods: The introduction of fascial anatomy has improved the study of human morphology from two-dimensional to three-dimensional, providing us with a new perspective for a deeper and more comprehensive understanding of the structure of the human body. Fasciology is a complete medical system established on the basis of fascia anatomy, which will lay the disciplinary foundation for upgrading the existing medical system to a three-dimensional medical model (internal medicine, surgery, and general health).

Results: Fasciology is an original new discipline system proposed by us after more than 20 years of research.It includes: fascial anatomy, fascial histology, fascial physiology, fascial pathology, fascial immunology and fascial diagnosis and treatment. Fasciology is the theoretical support to the wide concept of health. Fasciology is a breakthrough of human body view and methodology. Proposed view of the human body: The perspective of studying the human body-- the two-system theory. Methodology: Study of the human body in terms of time or lifespan. Meridians and acupoints: framework of nonspecific connective tissue throughout the body.

Conclusion: In the past, the study of human morphology was carried out in two ways: systematic anatomy and topographic anatomy. Fascial Anatomy presents a two-system theory, which regards the human body as a support and reserve system of non-specific connective tissue throughout the body

and the functional cells differentiated from the support and reserve system. The research on the mutual influence, mutual transformation and interact of the two systems is called Fasciology.

Funding: The paper was supported by Grants from the National Basic Research 973 Program (no. 2007CB512705) and the National Natural Science Foundation of China (no. 30801464).

Keywords: Fascial connective tissues, Visible Chinese human (VCH), Fascia Anatomy, 3D constructions, Meridians

A-0655

Association between the Anatomical Location of Glioblastoma and Its Correlation with Clinical Considerations. Systematic Review and Meta-Analysis

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Purpose: Glioblastoma is a primary malignant encephalic tumor. This tumor of the central nervous system can be located in the brain, cerebellum, brainstem and spinal cord. The purpose of the study was to relate the presence of glioblastomas with different regions of the encephalic and its relationship with other structure.

Methods: The databases Medline, Scopus, Web of Science, Google Scholar, and CINAHL were researched until January 2024. Two authors independently performed the search study selection and data extraction.

Results: A total of 123 studies met the established selection criteria with a total 6224 patients. In relation to the mean, the GBM between hemispheres had a mean of 33.36 (SD 58.00) in the right hemisphere and a mean of 34.70 (SD 65.07) in the left hemisphere, due to the difference in averages between hemispheres. There were no statistically significant differences P = 0.35. For the comparison between the presence of GBM in the frontal lobe and the temporal lobe, there was a mean in the frontal lobe of 23.23 (SD 40.03), while in the temporal lobe the mean was 22.05 (SD 43.50), for the difference in means between the frontal lobe and the temporal lobe, there was no statistically significant difference for the presence of GBM P= 0.178.

Conclusion: We believe that before a treatment it will always be correct to know where the GBM is located and how it behaves clinically, in order to generate correct conservative or surgical treatment guidelines for each patient. We believe that more detailed studies are also needed to show why the GBM is associated with mostly in some regions than in others, since the brain structure is homologous to other regions, which occurs in a lesser amount, which is why knowing the predominant presence in brain regions is very important.

Keywords: Glioblastoma, Encephalic tumor, Brain tumor, Glioblastoma ubication, Anatomy glioblastoma

A-0679

Pelvic Floor Complications during Childbirth- A Systematic Review and Meta-Analysis

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Purpose: Worldwide, there are regional and demographic differences in the prevalence of pelvic floor complications (PFCs) during childbirth. Pelvic floor complications have been found to occur more frequently in some studies than others, despite some studies reporting a low incidence. This systematic review and meta-analysis sought to identify which types of PFCs were seen to occur most frequently in the studies chosen, as well as to provide an updated and thorough summary of the incidence and risk factors associated with various types of PFCs during childbirth.

Methods: Search terms derived from free text words and medical topic headings (MeSH) were used to comb through a number of significant web databases. The first stage in the study selection strategy involved a search using keywords related to "pelvic floor," "childbirth," "complications," and "risk factors," which originally produced 759 papers.

Results: 10 studies relevant to our objectives were ultimately selected for the investigation. In majority of the studies, urinary incontinence (UIT) and anal incontinence (AIT) were found to be the most commonly occurring PFCs, with stress urinary incontinence (SUT), overactive bladder syndrome (OAB), pelvic organ prolapse (POP) being incidental in

decreasing order. The meta-analysis also reported the effects of UIT to be of significant impact in the studies in which it occurred. Although one study did report the occurrence of certain depressive symptoms following childbirth, the inference obtained was not very significant.

Conclusion: The findings highlight the need for further research on the prevention and management of pelvic floor complications during childbirth, particularly in relation to UIT and AIT. Clinicians should be aware of the high prevalence of these conditions and their associated risk factors (especially psychosocial and psychological health) to provide appropriate care for affected women.

Keywords: Childbirth, Maternal health, Pelvic floor disorders, Pelvic floor dysfunction

A-0682

Defining the Danger Zone to Preserve Iatrogenic Neurovascular Structures in the All-Inside Technique in Lateral Meniscus Repair: Preliminary Report Based on MR Imaging

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Purpose: Due to the risk of developing postoperative osteoarthritis in patients with meniscus injuries, orthopedic surgeons prefer to perform meniscus repair instead of meniscectomy. The all-inside technique is widely used in meniscus repairs, especially in the body and posterior horn of the meniscus. However, there are concerns about potential iatrogenic damage to peroneal nerve (PN) with this technique. This study aims to evaluate the risk of PN injury in lateral meniscus (LM) repair and to obtain preliminary information through MR images for optimal anchorage placement during arthroscopic all-inside LM repairs.

Methods: The study was carried out retrospectively using MR images in the radiology archive of Bayındır Hospital. The study will be conducted on a large series, but it is aimed to present the first results in a preliminary report and it was performed with 30 knee MRIs. The longitudinal length of LM was measured. The distance between the medial-lateral and midpoint of patellar tendon (PT) and PN was measured for both anterolateral and anteromedial approaches. After all measurements were completed, data analysis was performed with SPSS 22.00.

Results: The danger zone in repairing LM via its anteromedial portal extended 2.12±0.91 mm laterally from lateral edge of PT and 2.99±1.65 mm medially from medial edge of PT. We found that repair of LM via both its anteromedial and anterolateral portals relative to medial edge of PT may compromise PN. Potential PN injury was demonstrated in 11 of 30 knees (36.66%) via anteromedial portal and in 5 (16.66%) via anterolateral portal. A significantly higher number of potential injuries were found to occur when using anteromedial approach compared to using anterolateral approach (P=.003).

Conclusion: In lateral meniscal repair, it is safer to use anterolateral portal route in the All-inside technique. We believe that minimizing risk of iatrogenic neurovascular damage will prevent secondary complications.

Keywords: All-Inside Technique, Lateral Meniscal Repair, Neurovascular Structures

A-0695

Radiological Study of Atlas Arch Defects with Meta-Analysis and a Proposed New Classification

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Purpose: This study consists of a retrospective cohort study, a systematic review, and a meta-analysis which were separately conducted. This study aimed to investigate the prevalence of atlas arch defects, generate an evidence-based synthesis, and propose a common classification system for the anterior and

combined atlas arch defects.

Methods: The prevalence of arch defects was investigated in an open-access OPC-Radiomics dataset comprising 606 head and neck computed tomography scans from oropharyngeal cancer patients. A systematic review and meta-analysis were performed to generate prevalence estimates of atlas arch defects and propose a classification system for the anterior and combined atlas arch defect.

Results: The posterior arch defect was found in 20 patients (3.3%) out of the 606 patients investigated. The anterior arch defect was not observed in any patient, while a combined arch defect was observed in one patient (0.2%). A meta-analysis of 13,539 participants from 14 studies, including the present study, yielded a pooled-posterior arch defect prevalence of 2.07% (95% confidence interval [CI], 1.22%–2.92%). The prevalences of anterior and combined arch defects were 0.00% (95% CI, 0.00%–0.10%) and 0.14% (95% CI, 0.04%–0.25%), respectively. A common classification system of the AAD and CAD is also proposed A midline AAD, the commonest form, was classified as type A. Type B, the second most common form, refers to any AAD associated with a PAD. An AAD associated with the absence of the posterior arch was regarded as a subtype of type B. Types C and D were rare and identified as unilateral or bilateral AAD, respectively. Type E refers to any AAD associated with the absence of the posterior arch.

Conclusion: The anterior and combined arch defects were classified into five subtypes based on their morphology and frequency. The present study showed that atlas arch defects were present in approximately 2% of the general population.

Keywords: Cervical atlas, Computed tomography, Systematic review, Meta-analysis

A-0705

Ultrasound Imaging of the Seated Anatomy below the Ischial Tuberosity Using Ultrasound and MRI

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Purpose: Soft tissue composition below the ischial tuberosity (IT) and its link to pressure ulcer development has previously been studied using a variety of methodologies. This soft tissue injury is commonly noted in individuals with limited mobility. This study used novel approaches to image soft tissue of the buttocks in the unloaded and loaded conditions using ultrasound (US) and MRI.

Methods: The soft tissue composition of the buttocks was measured in twenty-six able-bodied participants and two males with a spinal cord injury (SCI). Data was collected using an innovative chair that allowed seated US acquisition of the buttocks and a newly developed MRI compatible loader. The unloaded condition was a lateral decubitus position. For loaded conditions, images were acquired in the seated upright position with US and the lateral decubitus position was used for MRI imaging where load was applied to the buttocks. US test-retest reliability was assessed.

Results: No statistical differences were noted between the scan days, making US reproducibility excellent, ICC = 0.934 - 0.981. US and MRI measures of tissue thickness were significantly correlated ($r = 0.68 - 0.91$, $p \leq 0.001$). The study noted underestimated unloaded tissue thicknesses when using US, with a mean bias of 0.39 - 0.56 cm. US and MRI measured total tissue thickness was reduced by up to 64.2 ± 9.1% ($p < 0.001$) when load was applied to the buttocks. The US and MRI total unloaded total soft tissue of the IT was correlated with loaded tissue thickness ($r = 0.54 - 0.67$, $p \leq 0.027$).

Conclusion: Tissue thickness played a role in how the soft tissue of the buttocks responded to loading. This data provides support for an US and MRI approach to determining soft tissue of the buttocks and the response of soft tissue to sitting and loading in a seated position.

Keywords: Pressure injuries, Seated anatomy, Spinal cord injury (SCI), Ultrasound imaging, Ischial tuberosity (IT)

A-0706

Establishing Alpha Angle Thresholds to Predict Femoroacetabular Impingement in Asymptomatic Individuals in the United Arab Emirates

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Purpose: In light of the reported increased incidence over the past few years, femoroacetabular impingement (FAI) has gained recognition as a clinical entity. It is characterized by an incongruency between articular surfaces of the hip joint that leads to soft tissue damage and joint stiffness and may eventually progress to osteoarthritis. Given the notable surge in the number of physically active adolescents presenting with FAI at a Dubai-based hospital, the study aimed to determine alpha angle thresholds that predispose patients with asymptomatic contralateral hips to hip arthroscopy.

Methods: Pre-operative radiographs and MRI studies of 50 patients (n = 50), within the age range of 15-62 years and who underwent unilateral hip arthroscopy, were extracted from the hospital's hip preservation registry and evaluated accordingly. Receiver Operating Characteristic was plotted using the alpha angle and the gold standard (i.e., side in which surgery was performed). The best threshold was then identified using the Youden Index.

Results: The alpha angle threshold for hip arthroscopy on the right side was 57 degrees, with a 76% sensitivity and an 81% specificity, while that of left side was 53 degrees, with a 71% sensitivity and a 65% specificity. Inter-rater reliability for both right and left sides ranged from significant moderate to significant almost perfect.

Conclusion: The findings of this study revealed that as the magnitude of the alpha angle increases, there is a greater probability that hip arthroscopy will be performed. As the presence of FAI can also be confirmed by employing quantifiable radiological hip angles, particularly the alpha angle, the thresholds proposed in this study may assist to decelerate and/or prevent osteoarthritis progression earlier in the disease process.

Keywords: Femoroacetabular impingement, Alpha angle, Threshold, Hip joint, Hip arthroscopy

A-0715

A Rare Variation of Posterior Belly of Digastric Muscle: A Case Report

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Purpose: The purpose of the study was to report a rare variation concerning the posterior belly of the digastric muscle found during routine anatomical dissection, aiming to contribute to the understanding of anatomical variations in the neck region.

Methods: The variation was observed during routine dissection performed in school of medicine at Istanbul Aydin University. The female cadaver of unspecified age and cause of death, was fixed with formaldehyde. Dissection of the neck region was performed according to standard techniques. In addition, routine histological technique was performed and stained with hematoxylen eosin.

Results: In the present case a rare variation of posterior belly of digastric muscle was observed. The posterior of belly of digastric muscle was observed to be a tendon. The 10 µm sections of the posteiror belly of digastric muscle revealed the presence of collagen fibers in the entire of the volume of the muscle resembling a tendinous structure.

Conclusion: According to the reviewed literature, variations in the shape, length, and innervation of the digastric muscle have been reported. Variations in the digastric muscle typically involve accessory muscle and differences in attachment points. Again in the literature previous classifications of digastric muscle, including variations in the posterior belly's origin and attachment points is mentioned. However, the present case is the first report to demonstrate a tendinous structure of the posterior belly of digastric muscle. Since digastric muscle forms the borders of neck triangles in the neck region, they constitute important landmark points for surgical operations. For this reason, we think that taking this variation into account will help understand the anatomy of this region during clinical evaluation and surgical operations.

Keywords: Variation, Suprahyoid muscle, Posterior belly of digastric muscle

A-0716

Chronic Sleep Deprivation Exacerbates Testicular Oxidative Stress and Impairs Sperm Motility by Disrupting Gonadal Zinc Expression and Bioenergetics

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Purpose: Chronic sleep deprivation (CSD) detrimentally enhances oxidative stress, which is closely linked to various diseases, including cardiovascular disorders, cognitive dysfunction, metabolic syndrome, and impaired reproductive activity. Given zinc's pivotal role in the anti-oxidative defense system and early spermatogenesis, this study aims to determine whether testicular Zn expression would significantly alter following CSD.

Methods: Adult male Wistar rats underwent three cycles of CSD, each consisting of five days of total sleep deprivation followed by a two-day break, were used in this study. The ionic level and spectral intensity of Zn were assessed by the time-of-flight secondary ion mass spectrometry (TOF-SIMS). The functional significance of Zn was assessed by oxidative levels, Cu/Zn superoxide dismutase (Cu/Zn SOD) expression, gonadal bioenergetics, and sperm mobility.

Results: Results indicated that normal rats exhibited robust sperm motility, high Zn levels, abundant Cu/Zn SOD expression, strong bioenergetics, and low oxidative stress in testicular tissues. Conversely, CSD led to decreased Zn expression, reduced Cu/Zn SOD activation, weakened bioenergetics, and enhanced oxidative stress in testicular tissues, corresponding well with decreased sperm motility.

Conclusion: These findings are the first to elucidate the functional anatomical evidence that impaired testicular Zn expression, together with reduced activation of Zn-related anti-oxidative enzymes may serve as the underlying mechanism(s) for the pathogenesis of CSD-induced reproductive disability.

Keywords: Chronic sleep deprivation, Reproductive system, Zinc, Oxidative stress, Ionic image analysis

A-0718

Assessment of the Relationship between the Position of the Bronchial Foreign Bodies and the Angles and Diameters of the Bronchi

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Purpose: Foreign body aspiration in the respiratory tract is a serious condition requiring emergency medical intervention, especially in children. In this study, the statistical relationship between the position of the foreign body in the bronchi and the angles and diameters of the bronchi was examined.

Methods: Cases where rigid bronchoscopy was performed and foreign bodies were removed under the diagnosis of foreign body aspiration at the between 2020-2023 were included. The patients' age, gender, the main bronchus where the foreign body was located, bronchial angles, and diameters were recorded, and the data were statistically evaluated.

Results: A total of 45 patients; 13 female, 31 male; with mean age of 11.02±18.82 were included in the study. A weak negative correlation was found between age and the position of the foreign body in the bronchi (r=-0.214). There was a low positive correlation between the presence of the foreign body in the right bronchus and the right bronchial angle (r=0.053). A weak negative correlation was found between the position of the foreign body and the diameter of the right bronchus (r=-0.239), and a higher negative correlation with the diameter of the left bronchus (r=-0.261). No statistical difference was found between the right and left bronchial angle.

Conclusion: Significant statistical relationships were found between age and the position of the foreign body, and between the position of the foreign body and the angles and diameters of the bronchi. This study has shown, contrary to the general belief that foreign body aspirations are more frequently encountered in the right bronchial system, they can be encountered in both bronchial systems regardless of age. The absence of a statistical difference between the right and left bronchial angles can explain this situation, but there is a need for studies involving larger case series.

Keywords: Foreign body aspiration, Tracheobronchial anatomy

A-0720

The Relevance of Anatomical Variations to South African Clinicians: A Survey

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Purpose: Variant research has been studied extensively by anatomists and generated specifically for clinicians to aid in daily practice. However, literature shows anatomical variations knowledge amongst surgeons and radiologists is lacking, which has contributed to cases of malpractice and litigation. With the limited research available on training of clinicians in variant anatomy in the clinical context investigating the relevance of anatomical variations to South African clinicians is crucial to understanding their impact in clinical practice.

Methods: A validated, anonymous, self-administered, questionnaire was disseminated to clinicians (surgeons and radiologists) practicing in South Africa through professional societies and directed emails. Relationships between professional details, exposure to variations in practice and perceived value of variant research of clinicians were investigated statistically.

Results: A total of 52 clinicians responded. Most clinicians (71.2%) acknowledged learning about anatomical variations in undergraduate and postgraduate medical training. Majority of surgeons (45.2%) and radiologists (43.8%) stated that encountering an anatomical variant had a direct effect on operation time or diagnostics required, respectively. Many clinicians encountered variants in clinical practice often (30.8%), or sometimes (25%). Clinicians employed in the private sector encountered variations more often than public sector employees (U=427.00;p-value=0.001). Majority of clinicians (65.4%) only engaged with anatomical variant research occasionally (26.9%), rarely (13.5%), almost never (17.3%), never (7.7%). Expectedly, a positive relationship (ρ= 0.375; p-value=0.009) was found between variation encounter frequency and variant research interaction frequency. Surgical (63.9%), Radiological (81.3%), were the most frequently consulted journals. Only 17.4% of clinicians consulted anatomical journals regarding variants.

Conclusion: This study demonstrates that both surgeons and radiologists regard variations to be relevant in clinical practice; however, the lack of engagement with variant research does not correspond with this. Clinicians and anatomists should strive to report anatomical variations in the platforms that clinicians most often consult with to best increase awareness and benefit medical research and practice.

Keywords: Anatomical variation, Anatomical knowledge, Clinicians, Exposure, Relevance

A-0721

An Anatomical Investigation of the Confluence of Sinuses in a South African Population Sample

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Purpose: The confluence of the sinuses occurs at the junction of the superior sagittal sinus, occipital sinus, the straight sinus and the transverse sinuses. It's a highly variant structure with regard to patterns of inflow and outflow, which are of clinical significance in neurosurgical procedures. This study aimed to investigate the confluence of the sinuses regarding its inflow and outflow patterns utilising a whole-body donor and imaging sample from the South African population.

Methods: The drainage pattern types of the confluences of the sinus were catalogued in a whole-body donor sample (n= 52) and magnetic resonance venography imaging sample (n=70). Measurements were taken at the inflow of the superior sagittal sinus into the confluence of the sinuses and the right and left outflow of the transverse sinuses.

Results: The most prevalent drainage pattern evident was the superior sagittal sinus draining to the right transverse sinus, within the dura mater (42.31%) and on the bony impressions (36.54%) of the body donor sample and the imaging sample (44.29%). The most prevalent dominance type in the dura mater and bony impression measurements was symmetry (59.62% and 69.23% respectively) and right dominance in the imaging sample (27.14%). These results were similar to previous literature using similar modalities. There were no statistically significant relationships between the drainage pattern types and sex or age of the respective individual. The drainage pattern categories were consistent in only 69.2% of the body donor sample between the dura mater and bony impressions of the same individual, which suggests that the use of an osteological sample alone may not be reliable to investigate the confluence of the dural venous sinuses.

Conclusion: The results of this study is clinically significant to neurosurgeons in Sub-Sharan Africa and the report of the

prevalence of drainage pattern types and dominance will contribute to the anatomical body of knowledge.

Keywords: confluence of sinuses, confluens sinuum, South African population, Torcular Herophili

A-0724

Morphometric Evaluation of Tymus, Lungs and Haller Index Using Fetal Magnetic Resonance Imaging in Fetuses Diagnosed with Ventriculomegaly

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Purpose: Magnetic resonance imaging (MRI) is a more discriminative method in fetal morphology studies and detection of congenital anomalies, providing excellent discrimination between tissues. In this study, we measured the area of the tymus and the area of the lungs at two different levels with fetal MRI in fetuses diagnosed with ventriculomegaly and calculated the Haller index.

Methods: In the study, MRI of 146 fetuses in the radiology archive were examined and 67 cases with ventriculomegaly were selected among them. 22 of these cases were excluded from the study due to image artifacts, and a total of 45 cases with gestational ages ranging from 22 to 36 weeks were evaluated. It was determined that these cases did not have any anomalies in the thorax region. In the images, the area of tymus and the area of lungs were measured separetly at the three vessels and tachea (3VT) view. In addition, lung areas were redefined at the four chamber cardiac view. All data obtained were compared statistically.

Results: In 3VT view there was a significantly and positive relationship between gestational age and area of tymus, area of right lung, and area of left lung. In four chamber cardiac view there was a significantly and positive relationship between gestational age and area of right lung, and area of left lung. However, no significant relationship was observed between gestational age and haller index. The lung area had statistically greather in right side both 3VT view and four chamber cardiac view than left side.

Conclusion: As gestational age increases, the fetal lung and thymus development progresses in relation to gestational age. Haller index, suggesting that this particular metric may not be a reliable indicator of developmental progression in the context examined.

Keywords: Fetal magnetic resonance imaging, Haller index, Lung, Thymus

A-0736

Sihler's Staining: Highlighting the Intramuscular Innervation of Intrinsic Hand Muscles

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It is crucial to have detailed knowledge on the intramuscular innervation of the intrinsic hand muscles when performing hand and reconstructive microsurgery. Sihler's staining is a method that highlights the innervation of intrinsic hand muscles by staining the myelin sheath of nerves while turning other tissues transparent and preserving the architecture of the muscles, creating a three-dimensional image of the innervation of muscles. This study aims to use the Sihler's staining technique to delineate the neuromuscular anatomy of intrinsic hand muscles by determining the position of nerves and intramuscular course of nerve branches, creating a blueprint of intrinsic hand muscles. Sihler's staining was carried out in 6 steps on the Thenar muscles, Adductor Pollicis and First Dorsal Interosseus muscle from specimens collected from 10 cadavers. These muscles are essential for the gripping and pinching motions of the hand. Specimens were photographed with nerves visible within the muscles, and the nerves were then mapped out. The results show that Sihler's staining method provides a clear visualisation of the innervation of intrinsic hand muscles as the nerves were stained violet. Mapping out the nerve supply through the Sihler's staining technique can aid in better understanding the intramuscular anatomy of intrinsic hand muscles, which would be useful for repairing damaged nerves from laceration injuries and determining the feasibility of intrinsic hand muscles for split muscle transfer.

Keywords: Sihler's staining, Intramuscular innervation, Intrinsic hand muscles

A-0744

Cadaver Study on the Adequacy of the Antero-Lateral Thigh Free Flap in Facial Reconstruction after Radical Parotidectomy

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Purpose: Radical parotidectomy may cause important functional facial defects because of the severed facial nerve branches, such as inability to close the eye, lack of oral competence and lack of facial expression, and aesthetic defects secondary to the volume defect of the removed soft tissues. The use of the antero-lateral thigh free flap with vastus lateralis nerve graft is being proposed as the optimal reconstruction method to cover the volume defect caused by parotidectomy and its vastus lateralis motor nerve graft for facial nerve reconstruction. Thus, the anatomic features of the flap are vital to a successful reconstruction of the severed area.

Methods: The study was performed on 6 cadavers. We have used a preauricular approach to the parotid gland. The skin flap was raised, which allowed visualization of the SMAS and its dissection. An anterograde approach to the facial nerve was performed, which allows the identification of the trunk of the facial nerve, and its different branches. The anterolateral thigh flap was raised, and the type and distribution of its perforator vessels, the dominant vascular pedicle, and the relationship with the vastus lateralis nerve were studied. An analysis was performed on the number of branches and its diameters, and its relationships with the muscle.

Results: The distribution of the branches of the facial nerve, its number, its diameter and the relationship with the facial musculoaponeurotic system are analysed. The results indicate that an accurate analysis of the crural branches innervating the vastus lateralis and its pedicle meet the conditions for obtaining a anterolateral thigh free flap with nerve graft.

Conclusion: The anterolateral thigh free flap can be optimal for facial reconstruction after radical parotidectomy.

Keywords: Facial paralysis, Radical parotidectomy, Antero-lateral-thigh free flap, Vastus lateralis nerve graft

A-0746

The Influence of Ramus Intermedius an Aberrant Coronary Branch on Left Coronary Artery Atherosclerosis Amongst Low-Risk Individuals

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Purpose: This study aims to elucidate the potential contributory effect of ramus intermedius (RI) as an aberrant vessel at the left bifurcation region (LBR) forming a plaque deposition at the left coronary artery (LCA).

Methods: A retrospective cross-sectional single-centre study was conducted among patients who underwent cardiac computed tomography angiography from January 2017 to December 2018. Of 438 patients, 139 patients with low cardiovascular risk were included in this study. The plaque deposition in the left main coronary, left anterior descending (i.e., proximal (pLAD), middle (mLAD), and distal (dLAD)) and left circumflex (i.e., proximal (pLCx), middle (mLCx), and distal (dLCx)), and RI arteries were identified and analysed. Descriptive statistics, Chi-square, and binary logistic regression tests were used in this analysis between patients with and without RI with plaque deposition at the LCA. A p-value < 0.05 was considered statistically significant.

Results: There were 33.8% (n = 47) of patients who had RI. The single RI vessel was more common (n = 42) than the double RI (n = 5). Generally, the pattern for plaque burden was found higher in pLAD (37%) followed by mLAD (28.8%), pLCx (22.5%), and LMCA (19%). The presence of RI doubled the risk for plaque deposition at these arteries compared to those patients without RI when analysed using multivariate analysis. Besides the LCA, the RI was also was found at risk for plaque deposition (30%, n = 14).

Conclusion: The RI increases the risk for atherosclerosis plaque deposition at the left coronary, especially those closest to the LBR.

Funding: Universiti Malaya Faculty Grant: GPF017C-2018.

Keywords: Ramus intermedius, Plaque deposition, Left coronary artery, Cardiac computed tomography angiography

A-0763

Evolution of the Mammalian Cecal Appendix

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Purpose: The appendix, a small blind pouch projecting off the cecum, is a notorious anatomical structure, namely due to its propensity for inflammation and resulting surgical interventions. However, recent research suggests that the appendix may serve crucial protective functions in boosting the body's immune defense against invading pathogens and re-populating the gastrointestinal tract with beneficial gut bacteria after bouts of illness. Thus, the appendix is characterized by an intriguing combination of potential adaptive advantage and severe health risk.

Methods: A comprehensive survey of the distribution and morphology of the cecal appendix across mammalian families was mapped onto a mammalian consensus phylogeny, and evolutionary analyses were conducted.

Results: A cecal appendix of some morphotype was found to be a recurrent trait found in several species of primates, rodents, lagomorphs, marsupials, and monotremes. The appendix has evolved independently numerous times throughout mammalian evolution, significantly more than would be expected due to chance alone, suggesting that it confers adaptive advantages. However, endeavors to identify a universal ecological, behavioral, dietary, and/or environmental factor driving appendix evolution were largely unsuccessful, suggesting it has a complex and diverse evolutionary history. Additionally, phylogeny-informed analyses revealed positive correlations between appendix presence and both cecal apex thickness and cecal morphology, suggesting that the appendix and cecum may be evolving together as a module, the cecoappendicular complex.

Conclusion: Ultimately, there is no single factor driving the evolution of the mammalian cecal appendix. Rather, each appendiceal morphotype has its own complexities and serves different beneficial functions, and is therefore evolving under different evolutionary constraints and pressures. However, one consensus pattern emerges across mammals: Previous interpretations of the appendix as a useless, vestigial remnant should be dismissed. This presentation will discuss the current state of the field regarding the pathophysiology, evolution, and adaptive functions of the cecal appendix, both in humans and the broader mammalian clade.

Keywords: Appendicitis, Cecal appendix, Gastrointestinal anatomy, Evolution, Comparative anatomy

A-0767

Where and When to Use Ultrasonography in Aesthetic Procedures?

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Purpose: The efficiency of using ultrasonography in clinical settings is a subject of controversy with pros and cons. The utilization of ultrasonography for cosmetic purposes on the face is a relatively recent advancement. Ultrasonography offers patients a sense of security during skin rejuvenation procedures, aiding practitioners in identifying blood vessels, nerves, and layers. However, a fundamental understanding of facial anatomical structure is essential, as ultrasonography presents these structures in two dimensions, potentially leading to difficulties.

Methods: Ultrasonography frequencies typically range from 10 MHz to 15 MHz when applied to the face. Frequencies lower than this range are suitable for visualizing deeper layers, making it challenging to focus on facial depth, while higher frequencies are used for observing skin layers.

Results: Doppler functionality aids in locating blood vessels, helping differentiate between veins and arteries. Unlike body ultrasound, pressure is not applied during facial observation due to the small and surface-level anatomical structures. However, excessive gel application is necessary to enhance visibility, which presents a drawback.

Conclusion: Ultrasonography is also beneficial in preventing vessel damage, particularly in identifying sentinel veins, facial vessels, and anterior cervical veins. For example, in the case of the sentinel vein, injecting botulinum neurotoxin in lateral canthal rhytide and frontalis areas often leads to bleeding. Furthermore, the use of ultrasound is advantageous when reducing the volume of the submandibular gland, as its varied

location and size can be challenging to palpate. The presence of the anterior cervical vein and facial vessels in proximity to the submandibular gland makes ultrasound a valuable tool.

Keywords: Ultrasonography, Anatomy, Filler, Botulinum toxin, Threads

A-0782

Morphometric Evaluation of the Mastoid Segment of Facial Nerve in Children

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Purpose: Due to the close relationship between the facial nerve (FN) and pathologies in the tympanic cavity, FN paralysis is one of the most serious complications of otological surgeries. Understanding surgical anatomy and variations of FN well is important to prevent iatrogenic FN injuries. Here we study the morphometric changes of the FN during the growth of children (0-18 years) and its relationship with important structures on the skull.

Methods: Computed tomography (CT) images of the temporal bone of patients aged 0-18 years were retrieved from the radiology department retrospectively between 2008 and 2022. The length and width of the FN and its distances to marking points on the skull were assessed with dedicated image handling software (Radiant Dicom Viewer). For examiner reliability, measurements were repeated by the same observer, one month apart. SPSS 22.0 was used for statistical analysis, and $p<0.05$ was accepted as statistically significant.

Results: CT images of 69 patients (138 sides, ages 0-18), 34 boys (mean age:10±5.15), and 35 girls (mean age:10.1±5.3) were examined. The mean FN length (FN-L) and width (FN-W) were 11.09±2.07mm, and 1.59±0.30mm respectively. FN-W was significantly larger in boys than girls($p=0.002$). Mean distances of FN to mastoid surface (FN-M), external auditory canal (FN-EAC), sigmoid sinus (FN-SS), posterior cranial fossa (FN-PCF), and midsagittal line of cranium (FN-MC) were 12.79±2.98mm, 3.73±1.49mm, 10.98±2.52mm, 6.06±2.25mm, 40±4.22mm. FN-M and FN-MC were higher in boys ($p=0.023$, $p=0.003$ respectively). It was found that FN-L, FN-M, and FN-MC increased significantly with age ($p=0.001$), and FN-EAC decreased ($p=0.044$).

Conclusion: Our findings demonstrate that the anatomical location and dimensions of the facial nerve in the temporal bone change during childhood and differ between genders. Specific details about the FN position are of utmost importance to otological surgery to prevent iatrogenic injuries.

Keywords: Computed tomography, Facial canal, Facial nerve, Mastoid surgery, Surgical anatomy of facial nerve

A-0794

Dimensional and Morphometric Variations of the Sella Turcica in Adult South African Population: Sex, Age, and Ethnic Related Changes

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Purpose: The Sella Turcica (ST) is an important anatomical landmark which occasionally filled with cerebrospinal fluid in a condition known as Empty Sella Disorder (ESS). ESS occurs when the pituitary gland contracts due to issues with the contents inside the ST and this has been linked with malocclusion which remains less explored. This study intended to investigate morphological and morphometric variations of ST concerning sex, age, and race as well as to document the prevalence of malocclusions in a South African adult sample.

Methods: ST scans of 32 patients and 21 dry and cadaveric skulls were investigated. Volume was measured using plasticine and other parameters were measured using a sliding vernier caliper and 3D slicer software.

Results: The width is the only linear parameter that showed significant ($P<0.05$) variations against sex. The mean length, width, AP diameter, and volume variation between groups ages 31-50 and 51-70 were 0.54mm, 3.60mm, 1.48mm, and 39.47mm. The length of ST in Black people varied from that of White people by 1.58mm. The width of ST in Black people was 10.90±2.68mm, and White people was 12.99±2.41mm which was statistically significant ($P<0.05$). Class 1 malocclusion was the most common type in this study and bridging of the ST was common in Class II.

Conclusion: This study revealed that the ST varies on different ethnic groups. Also, the width of the ST can be used to identify sex but size of the ST at various ages cannot be used to gauge an individual's growth because there were no significant differences.

Keywords: Sella Turcica, Sella dimensions, Morphology, Morphometry, Malocclusion

A-0879

Fascial Anatomy and Fasciology

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Purpose: With the support of digital human technology, has we proposed a new human anatomy research method: fascial anatomy after more than 20 years of anatomical research. Fascia anatomy believes hold that the human body is composed of a connective tissue (fascia) scaffold throughout the body and various differentiated functional cells supported and surrounded by the scaffold.

Methods: The former is called the support and reserve system; the latter is called the functional system. This way of dividing anatomy is called the two-system theory of human body structure. It embodies a new view of the human body (two-system theory) and a methodology for anatomical research (the axis of time and lifespan during human growth and development).

Results: The introduction of fascial anatomy has improved the study of human morphology from two-dimensional to three-dimensional, providing us with a new perspective for a deeper and more comprehensive understanding of the structure of the human body. Fasciology is a complete medical system established on the basis of fascial anatomy, which will lay the disciplinary foundation for upgrading the function and structure of the existing medical system to a three- dimensional medical model with increased perspective on how to prolong life the existing medical system to a three- dimensional medical model (internal medicine, surgery, and general health).

Conclusion: Fasciology also provides cultural and scientific basis for Traditional Chinese Medicine(TCM) from its origin. Finding the disciplinary status of Traditional Chinese Medicine TCM in biomedicine (scientific issues on the life span of species, length of life, health and longevity) has laid the disciplinary foundation for the revitalization of Traditional Chinese Medicine TCM.

Funding: Teaching Reform Project of Guangdong Provincial "New Medical Science" Construction Guidance Committee in 2023.

Keywords: Fascia, Anatomy, Fasciology, Traditional mChinese Medicine, Digital human technology

A-0892

Pneumatization of Sphenoid Sinuses in a South African Population: A Radiological Study

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Purpose: For safe execution of transsphenoidal surgery, detailed anatomical knowledge of the sphenoid sinuses (SS) is necessary. SS display significant population-specific anatomical variations in pneumatization, volume, and protrusion of important neurovascular structures. This study described the pneumatization, volume, and extensions of the SS within a South African population.

Methods: Computed tomography images of 63 patients were analyzed bilaterally using the Miele-lxiv workstation. The scans were assessed for pneumatization patterns, lateral extensions, posterior pneumatization and protrusion of the optic nerve (ON) or internal carotid artery (ICA), and volume.

Results: The prevalent type of pneumatization was the postsellar type (44.2%). Pneumatization of the greater wing was the most prevalent lateral extension (26.7%). The dorsal type was the most prevalent type of posterior pneumatization (60.0%). Statistically significant differences in ethnicity were identified within the diverse South African population, with pneumatization of the greater wing only observed in black South Africans (30.8%). Clival type of posterior pneumatization was prevalent in Indian/White South Africans (37.5%) while subdorsal type was only observed in black South Africans. ON or ICA may protrude into the sinus when the SS is extensively pneumatized. Group 4 classification (protrusion of ICA & ON) was the most prevalent (19.2%) after group 1(no protrusion).

Females presented a higher sphenoid sinus volume of 243 cm^3 (72.5-837 cm^3) and 98.5 cm^3 (21.0-456 cm^3) in males.

Conclusion: Pneumatized extension of the sphenoid sinus varied within the diverse South African population and when compared to other populations globally. The cranial base can be accessed from the SS through 'windows' created by the pneumatization directions. Therefore, knowledge gained from this study can be applied in pre-surgical planning for transsphenoidal surgery to minimize complications during surgery and ensure good postoperative results.

Funding: Funded by National Research Foundation (NRF).

Keywords: Sphenoid sinus (SS), Morphology, Morphometry, Internal carotid artery (ICA), Optic nerve (ON)

A-0934

Examination of Foramen Tympanicum with Cone Beam Computed Tomography

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Purpose: This study aimed to determine incidence foramen tympanicum (FT) in the healthy population and to examine the morphometric and morphological properties of this structure on the cone beam computed tomography images (CBCT).

Methods: CBCT images of 177 individuals between ages of 12-88, taken Planmeca ProMax device, were retrospectively examined with RadiAnt DICOM VIEWER software. The presence of any bony malformation of the skull skeleton was determined as exclusion criterion for the study. The incidence of foramen tympanicum and its diameter in the sagittal and transverse planes were measured on the images. The analysis of data included in research was carried out with SPSS25 program.

Results: Right and left side images of a total of 177 patients (41.92±17.28 s, male: 111, female: 66) were analyzed. 28 (7.9%) FTs were found on 326 sides. 15 of them were right side and 13 were left. Bilateral FT was found in 3 cases. No statistical difference was found between FT and gender and age. The average diameter in the sagittal axis was 1.6 ± 0.58 mm, average diameter in the transverse axis was 1.58 ± 0.56 mm. It was found diameter in the sagittal axis showed statistically significant difference between right and left sides ($p = 0.036$).

Conclusion: Complications such as tympanic membrane rupture, incus dislocation, and facial nerve injury have been reported during TMJ arthroscopy. It is clinically important to know the presence of FT and the anatomical features of FT in these cases.

Keywords: Foramen tympanicum, Cone beam computed tomography, Temporomandibular joint arthroscopy

A-0941

Training Obstetric Anaesthetic Invasive and Imaging Skills Using Lifelike Tissue Revealing Authentic Structure-to-Structure Ratios from Novel GAX-specimens with Innovative Contrast

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Purpose: The Society for Obstetric Anesthesia and Perinatology have jointly written practice guidelines subject to revision warranted by evolution of medical knowledge, technology, and practice. They provide recommendations supported by synthesis and analysis of current literature, expert and practitioner opinion, open-forum commentary, and clinical feasibility data. Improving patient safety and provider skill sets requires annual reviewing of training mediums regards individual/team simulation which affect outcomes. Obstetric anesthetic training requires invasive procedural skills with realistic anatomy tissue consistency, compliance, orientation and pressure haptics for translational learning experiences. Study objective was to dissect novel GAX-specimens with innovative BriteVu-contrast(BVc) for ultrasound and cross-sectional imaging versus formalin-fixed cadavers(FFC) identifying hands-on morphology and imaging of lower abdomen/pelvic/thigh region.

Methods: GAX-specimens(n=6;3-Male,3-Female) were MRI/CT scanned with BVc and FFC(n=18;11-Male;7-Female) were ultrasound scanned(GE Vscan-Air probe) and dissected.

Results: Literature search revealed no known GAX-specimen with BVc versus FFC studies for student/resident

anesthetic training. GAX-specimens provided superior quality tissue and exceptional imaging versus FFC, enabling detailed lifelike invasive procedures and dissection experience. GAX-specimens revealed palpable dermis and associated realistic structures regarding texture, responsiveness to needle insertion, surgical tools, hydration and appearance. FFC revealed hardened waxy dense dermis with poor palpation and associated structures were unnaturally firm and less compliant with decreased responsivenes to needles/surgical tool use, dehydrated tissue and dull in colour. Areas/structures of note was the lumbar spine flexibility enabling invasive anesthetic techniques to be conducted. Techniques for labor anesthesia include central neuraxial (spinal, epidural, and combined spinal–epidural), paracervical, and pudendal blocks and less often, lumbar sympathetic blocks can be conducted on GAX-specimens.

Conclusion: GAX-specimen bodies demonstrated realistic structures which allowed lifelike procedural experiences providing arguably the best training medium to date for obstetric anesthesia. GAX-specimens accurately revealed both static and dynamic anatomy orientation, movement, kinesthetic palpation with ultrasound and cross-sectional imaging of the lower abdomen/pelvis/upper thigh regions.

Keywords: Novel, GAX, Innovative, BriteVu

A-0950

Parotid Gland Protects and Provides Passage of the Dominant Artery, Its Terminal Branching and Clinically Relevant Branches of the External Neck, Face, Infratemporal Fossa, Pterygopalatine Fossa and Superficial Scalp

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Purpose: PURPOSE. Parotid gland(PG) represents an important structure for training surgeons to learn surface anatomy, approaches, and detailed dissections. PG is tremendous landmark teaching clinical anatomy to medical students representing quintessential neurovascular bundle. Its critical relationship within PG as landmark where external carotid artery(ECa) navigates to provide its terminal and other branches and altering its directions before exiting. PG consists of superficial and deep lobes(S-lobe & D-lobe) usually divided by the facial nerve(FN) and posterior facial vein. Fatty tissue between lobes facilitates mandibular movement. S-lobe typically lies lateral to FN and D-lobe lies medial to the FN. PG occupies the retromandibular fossa which can be considered lying at an approximate midpoint between vertex and the clavicle. Surgeons and radiologists are aware of the arterial network within PG, however, describing it and/or depicting it appears inconsistent causing issues for medical students. This study objective investigates PG arterial layout, function and landmarks between GAX-specimens and formalin-fixed cadavers(F-fC).

Methods: Literature search was conducted on contemporary texts(CTxts) and atlases(CAtls) for arterial content and function. Dissection comparing 6 GAX-specimens=12-sides with BriteVu-contrast for CT/MRI and 31 F-fC=57sides. PG appeared to provide protection and a landmark for branching.

Results: No known GAX-specimen versus F-fC PG arterial studies were identified. Majority of CTxts discussed ECa traveling to and within PG but lacked mentioning superficial temporal, maxillary, transverse facial and other associated arteries. Approximately 50% of CAtls revealed ECa within PG and 50% revealed maxillary and superficial temporal arteries often deep to PG with majority excluding associated arteries within PG. GAX-specimen and F-fC revealed superficial temporal, maxillary, transverse facial arteries and others noted within PG 54/57 sides.

Conclusion: This study revealed CTxts and CAtls could modify their descriptions and depictions to represent more consistent arterial branching within PG as key landmark for arteries to alter direction and keep tissue viable.

Keywords: GAX specimen, BriteVu, Novel, Surgery, Education

A-0952

A Quantitative Analysis to Define the Clinical Performance of Three Anatomical Facial Sagittal Planes

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Purpose: Quantifying the intrinsic asymmetry in the shape of the human face can be hard, but it is of clinical importance. Defining a facial sagittal plane (FSP) is challenging as 1) it should divide the face in two similar right-left halves; 2) the plane needs to be defined by three landmarks, one of which might not be coplanar with the others; and 3) these landmarks should be located in areas accessible for the clinical work. Currently there is no agreement on the "ideal" FSP. Our aim was to mathematically evaluate the performance of three FSPs in dividing the face in two similar halves.

Methods: The sample consisted of computed tomograms (CTs) of 51 individuals (17-55 years); 26 were from patients with a clinically symmetric face (Symm), and 25 from patients clinically asymmetric. The use of CTs was granted by the corresponding ethical committee. A CT-based 3D reconstruction of the skull of each individual was made. The landmarks chosen to build each FSP were: nasion, basion, incisive foramen (FSPa); nasion, anterior nasal spine, sella (FSPb); and opistion, superior end of the crista galli, anterior nasal spine (FSPc). The distance between bilateral landmarks gonion, zygion, porion, mastoid process and zygomaxillary and each FSP was used to statistically compare FSPs in terms of total asymmetry (TA), and asymmetry per landmark (APL), controlling by the effects of intraobserver error and sex.

Results: The three FSPs perform very similarly in terms of TA, in both groups (median TA_{Asymm}= 10.83-12.03 mm; TA_{Symm}= 8.48-10.58 mm). Only the distance MSP-gonion showed a statistically significant difference between FSPa-FSPc. APL for all landmarks, FSPs and groups ranged between 0.87 and 4.09 mm (median=1.82 mm).

Conclusion: Our results show that the three FSPs compared, built according to current clinical guidelines, perform mathematically similar, with few differences that may not be of clinical value.

Keywords: Facial Symmetry, Facial sagittal plane

A-0955

Sternocleidomastoid Muscle Deserves Formal Triangle Recognition with Internal Jugular Vein

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Purpose: Academically, the neck is divided into classic anterior and posterior triangles by an iconic landmark, the sternocleidomastoid muscle. Clinically, there are additional important triangles identified within these paired triangles which are not typically taught to medical students. However, there is an intermediate triangle (IT) lying within this landmark formed from the distal sternocleidomastoid. Internal jugular vein (IJV) is identified within IT and canulated for central lines more than 5 million times annually. Anatomy atlasses/texts do not highlight nor discuss IT or (Sedillot's). Study objective is to conduct dissections to identify IT and IJV on novel imaged GAX-specimens, fresh frozen cadavers (FFC) and formalin-fixed cadavers (F-FC).

Methods: Palpation and dissection were conducted on GAX-specimens (n=6:12 sides), FFC (n=18:36 sides) and F-FC (n=15:30 sides) with MRI and innovative contrast-CT scanning of GAX-specimens.

Results: Literature search revealed majority of texts/atlases do not acknowledge/discuss the IT with IJV. All specimen mediums (78-sides) dissected IT and IJV successfully. GAX-specimens provided lifelike palpation, mobility, imaging, and dissection. FFC sides were palpable, lifelike, less mobile, had 48-hour window. F-FC were poorly palpable, immobile with dissection resistance. Only GAX-specimens with contrast had patent full IJV's which were relatively superficial within IT available for realistic cannulation.

Conclusion: Based on 3 dissection mediums, this study consistently demonstrated the IJV within the IT. GAX-specimens can be a realistic lifelike skill teaching medium. Finally, dissections demonstrated the IT or (Sedillots) should be formally recognized in texts, atlases for training healthcare professionals.

Keywords: Novel Anatomy, Innovative Contrast

A-0974

Is There Any Variation in Morphology of Pelvicalyceal System between the Right and Left Adult Human Kidneys?

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Purpose: In order to maximise success and reduce complication in Shock Wave Lithotripsy, Lithotomy and retrograde intrarenal surgery in nephrolithiasis it is important to understand the anatomy and Morphology of the collecting system before the procedure. The aim of this study is to observe if there is any significant difference in Morphology of pelvicalyceal system.

Methods: 100 pairs of formalin fixed human cadaveric kidneys were collected from the department of Anatomy, Vardhman Mahavir Medical College and Safdarjung Hospital. Then dissected in coronal plane to study the pelvicalyceal system.

Results: Intrarenal Yshaped bicalyceal Right (25%), Left (28.33%). Extrarenal Y shaped bicalyceal Right (25%), Left (13.33%). Borderline Y shaped bicalyceal Right (5.00%), Left (11.66%). Intrarenal triangular tricalyceal Right (15%), Left (3.33%). Extrarenal triangular tricalyceal Right (5.00%), Left (13.33%). Borderline triangular tricalyceal Right (5.00%), Left (1.66%). Intrarenal radiate multicalyceal Right (1.66%), Left (8.33%). Extrarenal radiate multicalyceal Right (3.33%), Left (0%). Borderline radiate multicalyceal Right (3.33%), Left (0%). Unclassified Right (11.68), Left (20.03).

Conclusion: This study shows a statistically significant difference in intrarenal triangular tricalyceal type of pelvis between right (15%) and left (3.33%). This notable difference might largely influence the outcome of urosurgical procedures.

Keywords: Gross Morphology, Pelvicalyceal System, Classification, Statistical gnificance

[B. Neuroanatomy and Neuroscience]

A-0022

Neuroprotective Effect of Metallothionein of Dopaminergic Neurons in Rotenone-Induced Parkinson's Disease Adult Zebrafish Model

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Purpose: Metallothioneins (MT) are small cysteine-rich proteins known to serve multiple functions in the brain. MT was also reported to be dysregulated in the brains of Parkinson's disease (PD) patients. This study aims to elucidate the protective effects of exogenous full-length human MT2 peptide (hMT2) in a rotenone-induced PD zebrafish model.

Methods: Adult zebrafish were exposed to 5 μg/L rotenone water for 28 days to induce PD symptoms. Fish were treated with 0.2 μg/fish of hMT2 via intracranial injection either one day before or seven days after initiation of rotenone exposure. Fish were subjected to novel tank test upon completion of rotenone treatment and sacrificed after the behavioral test. Dissected whole brains were used for gene expression, dopaminergic neuronal (anti-tyrosine hydroxylase, TH) immunohistochemistry, brain dopamine and lipid peroxidation analysis.

Results: After 28 days of rotenone exposure, zebrafish exhibited a significant reduction in locomotor activity and increased anxiety behavior, as indicated by an increased in swimming time in the lower zone of the tank. Rotenone exposure also significantly reduced the gene expressions of dopamine transporter (dat) and increased the expression of th1 and th2, and pro-inflammatory cytokines (il1a, il1b, tnfα and cox2) in the brain. Rotenone-treated fish were associated with reduced dopamine levels and a decrease in dopaminergic neurons in the brain. Intracranial treatment with hMT2 provided neuroprotection in the zebrafish by attenuating the rotenone-induced locomotor dysfunction, anxiety, neuroinflammation, dopamine depletion, and degeneration of dopaminergic neurons.

Conclusion: These results indicated that hMT2 administration could be a potential treatment for PD by inhibiting neuroinflammation and preventing dopaminergic neuronal death.

Funding: This research was funded by the Ministry of Higher Education Malaysia through the Fundamental Research Grant Scheme (Grant number FRGS/1/2018/SKK08/UKM/03/5) and the Universiti Kebangsaan Malaysia through the Faculty of Medicine Fundamental Grant (grant number FF-2020-063).

Keywords: Metallothionein 2, Neurodegenerative disease, Neuroprotection, Pesticide, Dopamine

A-0050

NOX1 Triggers Ferroptosis and Ferritinophagy, Contributes to Neurodegeneration

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Purpose: Parkinson's disease (PD) is a neurodegenerative disorder. Ferroptosis-specific genes related to PD remain uncertain. Exploring the effects of NADPH oxidase enzyme-1 (NOX1) with the ferroptosis pathway.

Methods: 1) NOX1 was identified by bioinformatics analysis; (2) in vitro and in vivo model of PD to investigate the potential underlying mechanism of NOX1; (3) Transcriptome sequencing to find downstream signaling pathways;(4) CO-IP and ubiquitination analysis for NOX1 upstream factor.

Results: (1) NOX1 was upregulated in both in vitro and in vivo models of PD. (2) NOX1 was ubiquitinated by FBXW7; (3) The activation of the RUNX2/STK32A pathway by NOX1 facilitates ferritinophagy.

Conclusion: NOX1 triggers ferroptosis and ferritinophagy in PD models.

Keywords: NOX1, Parkinson's disease, ferroptosis, Ferritinophagy

A-0234

Development and Application of the FT-GO Method, a Multicolor Fluorescent Tyramide Signal Amplification System

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Purpose: Fluorescent immunohistochemistry is an indispensable technique to elucidate molecular localization and function. However, detection of low-abundance targets is difficult, impeding the acquisition of high-resolution images. In this study, we developed a highly stable and simple multicolor fluorescent signal amplification method, Fluorochromized Tyramide-Glucose Oxidase (FT-GO).

Methods: In the previous study, we reported a straightforward and cost-effective tyramide signal amplification (TSA) system, BT-GO (Biotinyl Tyramine-Glucose Oxidase), for bright-filed imaging. Unlike conventional TSA methods, BT-GO uses glucose oxidase to produce H_2O_2. H_2O_2 is inherently unstable and easily breaks down into oxygen and water when exposed to light, heat, or metal ions. However, in the BT-GO reaction, the enzymatic interaction between glucose and glucose oxidase ensures a stable supply of the compound and stable deposition of BT onto the tissue. In the present study, glucose oxidase was also used to generate H_2O_2 to deposit FT onto the tissue. We then validated the availability of FT-GO in fluorescent immunohistochemistry.

Results: We first demonstrated that FT-GO improved immunofluorescence signals while minimizing background noise, successfully enhancing the signals from 10- to 180-fold compared to the conventional methods in staining for a neuronal marker, NeuN. In comparison to indirect immunofluorescence detection methods, FT-GO revealed a broader

distribution of monoaminergic projection systems including catecholaminergic and serotonergic fibers in mouse and marmoset brains. To enable multiplex labeling with FT-GO, we deactivated antibody-conjugated peroxidase using sodium azide. We utilized FT-GO for multiplex fluorescent in situ hybridization histochemistry and successfully labeled neocortical interneuron subtypes by combining it with immunofluorescence. Finally, we showed that FT-GO dramatically increased the detectability of an adeno-associated virus tracer.

Conclusion: FT-GO showed robust labeling with a remarkably high signal-to-noise ratio, suggesting its potential as a versatile platform for histochemical analysis.

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Keywords: Fluorochromized tyramide, Glucose oxidase, Immunohistochemistry, In situ hybridization histochemistry, Adeno-associated virus

A-0272

Role of Calcitonin Gene Related Polypeptide (CGRP) in Diabetic Neuropathic Pain Model

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Purpose: The purpose of this stud was to find out the expression of CGRP in the DRG in diabetic neuropathy model and changes in CGRP expression with Metformin.

Methods: Thirty-two Balb/c male and female mice, 8 to 10 weeks age and weighing 25 to 35gms were given Alloxan (200mg/kg) to establish an animal diabetic model. Diabetic mice were divided into three groups. Group A were observed till three weeks for neuropathy to develop and then given intraperitoneal normal saline for 7 days. Group B were similarly observed for neuropathy till 3 weeks and then given single intraperitoneal injection of Metformin (200 mg/kg) for 7 days. Group C were further subdivided into C1 and C2. Group C1 was given single intraperitoneal injection of Metformin (200 mg/kg) for initial 7 days after diabetic establishment, while Group C2 was given daily single injection of Metformin (200 mg/kg) for continuous 21 days. Both mechanical and thermal hyperalgesia and allodynia were weekly recorded in each group. Mice were dissected and their DRG isolated. Immunohistochemistry was done to observe the expression of CGRP. Analysis of the data was done using MS Excel, Graph Pad Prism software version 5.0, SPSS version 22.0 and ImageJ analyzer.

Results: Neuropathic pain was validated in all the groups by significantly developed ($p < 0.001$) hyperalgesia and allodynia. Metformin administration was unable to reverse the behavior parameters (hyperalgesia and allodynia) in all the four groups ($p > 0.05$). On the other hand the IHC parameters of CGRP expression showed its strongly significant ($p < 0.0001$) relation in reducing CGRP expression in DRG slides of Group C1 and Group C2.

Conclusion: Earlier administration of Metformin, a cAMPK activator significantly reduces the up regulated CGRP expression in DRG sections of diabetic neuropathic model.

Keywords: Neuropathic pain, CGRP, Metformin, DRG, Animal model

A-0317

Stembark Ethanol Extract of Bombax Costatum Pellegr. & Vuillet Ameliorates Pentylenetetrazol-Induced Kindling in Rats by Enhancing Antioxidant Activity and Regulating GABA Level

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Purpose: Epilepsy is a neurological disorder resulting from excessive electrical discharges in the brain. This study evaluated the possible anti-epileptic potential of stem bark ethanolic extract of Bombax costatum (BC) on PTZ-induced kindling model in rat.

Methods: Thirty-five Wistar rats were grouped into five (n=7) and received normal saline, 35 mg/kg of PTZ, 5 mg/kg diazepam followed by 35 mg/kg PTZ after 30 minutes and BC stem back ethanolic extract at 125 mg/kg and 250 mg/kg followed by 35 mg/kg of PTZ intraperitoneally after 30 minutes.

BC was administered orally daily while normal saline and PTZ were given intraperitoneally every other day for 26 days. Seizure activity was evaluated using the Racine scale, modified elevated plus maze and force swim test were conducted thereafter.

Results: Pretreatment with BC significantly reduced ($p < .05$) the seizure score and increased GABA level in BC treated rats when compared to PTZ alone induced rats. The First transfer latency of PTZ alone treated rats was significantly increased ($p < .05$) relative to the control rats and rats pretreated with diazepam and BC extract. Pretreatment with BC extract at 250 mg/kg was shown to significantly increase ($p < .05$) the activities of catalase, reduced glutathione, and superoxide dismutase compared to the PTZ alone treated rats.

Conclusion: Conclusively, BC was found to prevent seizure, avert neurodegeneration, and enhance cognition in PTZ-kindled rats by regulating GABA levels and enhancing antioxidant activity.

Keywords: Bombax costatum, Glutamate, Pentylenetetrazol, Kindling, Oxidative stress

A-0333

Interplay between Acetylcholinestrase Expression, Gliogenesis and Neurogenesis during Ontogeny of a Postnatal Developing Visual Relay Centres in Wistar Rats Pups

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Purpose: The spatial patterns of neurons and glial cells in visual relay centres (VRC) ontogeny is crucial to explain the cellular mechanism in VRC postnatal neurogenesis. Acetylcholinesterase (AChE) plays a critical role in developmental processes in the brain. The pattern of distribution of cholinestrases activity has been used as a tool to study ontogeny of neural development in the nervous system This study is carried out to establish the relationship between pattern of distribution and localization of AChE, glia cells development and neuronal cell maturity during postnatal ontogeny of the VRC in Wistar rat pups.

Methods: Forty-five (45) first filial generation rats pups (n=5) used were studied in postnatal ages (P); 1, 5, 10, 20, 25, 30, 35, 40, and 45. They had access to suckling, weaning ad libitum after weaning they were given rat pelleted feed and water ad libitum. The brain tissues were excised, processed and stained to demonstrate AChE activity and glial cells immunohistochemistry to demonstrate expression of developing astrocytes.

Results: AChE expression was significant in the developing VRC neurons perikaya in P1, P5 and P10 and not within the neuropil, glial expression was not detected in P1, P5 and P10; this correlates with period of early VRC neuronal cell differentiation demonstrated in Haematoxylin and Eosin stain. The VRC of P15, P20; P25; P30, P35, P40 and P45 demonstrated AChE patterning fairly distributed in the neuronal cell body and the neuropil this correlates with marked expression of glial cellular processes in P15 to P45 which corresponds with period of critical neuron structural and functional development for visual activity.

Conclusion: There is an age related and neuronal activity pattern of AChE expression in the VRC, this controls its ontogeny and correlates with glial cell processes expression and neuronal cell maturity in a postnatal developing VRC.

Keywords: Ontogeny, Acetylcholinestrase, Postnatal neurogenesisis t, Visual relay centres, Glia Cells

A-0370

Targeted Delivery Tannic Acid Nanoparticles-Embedded siRNA with Enhanced Anti-Inflammatory Activities for Treating Retinal Ischemic Injury

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Purpose: Glaucoma is a multifactorial disease characterized by progressive damage to the retinal ganglial cells (RGCs) and consequent visual impairment. CX3CL1/CX3CR1 signaling has been documented to mediate the microglia activation and gliosis reaction during neurodegeneration. We developed a CX3CL1- functionalized apoptotic body nanovesicles-coated tannic acid (TA) nanoparticles (NPs) loading with a therapeu-

tic agent for glaucoma.

Methods: Apoptotic bodies (ABs) were obtained by chemically inducing apoptosis of adipose-derived stem cells, the functionalized ABs containing TA nanoparticles (TA-ABs) were obtained through a series of steps. Then, we established an in vivo mouse model of retinal ischemia/reperfusion and an in vitro model of oxygen and glucose deprivation/reoxygenation (OGD/R) in microglia. The experimental animals were subjected to functional, morphological, and behavioral analysis.

Results: In vitro experiments showed that TA-ABs had good biocompatibility, escape from the immune system and enhance accumulation in the inflamed area via the CX3CL1/CX3CR1 signaling axis, thereby achieving an affinity to activated macrophages and microglia. In vivo experiments showed that intravitreal injection of TA-ABs preserved the retinal structure and enhanced the retinal ganglion cells survival through inhibiting the CX3CL1/CX3CR1 expressions. In particular, these morphological benefits could be translated into remarkable functional improvements, as evidenced by the behavioral test and electroretinogram (mf-ERG) examination. It is further demonstrated that the TA-ABs can significantly suppress retinal inflammation and relieve pathological conditions with favorable safety properties in the induction of retinal I/R injury in mice.

Conclusion: The neuroinflammation is implicated in the pathogenesis of retinal I/R injury. Targeting the CX3CL1/CX3CR1 signaling may serve as an effective therapeutic strategy. These results can provide new therapeutic directions for diseases caused by retinal ischemia-reperfusion injury.

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Keywords: Glaucoma, Neuroinflammation, Apoptotic bodies, Tannic acid nanoparticle, Drug delivery

A-0400

Unravel the Role of Sphingosine 1-Phosphate Metabolism in Glial Cell Function after Central Demyelination

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Purpose: The brain is one of the most lipid-rich organs in the body, however, how lipid signaling molecules regulate glial cell function remains opaque. Sphingosine 1-Phosphate (S1P) is a signaling lipid essential for normal brain function during development. Whilst disrupted S1P signaling and altered expression levels have been implicated in neurodegenerative diseases such as Multiple sclerosis, the role that S1P metabolism plays in the injured central nervous system (CNS), in particular glial cell function, remains largely unclear. Here we present our recent new work concerning the role that S1P degradation plays in neuroinflammation and glial cell interaction in the injured CNS through selectively targeting Sphingosine 1-Phosphate lyase (SPL), the terminal enzyme that controls the final metabolic exit of S1P.

Methods: We adopted a high throughput drug screen approach using the US FDA-approved drug compound libraries together with a series of in vitro and in vivo assays including biochemistry, molecular binding, siRNA knockdown, neurobiology and histopathology together with an animal of inflammatory demyelination.

Results: We have identified new and selective inhibitors of SPL that display direct binding of recombinant SPL protein, effectively elevating S1P expression in vitro and in vivo. This is further supported by our cell model systems and siRNA knockdown through which the SPL inhibitors selectively reduce SPL activity and elevate S1P expression, an effect dependent on SPL expression. Our preliminary data suggest that selective inhibition of SPL activity in the injured CNS, by application of S1P restoration, reduced the extent of inflammatory myelin damage and oligodendrocyte loss, presumably via regulating microglia activity.

Conclusion: Our current data suggest that S1P plays an important role in regulating inflammatory demyelination and that controlling the metabolic pathway of S1P could be a strat-

egy that can be therapeutically modified for the treatment of neurodegenerative diseases.

Funding: The Judith Jane Mason and Harold Stannett Williams Memorial Foundation National Medical Program.

Keywords: Sphingosine 1-Phosphate, Glia cell, Oligodendrocyte, Microglia, Sphingosine 1-Phosphate lyase

A-0453

Absence of Hypothalamic Cholinergic Neurons in the Common Ostrich and Emu: Implications for Global Brain States during Sleep

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Purpose: To examine the presence/absence and nuclear parcellation of cholinergic neurons in the hypothalami of five birds: a Congo grey parrot (Psittacus erithacus), a Timneh grey parrot (P. timneh), a pied crow (Corvus albus), a common ostrich (Struthio camelus), and an emu (Dromaius novaehollandiae).

Methods: The study utilised the brains of 10 birds (2 of each avian species: Congo grey parrot (Psittacus erithacus), a Timneh grey parrot (P. timneh), a pied crow (Corvus albus), a common ostrich (Struthio camelus), and an emu (Dromaius novaehollandiae)). The brains we processed for free floating immunohistochemistry and stained for the ry to an antibody raised against the enzyme choline acetyltransferase (ChaT).

Results: Hypothalamic cholinergic neurons were observed in six distinct clusters in the medial, lateral, and ventral hypothalamus in the parrots and crow, similar to prior observations made in the pigeon. The expression of cholinergic nuclei was most prominent in the Congo grey parrot, both in the medial and lateral hypothalamus. In contrast, no evidence of cholinergic neurons in the hypothalami of either the ostrich or emu was found. It is known that expression of sleep states in the ostrich is unusual and resembles that observed in the monotremes that also lack hypothalamic cholinergic neurons.

Conclusion: It has been proposed that the cholinergic system acts globally to produce and maintain brain states, such as those of arousal and rapid-eye movement sleep. The hiatus in the cholinergic system of the ostrich, due to the lack of hypothalamic cholinergic neurons, may explain, in part, the unusual expression of sleep states in this species. These comparative anatomical and sleep studies provide supportive evidence for global cholinergic actions and may provide an important framework for our understanding of one broad function of the cholinergic system, and possible dysfunctions associated with global cholinergic neural activity.

Funding: Ajman University Research Grant: 2022-IRG-MED-3.

Keywords: Cholinergic, Choline acetyltransferase, Aves, Immunohistochemistry, RRID AB_2079751

A-0462

Development and Asymmetry of Fetal Neocortical Laminar Structure in Early and Middle Pregnancy

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Purpose: To explore the regional specific development pattern and asymmetry of fetal neocortical laminar structure from early to middle pregnancy, in order to enrich the early brain research of human life and provide reference for the development of normal fetal neocortex and disease diagnosis.

Methods: 24 fetal specimens aged between 10 and 18 gestational weeks were collected, and fetal brain T2- weighted images were obtained by magnetic resonance imaging. The 3D Slicer software was used to manually segment the neocortex of the fetal brain, which was divided into two parts: marginal zone and cortical plate layer (MZ-CP layer), subcortical plate and intermediate zone layer (SP-IZ layer). The volume and surface area were measured, and the changes in the neocortical laminar structure with age and side differences were analyzed. The deformation vector values of each sampling point of the fetal neocortical MZ- CP and SP-IZ were calculated using shape analysis, and the regional specificity and side differences of the morphology of the laminar structure during development were calculated by multiple regression analysis.

Results: From 10 to 18 gestational weeks, the absolute surface area, relative surface area, and absolute volume of bilat-

eral MZ-CP and SP-IZ showed linear growth with increasing gestational age, while the relative volume of MZ-CP showed linear reduction. Regional specificity of fetal neocortical development was found in the shape analysis, and the expansion rate of some areas in the parietal and temporal lobes was faster than in other brain lobes with increasing age. Meanwhile, similar to the postnatal brain torque phenomenon, fetal MZ-CP was deformed to the right near the frontal pole, and SP-IZ was deformed to the right near the frontal pole and to the left near the occipital pole.

Conclusion: This study provides earlier and more detailed information on the developmental changes and asymmetry of the cortical plate structure in fetuses aged 10 to 18 gestational weeks.

Funding: This work was supported by the National Natural Science Foundation of China (No. 31571237, 31771328).

Keywords: Frontal lobe, Development, Brain asymmetry, Fetal brain

A-0479

Widening the Papez Circuit: The Cingular Loop to the Nucleus Incertus in the Pontine Tegmentum

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Purpose: The Papez circuit was "a proposed circuit for emotion" and centered in a loop between the cingulum, the hippocampus, the mammillary bodies, the anterior thalamus and again the cingulum. This scheme was challenged by the lack of emotional alterations in the HM case and the focus on the amygdala as the core for emotion. Nonertheless, the prefrontal cortex was still considered as a key element in emotion and no attention was paid to the retrosplenial cortex. We noticed that the whole system received projections from the nucleus incertus in the pontine. Thus, we hypothesized that there is a long loop connecting the cingular cortex with the nucleus incertus, which also contain elements that modulate both cognitive and emotional processes.

Methods: We have arranged a series of anterograde and retrograde tracer injections in the rat into the three structures and some other related areas to study the projections between the prefrontal cortex, the retrosplenial cortex and the nucleus incertus.

Results: Retrograde tracer injection in the retrosplenial cortex resulted in labeling mainly in the ipsilateral nucleus incertus and also in several associative and prefrontal areas, especially the prelimbic and orbitofrontal cortex as well as anterior and lateroposterior thalamic nuclei. Interestingly subcortical afferents could be also traced from the medial septum, several hypothalamic and supramammillary nuclei. Retrograde tracer injections in the nucleus incertus resulted in labelling in the retrosplenial cortex but this projection was less important than those arising from the prelimbic and orbitofrontal cortices. Anterograde tracers in these regions confirm the occurrence of these projections.

Conclusion: All these data point at a new view of the cortical and subcortical processing considering a long loop involving the prelimbic and the retrosplenic cingulate system together with the medial septum, supramammillary nucleus and the nucleus incertus. As a whole, this loop may modulate both cognitive and emotional processes.

Funding: PsyCoMed project Horizon-MSCA-SE-01-101086247.

Keywords: Limbic system, Brainstem, Connections, Cingulum, Medial septum

A-0677

Rho Kinase Isoforms in Mouse Brain: Distribution and Modulation by Stroke

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Purpose: The Rho associated coiled coil protein kinase (ROCK) pathway is involved in the regulation of cytoskeletal organisation of cells and other activities such as cell proliferation, adhesion and apoptosis. Low levels of ROCK activity are associated with positive impacts on the brain, ROCK can also mediate numerous processes in stroke pathophysiology and recovery. There are two ROCK isoforms, ROCK1 and ROCK2, but cellular localisation of both isoforms in the brain has not been previously characterised. The focus of this project was

to investigate the cellular expression pattern of ROCK1 and ROCK2 in astrocytes in sections of mouse brain, and whether the expression levels of the ROCK isoforms changed after stroke.

Methods: A photothrombotic stroke model was used, using male (7-14 weeks old) and female (20-22 months old) C57B16 mice, where the left primary motor cortex was targeted. A standard immunofluorescence protocol was used to label astrocytes, and the two ROCK isoforms. To investigate cellular expression pattern, photo microscopy and image analysis were performed using GFAP to label astrocytes and specific antibodies to label ROCK1 and ROCK2.

Results: Under control conditions, ROCK2 appeared to be extensively co-localised with GFAP, whereas ROCK1 showed little co-localisation with GFAP. The expression of both ROCK1 and ROCK2 were also investigated after stroke, where the extent of co-localisation between ROCK1 and GFAP did not change in infarcted regions of the brain, but the extent of co-localisation between ROCK2 and GFAP significantly decreased in infarcted regions.

Conclusion: Astrocytes change significantly following neuronal injuries, including stroke, in order to limit neuronal damage and enhance repair. As decreased ROCK2 activity is associated with neuronal repair and improvements in brain function following injury, decreased co-localisation between ROCK2 and GFAP in infarcted brain areas may highlight a novel change in astrocyte function in response to injury.

Keywords: Rho Kinase, GFAP, Stroke, Astrocytes

A-0924

Morphological Alterations of Cortical Projection Neurons and Interneurons in a Murine Model of Spinal Muscular Atrophy

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Purpose: Spinal muscular atrophy (SMA) is a genetic neuromuscular disease, characterized by motor neuron (MN) loss and skeletal muscle atrophy, due to the mutation of the Survival Motor Neuron 1 (SMN1) gene and the consequent lack of functional SMN protein. However, recent preclinical and clinical studies also revealed some cerebral alterations.

Methods: To clarify them, we studied the sensorimotor cortex of SMNdelta7 mice, a severe SMA model, at early (postnatal day 4-5; P4/5) and/or late (P11-12) symptomatic stage. We performed immunofluorescence and molecular analyses to investigate number, distribution and organization of the cortical projection neurons and GABAergic interneurons (INs).

Results: At P11, we observed a reduction of about 40% of both corticospinal (Ctip2-positive) and callosal (Satb2-positive) cells in SMA cortex, together with a 38% reduction of vGlut1 signal. At P5, the reduction of cortical projection neurons was only 14% in SMA mice compared to WT. Although the results suggest that these changes occur concurrently with lower MN death, the evaluation of cell birth dating and distribution by thymidine analogues and other markers are helping us in revealing possible alterations in SMA cortex already at developmental stages. Considering the inhibitory INs, in the late disease stage we observed a significant reduction of GABA+ cells, and of GAD65 and GAD67 (GABA synthesis enzymes) expression. Moreover, parvalbumin INs were significantly reduced in number and morphologically altered. Furthermore, a significant reduction of GABAergic synapses in layers II/III and V were found.

Conclusion: The observed alterations could be directly related to the SMN lack. Better understanding the involvement of the cerebral cortex in SMA pathogenesis will aid in the comprehension of the mechanisms behind the disease progression, as well as in developing effective treatment approaches, beyond the spinal MNs, to improve clinical results.

Keywords: Motor neuron disease, Cerebral cortex

[C. Development, Cell Biology and Tissue Engineering]

A-0060

Flavonoids of Polygonum Minus, a Malaysian Herbal Plant as a Promising Hepatoprotective Agent against Cisplatin-Induced Liver Injury: A Histology and MAPK/JNK/ERK and p21 Signalling Transduction Pathways Study

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Purpose: Drug induced liver injury (DILI) is a key focus of research in drug development. The proposed mechanisms include oxidative stress, inflammation, DNA damage and apoptosis. Cisplatin (CP) is a chemotherapeutic drug for various tumours. However, it results in hepatotoxicity which limits its usage. Natural products, specifically flavonoids with antioxidant and anti-inflammatory properties have been extensively researched against CP-induced hepatotoxicity. They employ significant hepatoprotective effects by inhibiting the proposed mechanisms and targeting the signal transduction pathways. Polygonum minus (P. minus) which is locally known as 'kesum' possesses antioxidant and anti-inflammatory properties was used in this study. It was aimed to ameliorate the hepatoprotective effect of P. minus-flavonoid rich fractions (P. minus-FRF) in vivo via histology and MAPK/JNK/ERK/ p21 signalling transduction pathways study.

Methods: The P. minus leaves were naturally dried, extracted and fractionated to obtain flavonoids prior to in vivo study. Forty healthy male rats were divided into 5 groups: Groups A and B were administered with distilled water, Group C was given quercetin, and Groups D and E were administered with P. minus-FRF 100mg/kg and 300mg/kg for 14 days. At day 15, Group A was injected with normal saline whereas other groups were administrated with CP 10mg/kg and all rats were sacrificed on day 18. Liver samples were harvested for histology and signalling pathways measurements via ELISA kits.

Results: Rats treated with CP showed central vein congestion, sinusoidal dilatations, hepatocytes degeneration and necrosis while Pm-FRF groups preserved the liver architectures. Supplementation of Pm-FRF also ameliorated the MAPK/JNK/ERK and p21 protein signalling pathways in the liver.

Conclusion: Therefore, we conclude that using flavonoid alone as supplement or as an adjuvant with CP is promising, hence lowering the risk of DILI.

Keywords: Polygonum minus, Flavonoids, Cisplatin, Drug-induced liver injury, MAPK/JNK/ERK/p21 signalling pathways

A-0061

The Development of a Core Syllabus for Teaching Histology to Medical Students: The Cardiovascular, Lymphoid, Respiratory, Digestive Systems, and Integumentary Systems

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Purpose: Worldwide, medical curricula are changing to incorporate integrated anatomical teaching with clinically relevant content. Our goal was to provide educators who teach histology to medical students with guidance concerning a core syllabus that conforms to international standards.

Methods: To establish what topics were appropriate, a Delphi Panel was established under the auspices of the International Federation of Associations of Anatomists (IFAA). The Delphi Panel consisted of 13 academics from different countries, including basic science teachers and clinical educators. A total of 177 histological topics for the cardiovascular, lymphoid, respiratory, digestive and integument systems were each rated by the panelists as being either "Essential," "Important," "Acceptable," or "Not required" and involved two rounds of assessment. Ethical approval was not required as the project does not involve research on human subjects and is an audit of educational material.

Results: Each topic was analyzed in accordance with general rules established by the IFAA such that topics rated by over 60% of the panelists as being "Essential" were deemed as being CORE. Topics rated by between 30% and 59% of the panelists as being "Essential" were categorized as being RECOMMENDED. Topics rated "Acceptable" or "Not Required"

or rated as "Essential" by less than 30% of the panelists were classified as not being core or recommended.

Conclusion: This is only stage 1 of the development of the core syllabus and further review will require stakeholders (including IFAA member associations) commenting on the Delphi Panel's findings.

Keywords: Core Syllabus, Teaching Histology, Medical Students, Cardiovascular, Lymphoid, Respiratory System, Digestive System, Integument

A-0076

Noradrenaline Profiling and MCC-950 Intervention Unveil Diabetic Cardiac Autonomic Neuropathy in Type 1 Diabetes Mellitus Rat Model

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Purpose: Global concerns surround the rising prevalence of Type 1 Diabetes Mellitus (T1DM), emphasizing the need for a nuanced understanding of associated cardiovascular risks. Diabetic cardiac autonomic neuropathy (DCAN), characterized by cardiovascular irregularities in diabetics, remains inadequately explored, especially in T1DM. This study seeks to establish a link between T1DM and DCAN, investigating the stellate ganglia in a rat model with a focus on noradrenaline as a potential marker. Additionally, the viability of MCC-950, an anti-inflammasome, as a treatment is assessed.

Methods: Male Wistar rats were randomly assigned to Control and T1DM groups. T1DM rats received Streptozotocin injections and remained untreated until DCAN manifestation. Weekly evaluations of blood glucose and body weight were conducted. Non-invasive techniques and ELISA kits monitored vital signs and noradrenaline levels, evaluating cardiovascular parameters. After confirming DCAN, the T1DM group was divided into insulin-treated, MCC-950-treated, and untreated segments for two weeks. Histological analyses of stellate ganglia, aorta, and left ventricle were performed.

Results: The diabetic group exhibited significant changes in blood glucose, body weight, blood pressure, and heart rate, mirroring common clinical symptoms of diabetes. Week 14 witnessed a substantial surge in serum noradrenaline levels, signalling the onset of DCAN. Histologically, untreated rats displayed nerve cell shrinkage in stellate ganglia, notably ameliorated with MCC-950 administration. Evaluation of the thoracic aorta revealed improvements, including reduced intimal destruction, subintima cleft, and cytoplasmic clearing of smooth muscles in tunica media and submedia separation. Masson trichrome staining of the left ventricle depicted enhanced features like decreased collagen deposition, interstitial fibrosis, and normalized myocardial architecture, particularly following MCC-950 treatment.

Conclusion: This study deepens the understanding of DCAN's pathophysiology in T1DM, highlighting MCC-950's potential in mitigating adverse effects. Further investigation into therapeutic interventions for DCAN in diabetic patients is warranted.

Funding: Geran Putra IPM, Universiti Putra Malaysia.

Keywords: T1DM, DCAN, Noradrenaline, Stellate ganglia, MCC-950

A-0082

Purpose and Benefits of Academic Fetal Autopsies in Medical Research

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Purpose: Fetal autopsies are crucial since many related anomalies are missed through modern methods of examinations, even if these have revolutionised process of determining cause of fetal mortality. The major objectives of fetal or perinatal autopsy is to decipher cause of death and aid in counselling parents for future pregnancie.

Methods: Ethical clearance should be obtained from institutional ethical committee prior to conduction of an autopsy. On the other hand, medico legal autopsies are carried out by requisition from a police officer, under s 174 of Criminal Procedure Code (CrPC). Fetuses can be obtained through elective abortions conducted as per MTP act Govt of India (1971) and also through still births. A requisition form from a gynaecologist or a neonatologist is a prerequisite in case of an academic postmortem. All autopsies should follow stringent rules of ICMR which are based on Helsinki declaration. The fetuses with congenital anomalies can be preserved and displayed in the anatomy or pathology museum for teaching medical stu-

dents. After all measurements and thorough external/ internal examination, normal fetuses can be utilized to perform developmental studies, histogenesis of various organs and observe the expression of various molecular markers. Karyotyping and whole body radiography can be carried out wherever necessary.Fetal autopsy report with photographs to document external and internal abnormalities is handed over to parents with proper relevant counselling.

Results: In over 100 fetal autopsies performed in Institute, CNS Malformations (Anencephaly, Spina Bifida), Renal Malformations (Bilateral renal agenesis, Urorectal septal defects), CVS Malformations (Ventricular septal defects, Co-arctation of aorta, Diaphragmatic Hernia), Gastroschisis and Omphalocoele were observed. Isolated Malformations were identified in 76%, Multiple Malformations in 2%, Hydrops Fetalis in 2%, Skeletal dysplasia in 2%, No fetal pathology in 14%, and 4% were Macerated.

Conclusion: Studies have documented that fetal autopsy is an important procedure to substantiate and add to clinical information.

Keywords: Fetus, Research, Malformations, Development, Autopsy

A-0085

Serelaxin Released from Self-Assembling Peptide Nanofibers Inhibits Cardiac Fibrosis and Promotes Repair of Infarcted Myocardium

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Purpose: Serelaxin plays a vital role in anti-fibrotic and promotes cardiomyocyte survival and proliferation. However, their delivery for sustained release in MI-affected areas has proved to be challenging.We present a study on the sustained delivery of serelaxin to areas of MI in a self assembling peptide nanofibers (SPNFs) and thus improve cardiac function by promoting endogenous cardiac repair.

Methods: The functionalized SPNF was constituted with self-assembling motif, serelaxin-binding site. Self-assembly and structural features of SPNFs were viewed using a atomic force microscopy (AFM). Serelaxin released from the SPNF was detected by ELISA. Myocardial infarction (MI) models of the female rats were established by ligation of the left anterior descending coronary artery. Using injectable SPNFs, which bound and sustained delivery of serelaxin to the myocardium at the injected sites for 28 days was achieved, fibrosis as well as angiogenesis, and myocardial regeneration were examined.

Results: We found that the designer RADA-RPR bound serelaxin and that serelaxin released from the functionalized SPNF could significantly reduce myocardial fibrosis and the left ventricular ejection fraction (LVEF) was markedly improved as well as promoted proliferation of cardiomyocytes. Furthermore, angiogenesis and myocardial regeneration were enhanced in the MI models at 4 weeks after delivery of SPNF-serelaxin along with attenuation of adverse myocardial remodeling and significantly improved cardiac function.This cardiac functional repair coincided very well with substantially lower fibrotic tissue formation, expanded microvasculature, and myocardial regeneration in the infarct area.

Conclusion: These results demonstrate that the SPNFs can deliver serelaxin to areas of MI and thus inhibit cardiac fibrosis and improve cardiac function by promoting the proliferation of cardiomyocytes and revascularization. The sustained release of serelaxin with SPNF is a promise strategy to enhance repair of the infarcted myocardium.

Keywords: Self-assemble peptide nanofibers, Serelaxin, Cardiac fibrosis, Myocardial infarction, Endogenous myocardial regeneration

A-0344

Generation and Transcriptional Characterization of Human Embryo and Fetal Tissue-Derived Inner Ear Organoids

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Purpose: Molecular studies on inner ear development in humans are hampered by the limited access to fetal material. Through the use of organoids as an in vitro model, the understanding of inner ear morphogenesis can be refined by strate-

gically replicating in vivo events within a controlled environment. By using species specific tissue, the aim is to elucidate the efficiency of the organoid generation protocol in mimicking the dynamic signaling processes that orchestrate human inner ear morphogenesis.

Methods: The methodology involves the isolation of human inner ear tissue from embryonic and fetal samples. Dissociated cells were firstly cultured to form inner ear organoids. By modulating key signalling pathways and the inclusion of various small molecules, the organoids were expanded whilst maintaining an otic progenitor identity. Subsequently, a directed differentiation was performed, aiming towards an inner ear hair cell fate. Organoids from both expansion and differentiation phases were then characterized by immunostaining and RNA sequencing.

Results: Results indicated that the organoids progressively increased in size during expansion, whilst expressing otic epithelial progenitor markers EPCAM, SOX2 and PAX2. Differentiation-phase organoids showed no further change in size but expressed markers of hair cell identity such as POU4F3 and MYO6. Transcriptomic analysis revealed distinct clusters for each organoid subtype, with upregulation of differentially expressed genes. Comparison with ex vivo otic progenitors demonstrated a transcriptional profile which is comparable to otic tissue at a more primitive state, thereby suggesting potential reprogramming events occurring during the in vitro culture.

Conclusion: In conclusion, the study proves to be a valuable tool for enhancing our understanding of inner ear organoid generation protocol. It has also shed light on the reliability and reproducibility of the model when applying it to a more renewable cell source for potential therapeutic use and disease modelling.

Funding: Human fetal samples were collected from medically terminated pregnancies. This was performed following the full approval of the Health Research Authority and Research Ethics Committee (HRA/REC) (IRAS application ID 193822, Sheffield number STH1908) and in adherence to the Polkinghorne guidelines/Human Tissue Act (HTA). Informed consent was obtained from patients after the decision to terminate the pregnancy.

Keywords: Inner ear, Human inner ear, Hair cell, Inner ear organoids, Transcriptome

A-0356

Mesenchymal Stem Cell-Encapsulated Hydrogel for Intervertebral Disc Regeneration

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Purpose: Intervertebral disc degeneration is the underlying cause of low back pain (LBP), which results from an imbalance in extracellular matrix homeostasis, increased inflammation, nerve ingrowth, and sensory sensitisation, contributing to the onset of LBP. Our study aims to determine the efficacy of hyaluronic acid (HA)/collagen (COLII) hydrogel in promoting disc regeneration.

Methods: We fabricated hydrogel using type II collagen (COLII) and hyaluronic acid (HA). We encapsulated mesenchymal stem cells (MSCs) in a 3D hydrogel system before preconditioning in chondrogenic media for 14 days in culture. Post-implantation of hydrogel in a surgically induced disc injury model of pain in the rat tail, we evaluated the the disc hydration and height by MRI and plain radiograph, respectively. Post-mortem, we assessed for histology by H&E and Alcian blue staining and deposition of matrix content via the integrin-β1/MAPK pathway.

Results: There was an increase in T2 MRI in the MSC-encapsulated hydrogel-treated injury group, suggesting treatment increases disc hydration. We observed hydrogel with MSCs restored the disc height indicated by a higher disc height index. H&E revealed improvement in the NP cellularity and AF lamellae in the treatment group compared to the injury group, where AF was disorganised, and irregular distribution of NP cellularity was evident. Alcian blue staining demonstrated a strong presence in the NP, suggesting a predominant proteoglycan content for matrix repair.

Conclusion: Our results strongly suggest that this hydrogel could be a potential treatment for LBP associated with degenerative discs.

Funding: This research was funded by the Ministry of Higher Education, Malaysia, under the Fundamental Research Grant Scheme (grant number FRGS/1/2022/SKK10/UKM/02/12).

Keywords: Hydrogel, Mesenchymal Stem Cells, Intervertebral Disc, Tissue Regeneration

A-0357

Polyphenol Content, In Vitro Free Radical Scavenging Activity and Cytotoxic Effects on Colon Cancer Cells of a Cereal Grain Waste Product: Type III Tannin Sorghum Bran

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Purpose: Sorghum is an underutilised nutritious cereal grain native to Africa and serves as a staple in many developing countries, especially in the African continent. It is rich in polyphenols that are concentrated in its outer layers (bran). Sorghum bran is considered as milling waste but has the potential to be developed into nutraceutical products. The known health benefits of sorghum polyphenols include among others, antioxidant, anti-inflammatory, and anticancer properties. This study explored the potential of polyphenols extracted from sorghum bran in combating oxidative and nitrosative stresses closely associated with major non-communicable diseases (NCDs). Further, the study investigated the in vitro effects of the extract on the growth of colon cancer cell lines.

Methods: Sorghum grains were decorticated to obtain the bran from which polyphenols were extracted using 75% aqueous acetone. The extract was dried to yield a fine powder of the crude polyphenol extract. The total polyphenol, flavonoid and tannin contents in the extract were quantified using chemical assays. The free radical scavenging activities and the impact on cell growth were investigated in three human colon cancer cell lines (HT-29, HCT-116 and Caco-2 cells).

Results: The extract presented with high total polyphenol, flavonoid and tannin contents, and potent dose-dependent antioxidant activity and nitrates/nitrites scavenging activity. A strong positive correlation between the phenolic contents and antioxidant activity was observed, suggesting that the free radical scavenging is attributable to the polyphenols in the extract. The effects on cell growth followed a dose- and time-dependent pattern where exposure to higher extract concentrations for extended periods resulted in significantly lower cell numbers.

Conclusion: In conclusion, polyphenol-rich extracts of sorghum bran possess a potential for combating NCDs through the inhibition of oxidative and nitrosative stresses and inhibiting the growth of cancer cells. Future studies should assess these effects in non-cancerous colon cells, to fully confirm the anti-cancer effects.

Funding: National Research Foundation, South Africa, Grant no. 141359.

Keywords: Non-communicable diseases, Sorghum, Polyphenols, Antioxidant, Cytotoxicity

A-0471

Kmt2d Regulates Ameloblast Differentiation during Tooth Enamel Development

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Purpose: Enamel hypoplasia (EH) is a developmental defect in which the dental enamel is inadequately formed. Any perturbation in this 'amelogenesis' process may result in various forms of EH. Mutations in KMT2D cause Kabuki syndrome (KS), which involves various dental anomalies, such as EH. However, little is known about the function of KMT2D or the underlying mechanism in amelogenesis. We hypothesized that KMT2D coordinates amelogenesis by activating the expres-

sion of key signaling pathways and transcription factors (TFs) that are required for amelogenesis.

Methods: We generated a conditional knockout (cKO) mouse with ectoderm-specific deletion of Kmt2d (Krt14-Cre;Kmt2d$^{fl/fl}$). Using these mice, we comprehensively examined the structural and histological features, as well as cellular and molecular consequences, of Kmt2d deficiency using micro-computed tomography (CT), hematoxylin and eosin staining. We also re-analyzed single cell RNA-seq datasets from the mouse incisor and the KMT2D ChIP-seq datasets from human keratinocytes.

Results: Kmt2d-cKO mice exhibited 100% penetrant EH, shown from micro-CT analysis. Histological analysis demonstrated that, at birth, the Kmt2d-cKO molar tooth germ showed abnormal shape with delayed ameloblast differentiation, which may directly contribute to EH. Re-analysis of single cell RNA-seq dataset from the mouse incisor showed that Kmt2d is involved in amelogenesis. Moreover, re-analysis of KMT2D ChIP-seq dataset suggest that a large portion of EH causal genes are regulated by KMT2D in amelogenesis and Kmt2d may cooperate with known key epithelial regulatory TFs to direct amelogenesis.

Conclusion: Kmt2d, as an epigenetic coactivator, coordinates amelogenesis by activating the expression of key signaling pathways and TFs that are required for ameloblast differentiation, in part possibly by partnering with master regulator TFs for epithelial differentation. Our ongoing studies focus on further identifying the precise epigenetic mechanisms by which Kmt2d regulates dental enamel development.

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Keywords: Tooth, Enamel, Differentiation, Epigenetic, Regulation

A-0490

Development of Disc-on-a-Chip Model Using Microfluidic and Hydrogel System

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Purpose: The advancement of the organ-on-a-chip model provides a three-dimensional (3D) platform to replicate the anatomical features of the intervertebral disc (IVD) in physiological and pathological responses. This project aims to develop a disc-on-a-chip device, a miniature IVD model, using a microfluidic-based gradient device co-cultured with cell-encapsulated hydrogel to mimic the heterogeneous structure of the IVD consisting of nucleus pulposus (NP) annulus fibrosus (AF) and sensory neurites of dorsal root ganglion (DRG).

Methods: Using a 3D printing approach, we fabricated a microfluidic device by casting PDMS into a 3D-printed mould. After plasma treatment with oxygen, the device was placed on a microelectrode array glass. To create a 3D microenvironment of the IVD, we printed NP and AF cells and DRGs onto the device, either with a collagen or hyaluronic acid hydrogel, using a 3D bioprinter. The microfluidic device was computationally simulated using COMSOL software for the shear stress and fluid velocity. The cell viability, metabolic activity and phenotypic markers of AF and NP will be observed. The sensory neurite of DRG and local field potential will be measured.

Results: We successfully designed the disc-on-a-chip, comprising the NP, AF and sensory regions. Computational simulation revealed shear stress was increased with increasing pressure. Fluid velocity was also increased in response to higher pressure. The metabolic activity of AF and NP was higher. The cell viability indicated a homogenous distribution of cells in the hydrogel system within the device. The expressions of SOX9, ACAN, COLII, COLI and FN indicated phenotypic markers for the NP and AF. The expressions of peripherin and PGP9.5 indicated sensory neurites.

Conclusion: These findings suggest that disc-on-a-chip mimics the 3D microenvironment of the IVD, which could be employed for disease modelling and therapeutic testing.

Funding: Health Research Board, Ireland.

Keywords: Low Back Pain, Disc-on-a-Chip, Microfluidic, 3D Printing, Bioprinting

A-0523

Placental Modifications Secondary to Maternal Hyperglycaemia Resulted in Impaired Pregnancy Outcomes

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Purpose: Hyperglycaemia affects 17.5% pregnancy in Malaysia, twice higher than global data. Its sequelae include intrauterine growth restriction, macrosomia, foetal death, neonatal respiratory distress syndrome, neonatal hypoglycaemia and many more. This study aimed to investigate placental response towards hyperglycaemia at mid- and late gestation so that appropriate inteventions may be introduced at the right time.

Methods: Pregnant Sprague-Dawley rats were injected with 45 mg/kg body weight of Streptozotocin intraperitoneally (i.p) on gestational day (GD) 7 to induce hyperglycaemia. Control (Con) animals received i.p injection of 1 mL citrate buffer vehicle. Hyperglycaemia was confirmed at GD13. Maternal weight, food intake and blood glucose levels were monitored regularly. At GD15 (mid-gestation) and GD21 (term), foeto-placental units were collected, inspected and weighed. Placentas were processed for morphological and stereological analyses.

Results: STZ animals had 39% reduced pregnancy weight gain despite a 27% increased food intake. At mid-gestation, hyperglycaemic (STZ) placenta showed increased efficiency with no foetal resorption but at term, this group demonstrated 28% reduction in placental efficiency and 14% increased foetal resorption. The junctional zones (JZ) of STZ placentas showed one-fold increased glycogen cells (GCs) deposition at GD15, which doubled at GD21. Maternal vascular spaces (mvs) in the labyrinth zone (LZ) of STZ groups were also reduced by 60% as the pregnancy progressed from GD15 to GD21.

Conclusion: Maternal hyperglycaemia impaired pregnancy weight gain despite hyperphagia. It altered placental architecture via increased GCs deposition in the JZ and altered vascular remodelling in the LZ. These may have led to placental insufficiency and manifested as increased foetal resorption and reduced foetal body weight. Placenta was able to resist the effects of hyperglycamia at mid-gestation but this ability was obliterated following a long-term exposure. These findings therefore suggested that timely intervention is important in hyperglycaemic pregnancy to prevent a potentially irreversible structural changes in the placenta.

Funding: Fundamental Research Grant Scheme, Ministry of Higher Education, Malaysia.

Keywords: Placenta, Hyperglycaemia, Histology, Pregnancy, Glycogen cells

A-0547

Targeting HSP90 Alters the Proteasome System in Colon Cancer Cells and Enhances Their Immune Recognition

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Purpose: Colorectal cancer is constantly associated with high mortality rate worldwide. Despite the ceaseless efforts to update the treatment protocol for colorectal cancer, the treatment options have high failure rate and recurrence chances. Heat shock protein 90 (HSP90) is a ubiquitously expressed chaperone that plays a critical role in regulating the expression level of proteins that are essential for many cellular processes. 26S proteasome is known to be regulated by HSP90. Cancer cells, including colon cancer ones, are addicted to intensifying the expression of 26S proteasome subtype in order to increase their survival and tumorigenesis. We hypothesized in this study the possible changes in proteasome system in colon cancer cells after inhibiting HSP90.

Methods: RKO colon cancer cells were used in our study. These cells were treated with a potent HSP90 inhibitor; AT13387. Different doses of AT13387 were used. The 26S proteasome activity and the protein levels of 26S proteasome-related subunits were measured using Fluorogenic substrate, Western blotting, and immunostaining. The immunoproteasome activity and its specific subunits were also detected using Fluorogenic assay, Western blotting, and immunostaining. Furthermore, HLA-DR was measured after treating RKO cells with AT13387.

Results: Our results showed for the first time that inhibiting HSP90 caused the downregulation in the activity of 26S proteasome and the protein expression of PSMD4 and PSMB5. On the other hand, immunoproteasome activity and the protein expression of its related subunits; PA28α, LMP2, LMP7, and MECL-1 were significantly upregulated in AT13387 treated

RKO cells. Consequently, the expression of the immunogenic marker; HLA-DR was substantially elevated on the surface of AT13387 treated RKO cells causing their detection by peripheral blood mononuclear cells (PBMCs).

Conclusion: Targeting HSP90 in colon cancer cells, particularly the poorly differentiated type, induced changes in the proteasome system and increased their immune recognition.

Funding: The Deanship of Scientific Research, Yarmouk University, Jordan (Grant # 29/2021 and Grant # 13/2022).

Keywords: RKO cells, HSP90, 26S proteasome, Immunoproteasome, Survival

A-0646

Efficacity of a Traditional Kaolinite-Based Ceramic Implant Lokpo on Bone Regeneration in Aging Rats Pilot Study

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Purpose: To show the effects of a traditional ceramic rich in aluminium oxide, "Lokpo", on bone regeneration in a critical size defect of the calvaria of aging rats.

Methods: Critical size bone defects were surgically created on the calvaria of eighteen Sprague-Dawley aging rats. Subsequently two groups of nine rats were formed. The bone defects in the first group were filled with "Lokpo" while those in the second group were left empty. A comparision of bone neoformation was performed using reverse transcription polymerase chain reaction (RT-qPCR), ex-vivo radio-visio-graphy (RVG) and demineralized histology after seven, thirty and ninety days of follow-up, respectivly.

Results: At day seven, RT-qPCR showed supptession of precursor genes for osteoblast differenciation in Lokpo-filled defects. At days thirty and ninety, a significant reduction of Lokpo-filled bone defects was observed at ex-vivo RVG. The demineralized histology technique confirmed the presence of bone neoformation in the critical-sized bone defects filled with "Lokpo", which was non-existent in the control group.

Conclusion: This preliminary work demonstrates the effectiveness of "Lokpo" on bone regeneration, particularly craniofacial regeneration. It could be, with further studies, an alternative to the Bioglass 45S5, which is the gold standard of osteo-conductive biomaterials to replace autografts.

Keywords: Bone regeneration, Sprague-Dawley rat, Aluminium oxide

A-0723

Effect of Late Prenatal THC Exposure on Placenatal Morphometry and Morphology in Wistar Rats

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Purpose: this experiment is aimed at examining the effect of late prenatal exposure of THC in the placental morphology of rat.

Methods: A total of 18 rats, comprising 6 males and 12 females designated for mating, were obtained from a certified institute with weights ranging from 120kg to 150kg. Rats were grouped into control and experimental groups. Pregnant experimental group was administered 150mg/Kg body weight of THC at their Late phase (from 15th day of gestation) till day 19 of gestation. The placentae were harvested by performing a caesarean section, followed by measurement of placentae morphometry and tissues taken for H&E. The data was expressed as means ± SEM. Statistical analysis was performed using GraphPad Prism software version 5.0 with the significance level of $p < 0.05$.

Results: The result showed that the ingestion of THC during the late prenatal phase has its own impact. The placental weight, thickness and diameters of control and experimental animals were (0.468±0.017; 0.403±0.027), (0.354±0.021; 0.386±0.039), (1.264±0.041; 0.403± 0.027) and (1.230±0.047; 0.95±0.039) respectively. It was statistically significant at $P<0.05$.

Conclusion: The effect of late phase THC administration was observed on the placentae morphometry leading to less

functionality of the placentae. Further studies should be carried out for more knowledge.

Keywords: Marijuana, Placenta Morphometry, Placenta Morphology, Delta-9-tetrahydrocannabinol (THC)

A-0761

High BMP4 Expression Enhances the Capacity of Human Adipose-Derived Stem Cells (ADSC) for Corneal Differentiation

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Purpose: Adipose-derived stem cells (ADSCs) are mesenchymal stem cells (MSCs) found in human fat tissues. ADSCs showed promising potential as an alternative source for tissue engineering toward ectodermal lineage cells such as corneal epithelium. One of the key pathways involved in corneal differentiation is bone morphogenetic protein 4 (BMP4) signaling. This study evaluated the levels of basal BMP4 expressions in primary human ADSCs from subcutaneous and visceral adipose tissue depots and its correlation with the differentiation capacity towards corneal epithelial-like cells following the co-culture method.

Methods: Primary human subcutaneous and visceral ADSC samples were isolated from six women who underwent elective caesarean section. Isolated ADSCs underwent MSC characterisation followed by a 15 days differentiation period. The differentiation method involved co-culturing the ADSCs with telomerase-immortalised human corneal epithelial (hTCEpi) cells. Undifferentiated primary ADSCs were used as negative control. The expressions of BMP4, OCT4, CK3 and ABCG2 were assessed on several time points during the differentiation period. Immunocytochemistry was done to assess the CK3 and ABCG2 proteins expressions on day 15.

Results: Visceral ADSCs was found to expressed a significantly higher BMP4 compared to those from subcutaneous depot. Higher CK3 expression showed by the visceral ADSCs on day 9 and 15 of differentiation compared to the undifferentiated control. In contrast, the ABCG2 expression in visceral ADSCs was lower compared to the undifferentiated control. Additionally, OCT4 expressions were decreased in both ADSCs at the end of differentiation. Immunochemistry analysis on day 15 showed that the number of CK3-positive cells in visceral and subcutaneous ADSCs were similar. In addition, ABCG2-positive cells in visceral was lower compared to the subcutaneous ADSCs.

Conclusion: These findings suggest that higher BMP4 expression in visceral ADSCs correlates with higher differential capacity towards corneal epithelial-like cells as seen in the high CK3 gene expression.

Funding: This research is funded by Faculty of Medicine, University Kebangsaan Malaysia.

Keywords: ADSC, Subcutaneous, Visceral, BMP4, CK3

A-0915

Glia-Like Cells Induced from Human Mesenchymal Stem Cells Exhibit Enhanced Therapeutic Effects for the Sequelae of Cerebral Infarction

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Purpose: The escalating incidence of stroke, predominantly cerebral infarction, poses a substantial burden, with a considerable proportion of patients experiencing severe neurological aftereffects. However, effective treatments for chronic cerebral infarction are lacking. While stem cell therapy holds theoretical promise for brain regeneration and plasticity, clinical trials, particularly involving mesenchymal stem cells (MSCs), have fallen short of demonstrating significant therapeutic efficacy. Therefore, exploring additional strategies to augment MSC potential or therapeutic efficacy may yield significant advancements in MSC applications, presenting enhanced clinical opportunities in the future. This study aims to explore the therapeutic potential of glia-like cells induced without genetic modifications from hu-

man mesenchymal stem cells (ghMSCs) in alleviating chronic sequelae resulting from cerebral infarction.

Methods: Transcriptomic analysis revealed the acquisition of neuroprotective astrocytic characteristics by ghMSCs. Both ex vivo simulations using organotypic brain slice cultures and in vivo experiments demonstrated superior neuroregenerative and neuroprotective effects of ghMSCs compared to hMSCs.

Results: The dose-dependent efficacy of ghMSCs in restoring neurobehavioral functions and reducing chronic brain infarction were also observed. The observed beneficial effects were attenuated by a CXCR2 antagonist, implicating the involvement of the CXCR2 signaling pathway in mediating these effects.

Conclusion: In conclusion, this study suggests the potential of ghMSCs in treating refractory sequelae resulting from chronic cerebral infarction, with CXCR2 playing a crucial role in the underlying therapeutic mechanisms.

Funding: This research was supported by the Korea Health Technology R&D Project through the Korea Health Industry Development Institute (KHIDI) funded by the Ministry of Health & Welfare, Republic of Korea (Grant No: HI20C0253, HU21C0113 and HU21C0007), and by the National Research Foundation of Korea (NRF) grant funded by the Ministry of Science and ICT (MSIT) (Grant No: 2019R1A2C1087192, 2022R1A2C1091804 and RS-2023-00278819).

Keywords: Cerebral infarction, Glia, Mesenchymal stem cell, Neuroregeneration, Neuroplasticity

[D. Biological Anthropology]

A-0039

Sex Estimation Using Dimensions around the Metatarsal Diaphyseal Nutrient Foramen in South African Population: Application of Discriminant Function Analysis and Logistic Regression Models

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Purpose: In light of the high number of murder cases in South Africa, it is important to develop new population-specific sex estimation standards for the identification of human remains in forensic settings. The metatarsal bones have been used previously, but the dimensions around the diaphyseal nutrient foramen have not been utilised in sex estimation. The current study aimed to determine the usefulness of the dimensions around the nutrient foramen of metatarsal bones in estimating sex in the South Africans of European descent (SAED).

Methods: Five measurements around the nutrient foramen were taken from a total of 876 metatarsal bones (first to fifth) from 186 individual skeletons (99 males, 87 females) of known sex and population affinity. Measurements subjected to direct and stepwise discriminant function (DFA) and logistic regression (LRA) analyses included total length, distance from proximal end to nutrient foramen, circumference, and mediolateral and dorsoplantar diameters at the level of the nutrient foramen.

Results: All measured parameters showed significantly higher means in males compared to females across all metatarsal bones ($p<0.05$). Classification accuracies associated with univariate discriminant functions ranged from 56.4-79.7%. The original classification accuracies for multivariate functions of the stepwise and direct DFA ranged from 83.1-88.3% and 85.5-88.3%, respectively. The original classification accuracies for multivariate functions of the stepwise and direct LRA ranged from 83.3%-88.7% and 86.2%-88.3%, respectively. The cross-validation classifications showed a drop of 0-2.4% for DFA and 0.2-1.1% for LRA. Males were classified with higher accuracies throughout. The width measurements were better predictors of sex than length measurements.

Conclusion: The dimensions around the metatarsal bone nutrient foramen exhibit sexual dimorphism in the SAED. The generated DFA and LRA functions from the dimensions around the nutrient foramen produced high average classification accuracies which are useful in sex estimation during forensic human identification.

Funding: This study was undertaken with funding from the Smieszek fellowship (2022, 2023) and the University of the Witwatersrand Faculty research grant (2023) awarded to Arthur Manjatika.

Keywords: Metatarsal bones, Diaphyseal nutrient foramen, Discriminant function analysis, Logistic regression analysis, Sex estimation

A-0068

Digitalization of Forensic Anthropology: Sexual Dimorphism of Frontal Sinus via Geometric Morphometric in Malaysia

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Purpose: Biological profiling is necessary for skeletonised remains. The estimation of biological sex is of paramount relevance in the analysis of skeletal remains recovered in forensic contexts. The traditionally used linear measurement has low reliability and size- oriented, whereas geometric morphometric (GM) is reliable in characterising the shape. However, studies of frontal sinus (FS) among Malaysians using GM method for sexual dimorphism are unexplored. This study aims to assess sexual dimorphism for forensic identification purposes, from Malaysian population, and a depiction of the size- and shape-related sexual dimorphism of the frontal sinus using geometric morphometrics approaches.

Methods: Skull radiographs of 504 adult Malaysians comprising males and females of Malay, Chinese and Indian races aged of ≥20 years old, were retrieved from University Malaya Medical Centre. FS patterns were descriptively classified according to its existence, symmetrical, dominance and lobulations. Then, eight landmarks were applied to the radiographs using TPSDig2 software. GM analysis including Principal component (PC) analysis, Procrustes analysis of variance ANOVA, canonical variates analysis (CVA) and discriminant function analysis (DFA), were performed using MorphoJ software.

Results: Bilateral presence of FS is common (95.4%). The first three PC exhibited 83.0% variation. ANOVA revealed significant differences in centroid size and shape of FS between different sex. DFA demonstrated average classification accuracy of 80.6% for sex estimation.

Conclusion: FS is a valuable tool for sex identification. This is the first such study looking at the FS for profiling amongst Malaysian population.

Keywords: Frontal Sinus, Sexual Dimorphism, Geometric Morphometric, Forensic Anthropology, Malaysian Population

A-0172

Frontal Sinus Anterior Wall Thickness amongst Malaysians: A Colour-Mapping Gradient Effect Method for Forensic Anthropology Application

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Purpose: The well-preserved frontal sinus (FS) anterior wall is crucial for identifying unknown skeletal remains. Traditional osteometry, relying on calliper measurements on the bone, limits internal skeletal evaluation. Imaging offers internal structural evaluation. Two-dimensional radiographs cause superimposition, while three-dimensional (3D) imaging eliminates overlapping issues. Prior studies lacking of comprehensive thickness of FS anterior wall, specifically in Malaysian population, prompting a shift to thickness evaluation with new approach of colour-mapping (CM) for both quantitative and qualitative assessments. Therefore, we aimed to evaluate 3D FS anterior wall thickness with CM's applicability in relation to sex, race, and age in Malaysia.

Methods: We retrieved 393 head computed tomography (CT) scans comprising males and females of Malay, Chinese and Indian aged ≥20 years old. The 3D FS anterior wall models were reconstructed from CT scans using 3DSlicer. CM techniques visually assessed the thickness distribution pattern across the surface area. Five types of grids with 12 regions of interest (ROIs) each covering superior, body and inferior region were developed and applied onto the FS area. Thickness measurements (mm) within 12 ROIs were recorded.

Results: Statistical analysis revealed significant thickness variations among sex and age groups. Thickness was generally highest in females, Chinese, and the old adult age group. CM demonstrated consistent thickness patterns across sex, race, and age groups, with the thinnest at the superior region, increasing towards the body, and thickest at the inferior region.

The 12 ROIs showed varying thickness, with the superior-central being the thinnest, lateral thicker, and inferior the thickest.

Conclusion: The thickness analysis using 3D FS anterior wall model with CM is reliable for sex and age estimation of Malaysians, highlighting the potential in forensic anthropology application.

Keywords: Frontal Sinus Anterior Wall, Colour Mapping, Forensic Anthropology, Malaysian Population, 3D Model Reconstruction

A-0186

Exploring Sexual Dimorphism in Pubic Symphyseal Surface: Utilization of Three-Dimensional Statistical Shape Modeling

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Purpose: While age estimation methods for the pubic symphyseal surface have been developed separately for males and females, there is still a lack of clear indication regarding the specific anatomical locations that exhibit sexual dimorphism. The purpose of this research is to illustrate morphological differences in the pubic symphyseal surface between sexes, utilizing statistical shape modeling to comprehensively capture intricate details.

Methods: The analysis utilized 3D pubic symphyseal data from CT scans of a total of 252 cadavers, evenly distributed between modern Korean adult males and females (126 each). CT images underwent post-processing, and the data is analyzed using the ShapeWorks. Morphological differences between sexes were visualized using vector data, and statistical significance was assessed using Hotelling's T-squared test ($p<0.05$).

Results: The sexual dimorphism of the pubic symphyseal surface, spanning all age groups, reveals narrower width and a more pointed superior point (or border) in females. Notably, females exhibit increased prominence of the symphyseal surface, particularly in lower half. The morphological differences in the pubic symphyseal surface between males and females are minimal in their 20s, gradually increasing with age and peaking in their 50s. Beyond the age of 60, the morphological differences persist but diminish in magnitude. Remarkably, in the least sexually dimorphic group, the 20s, there is minimal disparity in the overall width or contour of the symphyseal surface. However, a distinct prominence is observed in the ventral margin of the symphyseal surface in females.

Conclusion: This study provides significant insights into sex-specific differences in the pubic symphyseal surface, emphasizing the utility of statistical shape modeling in biological, and forensic anthropology. Moreover, it lays the groundwork for developing sex-specific age classification model for the Korean population.

Funding: This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) in 2023. (2018R1A5A7023490).

Keywords: Pubic Symphyseal Surface, Sexual Dimorphism, Statistical Shape Modeling

A-0217

How the State of the Dentition Impacts the Morphology of the Human Maxilla in a South African Population

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Purpose: Tooth loss reduces loading forces on the surrounding bone and results in resorption across the craniofacial bones. While craniofacial morphology has been extensively studied in dentate and edentulous individuals, a paucity of information exists around the impact of partial edentulism on the maxilla. Thus the aim of this study was to investigate whether the state of the dentition affects the morphology of the maxilla in a South African population.

Methods: Skulls were sourced from 456 individuals aged between 13 and 85 years from the Raymond A. Dart Collection of Human Skeletons in the School of Anatomical Sciences, University of the Witwatersrand. The study sample was divided into three groups: dentate (n=65), partially edentulous (n=211) and edentulous individuals (n=80). These groups were further divided into males and females. A Microscribe G2 was

used to digitize 26 fixed and floating landmarks on the maxilla. The co-ordinate data was used to assess the effects of tooth loss on the size and shape of the general maxilla and changes in size and shape between males and females across the states of the dentition.

Results: Edentulous maxillae were smaller across all the linear measurements and appeared to have a shorter facial profile, narrower alveolar arch and were less prognathic, owing to a shorter basion-prosthion length, when compared to dentate and partially edentulous individuals. Those partially edentulous individuals with an absent anterior dentition had a shorter anterior alveolar arch and upper facial height when compared to partially edentulous individuals in which the anterior dentition was present. The maxilla of males across all the states of the dentition were shown to be larger than females, with the exception of their alveolar arch height.

Conclusion: Tooth loss resulted in bone resorption and affected the entire morphology of the maxilla, with the most noticeable shape and size changes occurring in edentulous individuals.

Keywords: Edentulous, Dentate, Maxilla, Partial edentulism

A-0275

The Effects of Marabunta (Army Ant) Invasion on Post-Mortem Interval (PMI) Estimation of Carcasses on Soil Surface of Okuku, Cross River State, Nigeria

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Purpose: This study investigated the activities of Marabunta (army ant) on porcine carcasses in clandestine and open soil surface at Okuku, Nigeria in order to understand its contribution to PMI estimations in this region.

Methods: Four pigs weighing between 18kg and 20kg were used for this study. Two were placed under densely covered trees and other two were placed in open soil surface. Carrions were placed about 20m apart and metal cages were used to protect them from aerial and land scavengers.

Results: Swarm raids of army ant invaded one of the carrions placed under the shade 24 hours post-mortem, and this progressed for about 10 days delaying decomposition. However, the three remaining carrions followed already established decomposition stages in this region and reached mummification / skeletonization by the fifteenth day. The army ants significantly slowed down the decomposition rate by preventing other insects from gaining access and ovipositing on the carrion. It was further observed that the aggressive and predatory foraging behaviour of the army ants left some forensically relevant impressions on the carrion after the army ants abandoned it on the eleventh day. The most striking feature left behind was the irregular serpiginous scalloped areas of superficial skin lesions; and fenestrated and gnawed holes on the carrion's skin which could easily be misinterpreted by an inexperienced forensic expert as ante-mortem or perimortem abrasions. There was also absence of the pungent repugnant smell that is normally characteristic of advanced decomposition stage.

Conclusion: Findings from this study showed army ants secrete fluids probably formic acid which delays decomposition rate. These data have provided more insight in understanding the complexities and variations that exist in PMI estimations of this region.

Keywords: Army Ants, Carrions, Forensic Entomology, Forensic Taphonomy, Post-mortem Interval

A-0290

Reliability of Three-Dimensional Computed Tomography (3DCT) in Obtaining Population-Specific Data from the Femur for Sex Estimation in Black South African Population

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Purpose: When different populations of the human species are exposed to similar environmental factors, they may exhibit a similar pattern of growth characteristics and these changes may undergo a transition over time. Other bones such as the

pelvis and skull have been shown to demonstrate better sexual dimorphism which is an advantage in forensic studies. However, in a forensic scenario, the femur could be the only preserved bone. Correct sex estimation is important in the identification of an individual because it narrows the matching possibilities and guarantees the certainty by which sex-specific parameters can be correctly estimated.

Methods: The CT records of the right femur of 280 Black South Africans (50% sex ratio) that are stored in the Radiology Department of Charlotte Maxeke Johannesburg Academic Hospital, Johannesburg, South Africa were assessed. The Xiris and IntelliSpace software was used to reconstruct the images into two-dimensional (2D) and/or three-dimensional (3D) formats of the bone from which measurements were taken. Equations for sex estimation that have been previously derived using femoral measurements obtained by direct osteometry from the same population group, were tested using data from the current study.

Results: Though previous equations presented some sets of average classification accuracies that were considered satisfactory, however, since the present study utilized a CT-scan approach on a contemporary population, new sex-estimation equations were derived using the discriminant function analysis. The new equations yielded high average sex classification accuracies of 65.0% to 82.9% for univariate and 79.30% to 84.30%, for multivariate analyses.

Conclusion: The results indicate that population-specific femoral measurements obtained by CT are more reliable than those obtained by direct osteometry from the same population group. The high average classification accuracies show that the femur has a high sexual dimorphism and as such, is very relevant to forensic applications.

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Keywords: Sex-estimation, Black-South-Africans, Femoral-measurements, Computed-Tomography, Discriminant-function-analysis

A-0352

Ancestry Estimation of the Skull in Indonesian and Thai Populations by Using Morphometry

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Purpose: This study aimed to estimate ancestry more specifically in Indonesian and Thai populations using skulls.

Methods: The sample consists of adults aged 18 to 60 years, with a total of 255 samples (91 Indonesian skulls and 164 Thai skulls). The samples with normal conditions, exclude samples with pathological conditions affecting the skull or fracture. The method in this study uses morphometrics by taking measurements of the skull with specified landmarks. The variables studied include cranial measurements, facial measurements, nasal measurements, orbital measurements, and mandible measurements, for a total of 48 parameters. The data analysis techniques used were comparative statistics with t-test analysis.

Results: The results showed that there were significant differences between the Indonesian and Thai populations. 31 and 32 parameters were significantly different in females and males, respectively. The best parameter of this research is nasal measurement; only the al-al (alare to alare) variable was not significant in the male and female samples.

Conclusion: In conclusion, the skull measurements can be used to estimate ancestry for both males and females in Indonesian and Thai populations. Through the results of this study, it is necessary to develop a more specific identification method for each population considering that even in one ancestry group, certain parts such as the nose have significant differences. Because in each population there are human variations that can be formed from biological growth and development processes and environmental influences.

Keywords: Forensic anthropology, Skull, Ancestry, Thailand, Indonesia

A-0443

Collecting Three-Dimensional Model Data of Ancient Skeletons in Mahan and Baekje Region for Further Research

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Purpose: This study aims to secure data for analysis of physical attribute of Baekje's capital and regional residents during Three Kingdoms Period.

Methods: We made a list of excavational details (archive institutions, residual status, analysis availability) of Mahan and Baekje region (Gyeonggi, Chungcheong, and Jeolla) in the Three Kingdoms Period. Then we excluded skeletons of 5 archaeological sites that are in poor condition or from different era, or loan of the skeletons is prohibited, among 33 archaeological sites. Since 3D models of skeletons excavated from 3 sites had been procured beforehand, in effect, the skeletons of 25 sites were loaned, scanned, and remodelled. The regional distribution of excavation was 1 site in Seoul, 18 sites in Chungcheongnam-do, 2 sites in Jeollabuk-do, and 7 sites in Jeollanam-do.

Results: The next step of this study was scanning computed tomography (CT) and rendering three-dimensional (3D) models of available skeletons to build 3D skeletal model database. The result 151 Mimics project files composed of 2,550 Skeletal object files. Object files that are feasible for forensic anthropological assumption were: 48 object files for sex, 2 object files for age and 12 object files for facial approximation.

Conclusion: We expect this study will contribute vitalization of archaeological skeletons by integration of distributed data. This study not only writing an inventory but also provided 3D models to understand morphologically important features and to invigorate future research. In addition, as an example of system deployment consisted morphological database and ancient skeletal storage, the result of the study would suggest direction of national or other regional scale.

Keywords: Mahan and Baekje, Three Kingdoms Period, Computed tomography, Three-dimensional model

A-0447

Sexual Dimorphism from Twelfth Thoracic Vertebra (T12) on CT Scan: A 3-Dimensional Geometric Morphometric Approach

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Purpose: Recent anthropological research has focused on various human skeletal elements to estimate biological profile and aid in forensic identification. Exploration of less commonly used bones also important for personal identification of an unknown individual. The last thoracic vertebra has been reported sexually dimorphic by conventional morphometric method. Geometric morphometry has emerged as a beneficial tool in assessing shape variations in the human skeleton. This study aimed to explore sexual dimorphism of twelfth thoracic vertebrae (T12) using computed tomography (CT) scan by geometric morphometric in Malaysian population.

Methods: CT scan of 391 subjects comprising 192 males and 202 females of known individuals were collected retrospectively. The samples were adult Malaysian population aged from 18 to 69 years old. Forty landmarks were applied on digitalised CT scan using Stratovan Checkpoint software. Geometric morphometric analysis was performed by MorphoJ software.

Results: The results showed that the first ten principal components (PC) contributed to 51.6 % of the 12th thoracic vertebra variation. Procrustes ANOVA indicated that the centroid size and shape were significantly different ($p<0.05$) between sexes. Canonical variate analysis (CVA) revealed that there is a significant difference in Mahalanobis and Procrustes distances. Discriminant function analysis (DFA) after cross-

validation demonstrated 86.5% classification of sex with accuracy rates of 89% for males and 84% for females.

Conclusion: This study revealed T12 is sexually dimorphic among Malaysians, highlighting the potential of geometric morphometrics to provide valuable insights into skeletal variations.

Keywords: Sex, Thoracic vertebrae, Geometric morphometric, Forensic Anthropology

A-0530

An Analogous Organ of Myodural Bridge in Fishes and Amphibians: An Anatomical Structure Related with the Circulation of Cerebrospinal Fluid

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Purpose: The myodural bridge (MDB) was described as a dense fibrous tissue connecting the suboccipital musculature with the spinal dura mater in human studies. Now, the concept of the MDB was perceived as an exact anatomical structure presumably essential for critical physiological functions in the human body and might exist in other vertebrates as well. To determine the existence of the MDB in other vertebrates and to lay a foundation for the functional study, representatives in amphibians and four different Pisces were examined.

Methods: Histological sections of amphibians and fishes were observed based upon three different sides.

Results: It was found that the dense fibrous tissue connected the interarcuales muscle (IAR) and the spinal dura mater through the dorsal atlanto- occipital interspace in the Xenopus laevis. Dense fibrous connections between the muscle and the vertebral canal membrane were shown by Masson staining in four kinds of fish. These observed connective tissues were similar to the MDB previously described in other vertebrates. It is presumed that the MDB- like structure would transmit forces of contraction from muscles to the vertebral canal membrane, impacting the cerebrospinal fluid circulation.

Conclusion: This study proves that the MDB structure as an analogous organ is a universal existence in amphibians and fishes. We proposed that the MDB is an evolutionally universal and conserved structure in vertebrates. Thus, this study could provide insight into our understanding of the universal normal anatomical structure of the MDB as an analogous organ in vertebrates.

Keywords: Myodural Bridge, Vertebrate, Amphibians, Pisces

A-0541

3-Dimensional Geometric Morphometrics Revealed Malaysian First Rib Sexual Dimorphism

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Purpose: The objective of this study is to explore the sexual dimorphism of the first rib utilizing a 3-dimensional geometric morphometric approach within the Malaysian population.

Methods: Computed tomography (CT) scans of 376 individuals (187 males and 189 females) from a known Malaysian population aged 18 to 69 years were retrospectively collected. Seventeen landmarks were placed on the right first rib in digitalized CT scans using Stratovan Checkpoint software, followed by geometric morphometric analysis conducted using MorphoJ software.

Results: The findings indicated that the initial ten principal components (PCs) accounted for 81.18% of the variability observed in the right first rib. Procrustes ANOVA demonstrated significant differences ($p < 0.05$) in both centroid size and shape across sexes. Canonical variate analysis (CVA) further highlighted significant differences in Mahalanobis and Procrustes distances between sexes. Discriminant function analysis (DFA), following cross-validation, yielded a sex classification rate of 84.64%, with accuracies of 82.81% for males and 86.47% for females.

Conclusion: In summary, the discovery of sexual dimorphism in the right first rib among Malaysians highlights the effectiveness of geometric morphometrics in improving sex determination accuracy. This has significant implications for forensic investigations and our understanding of population demographics.

Funding: LESTARI grant (600-RMC/MyRA 5/3/LESTARI (128/2020)).

Keywords: Sex estimation, Geometric Morphometric, Forensic Anthropology, First rib

A-0584

A Technical Forensic Protocol for 3D Observation and Documentation of Human Decomposition

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Purpose: The changes that occur to the human body after death reflect a multitude of complex biological processes, which can be impacted by many variables that are not yet fully understood. Typically, information is obtained through in-situ examination and/or 2D data collection, which may restrict the availability of data and prevent the collection of valuable information. To address this gap, the aim is to present a protocol for 3D data collection of human decomposition in remote outdoor environments, providing preliminary results of human decomposition in 3D. The objectives include presenting an approach and framework using wildlife cameras, and to perform 3D observation and analysis of a decomposing body.

Methods: The method includes the design and construction of a walk-in cage, including five frames holding 30 cameras, installed at the Australian Facility for Taphonomic Experimental Research. Preliminary trials completed on human subjects in Zurich and Sydney provided promising results through the generation of a 3D model, in which movement of the donor was also recorded and examined.

Results: Comparing the 3D model generated from wildlife cameras with a high-quality 3D model showed only minor discrepancies of deviation between the models. The wildlife camera showed only small discrepancies (up to 0.5cm) between the DSLR and the wildlife model. Problematic areas show up to a 2cm deviation from the highly accurate model, at the boundary line between body and ground surface. No part of the donor was indicated to have a large deviation of 2cm or more.

Conclusion: This study demonstrated that 3D documentation of human decomposition in an uncontrolled, remote, outdoor environment, using a wildlife based photogrammetric system is possible, and that it is a promising tool for forensic taphonomic researchers. Improving our knowledge of human decay has the potential to assist investigations requiring post-mortem interval estimations.

Keywords: Forensic Anthropology, Forensic Taphonomy, Digitisation, Decomposition, Photogrammetry

A-0837

A Comparative Study of Micromorphological Characteristics of the Uncinate Process of Cervical Vertebrae in Adult Humans and Macaques

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Purpose: This study aims to compare the microstructure and morphometric parameters of uncinate process trabecular bone between adult humans and macaque using micro-CT, and that provides a foundation theory for advancing the understanding and potential treatment of cervical spondylosis.

Methods: We employed micro- CT to examine specimens of adult human and macaque C3 C7 cervical vertebrae. Morphological parameters of the trabecular bone of the uncinate processes were measured, and differences between them were compared.

Results: The trabecular bones within the uncinate processes of the human cervical vertebrae were intricately criss-crossed, predominantly in the longitudinal direction, and seamlessly transitioned into the trabecular bone within the vertebral body, whereas that of the macaque displayed a grid-like pattern with no obvious regularity. Significant differences

were observed in trabecular thickness (Tb.Th), connectivity density(Conn.D), bone surface/total tissue volume (BS/TV), BS/bone volume (BV) of the uncinate processes between the sides of the human cervical vertebrae ($P < 0.05$), and in BS and BV/TV of those between the sides of the macaque cervical vertebrae ($P < 0.05$). The peak values of all parameters of the uncinate processes in the human specimen were predominantly concentrated in the C4 6 region, with no significant difference observed with increasing vertebral sequence ($P > 0.05$). All parameters, except the Tb.Th ($P > 0.05$), of the uncinate process, were significantly different between the adult human and macaque cervical vertebrae.

Conclusion: Micro-CT technology allows for observing microscopic morphological features of the cervical vertebra's uncinate process between adult humans and macaques. Quantitatively comparing the morphometric differences in the trabecular bone of the uncinate process between human adults and macaques provides a theoretical basis for preventing and treating cervical spondylosis.

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Keywords: Uncinate process, Morphological characteristics, Micro-CT, Trabeculae bone, Adults and macaques

A-0847

Anatomical and Physiological Adaptations: Aquatic vs. Terrestrial Mammals

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Purpose: This study aims to elucidate the anatomical adaptations of aquatic and terrestrial mammals through a comparative analysis of skeletal morphology, respiratory physiology, thermoregulatory mechanisms, and locomotor structures. By examining these adaptations, our objective is to deepen our understanding of evolutionary processes and ecological interactions shaping mammalian diversity.

Methods: Literature searches were conducted using academic databases such as PubMed, Google Scholar, and Web of Science. Keywords including "aquatic mammals," "terrestrial mammals," "comparative anatomy," and specific anatomical terms (e.g., "skeletal structure," "respiratory system") were employed to identify relevant peer-reviewed articles, books, and scholarly resources. The search strategy prioritized studies published in reputable scientific journals and books authored by experts in the field of comparative anatomy.

Results: The literature review revealed intriguing insights into the anatomical adaptations of aquatic and terrestrial mammals such as: reduced limb elements and modified vertebral structures conducive to efficient swimming, prolonged underwater breath-holding, including enlarged lung capacities and enhanced oxygen storage mechanisms, blubber and vascular adaptations in aquatic mammals for maintaining body temperature in cold water environments, diverse appendages optimized for swimming propulsion in aquatic mammals and versatile terrestrial limb structures enabling terrestrial locomotion in diverse habitats.

Conclusion: Through an extensive literature review, this study has highlighted the remarkable anatomical adaptations distinguishing aquatic and terrestrial mammals. The synthesis of findings underscores the evolutionary versatility of mammalian biology in adapting to diverse habitats. Insights into skeletal morphology, respiratory physiology, thermoregulation, and locomotor adaptations shed light on the functional strategies employed by mammals to thrive in aquatic and terrestrial environments. This comparative analysis deepens our

appreciation for the interconnectedness of life and the adaptive mechanisms that drive biological diversity. Further research in this area is essential for elucidating the evolutionary processes shaping mammalian form and function, with implications for conservation and ecological management.

Keywords: Comparative anatomy, Aquatic mammals, Terrestrial mammals, Skeletal adaptations, Respiratory physiology

A-0923

Vomeronasal Organ: Do Baleen Whales Have It?

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Purpose: Baleen whales (mysticetes) have two depressions on the upper lip undersurface at the rostral tip. It is hypothesized that they lead to a vomeronasal organ (VNO) for chemoreception (e.g., to detect pheromones), similar to closely related artiodactyls.

Methods: Eight species of mysticete whales were examined post mortem from fresh beach-stranded carcasses. Access to samples was provided by the Marine Mammal Health and Stranding Response Network (Atlantic Marine Conservation Society, NY, Marine Mammal Stranding Center, NJ, Mystic Aquarium, CT), San Diego State University, the Smithsonian Institution (US National Museum of Natural History), and Otago University (New Zealand). Species included blue (Balaenoptera musculus), fin (B. physalus), sei (B. borealis), minke (B. acutorostrata), humpback (Megaptera novaeangliae), gray (Eschrichtius robustus), right (Eubalaena glacialis), pygmy right (Caperea marginata). Distal third of rostrum was explored through transverse cuts along the mesorostral cartilage immediately dorsal to vomer (two fins, one gray), and after removal of mesorostral cartilage (two minkes). Upper lip (two humpbacks, three minkes) and cribriform plate region (one fin, one gray) were examined histologically.

Results: External examination confirmed paired indentations on the ventral upper lip, but no gross opening was found. The indentations recessed approximately 0.5-1cm at the deepest point (medially) and were either complete or incomplete ovoid depressions often with a raised center. Peripheral nerves (sensory?) were embedded among dense connective tissue and adipocytes. Variably sized vacuoles lined with flat to plump cells were observed, but function is unknown. No VNO, olfactory nerves, or chemoreceptive epithelium was found.

Conclusion: No VNO or associated structures indicative of chemoreceptive function were observed grossly or microscopically in upper lip, mesorostral cartilage, vomer, or hard palate tissues, despite appearance of paired depressions on upper lip. These data suggest indentations are vestigial VNO remnants. Chemoreception may be compromised for whales as chemical signals (e.g., hormones in urine) may be diluted in water.

Keywords: Vomeronasal, Chemoreception, Whale, Baleen, Mysticete

[E. Anatomical Education]

A-0043

Enhancing Dental Education: Evaluating the Students Perception and Course Experience of an Integrated Anatomy and Physiology Course at Ajman University

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Purpose: Anatomy and physiology knowledge forms the cornerstone of dentistry, underpinning accurate patient examination, anesthesia, and surgical procedures. While traditionally taught as separate subjects, recent trends emphasize integration. At Ajman University, we have integrated these subjects into a comprehensive "Integrated Biological Sciences" (IBS) course. This study sought to evaluate the clinical relevance of this integrated approach and gather student feedback to enhance dental education.

Methods: We conducted a survey among first-year BDS students at Ajman University. Students provided immediate feedback at the end of the IBS course via Students' Evaluation of Educational Quality (SEEQ) and Course Experience Questionnaire (CEQ). Content analysis was used for open ended questions. Academic performance data were also analyzed.

Results: The integration of anatomy and physiology into a comprehensive IBS course has been well-received by students at Ajman University. The students highly valued the IBS course, perceiving it as foundational for clinical practice. High

achievers were very positive in all CEQ and SEEQ dimensions when compared to their low achiever classmates (P>0.05). Furthermore, there was a consensus on the need for further integration into the broader dental curriculum. Feedback suggests that aligning course content with clinical practice is vital. As dentistry evolves, this integrated approach ensures graduates meet the UAE's competency standards. Ongoing curriculum development and integration are key to bridging the gap between basic science and clinical practice.

Conclusion: This study highlights the importance of integrating anatomy and physiology into dental education, ensuring clinical relevance. Stakeholder feedback serves as a valuable guide for curriculum enhancement.

Funding: Ajman University.

Keywords: Anatomy, Physiology, Integrated biological sciences, Course experience, Curriculum integration

A-0049

Perspectives on Organ Donation and the Relationship between Spiritual Beliefs and Willingness to Donate: A Cross Sectional Study of Nigerian Medical and Allied Health Students

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Purpose: This study explored how the spiritual beliefs of medical and allied health students affect their willingness for organ donation.

Methods: An online questionnaire developed from interviews and Spirituality Orientation Inventory was used to survey 604 Nigerian medical and allied health students, including questions on students' views on organ donation, spiritual beliefs, and spiritual reasons for organ donation choices. Descriptive analysis, crosstabulation, and Chi-squared tests, were used to determine proportions, and relationships between the variables, respectively. Statistical significance was set at p<0.05.

Results: The majority (72.6%) of students support organ donation in principle. Yet only 38.25% are willing to donate posthumously, with 37.1% undecided, and a mere 16.89% willing to donate while alive. Predominantly, students identify as Christians (87.7%) or Muslims (11.6%). Approximately 43.05% are uncertain if their religion endorses body donation, while 55.46% aim to follow their religious teachings and 25.99% try to do so. Belief in reincarnation (38.9%) and life after death (72.9%) are prevalent among respondents. Notably, the belief in reincarnation, life after death, and religious adherence significantly influences willingness to donate organs, whether posthumously or while alive (p<0.05).

Conclusion: There is a noteworthy disparity between the theoretical support for organ donation and the actual willingness to donate, particularly while alive, among Nigerian students. The strong correlation between specific spiritual beliefs and the willingness to donate organs, emphasizes the substantial influence of spirituality on this decision-making process. There is a need to consider spiritual factors when devising strategies to meet the increasing demand for donor organs.

Keywords: Organ donation, Religion, Spirituality, Medical Students, Nigeria

A-0071

Introduction to Examination Evaluation: A Qualitative and Psychometric Review of Gross Anatomy Assessment Test at the Department of Anatomy, University of Rwanda

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Purpose: To assess the reliability of the gross anatomy assessment test in measuring the expected knowledge.

Methods: A purposive sampling method was used to select the first continuous assessment test from the Gross Anatomy 2 and Gross Anatomy 3 modules at the Department of Anatomy, University of Rwanda. The Zipgrade app was used to prepare the marking guide and electronic marking. The Zipgrade app analyzed test items and informed the researchers which test item was most challenging or easiest for the students. A qualitative and psychometric assessment of the test item was performed by comparing the test questions to the answer options

provided. The discrimination factor was calculated using the Zipgrade app. To assess the reliability of the difficult or easy test items, the Kuder-Richardson (KR-20) formula was used.

Results: In Gross Anatomy 3, question 28 was the most difficult item, and 3.1% of the students passed. Qualitative analysis of the question revealed that it failed to meet the qualitative standard due to the inclusion of the option "None" on key "E." The Discriminatory factor was -0.085 for question 28, and the reliability was 1.0. Question 42 was the easiest, and 100% of the students passed. Qualitative analysis of the question revealed that it met the qualitative standard, and the reliability was 1.0. In gross Anatomy 2, question 16 was the most difficult, with 0% pass. There was no discriminatory factor for this question. Qualitative analysis revealed that it met the qualitative standard, and the reliability was 1.0. Question 24 was the easiest, with 98.3% of students passing; the discriminatory factor was 0.026, qualitative analysis revealed that it met qualitative standards, and reliability was 1.0.

Conclusion: The study identified some measurement errors in the test items, which are normal and expected in an examination.

Keywords: Qualitative analysis, Psychometric analysis, Discriminatory factor, Reliability

A-0079

A Practical Active Learning Approach in Neuroanatomy Education amongst Preclinical Students

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Purpose: Neuroanatomy is a complex subject that is often considered challenging for undergraduate students. Various methods have been employed in teaching neuroanatomy, reflecting the complexity of the subject and the need for effective education approaches. The field of anatomy education has seen the implementation of constructivist learning approaches in teaching practices in accordance with the advocation of active learning methods to complement traditional passive learning by education theorists. In an attempt to break the complexity of neuroanatomy teaching and learning and to lessen neurophobia, this study aims to provide a practical active learning approach in neuroanatomy teaching and learning amongst preclinical students.

Methods: This study was conducted over six weeks with the participation of 80 preclinical students. Throughout the period, students received their traditional 1-hour didactic lecture for every neuroanatomy topic alongside four practical sessions. During the four practical sessions, students were given four separate tailor-made active learning activities. The practical activities are respectively; (1) Drawing, colouring, and labelling bones of the skull and vertebrae, (2) Creating a "Brain-Hat" that represents the functional and anatomical lobes of the cerebral cortex, (3) Creating a three-dimensional anatomical representation of the brainstem, and (4) Drawing the vasculature of the head and neck. A pre-activity and post-activity quiz was given to each student to assess their understanding of the selected topics. A feedback questionnaire was conducted at the end of the module period to assess the students' perception of the activity.

Results: In brief, the post-activity quiz results showed a significant increase in marks amongst students as compared to the pre-activity quiz, signifying an increase in understanding and memory. Students feedback indicated that the active learning sessions promoted student interest, engagement, understanding, and memory retention.

Conclusion: In conclusion, incorporating an active learning approach throughout the neuroanatomy syllabus may help in tackling neurophobia amongst preclinical students.

Keywords: Anatomy Education, Neuroanatomy, Active Learning, Preclinical Sciences, Constructivist Learning Theory

A-0092

Students' Perception toward Blended Anatomy Learning Modalities at the University of Rwanda

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Purpose: To assess the Students' perception toward blended anatomy learning modalities at the University of Rwand.

Methods: A cross-sectional study was used with a sample size of 135 determined and drawn from the study population of students who had registered for two modules of anatomy . A validated online questionnaire was distributed to 135 first-year students. The data were exported from Google form to Microsoft excel 2013 for cleaning and coding. For further analysis, cleaned data were then exported to SPSS version 25. Data were analyzed descriptively using mean, standard deviation, frequency, and percentages.

Results: Students participated actively in reading online learning resources and doing learning activities during the lockdown and after reopening of the university. The learning outcomes were clear (43.1%), the anatomy modules were well organized (83.6 %), the anatomy modules were delivered promptly (78.5 %) and the module content-wise adequate (68.1%). The limitation to satisfaction was on limited ICT infrastructures such as access to laptops, the internet, and the reliability of the learning management information system where only 40.5% used their own laptops. In practical sessions of Anatomy modules, students expressed a high level of satisfaction. Cadavers structures were clear, instruct, give and helpful (82.3%) while Anatomical Models as teaching materials were sufficient at the level of 83.2%. The most common suggestions provided by the students were to extend the time for the practical session (44%), and to increase the number of facilitators (5.2%).

Conclusion: The covid-19 pandemic has been an enormous global challenge. However, it has been an opportunity also for educational reforms and innovation on its core objectives of delivering knowledge, skills, and attitudes without compromising the quality. The combination of online and face-to-face teaching of the anatomy modules has been highly appreciated by UR medical students.

Keywords: Anatomy, Blended learning, ELearning, Students, Perception

A-0177

Evaluation of Anatomy Comic Strips

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Purpose: The author has drawn hundreds of episodes of anatomy comic strips in English for two decades. The comic strips are being serialized in the PLEXUS, IFAA newsletter. All the comic strips can be viewed on the homepage (http://anatomy.co.kr). It was intended to enable medical students to learn the complexities of anatomy in a straightforward and humorous way.

Methods: 93 Korean medical students, who looked through the comic strips, were surveyed with questionnaire.

Results: The anatomy grades were higher in students who read the comic strips than those who did not. The comic strips facilitated memorizing anatomy and assuming attitude toward anatomy. The comic strips also facilitated enjoying with medical persons and non-medical persons. The students may laugh at the comical situations of comic strips only after acquisition of anatomy knowledge; they then recognize how anatomy enriches them. Nowadays, students are reluctant to specialize in anatomy because of the prejudice that living as anatomists is boring and exhausting; the comic strips could be an innovative tool to demonstrate intriguing and worthwhile activities of anatomists.

Conclusion: Creation and educational use of the benefiting comic strips are ongoing. The author inputted the suitable comic strips to the textbooks such as a neuroanatomy book (Visually Memorable Neuroanatomy for Beginners. Academic Press, 2020).

Keywords: Artistic anatomy, Cartoons, Humor, Medical education, Questionnaires

A-0218

Knowledge Retention of Undergraduate Medical Students in Regional Anatomy following a One-Month Gross Anatomy Course Setting

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Purpose: Knowledge retention presents a major concern for medical students and educators to achieve optimal learning outcomes. Practical dissection courses facilitate the consolidation of anatomy knowledge. Previously, it was shown that regional anatomy dissection course is more beneficial over a 3-month than a 1-month duration regarding pre examination knowledge. This given study aimed to assess if follow-up anatomy interventions may help consolidate regional anatomy knowledge and facilitate knowledge retention of undergraduate medical students. It was hypothesized that knowledge retention could be enhanced using post-dissection teaching interventions.

Methods: Upon completion of the dissection course, OSPEs were performed for the neck, thorax and abdomen immediately before the start of the oral examinations, with follow-ups at 6 and 12 months. Between each of the examinations, virtual and in-presence lectures and seminars on (radiologic) anatomy and pathology were held, including Cinematic Rendering but without additional teaching on human tissues.

Results: Significant improvements were observed for the neck and abdomen region in the 6- and 12-month follow-up OSPEs. The effects of knowledge gain were less marked in ethanol-glycerin- than in Thiel-embalmed tissues. Student perceptions on tissue quality correlated positively with their assessment on tissue suitability for examination preparation.

Conclusion: In conclusion, even anatomy teaching interventions not utilizing human tissues may help consolidate and improve regional anatomy knowledge over a one-year term. Knowledge retention can be enhanced by accompanying virtual and physical teaching interventions.

Keywords: Embalming, Knowledge retention, OSPE, Regional anatomy dissection course, Undergraduate medical education

A-0233

The Open Anatomy Explorer

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Purpose: The Open Anatomy Explorer (OPANEX) is an open-source, web-based platform designed for the exploration and manipulation of three-dimensional (3D) models. Offering a multifaceted toolkit, OPANEX enables users to upload and annotate 3D models, customize 3D settings, and construct quizzes for educational purposes. The platform incorporates two distinct user interfaces, designed to accommodate the needs of both students and instructors. A distinctive feature of OPANEX is its capability to facilitate the exchange of labeled 3D models across educational institutions through import and export functionalities, fostering the collaborative development of an open-source library for 3D models. The source code for OPANEX is freely accessible on GitHub at https://github.com/biocat-ugent/Open-Anatomy-Explorer.

Methods: Launched in the academic year 2023-2024 within the faculty of Medicine & Health Sciences at Ghent University, Belgium, OPANEX underwent evaluation through a survey targeting first-year medical students.

Results: The survey comprehensively gathered insights into the utilization of anatomy course materials, perceptions of digital anatomical models, and overall user experiences with OPANEX, providing valuable feedback for further enhancement and refinement of the platform.

Conclusion: Beyond its foundational application in anatomical education, OPANEX demonstrates versatility by finding utility in diverse fields such as chemical engineering, material science, and archeology. The adaptability of the platform

extends its impact across various scientific domains.

Keywords: 3D models, 3D visualisation, Web-based, Anatomy, Education

A-0250

The Development of Multimodal Instructional Classrooms and Media in Gross Anatomy and Neuroanatomy using 3D Scanning, 3D Printing, and 3D Display Technologies

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Purpose: The recent past intermittent discontinuation of on-site teaching due to the Covid-19 pandemic led to the necessity for ongoing adaptation in anatomical education methodologies. Traditional video-based instruction sourced from genuine dissections, has proven inadequate, primarily due to its two-dimensional nature and lack of interactivity, resulting in reduced learner engagement. Our study was conducted as a response to this gap with the design and implementation of a Virtual Anatomical Dissection Room (VADR). unforeseen challenges such as those presented by the pandemic.

Methods: A 3D photogrammetry process was used to generate both a 360 degree panoramic room and a 3D meshed structure for further 3D visualization purposes. The 3D models scanned were adjusted for compatibility with the AR/VR systems of Sketchfab 3D Viewer, and VR presentation models were developed that used VR glasses like Google Cardboard or active VR glasses such as Oculus Quest 2.

Results: We demonstrated the implementation of a Virtual Anatomical Dissection Room grounded in 3D modeling, enhanced with AR/VR, and holographic display technologies. Furthermore, have successfully developed and produced multimodal instructional media for neuroanatomy and the creation of a repository. Lastly, we modified the 3D scanned models to be shown for the first time on a cutting-edge 3D holographic display, where the viewer can observe the models to be 3D with depth in real-time.

Conclusion: This virtual space in the form of 3D modeling of real laboratory environments and bolstered by AR/VR technologies, extends interactive learning opportunities, enabling students to navigate and analyze anatomical structures as if in a physical lab setting. NThe culmination of this research supplies educators and students with dynamic and adaptive learning media, to meet the rigors of modern anatomical education and unforeseen challenges such as those presented by the pandemic.

Funding: This work was supported by the Faculty of Medicine, Srinakharinwirot Research Grant (contract no. MED-RES-300 140/2565), and the Srinakharinwirot University Grant (contract no. URMS 379/2565).

Keywords: Virtual Anatomical Dissection Room , 3D modeling and printing, Augmented Reality (AR)/virtual Reality (VR), Holographic display technology

A-0257

The Vital Role of Anatomy Demonstrators in Delivering Anatomical Education Worldwide

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Purpose: Anatomy Demonstrators (ADs) have played a pivotal role in delivering anatomical education. Despite advancements in technology-enhanced learning, the demand for ADs in the United Kingdom has increased. This study explores the merits and drawbacks of the UK AD role, drawing comparisons with analogous positions worldwide.

Methods: Our research, (ER/BSMS3741/1) utilising mixed questionnaire and focus group methodologies (N=50) reveals that UK ADs form a dynamic, engaged, and diverse cohort, enjoying a net positive and fulfilling role. The benefits extend beyond personal development, contributing significantly to anatomical knowledge and teaching skills whilst ADs foster a symbiotic relationship with clinical practice and enhanced exam success rates. Peer and near-peer teaching (NPT), as evidenced in broader literature, yields positive outcomes for students and educators alike. However, challenges such as inadequate financial compensation, limited training, and insufficient feedback persist.

Results: Internationally, China instigated roles resembling ADs in the 2000s, while in the US, surgical residents typically integrate teaching into their clinical roles and Indian ADs found their position beneficial for career progression. A global perspective emphasizes the ubiquity of benefits from NPTs and interprofessional teaching models, despite shared challenges including reduced curriculum time for anatomy and increased focus on clinically relevant content with similarly limited literature on AD role negatives. Looking toward the future, a dichotomy emerges in the UK ADs' vision for medical education, torn between technology-enhanced learning and the irreplaceable in-person dissection/prosection teaching. Meanwhile, the global theme of neglecting the training and support needs of ADs becomes apparent. To address these issues, the role of ADs should evolve to integrate technology-enhanced learning while prioritizing comprehensive training and ongoing professional development.

Conclusion: In conclusion, the expanding role of ADs in UK anatomical education necessitates a concerted effort to define, understand, and govern the role, emphasizing training and support for the benefit of all stakeholders involved.

Keywords: Medical Education, Anatomy Demonstrator, Career, Teaching, Clinical

A-0274

Comparing the Instructional Efficacy and Cognitive Load of Different Technology-Enhanced Small-Group Tasks in Sectional Anatomy Learning

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Purpose: Learning 2D sectional anatomy facilitates the comprehension over 3D anatomical structures, anatomical relationships, and radiological anatomy. However, the efficacy and cognitive load efficiency of technology-enhanced collaborative instructional activities in sectional anatomy remains unclear, especially if theoretical frameworks, namely the Cognitive Theory of Multimedia Learning (CTML), are applied during instructional design. Therefore, this pilot study compared the knowledge gains and perceived mental effort experienced by students learning sectional anatomy of the chest in distinct 45-minute-long technology-enhanced collaborative learning tasks.

Methods: A sample of 115 first-year medical students was randomly divided into three experimental groups that used different supporting technologies to learn the sectional anatomy of the chest: IMAIOS e-learning platform and Microsoft Surface Hub (n= 37); Anatomage table (n= 38); Anatomage table with digital models/presets designed in accordance with the principles of the CTML (n= 40).

Results: Pre- and post-learning tests revealed that significant knowledge gains in sectional anatomy were obtained by all groups even though no inter-group differences were found. The Paas 9-point Likert mental effort rating scale showed that all groups exerted similar amounts of mental effort in the learning phase and in the post-learning test. In addition, no significant inter-group differences were found.

Conclusion: These preliminary results show that collaborative technology-enhanced tasks were effective in improving understanding over sectional anatomy. However, the efficacy and cognitive efficiency of learning were not significantly impacted by the educational technologies being tested nor by the application of CTML principles in instructional design. Further studies must be conducted as the unidimensional Paas 9-point Likert mental effort rating scale may not have been a sufficiently robust indicator of the multidimensional construct that is cognitive load.

Keywords: Cognitive Theory of Multimedia Learning, Sectional Anatomy, Mental Effort, Anatomage, Technology-enhanced

A-0277

An Examination of Emotional, Physiological and Psychological Responses to Cadaveric Dissection in First-Year Medical Students

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Purpose: Despite the well-recognized challenges faced by students in adapting to learning anatomy through cadaveric dissection, a notable gap persists in the use of validated scales to quantify emotional, physiological, and psychological re-

sponses within the context of anatomy dissection sessions. This study aims to quantify the experience of medical students learning anatomy through cadaveric dissection with the use of three previously validated scales.

Methods: Participants consisted of first-year students at Brighton and Sussex Medical School (BSMS). The survey instrument incorporated established scales such as the Discrete Emotion Questionnaire (DEQ), the German State Disgust Scale (GSDS), and the Impact of Events Scale (Revised) (IES-R). Ethical approval was granted by BSMS Research, Governance and Ethics Committee (ER/BSMS9GHM/9).

Results: As students gained exposure with cadaveric dissection, they reported diminishing levels of negatively valanced emotions, coupled with an elevation in positively valanced emotions. Notably, disgust was the only negatively valanced emotion that non-significantly increased between the timepoints. Physiological responses associated with anxiety significantly decreased ($p < .001$) while those associated with disgust showed little change between the sessions. After session one, 17.3% (n=9) students met the criteria for partial post-traumatic stress disorder (PTSD), whereas only three (6.5%) met the criteria for partial PTSD post the second session. The emotional, physiological, and psychological consequences of cadaveric dissection sessions exhibited associations with students' gender and prior exposure to cadavers. However, the influence of students' age, mental health, or recent bereavement was comparatively less pronounced.

Conclusion: Despite students experiencing initial challenges with cadaveric dissection, rapid adaptation to this format of learning anatomy is observed. This research implies that the process of learning anatomy through cadaveric dissection offers medical students a controlled setting to familiarize themselves with working in proximity to deceased individuals. This environment may constitute a crucial developmental phase in their progression towards medical professionalism.

Keywords: Dissection, Emotion, PTSD, Disgust, Anxiety

A-0279

Virtual Reality in Anatomy Teaching

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Purpose: Implementing Virtual Reality (VR) into anatomical education can bring opportunities and challenges to both the learners and the teachers due to its novel nature and steep learning curve. Brighton and Sussex Medical School started to introduce VR during the COVID-19 pandemic, with a focus to support surgical education. A stepwise approach has since been taken to its adoption for undergraduate medical students.

Methods: Using in-house filmed 360-video cadaveric content from donors who had consented to providing images, short clinical videos were created and used through 10 VR headsets in Living Anatomy and Ultrasound (LAUS) teaching sessions at the medical school. The content was selected to reflect clinically relevant areas for each session, each video was <10 minutes in duration, involving a range of multiple viewpoints, hot spots to provide information, multiple choice questions and clinical imaging. Students were then asked for their initial thoughts on the resource.

Results: Preliminary analysis of evaluations from students (n=91) suggest that 89% of respondents found the resources to be beneficial to their learning. Common praise for the modality centred around how 'interactive' and 'immersive' the resource was, with numerous students citing their enjoyment of how close to a clinical experience it felt; one student writing that it "felt like you were in the room with surgeons". Many respondents also described the experience as 'fun', which is a common theme among gamified learning resources, whilst also finding the content 'useful' in aiding their learning. Utilising resources which students are more likely to engage with due to enjoyment has been shown to improve learning outcomes.

Conclusion: There is often trepidation around introducing new technologies to teaching, but our activities have shown that with mindful implementation, VR can be a fantastic resource to bolster student learning.

Keywords: Anatomy, Education, Virtual Reality, Technology, Innovation

A-0287

The Global Neuroanatomy Network (GNN): An Academic Repository for Educators Worldwide

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Purpose: The Global Neuroanatomy Network (GNN) aimed to create a virtual community of practice (CoP) for established and novice educators to share and adapt peer-reviewed clinical cases and teaching resources specifically for neuroanatomy education.

Methods: A small social media network of educators (23 academics from 22 institutions in 11 countries) conceived and designed the repository. Structured submission forms captured best practice for teaching resources and neuroanatomical rationale for clinical cases. Keywords, tags, and indexing ensured the repository is a searchable database. Contributions were solicited for exemplars and piloted through a customized peer-review process. In November 2023, the GNN website was launched to open the repository to educators worldwide while simultaneously inviting global contributors. Google Analytics 4 assessed the initial impact through anonymized, aggregated data.

Results: As of January 2024, the GNN has 230 registered members from 39 countries on six continents and has been viewed from 53 countries with 927 engaged sessions. Currently, 17 teaching resources and three clinical cases are posted, while 13 submissions are pending peer-review. At this time, the most viewed teaching resource is a 3D Printed Spinal Pathways Model (n = 39), and the Lateral Medullary Syndrome is the most viewed clinical case (n = 13).

Conclusion: Our preliminary results demonstrate global engagement with the GNN, suggesting a strong potential for this collaborative CoP approach. Therefore, this repository may fill the gap that neuroanatomy educators often face in developing innovative pedagogical approaches to teach complex and challenging content. Many of these teaching approaches are refined classroom experiments without the benefit of collaboration, critique, or dissemination beyond their classroom or institution. Furthermore, educators may lack access to clinical cases that can support the neuroanatomical rationale for clinically oriented neuroanatomy coursework. The GNN provides a peer-reviewed virtual repository of this content that may not align with traditional scholarly dissemination mechanisms (e.g, manuscripts).

Funding: Funded by an Innovation Grant from the American Association for Anatomy.

Keywords: Community of Practice, Virtual Repository, Neuroanatomy Education

A-0308

Anatomy Teaching Models before and during the Covid-19 Pandemic: Teaching Models Assessment

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Purpose: Covid-19 pandemic imposed immediate changes in teaching Anatomy, from in-person to online. The aim of our study was to compare results of Anatomy exams, examine the students' attitudes to these two different teaching models and propose a more desirable model.

Methods: In the retrospective part of the study, Anatomy exam results of 211 students studying in person in 2018/2019 (before pandemic), and of 214 students studying online in 2020/2021 (during the pandemic) were analyzed. The prospective part comprises comprehensive survey of the students' attitudes towards in-person teaching model - 136 students, and online teaching model - 118 of the respective aforementioned academic years.

Results: Anatomy exam was passed by 76.3% of students after in-person teaching, compared to only 49.1% after online teaching. The survey showed that within the in-person model, teachers were more available ($\chi^2(2, N=254) = 39.705$, $p < .001$), students were more satisfied with the exam ($\chi^2(2, N=254) = 9.587$, $p = .008$), more confident of their knowledge ($\chi^2(2, N=254) = 23.464$, $p < .001$), and appreciated the quality of this model more ($\chi^2(2, N=254) = 50.263$, $p < .001$) than the online generation. Only 51.7% of students in online generation believed that online studying prevented the spread of Covid-19. Attitudes expressed in open-ended questions were more positive about in-person than online teaching, where the absence of laboratory works in-person received the biggest criticism.

Conclusion: In-person model was shown to be better. However, teaching aids, such as PowerPoint presentations with recorded voice and video records of laboratory works, applied in online teaching at the Department of Anatomy, Faculty of Medicine, University of Novi Sad, should be incorporated into the future teaching models.

Keywords: Anatomy, Undergraduate education, Covid-19, Distance learning, Assessment

A-0324

The Creation of an Integrated Instructional Display for Embryology Incorporating 3D Modelling, Digital Light Processing 3D Printing and Augmented Reality

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Purpose: With the subject of human embryology and the development of organ systems involves the understanding of the alteration to the various organ system; the gradual reduction in the time and resources dedicated to instructing medical and paramedical students in this subject have led to a corresponding decrease in educational resources. This includes to an inadequate number and accessibility to true-to-life models, the present-day shift towards to 2D illustrations of embryological structures or at best 3D virtual illustrations.

Methods: mbryological serial sections were digitized and reconstructed into detailed 3D models using AMIRA software. These models were further refined for texture and color accuracy, then 3D printed with high anatomical fidelity using UV-sensitive resins. The final models, suitable for both public viewing and augmented reality (AR) applications, were uploaded to Sketchfab and underwent validation against original histological sections and 2D representations to confirm their accuracy and reliability.

Results: We converted raw embryological data obtained from the open-sourced 3D Atlas of Human Embryology of the Academic Medical Center (AMC-Amsterdam, Netherlands) into 3D models of the different stages of the nervous system; and subsequently use 3D sculpting and Digital Light Processing (DLP-SLA) 3D printing to produce true-to-life, enlarged 3D printed models for use in the instruction of the "Development of the Nervous System". Furthermore, the models were further placed onto a display that includes accompanying legends and captions, QR codes that allows for the student and instructors to view the 3D models on other platforms a; along with augmented reality (AR) image markers that allow the viewer to visualize the models on their hand-held smartphone/tablets in real-time.

Conclusion: This study resulted in the greater equality in

accessibility through the instructional media and allowed for the instructor to further modify the models to better cater to their needs as well as produce reproducible models at scale.

Funding: This work was supported by the Faculty of Medicine, Srinakharinwirot Research Grant (contract no. MED-RES-300 140/2565), and the Srinakharinwirot University Grant (contract no. URMS 379/2565).

Keywords: Embryology, 3D rendering, Serial sections, 3D reconstruction, Augmented reality

A-0374

Human Mannequin: Learning Anatomy and Clinical Skills via Surface Marking of the Chest Wall, a Distinctive Non-Cadaveric Approach

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Purpose: Anatomical landmark's are essential for determining the exact location of internal organs for clinical examination. The thorax houses the cardirespiratory organs which can be examined to acertain health condition of a person. This teaching method uses transparent apron for surface marking of the thorax, after which clinical examination were performed.

Methods: Students were given the chest wall anatomy prelaboratory handout prior to the practical session. During the session , the students were randomly divided into groups of three each and given a transparent apron.One student served as a manequine and wore the apron, another student searched for the anatomical landmark on the chest and the last student trace the identified landmarks with a marker. Finally, percussion and auscultation of the chest were performed.

Results: The clavicle, sternum, ribs and intercostal spaces were drwan on the apron.The exact location of the internal organs were identified. Clinical examination such as percussion and auscultation were easily performed without mistakes.

Conclusion: Students learnt clinical skills on their peers using just apron and markers, which is effective, live, fun and cost effective. Finally a positive feedback were gathered anecdotally.

Keywords: Chest wall, Surface anatomy, Clinical skills, Education, Anatomy

A-0383

A Comparison of Pasifika and New Zealand European Students' Visual Attention to Anatomical Images

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Purpose: In New Zealand institutions, there is a growing number of Pasifika students who take anatomy courses. However, there is an overrepresentation of underachievement and course dropout among Pasifika students in anatomy courses. Anatomy education includes topics that are considered tapu (taboo/sacred) in Pacific cultures, and thus may affect Pacific Islands students learning experience. Here, we aim to determine if there is ethnic difference in the visual attention to anatomical images between New Zealand European (NZE) and Pasifika students.

Methods: Using a pair of eye-trackers (Tobii eye-trackers wireless glass II, Sweden), we collected data on visual attention to anatomical images between 31 NZE and 31 Pasifika anatomy students. Participants viewed a PowerPoint slide that featured 17 distinct body regions, with each region displaying three types of anatomical images (cadaver, plastic model and surface anatomy). Two-way ANOVA was used to determine the interaction effect of ethnicity and image type for the number of first-second fixations (FSF) and latencies to each image type.

Results: Significant interaction effects between ethnicity and image type were found for FSF to hand, gluteal region, shoulder, foot, and male perineum. Pasifika students had fewer FSF to the surface anatomy of the hand, gluteal region, and male perineum, but more FSF to a plastic model of the gluteal region, foot, and male perineum as well as cadaver image of the shoulder foot than NZE students.

Conclusion: Our preliminary finding provides objective evidence for ethnic difference in visual attention to anatomical images, including those which are tapu for Pasifika students.

Funding: Department of Anatomy, University of Otago.

Keywords: Visual attention, Ethnic differences, Teaching delivery

A-0394

Responses of Students with Prosection-Based Anatomy Instruction When Exposed to a Short Dissection Course

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Purpose: In common with most Australian medical schools, anatomy instruction in The University of Sydney's graduate medical program is conducted using prosected human donors. Basic science anatomy instruction occurs in Year 1, with prosections allowing an efficient way for students to quickly become familiar with anatomical structures. For students seeking a more immersive experience, we developed an elective 5-day clinically oriented dissection course. We sought the students' perspectives of how dissection differed from their experiences during their standard anatomy instruction.

Methods: The dissection course, focused on the lower limb, was attended by 24 students from years 1 and 2 of the 4-year graduate entry medical program. Each day, pairs of students dissected a lower limb after attending the morning's relevant anatomy lectures and clinical presentations. Qualitative data were collected using pre-course surveys (asking anticipated difficulties) and post-course surveys (asking what was helpful, surprising, and how the course supported their knowledge and skills beyond their regular program). Thematic analysis was used to code and categorise the responses.

Results: The pre-course survey response rate was 83.3% (20/24). Common themes were concerns about technical skills to dissect and anatomical knowledge. The post-course survey response rate was also 83.3% (20/24). Students noted multiple helpful aspects, from the actual anatomy (understanding layers, revision), to dissection techniques, to the course itself (structure, guidance from tutors, being hands-on). Aspects that surprised students were the amount of connective tissue and fat present, as well as the increase in skills personally. Regarding the value beyond the program, most comments spoke to the deeper level of learning possible, and also experience with surgical tools and techniques.

Conclusion: The overall positive experience of the students cited factors in both course design and subject. No pre-course concerns were mentioned after the course; students gained a deeper understanding of anatomy, dissection, and greater self-confidence.

Keywords: Dissection, Prosection, Anatomy education, Medical students

A-0416

Enhancing Student Visualization and Recognition of Musculoskeletal Anatomy: Design, Implementation, and Evaluation of 3D Interactive Learning Modules

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Purpose: The study of musculoskeletal anatomy of the limbs is essential for students enrolled in health and medicine programs. However, the volume, complexity, and highly visual nature of musculoskeletal anatomy content presents challenges for course design and delivery, and for learners' comprehension of the content. Pedagogical studies have demonstrated that 3D interactive learning experiences enhance student engagement and recollection of anatomical content. This research discusses the design, implementation, and evaluation of 3D interactive learning modules for improving students' recognition of structures of the musculoskeletal system and their ability to visualize the spatial orientation of its associated anatomical structures.

Methods: The interactive learning modules were created by filming demonstrations of anatomical structures, with interactivity added to the videos using H5P. The interactive aspect of each video included an information icon for each structure demonstrated, formative quizzes with immediate feedback, and a summary of individual performance. The learning modules were uploaded to course learning management system.

Results: Practical assessment performance data was collected and analyzed from first- and second-year students enrolled in advanced functional anatomy of the limbs courses. Statistical analysis was performed in SPSS.

Conclusion: The interactive learning modules proved valuable in assisting learners to recognize and visualize musculo-

skeletal structures of the limbs. Practical assessment results were greatly improved for student cohorts that had completed the interactive learning modules when compared with those that had not. Student feedback also showed increased engagement with the course content. Future analysis of these learning modules will involve comparing student performance and satisfaction between different courses and cohorts, and their impact on students' theoretical anatomy knowledge.

Keywords: Anatomy, Musculoskeletal, Education, Innovation, Assessment

A-0449

Representing Diversity: An International Exploration of Representation in Anatomy Staff and Students

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Purpose: Recent discussions in the anatomy community have highlighted the need for greater inclusion and representation of diverse populations in anatomical education. Our research identified that a proportion of staff and students involved in anatomy teaching and learning do not feel represented within their curricula. We are currently analysing the data to better understand the factors and explore the impact of demographic variables on such perceptions.

Methods: In this pilot study, a combination of questionnaires and focus groups were employed to gather data regarding individuals' lived experiences of inclusion and exclusion within anatomy education. Qualitative and quantitative data were obtained by convenience sampling and adhered to inclusive research methodologies, such as community-based participatory research. Reflexive thematic analysis was used to contextualise inclusion within its broader social, historical, and political dimensions.

Results: Responses were received from 137 staff and 122 students from over 20 countries, although data collection is still ongoing. Initial responses from questionnaires indicate that 28% of staff and 33% of students do not feel represented by their curricula. Our data exposes notable hurdles to inclusion, such as inadequate representation, cultural barriers, time constraints, and institutional limitations. Despite these challenges, the research has uncovered promising initiatives, including the incorporation of diverse curriculum resources, adoption of inclusive language, implementation of student support programs, and a widespread enthusiasm for enhancing inclusion within medical education.

Conclusion: Our data shows that current anatomy education does not adequately represent the diversity of populations. These findings demonstrate the need to assess existing anatomy curricula and proactively develop initiatives to enhance inclusion and representation.

Keywords: Inclusivity, Representation, Diversity, Inclusion, Anatomy education

A-0451

Unveiling Perceptions: Evaluating Anatomy Education in the New Integrated Case-Based Curriculum using AEEMI Framework

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Purpose: The intersection of the pandemic and advancements in curriculum design has spurred the emergence of new anatomy curricula in medical education. It is paramount to scrutinise the anatomy education environment within a new curriculum to ensure impactful learning experiences. Using the validated Anatomy Education Environment Measurement Inventory (AEEMI) this study aims to evaluate medical students' perceptions of anatomy knowledge, educators, subjects, and learning resources, to discern potential shifts in perception following the implementation of the new curriculum.

Methods: A validated 26-items AEEMI were administered to 270 consenting medical students at Newcastle University Medicine Malaysia (NUMed). Utilizing a five-point Likert scale, participants assessed their perceptions across five domains of AEEMI: anatomy knowledge relevance, anatomy teachers, anatomy subject mastery, and anatomy learning resources. To evaluate student perceptions of the newly implemented integrated case-based format curriculum at NUMed since 2018/2019, a comparative analysis was conducted between the old and new curricula based on the average scores in each domain.

Results: The Mann-Whitney U test revealed no significant

difference in anatomy subject mastery scores between students in the old and new curricula (z = -1.705, p = 0.088). However, the old curriculum group demonstrated significantly higher scores across the other four domains: (i) anatomy knowledge relevance (z = -3.064, p = 0.002), (ii) positive perceptions of anatomy teachers (z = -6.178, p < 0.001), (iii) negative perceptions of anatomy teachers (z = 3.061, p = 0.002), and (iv) perceptions of anatomy learning resources (z = -4.938, p < 0.001).

Conclusion: AEEMI effectively assesses student perceptions of the new curriculum, revealing areas for improvement across five domains. Concerns about anatomy subject mastery persisted in both curricula, with other domains receiving moderate scores. Notably, students from the old curriculum expressed more positive perceptions, possibly influenced by reduced anatomy contact hours and the pandemic's impact.

Funding: This project was funded by the Newcastle University Medicine Malaysia (NUMed) Internal Research Grant (NIRG). Grant number: 226900-IG5.

Keywords: Anatomy Education Environment Measurement Inventory (AEEMI), Integrated case-base anatomy curriculum, Validated instrument, Anatomy subject mastery, Pandemic

A-0494

Impacting Surgical Training: Role of Surgical Anatomy Dissection Courses

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Purpose: Human anatomy is one of the fundamental pillars of basic medical sciences, which forms the cornerstone of the ever-evolving medical practice. It is, therefore, important to strengthen anatomy education at all stages of medical training. Since 2020, the Department of Human Anatomy, in collaboration with the Department of Surgery, organized surgical anatomy dissection courses to improve surgical practice safety and competence.

Methods: The aim of this educational study was to share lessons learned from organizing anatomy dissection courses and measure the impact on knowledge and skills acquisition by surgical trainees. Courses were designed with clear learning objectives and programs. A pre-test was administered to trainees before the dissection course, and a post-test was organized at the end of the course. Descriptive statistics were used to compare pre- and post-test scores. A p-value less than 0.05 was considered statistically significant. The Likert scale was used to measure trainees' satisfaction at the end of every course.

Results: From August 2020 to December 2021, 11 cadaveric dissection courses were organized, 173 trainees from 6 Surgical Residency programs: Plastic surgery, General surgery, Orthopedic surgery, Urology, Neurosurgery, ENT, and from Obstetrics and Gynecology. Nineteen trainers from Surgery department and Anatomy department were involved. There was a significant improvement in marks in the post-test test as compared to the pretest score. The average increase in the mark was 26.4% with a 95% CI [23-0 – 29.7], p-value < 0.001. There was a negative correlation (r=-0.8948, p-value < 0.001) between the marks at pre-test and the improvement score, suggesting that the lowest performers on the pre-test had the biggest post-test improvement. Trainees' satisfaction was at a high level. 87.6% of trainees reported a desire to pursue training to become anatomy educators in the future.

Conclusion: Cadaver-based surgical procedures simulation should be encouraged and integrated into surgical curricula.

Keywords: Anatomy, Dissection, Surgical training, Surgical anatomy, Cadaver course

A-0524

Bridging Cultural Chasms: Revolutionizing Anatomical Education for Global Impact

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Purpose: Anatomy education is vital in shaping competent healthcare professionals, yet its complexity often challenges learners, leading to suboptimal retention rates worldwide. This paper investigates the fusion of cultural considerations with anatomical education, aiming to develop pedagogical methods that resonate across diverse cultural contexts. This study explores the integration of cultural considerations into ana-

tomical education to enhance learning outcomes and promote cultural sensitivity among healthcare professionals.

Methods: Through surveys and case studies, we examine innovations in curriculum design, pedagogy, and technology within anatomical education. We also evaluate the impact of cultural perspectives on learning outcomes compared to current pedagogical trends.

Results: Our findings advocate for a paradigm shift towards culturally sensitive anatomical education, fostering empathy and ethical discernment among future healthcare practitioners globally. We emphasize the need for collaborative efforts to develop pedagogical strategies that transcend geographical boundaries and shape the future of healthcare education. Embracing technological advancements, the paper examines the efficacy of virtual anatomical models in reshaping traditional teaching methods. However, it highlights the need for validation protocols and longitudinal retention assessments to ascertain their educational value. Furthermore, the paper illuminates the evolving role of anatomists as cultural navigators, integrating historical and ethical narratives into anatomical education.

Conclusion: With a focus on current trends in medical education, this paper calls for educators to embrace cultural diversity as fundamental to anatomical education. It urges a collaborative effort to develop globally relevant pedagogical strategies that transcend geographical boundaries and shape the future of healthcare.

Keywords: Anatomy, Culture, Innovations, Pedagogy

A-0545

Body Donation and the Cultural Imperatives of the Reincarnation Process: Perspectives of Nigerians Resident in Nigeria and Those in Diaspora

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Purpose: The practice of body donation for anatomy education has suffered a lot of limitations especially in developing nations. Literature is replete with severally adduced reasons for these limitations. This study was aimed at assessing the cultural belief of Nigerians resident in Nigeria and those in diaspora, in reincarnation and how it affects body donation. It draws attention to some cultural imperatives which may be part of the limitations to the success of the body donation program (BDP).

Methods: A standardized 20 item cross sectional questionnaire structured in four parts was administered to 224 adult Nigerians in two categories; 138 Nkigerian respondents' resident in Nigeria (Nigeria category) and 86 Nigerians who had spent at least ten years of their adult life in Europe or United States (Diaspora category).

Results: Results showed that out of the 138 Nigerian respondents in Nigeria 58.7% felt the BDP cannot work while only 1.5% agreed that it is workable in the long run. More importantly, out of the 86 Nigerian respondents in Diaspora, 35% felt the BDP cannot work while 36% agree that it is workable in the long run with aggressive awareness programs. Hence, this paper clearly observed the cultural limitations of the belief in reincarnation to the BDP in Nigeria.

Conclusion: The observed results from this study which showed more willingness for acceptance of body donation on the part of Nigerian respondents from advanced societies indicates that for the adoption of modern cadaver sourcing methods, literacy and awareness creation will be cardinal in achieving desired goals.

Keywords: Body donation, Reincarnation process, Nigerians in Diaspora, Anatomy education

A-0564

Is There a Difference between Student and Staff Perceptions of Social, Teaching, and Cognitive Presence?

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Purpose: Module evaluations are used by higher education institutions to monitor student perception of their course and identify areas for enhancement. However, such surveys rarely delve deeply into factors which contribute meaningfully to student learning and experience. As a result, superficial and unconstructive feedback is sometimes received which can be hard to act upon. To address this, we have developed a new

module/ evaluation toolkit based on Garrison's Community of Inquiry framework. This framework outlines that a students' educational experience is formed by three key interdependent presences: teaching, social, and cognitive.

Methods: The toolkit supports educators to evaluate both staff and student perceptions of the three presences, identify gaps between perceptions, and provide suggestions to help resolve the gaps identified. The toolkit was piloted mid-way through a final year anatomy module at Cardiff University, and responses were obtained by the module lead and 14 students (23% response rate).

Results: Analysis of the results demonstrated that students generally scored teaching, social, and cognitive presences higher than the module lead, indicating greater student satisfaction in these areas than anticipated by staff. However, some important elements in cognitive presence were scored lower by students than staff. e.g. "I have developed solutions to course problems that can be applied in practice" and "I can describe ways to test and apply the knowledge created in this course", indicating areas needing enhancement. Interestingly, pilot data from other modules in the University have indicated that cognitive presence is the area with the greatest discord between staff and student.

Conclusion: These results indicate that the toolkit is a potentially valuable instrument to highlight areas within a module or programme (and potentially HEIs) which are in need of enhancement and this tool could be particularly valuable in anatomy where constructivist approaches are used.

Keywords: Community of Inquiry, Evaluation, Constructivism, Cognitive Presence

A-0577

Can We Mitigate the Effect of Examiner Bias Prior to Conducting Viva Voce Examination?

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Purpose: Viva voce examinations require a certain level of inter-rater reliability, presumably mitigated by examiner experience, training and potentially the design of the examination. We hypothesised that examiner biases could be mitigated through comprehensive examiner training. Thus, we aimed to assess whether examiner bias still influences test scores in viva-based anatomy assessments, even after extensive examiner training.

Methods: Formative team-based viva voce examinations were conducted in an Australian medical school. First-year students had two vivas covering limbs, thorax and back, while second-year students completed one neuroanatomy viva. Each viva contained four topics, assessing general structure, key relationships, and clinical applications using donor-based and synthetic anatomy resources. Each group was evaluated by an independent clinician (n=9). Examiners were actively involved in teaching anatomy, met weekly to discuss examination format and curriculum development, watched instructional videos, and were provided with a semi-structured proforma for asking questions. Subsequently, they conducted mock vivas, independently provided marks, followed by discussions focussed on standardising marks before the actual viva. Non-parametric factorial models were used to analyse the impact of examiner bias and design of viva examinations on student scores.

Results: Across 765 student-examiner encounters, the median unstandardised score was 39/50 (q_1,q_3=34,42). Test scores significantly varied among examiners (Kruskal-Wallis; Chi^2= 76.196,p<0.001). Examiners had a greater impact on scores (aligned-ranks-transformed ANOVA; F=13.10,partial-eta^2=0.40,p<.001) compared to the design of the exam (F=4.08,partial-eta^2=0.05,p<0.05).

Conclusion: Despite efforts to standardise questions and train examiners, our findings underscore the presence of significant examiner bias in viva voce examinations. Therefore, post-standardisation of scores among examiners is crucial for fair and accurate assessment outcomes. Ongoing research will evaluate broader validity evidence for vivas to inform the role of this assessment in anatomy education.

Keywords: Viva voce, Bias, Standardisation, Examiner training, Assessment

A-0593

Are Viva Voce Examinations an Authentic Assessment Method in Undergraduate Anatomical Education?

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Purpose: Anatomical knowledge application, including communication, is foundational to medical practice. Despite this, written assessments engaging multiple choice questions (MCQs) are the predominant approach to anatomical assessment in undergraduate medical education. Viva voce assessments may provide a more authentic assessment approach, but fell out of favour due to poor reliability. The impact on learning, however, is an understudied aspect of viva voce validity evidence. This study aimed to explore medical student perceptions on viva voces, and their role within undergraduate anatomy assessment.

Methods: Formative team-based viva voce examinations were conducted in an Australian medical school. During a 12-week semester, first-year students completed two vivas (weeks 8/9 and 12), while second-year students completed one viva (week 12). Teams had a median of 3 members, and were based on students' regular dissection groups, with the intent of fostering engagement in dissection by having an aligned assessment. Students completed post-viva surveys, including 6 Likert scale responses and 3 free text responses.

Results: 184 feedback forms were completed. Likert scale responses indicated that while most students strongly agreed that viva voces aid their ability to apply anatomical knowledge in future, responses were neutral regarding preferences for viva over written examinations. Thematic analysis of free text responses identified that participants perceived viva voce examinations as authentic representations of how they would apply anatomical knowledge to communicate during their future careers. Feedback dialogues with assessors were perceived as facilitating self-regulated learning. Perceptions of how vivas may be most effectively engaged within assessment regimes varied (e.g. comparison of vivas as an assessment of learning versus an assessment for learning).

Conclusion: Viva voce assessments were valued by students as an authentic opportunity to apply their anatomical knowledge through communication, whilst engaging in feedback that could inform learning approaches. Further research is required to determine the role of viva voces within assessment programs.

Keywords: Anatomy, Education, Viva voce, Authentic, Assessment

A-0639

Evaluation of Anatomy Knowledge Requirement of Obstetrics and Gynecology Residents : A Cross-Sectional Self-Assessment Study

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Purpose: Adequate understanding of anatomy is of utmost importance in obstetrics and gynecology procedures and management of complications. Thus, residents' opinions on the competency of their understanding of anatomy and their need for additional education on anatomy were investigated.

Methods: 75 obstetrics and gynecology residents within different periods of their training in various hospitals in Istanbul were included in the study. A questionnaire prepared using Google Forms was sent via social media. Sociodemographic characteristics, past anatomy training, current needs for additional anatomy training and current pelvic anatomy knowledge were evaluated. The study was approved by the local ethics committee (13.12.2023-2023/0900). The Chi-squared test was used for comparison of categorical variables.

Results: 75 individuals aged between 25-36 years participated in the study. 34.7% of the participants were 1st year, 20% were 2nd year, 26.7% were 3rd year, and 18.7% were 4th year residents. 86.7% of the participants stated that they studied on cadavers, and only 17.3% of them had encountered perineum dissection during medical education previously. Only 5.3% of the participants stated a sufficient current anatomy knowledge. 98.7% of the residents indicated a need for anatomy training during residency. First choice for both genders was training during the intervention in the operating room without any significant difference($p>0.05$). Besides preference for digital anatomy applications was higher in females while preference for anatomy videos was higher in males($p<0,05$). Correct answer rates for 9 out of 14 questions asked to evaluate pelvic

anatomy were below 50% for both genders. When the answers were evaluated by year, third-year residents were found to be more successful in five questions with a statistical significance.

Conclusion: There is a lack of anatomy knowledge among residents, regardless of their seniority. Rather than being an optional education, a system that is compulsory for all seniority levels can be developed to ensure safe interventions.

Keywords: Anatomy education, Residency, Obstetrics and gynecology

A-0657

How Much Do We Benefit from Technology while Studying Anatomy?

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Purpose: Future healthcare professionals, including medical, dental, and health sciences students, have encountered significant changes in study methodologies and resources preferred due to the COVID-19 pandemic. Therefore, we aimed to evaluate the alterations in study methodologies preferred by students, which include the utilization of online platforms, virtual resources, and digital collaboration tools together with conventional education methods and resources. The challenges students face in adapting to the technology following the pandemic have been encountered.

Methods: 856 students participated in this cross-sectional study. A questionnaire including 35 questions was prepared using Google Forms and distributed via social media. The study was approved by the local ethics committee (20.12.2023-2023/0931). Demographic characteristics and technological literacy, the content and structure of the anatomy education, study preferences of anatomy, and digital resource preferences were evaluated. Categorical variables were presented by frequency and percent.

Results: In theory, 91% of students preferred lecture notes (slides, in-class notes) for anatomy studies, while 74% preferred them for practical classes. However, among the participants, 28% stored their written resources in hard copy, while 57% favored digital formats. Among the digital resource preferences, the most popular responses were YouTube (92%), websites (52%), applications (41%), and Instagram (38%) respectively. Regarding phone screen time, 37% reported 0-4 hours, 57% reported 5-9 hours, 5% reported 10-14 hours, and 1% reported 15+ hours. While 96% of the students preferred Turkish, 54% indicated using English resources. 75% of the participants did not consider Turkish digital resources to be sufficient. The primary reasons for selecting digital resources were diversity of visual content (66%), language (60%), videos (49%), compatibility with the educational curriculum (49%), and pricing policy (43%).

Conclusion: Students' perceptions regarding utilization of resources including the digital ones will contribute to the enhancement of anatomy curricula.

Keywords: Anatomy Education, E-Learning, Technological Literacy, Digital Resources, Adaptability

A-0700

Accelerating Medical Learning: AI-Powered Personalized SBA Question Generation for Enhanced and Sustainable Progress Tracking

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Purpose: Single-best Answer (SBA) questions are pivotal in supporting medical students' learning and assessing their factual and applied knowledge. While existing software tools offer SBAs, they often lack several key features, such as personalised progress tracking and curriculum customisation. Recognising these shortcomings, we have developed an innovative initiative leveraging fine-tuned Generative Pre-trained Transformer (GPT), GPT-3.5-Turbo and GPT-4 to generate extensive arrays of pre-clinical questions for student revision and progress tracking.

Methods: Our approach involves empowering students to upload their personal notes tailored to their course and enabling our trained GPT models to generate SBAs based on the uploaded resources. Through rigorous training on diverse datasets comprising example SBAs, these models have demonstrated remarkable reliability in generating SBAs that accurately reflect the nuances of medical knowledge. Our current focus lies in fine-tuning these models to enhance their perfor-

mance and output options further. The designed system contains a React-based frontend, which interfaces with a backend responsible for extracting and parsing text from uploaded PDF resources. Currently employing few-shot learning techniques, we train the GPT model tailored for SBA generation in a structured JSON format by utilising a support set of sample SBAs authored by experts.

Results: Our preliminary results have showcased tangible improvements in the reliability and efficiency of the system compared to conventional approaches, with notable reductions in latency and enhanced scalability in question production. Additionally, we have successfully scaled up question production while maintaining consistency in output format.

Conclusion: Moving forward, we plan to fine-tune our GPT models on larger datasets of SBAs, anticipating further improvements in latency and reliability. This scalability is crucial for horizontal expansion across faculties and vertical expansion into educational levels beyond medicine, such as A levels and GCSEs. Our initiative holds great promise in revolutionising student assessment and learning through personalised question generation and progress tracking.

Funding: Our project is funded by the College Teaching Fund (CTF), focusing on generative artificial intelligence (AI) at King's College London (KCL).

Keywords: Single-best Answer (SBA) Question, Question Generation, Progress Tracking, Artificial Intelligence (AI), Medical Education

A-0737

Objective Corroboration of Porcine Tissue Properties as a Surrogate for Surgical Skills Training

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Purpose: Porcine material is a common surrogate for soft-embalmed human donors in surgical skills training, but its suitability has yet to be objectively examined. This study evaluates the suitability of porcine material as a substitute for human tissues in surgical training by comparing their qualitative and mechanical properties when preserved with four embalming solutions.

Methods: Porcine and human tissue samples were embalmed with either Surgical Reality Fluid (SRF), Saturated Salt Solution (SSS), Imperial College London (ICL), or Ethanol-Phenol (EP) embalming solutions. Tissue suitability was subjectively evaluated using the McMaster Embalming Scale (MES) by residents practicing standardized surgical skills. One sample of skin, cortical bone, and intercostal muscle was excised from each specimen to undergo empirical testing (skin - puncture, incision, tearing, electrocautery, fluid content; bone - sawing; muscle- chest tube insertion). Data were analyzed via two-way ANOVAs.

Results: MES suitability ratings demonstrated interactions between tissue and solution ($p<0.05$). Particularly, SSS was rated less suitable than other solutions, and SRF was more suitable than other solutions in porcine but less in human tissues. Mechanical testing demonstrated some solution-dependent human-porcine differences. Porcine skin required more force to pierce, cut, and tear than human skin ($p<0.05$), but was not significantly different for chest tube insertion, bone sawing, or electrocautery tests. SRF demonstrated an opposing trend in puncture, tearing, and fluid content tests and ICL required more force during chest tube insertion on porcine tissue.

Conclusion: Human-porcine differences, with solution-specific variations, were demonstrated across mechanical metrics, suggesting that embalming solutions differentially affect human and porcine tissues in a quantifiable way. Limited MES human-porcine differences, however, suggest that despite quantitative differences, porcine tissue remains a suitable human surrogate for surgical skills training. Still, those using porcine tissue should optimize solution-tissue pairings for more refined surgical skills where fidelity is of greater importance.

Funding: PSI Grant #22-23.

Keywords: Surgical Skills Training, Cadaveric Training, Soft-Preservation, Embalming Solutions, Surgical Simulations

A-0739

Anatomy Teaching beyond the Binary - Rethinking Sex and Gender

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Purpose: Anatomy educational narratives of sex typically build on biologically essentialist, androcentric, gender polarised assumptions, with a focus on reproductive capacity as key markers of sex differences. However, contemporary understanding recognizes the complex interplay of biological, social, cultural and psychological factors in our understanding and expression of sex and gender. This calls for a re-evaluation of how sex and gender are addressed within anatomy curricula.

Methods: Since 2018, a 3-hour interactive seminar titled 'The Anatomy of Sex and Gender' has been implemented across 7 programs spanning undergraduate, graduate and professional anatomy education at multiple UK universities. Approx. 500 students have participated to date. Session content covers diverse topics encompassing critical perspectives on biological determinism, the social construction of sex categories, gender theory, LGBTQ+ health issues and pedagogic best practices regarding terminology and inclusivity. Teaching methods encourage critical thinking through research activities, discussion, and consideration of discipline-specific norms.

Results: Feedback from staff and students indicate that the seminar provided valuable dedicated time to consciously explore complex sex and gender themes. The worked example of applied critical thinking also empowered students to challenge assumptions in their learning. Challenges included managing sensitive disagreements and overcoming perceptions that philosophical content falls outside scientific discipline boundaries.

Conclusion: Mainstreaming dedicated consideration of sex and gender issues strengthens anatomy education regarding diversity, equity and inclusion. This enhances learner empowerment regarding social justice while upholding disciplinary priorities concerning accurate, precise and clinically considerate use of language. Furthermore the desire for this session evidences our disciplines willingness to become more inclusive and invites the wider anatomy community to challenge their assumptions on sex and gender.

Keywords: Sex, Gender, Inclusivity, Diversity

[F. Ethics in Anatomy]

A-0221

Unveiling Anatomy Education: Exploring Access Paradigms Post 'My Dead Body' Documentary

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Purpose: My Dead Body was a documentary that featured the first consented Public Display donor in the United Kingdom. The 30-year-old donor, Toni, had a rare adenocarcinoma of the lacrimal gland. She donated her body for Anatomical Examination and Public Display, specifically consenting to not be anonymous. To understand the different perspective of students and this public evaluations from the workshop and social media were analyzed using qualitative and quantitative methods.

Methods: Twelve laboratory workshops were delivered to 413 healthcare and research students. A documentary, which charted her illness using her own diaries and her family's experiences, intertwined the scientific exploration of the body through the dissection process. The documentary was viewed by over 1.5 million and social media comments highlighted the public's interest.

Results: Evaluation of the student workshops and analysis of digital media and social media content highlighted admiration and gratitude for the donor, the value of education, and that whilst it was uncomfortable to watch it has value in reminding us of life, our bodies, and our purpose.

Conclusion: Within the anatomy community questions remain as to what public display is and what its purpose is? This talk focuses on a key question: Should anatomists be the gatekeepers of who can access anatomical learning through donors?

Keywords: Public Display, Donor, Public Dissection, Anatomical Education

A-0230

Body Sourcing for Anatomical Research and Education in the Republic of Serbia

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Purpose: Human bodies are essential in anatomy education and research in many institutions across the globe. However, a knowledge gap exists concerning the sourcing and treatment of human remains in many parts of the world, as well as institutional compliance with the IFAA recommendations of good practice for body donation. These recommendations advise that willed body donation with explicit written consent is the ethical way of body sourcing. The aim of this study was thus to investigate body sourcing for anatomical education and research in The Republic of Serbia, where current legislation allows for body sourcing by both explicit and presumed consent.

Methods: A validated, self-administered, online questionnaire was distributed to all five anatomy departments in Serbia.

Results: Responses were received from all departments, indicating all utilise human remains. Four departments source bodies from the community (one exclusively by explicit and three by explicit and presumed consent) and one relies on plastinates (acquired from a supplier that sources bodies by explicit consent). The number of bodies used in teaching ranges from one to fifteen. Two departments have body donation programmes. One department informs students about the bodies' provenance and conducts a memorial ceremony for the donors.

Conclusion: Not all departments in Serbia source bodies by explicit consent as advised by the IFAA. It is recommended that all anatomy departments in Serbia that use bodies sourced from the community, should have body donation programmes, improve students' knowledge about donation, establish memorial ceremonies and develop body donation outreach programmes addressing the public. These actions, successfully applied in many institutions globally, could increase the number of donations and demonstrate the importance of donations and respectful treatment of bodies in anatomy laboratories. Change in legislation which would only allow willed body donation is also recommended to bring Serbian institutions into full compliance with the IFAA recommendations.

Keywords: Body donation, Bioethics, Serbia, Anatomy education

A-0278

Human Body Donation in South Africa: The Inconsistencies of Informed Consent

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Purpose: The importance of providing and obtaining Informed consent is vital in upholding the ethical standards associated with the procurement & utilisation of deceased human bodies for medical education and research. In South Africa, the National Health Act (2003) regulates the aforementioned; however, individual universities are equally responsible for ensuring that donor rights are protected. Therefore, the ability of a potential donor to accurately discern whether to enter into a body programme upon death is of significance - not only in terms of the functioning of a tertiary education institution; but also, in safeguarding the morality of humanity.

Methods: Information and consent forms collected from South Africa's seven human body donation programmes (HBDP) were analysed and evaluated to determine the scope of utilization of bodies and commitments made by HBDP to donors. The results of this study were considered against the 2014 International Federation of Associations of Anatomists guidelines and other recently published studies on HBDP informed consent processes.

Results: Only two of the seven HBDP provided information and consent forms in more than one language. Most allowed donors to select how their bodies will be utilized – education, training, and/or research. Five of the seven HBDP made provisions for the return of ashes to the next of kin. Only one tertiary educational institution mentioned the occurrence of a memorial service in its documentation.

Conclusion: Standardising HBDP documentation assists in providing transparency and the elimination of inconsistencies surrounding the utilisation of donor bodies within the academic context. The revision of terminology and level of language employed will also allow for greater inclusivity.

This process should however be conducted with the necessary oversight ensuring compliance and ultimately assisting in the requisite policy and legislative reform.

Funding: Financial support for this research by the South African National Research Foundation (grant number 115357). Opinions expressed and conclusions arrived at are those of the authors and are not necessarily to be attributed to the NRF.

Keywords: Body donation programmes, Consented donations, Informed consent, Gross anatomy education, Human research

A-0280

Recent Attitudes of Turkey towards Body and Organ Donations

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Purpose: This study aims to determine the attitudes of the Turkish population towards organ and body donation and to provide solutions to concerns about donation.

Methods: For this purpose, a survey was created by two expert anatomists through a Google form. The survey included 8 descriptive questions about individuals and 17 statements related to "Body and Organ Donation." Using the Snowball Sampling method, surveys from 15,451 individuals aged 18-75 belonging to different sociodemographic and cultural groups who participated between November 1, 2023, and January 1, 2024, were accepted.

Results: Although 96.2% of participants had not yet donated organs, 58.7% expressed a willingness to donate. Reasons for wanting to donate organs included saving someone's life, serving humanity/helping people, and donating for the needs of their relatives. Reasons for participants not wanting to donate organs included concerns about losing bodily integrity, hesitation due to limited knowledge, and religious reasons. While 57.1% of participants claimed to know how and where to donate organs, only 29.5% of participants claimed to know how and where to donate bodys. Of the participants, 18.3% viewed body donation positively, citing contributions to health education, feeling more useful, and the functional loss of their bodies after death as reasons. Among those who did not view it positively (81.7%), reasons included body exposure, religious inappropriateness, and dissatisfaction from their families.

Conclusion: As a result of this study, it was observed that organ donation campaigns, which have been ongoing for many years in Turkey, have been positively received. However, due to a lack of campaigns related to bodys, which play a crucial role in medical education, the majority of the population has a negative perception of donation due to insufficient knowledge. To increase awareness and improve attitudes towards body donation, it is recommended to organize seminars, conferences, panels, and educational activities on body donation.

Keywords: Body donation, Cadaver donation, Organ donation

A-0304

The Perspectives of Donor Families on the Whole-Body Donation Process: A Qualitative Study from Türkiye

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Purpose: Family involvement and its effects on the body donation process in general are not well understood in Türkiye, where donations are relatively low. Therefore, this study aimed to investigate opinions and experiences of surviving family members with a qualitative approach to understand the body donation phenomenon from their insights.

Methods: A series of in-depth interviews were conducted with 21 surviving family members of body donors. Donations were made to the Anatomy Departments of Ege University Faculty of Medicine and KoçUniversity School of Medicine between 2020 and 2023. The transcriptions of the interviews were thematically analyzed to construct relevant themes on families' experiences under five time-line categories: Decision-making, Official Application, Donation, Use as A Cadaver, and Ceremony. Ethical approval for the study was obtained from KoçUniversity Committee on Human Research (Document no: 2023.025.IRB3.009 ; Date: February 01, 2023).

Results: Themes were constructed according to two main

stakeholders: family and institution which revealed factors that facilitated or complicated the donation process. Early awareness and involvement of the family members was a pronounced sub-theme. The positive attitude of the receiving institution significantly contributed to the smooth completion of the donation. The donation changed the bereaved family members' perspective in their journey toward finding closure with their loss.

Conclusion: This study showed that the responsibilities of the receiving institutions and anatomists should be reevaluated under the light of the families' perspective to ensure the fulfillment of the donor's will. The insights from the study can initiate the development of effective donation policies and improve current practice employed by the authorities to ease the overall donation process for the donor and their families, and the institution.

Keywords: Body donation, Cadaver, Family involvement, Anatomy department, Türkiye

A-0630

When Ethics and Need Collide: The Importation of Human Tissue in Australia

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Purpose: This study examined the use of imported human tissue for training and contracted workshops in the context of Australian legal and ethical standards.

Methods: Information was collected as part of a national survey of the seventeen Australian body donor programs.

Results: 10/17 body donor programs freeze bodies, with most using frozen tissue for their training needs along with imported tissue procured from the United States. A number of purpose-built surgical training clinical facilities also import tissue. Importation of human tissue requires Ministerial approval and evidence that the tissue was sourced to a commensurate standard as that required for local donors (informed consent). Commercial dealings in human tissue are illegal, subject to provisions permitting reimbursement of costs in the supply of tissue. However, the documentation provided by the supplier is accepted for the purposes of proving (1) that the tissue was sourced from a consenting donor; and (2) that payments are for reimbursement of costs. There are well-documented concerns about the consent practices and for-profit status of "body brokers" in the United State. Local supply of donated bodies in Australia exceeds the demand for embalmed bodies and thus many programs have limited their acceptance area. Facilities for freezing bodies are currently limited, however, their expansion would obviate the need to import human tissue. The practice of importing human tissue seems to have evolved to meet the demand to conduct contracted workshops. It represents an ethical double standard with the standards and care afforded local donors and their families different to that directed towards overseas donors. It is also a potential reputational threat to local programs as the community is unlikely to accept that the legality of using imported tissue absolves anatomists of their ethical responsibilities to the overseas donors.

Conclusion: Ethical standards should be consistent whether tissue is locally sourced or imported.

Keywords: Body procurement, Importation of human tissue, Ethical standards, Commercialisation of human tissue

A-0697

Reflecting on Cadaver Procurement of the Past to Protect the Future

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Purpose: The public image of anatomy at Higher Education Institutions (HEIs) in South Africa incorporates gross, microscopic, and anthropological anatomy, which involves the use of human remains (i.e. cadaveric and skeletal material) for teaching and research. In the recent decade, there have been ongoing debates on the latest trends in anatomical pedagogy due to the change in curriculum and methods of teaching anatomy. The ethical problems associated with using unclaimed bodies versus donated bodies are the lack of informed consent and autonomy. Some of the challenges of cadaver procurement are based on individual diversities, legislative interpretation, and cultural, religious, sociological, economic, and educational statuses. Although body donation programs exist at HEIs, this does not alleviate the challenges of cadaveric shortages and the increasing needs of these institutions. An evaluation of the methods of procurement of cadavers at a select South African

HEI was warranted.

Methods: This study documented the demographics, method of procurement, retention and disposal of cadavers at all HEIs in South Africa that use cadaveric material for teaching and research. Cadaver records from the date of inception of University of Kwazulu Natal (1952 & 1982) to the end of the research collection period of this study (i.e. December 2022) were obtained from the cadaver register book. Ethical Clearance was obtained for the study.

Results: The methods of procurement of cadavers observed in the current study were body donation, unclaimed bodies from hospitals, unclaimed bodies from state mortuaries; obtained from another university and bodies of criminals.

Conclusion: Cadaver shortages have been evident around the world and in South Africa this had a considerable negative impact on anatomy teaching and research. However, consultation with indigenous and appropriate stakeholders regarding a way forward to resolve cadaver shortages for teaching and research should occur thus creating awareness of the benefits of donation to society.

Keywords: Cadaver procurement, Ethics, Anatomical education, Body donation

[G. Anatomical Terminology]

A-0072

Anatomical Terminology (TA 2) with Russian Equivalentes

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Purpose: On the initiative of the President of SMSAHE, Professor Dmitriy B. Nikityuk and Vice-President of SMSAHE, Professor Sergei S. Dydykin began correspondence with the Executive Committee to legitimize the initiative to translate, adapt and publish the Anatomical Terminology (TA 2) with the Russian equivalent of the terms.

Methods: Having received approval from FIPAT for the translation of TA2 into Russian, in November 2020 the Russian Anatomical Terminology Committee (RATC) was formed to release a new edition of anatomical terminology in Russian, consisting of: Editorial Board of the Committee: Academician of the Russian Academy of Sciences, Professor Dmitriy B. Nikityuk- editor-in-chief, Professor Sergei S. Dydykin, Professor Igor V. Zadnipryany, Professor Il'ya I. Kagan, Professor Marina Yu. Kapitonova, Professor Yuryi L. Vasil'ev.

Results: In this edition of the TA 2, RATC strictly followed the official list of Latin terms and endnotes FIPAT. Latin and English (UK and US) texts are given in accordance with those posted on the official FIPAT website. At the meetings of the RATC, the "Regulations on the compilation of Russian equivalents of TA 2". Take as a basis that Russian anatomical terminology is not a simple translation of Latin terms, but represents a historically established system that reflects the contribution of Russian scientists to human anatomy. The committee tried to preserve the terms, interpretation, location of the origin as much as possible and only in some cases, such as a historically different interpretation in Russia and abroad, make changes.

Conclusion: Endnotes are placed in a separate section at the end of each part (chapter). The Russian edition also added an alphabetic index for 3 languages - Latin, Russian and English.

Keywords: Oral, Terminology, Anatomy, Russian

A-0366

Are Eponyms the Achilles Heel of Anatomical Terminology? Views of Anatomy Journal Editors

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Purpose: Eponymous terminology is entrenched in anatomy, but whether eponyms are inclusive, ethical, and relevant to anatomists in the 21st Century, is unclear. Arguments, unsupported by research, exist both for and against the use of eponyms in anatomy. Editors-in-Chief and Senior Editors for the principal anatomy journals have a direct influence on terminology used in anatomical publications. Thus, the perceptions of editors regarding the relevance, ethics and inclusivity of anatomical eponyms in publications were investigated.

Methods: Ethical clearance for the study was granted by the Human Research Ethics Committee of the University of the Witwatersrand, Johannesburg. A validated, online and anonymised survey including open-ended questions was distributed to 22 Editor-in-Chiefs of anatomical journals.

Results: A response rate of 73% was achieved. Only 56% of the respondents were aware that eponyms had been censured since the Nomina Anatomica of 1895, yet most (88%) were aware of their increasing use in medical disciplines. Most editors found the use of Latin- and Greek-derived terms more useful than eponyms when communicating with peers (75%) and students (94%). Half of the editors (50%) followed the Terminologia Anatomica 2 with regard to use of eponyms when considering manuscripts in their journal. Additionally, many editors did not consider the continued use of eponyms an ethical concern (50%) or relevant to ethics (44%). Lacking consensus exists as half (50%) of the respondents thought that eponyms should not be excluded from use, while many editors believed that the responsibility for restricting their use should rest with anatomical societies, editors, reviewers, educators or a combination of all stakeholders.

Conclusion: Further opinion from emergent anatomists, clinicians and students should be garnered to provide a modern and diverse perspective on this topic. Enhanced awareness among anatomists of the stance of the IFAA's Anatomical Terminologies regarding eponym usage would guide authors, educators, and editors in best practice.

Keywords: Eponyms, Anatomy, Terminology, Ethics, Publishing

A-0472

Naming Variants: A First-Stage Proposal for a Terminology of Anatomical Variants and a System to Account for Its Nomenclature

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Purpose: At the moment there seems to be no fixed system to account for anatomical variants. This is probably the main reason why no such nomenclature seems to have been thus far attempted.

Methods: New work is being produced on variant anatomy all the time, but without consistent and easily discernible names, and a system for recording those names, all this valuable research and knowledge will not reach its widest possible audience – and much of it risks being lost due to the haphazard and unsystematic way that it is currently being (un)organized. A system for naming variants may be more challenging than the ones used for the other terminologies in anatomy, but such a system is a sine qua non before we can fully bring a terminology to life.

Results: We think that it is not only imperative that the anatomical community works to develop a new terminology for anatomical variants, but, as Latinists who use, teach, and study the various terminologies that IFAA/FIPAT produces, we also think that it is important that Latinists and anatomists work together to address the specific needs of this new terminology, and to hopefully establish clear guidelines that help everyone going forward – both those who create terms for the new nomenclature and, perhaps more importantly, those of us who will use it as a resource.

Conclusion: This paper proposes forming just such a working group, of anatomists who work with anatomical variants and informed Latinists like ourselves, in order to create a pathway for this innovative and necessary new nomenclature.

Keywords: Terminology, Variant Anatomy, Latin

A-0967

Proclaiming Terminology for the Conjoined Masseter and Medial Pterygoid Muscles from Decades of Human Dissections and over a Century of Surgical Recognition

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Purpose: Clinical anatomy dissection spanning 4 decades from the senior author and over a century of a surgically recognized conjoined muscle deserves formal terminology acknowledgement mirroring the morphology improving anatomy accuracy. Benninger has taught a dissection technique and analysed the masseter-medial pterygoid intermediate or central tendon(MMPIT) during the past 4 decades from several different prepared donor cadavers. Cross-sectional imaging has consistently demonstrated a tendinous sling conjoining

masseter-medial pterygoid muscles. Eschmarc in the latter half of the nineteenth century described the pterygo-masseteric sling as part of a mandibular surgical technique. Masseter is recognized as the strongest muscle in the body for its size. Fundamentally, tubercles are formed by the torque created from powerful muscles acting on tendons inserting into bone. Therefore, a formidable tubercle should form from the distal masseter and distal medial pterygoid(MP) insertions, however, modest tubercle(ridge) is created. The study objective is to provide formal terminology from anatomy dissection, surgery and radiology regarding MMPIT.

Methods: Literature search was conducted on contemporary anatomy texts(CTxts)/atlases(CAtls) and surgical texts/literature for MMPIT. Benninger dissection technique(BDT) includes gradual, deliberate, controlled finger-tip advance and slide MMPIT separation from inferior mandibular border region with GAX-specimens(6=12-sides) with BriteVu-contrast for CT/MRI, fresh-frozen-cadavers(FFC)18=36sides and formalin-fixed-cadavers(F-fC)350=689sides(11-sides had distal masseter insertion cut).

Results: No MMPIT identified in contemporary anatomy texts(CTxts)/atlases(CAtls). However, surgical texts/procedures consistently described pterygomasseter sling/tendon terminology. All GAX-specimens, FFC, F-fC had BDT allowing 737-sides revealing MMPIT. Anatomy websites mention the MMPIT. Although there is inconsistency about 2 or 3 regions/heads/parts of the masseter, all consistently agree the superficial head joins the medial pterygoid forming the MMPIT. Our data reveals the sling in multiple preparations, imaging and surgical texts. The masseter and MP rarely have anomalies.

Conclusion: This study revealed the MMPIT should be formally recognized in TA and taught during basic medical anatomy courses.

Keywords: Mixed reality, Ultrasound, Innovative medical education

A-0968

Orbicularis Oculi, Formally Has 3 Recognized Anatomy Sections with 1 further Divided into Superficial and Deep, Yet Conventional Teaching Texts/Atlases Don't Use This Fundamental Terminology

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Purpose: The Terminologia Anatomica 2nd ed.(TA2) approved by the International Federation of Associations of Anatomists (IFAA), formally recognized orbicularis oculi muscle (Orb-OcuM) as having 3 components, 1. Orbital, 2. Palpebral & Deep Palpebral and 3. Ciliary. The deep palpebral muscle is also recognized as lacrimalis or Horner's muscle(1822) but should be addressed as Duverney's muscle(1730) because he published the muscle's description approximately 92 years prior to Horner. Regardless, Duverne y-Horner term improves recognized TA2. Interestingly, Hollinshead wrote "LT Jones(1957) described delicate muscle fibers at the free edge of the lid have been separately designated as the ciliary muscle of Riolan, a complication of no practical usefulness." Hollinshead may have been accurate at the time but would certainly retract those words today due to their clinical significance. Healthcare students were confused and complained about the fundamental terminology, written content, and/or illustrations from contemporary medical anatomy texts/atlases versus electronic anatomy sites. The overwhelming issue was majority of contemporary texts/atlases describe and/or illustrate 2 parts of Orb-OcuM, orbital and palpebral. Objective of this study was to compare contemporary anatomy texts(CAnaTxts)/atlases(CAnaAtlases)/websites(CAnaWebs) for Orb-OcuM description with subsequent dissections.

Methods: Literature search was conducted on CAnaTxts/CAnaAtlases/CAnaWebs for Orb-OcuM. Dissection of Or-OcM from GAX-specimens(6=12-sides) with BriteVu-contrast for CT/MRI, fresh-frozen-cadavers(FFC)18=36sides and formalin-fixed-cadavers(F-fC)55=110sides. Total of 158sides dissected.

Results: Literature search revealed no CAnaTxts/CAnaAtlases revealing Orb-OcuM TA2-terminology fully. All CAnaTxts/CAnaAtlases/CAnaWebs identified orbital and pal-

pebral aspects(100%) but 67% CAnaTxts described lacrimalis with no ciliary regions. CAnaAtlases did not identify lacrimalis/ciliary regions(100%). CAnaWebs mentioned lacrimal 90% and recognized ciliary 60% for Orb-OcuM TA2-terminology. 152/158 sides(96%) all dissections revealed lacrimalis.

Conclusion: Orbital and single palpebral regions of Orb-OcuM were identified in all CAnaTxts/CAnaAtlases/CAnaWebs and dissections. However, TA2-terminology of lacrimalis and ciliary regions of Orb-OcuM is poorly represented in CAnaTxts(67%-lacrimalis,0%-ciliary), CAnaAtlases(0%-lacrimalis,0%-ciliary), but relatively well represented in CAnaWebs(90%-lacrimalis,60%-ciliary) and 96%-lacrimalis from dissections.

Keywords: GAX-Specimens, Anatomy Education and Terminology, Orbicularis Oculi

[H. Inno-Anatomy]

A-0028

Using Neuronavigation amongst Undergraduate Medical Students - An Opportunity to Promote Active Learning?

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Purpose: This presentation aims to assess the impact of neuronavigation technology on the active learning process of Skull Base anatomy among undergraduate medical students. The study addresses the need for innovative pedagogical approaches in the intricate area of Skull Base anatomy, focusing on how neuronavigation can aid in the comprehension of this complex region and its clinical significance.

Methods: A cohort of undergraduate students was introduced to neuronavigation tools during their Head and Neck Anatomy modules. The method involved observing skull base anatomy during performance of surgery on the Skull Base, complemented by traditional didactic teaching. Student engagement and understanding were measured using structured assessments before and after the intervention, and educator feedback was collected to evaluate the teaching methodology.

Results: Preliminary findings indicate that neuronavigation significantly improved the students' spatial orientation and understanding of Skull Base anatomy. It also increased their ability to identify key anatomical landmarks and appreciate the clinical relevance of the Skull Base region. The feedback highlighted the benefit of integrating technology with traditional learning to create a comprehensive educational experience.

Conclusion: Introducing neuronavigation in the teaching of Skull Base anatomy has proven to be a valuable educational enhancement, facilitating a deeper understanding of a challenging anatomical area. It also prepares students for advanced surgical training and aligns with the modern trajectory of medical education that embraces innovative technologies. The success of this program supports expanding the use of navigation to other complex anatomical regions. However, further evaluation of this in a larger cohort is needed to confirm the findings.

Keywords: Neuronavigation, Applied Anatomy, Active Learning, Skull Base Anatomy, Anatomical Education

A-0107

Cinematic Rendering and Histo Digital as New Innovative Anatomy Tools

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Purpose: The integration of medical imaging into preclinical anatomy courses is standard in many medical schools. However, the interpretation of two-dimensional grayscale images is difficult, and conventional volume rendering techniques only provide images of limited quality. In this respect, more photorealistic visualization through Cinematic Rendering (CR) offers better results for anatomical education. In addition, a new method is demonstrated with which serial histological sections can be reconstructed and visualized in 3D using a newly developed technology HiD®(Chimaera GmbH, Germany). Aim of the talk is to demonstrate by examples the possibilities of both methods for science and for anatomical teaching.

Methods: Cinematic Rendering and HiD have been used in different anatomical research settings to explore distinct anatomical features in 3D.

Results: Using various CT and MRI data sets of patients and scientific examination tissue from anatomy, entire patients, heads, organs, teeth, lacrimal glands and even smaller structures are reconstructed in 3D, thus demonstrating the possibilities of cinematic rendering and HiD®.

Conclusion: Both methods allow the creation of 3D data sets that provide new insights into microscopic and macroscopic anatomy and, in addition to new scientific approaches, open up new concepts for anatomical teaching.

Funding: Supported by a grant from the Deutsche Forschungsgemeinschaft DFG (PA738/15-1).

Keywords: Cinematic Rendering, Histo Digital, Threedimensional Reconstruction, Innovative Anatomy

A-0175

3D Photogrammetry Models of Human Specimens for Education in Anatomy

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Purpose: Cadaver-based instruction is not available in all medical institutions. We usually use two-dimensional (2D) photography and three-dimensional (3D) models in medical education. While 2D images sacrifice depth, 3D models oversimplify anatomical structures. Photogrammetry, a technique that overlays 2D photographs to create digital 3D models, addresses these shortcomings by creating digital models of real human specimens.

Methods: The human specimens stored at the Ewha Medical Academy were photographed. A camera equipped with a polarization filter on a lens (50mm f/2.8 Macro, Nikon, Japan) and a polarizing film on lighting were used. The camera settings included an aperture set at F10, lighting intensity ranging from 70-75% of 400W, and a fixed ISO at 100. The images were processed into 3D models using RealityCapture (Capturing Reality, Slovakia), then refined with Blender (Blender Foundation, Netherlands), 3ds Max (Autodesk, United States), and ZBrush (Maxon, Germany). Optimization for VR and AR visualization was performed using Pixyz Software (Unity Technologies, United States), with models stored in MariaDB (Monty Program AB, Sweden) and implemented in Unity. The visualization was reviewed on Meta Quest 3 and Android-based tablets.

Results: Twenty specimens from the head, neck and upper limbs were created into 3D models. The original texture and color of the specimen were preserved in its 3D model. Even the concave and convex parts of the specimens were rendered in 3D with remarkable detail and integrity.

Conclusion: This study suggests that photogrammetry is a viable method for converting cadaveric material into interactive 3D models and offers significant potential for anatomy education. There has been a steady demand for online learning resources nowadays. Not only is photogrammetry cost-effective, making it easy to create realistic 3D models of various human specimens, but these 3D photogrammetric human models are also easily accessible and clearly depict human anatomy, serving as valuable learning resources.

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Keywords: Photogrammetry, 3D computerizing models, Medical education, Human specimens

A-0225

Encouragement from the Right Source: Introducing Short-Content Module to High School Students in the Context of Anatomy Education

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Purpose: The Malaysian Ministry of Education has noted a diminished engagement in Science, Technology, Engineering, and Mathematics (STEM) among high school students. Human anatomy, a fundamental subject for medical sciences at the tertiary level, is encompassed within STEM. As one of the civil society actors, the present study intends to evaluate the knowledge in Human Anatomy by implementing an Interac-

tive Anatomy Module Laboratory-based (IAML) experience.

Methods: A concise module for high school students has been developed as part of Newcastle University Medicine Malaysia's one-day anatomy outreach program. A total of 87 students from the state of Johor were immersed in a range of hands-on activities that incorporated human anatomy materials and 3-dimensional (3D) anatomy software. The IAML facilitators, consisting of anatomists and clinical instructors, guided students through three distinct stations: the exploration of human heart, the histological examination of the heart wall, and cardiopulmonary resuscitation, each lasted approximately 30 minutes. To evaluate the effectiveness of the module's knowledge-transfer activities, students underwent pre- and post- assessments, with questions tailored to each activity.

Results: A paired sample t-test was conducted to evaluate the impact of IAML on students' assessment marks. The findings revealed a substantial improvement in student marks from before (5.94 ± 1.597) to after (7.79 ± 1.615) the module ($t86 = -10.815$, $p < 0.001$). The mean increase in the assessment marks was 1.851, with a 95% confidence interval ranging from -2.191 to -1.510. The eta squared statistic (0.58) indicated a large effect size.

Conclusion: IAML serves as a valuable catalyst in nurturing student knowledge in anatomy, via an interactive and hands-on approach. Through multimodal hands-on activities, IAML instilled inspiration and facilitated the development and assessment of metrics. This endeavour is crucial for continual progress in enhancing students' engagement with human anatomy and cultivating interest in STEM disciplines.

Keywords: Interactive Anatomy Module (IAML), Laboratory-based, Outreach Program, High School Students, Knowledge-transfer Program

A-0265

Evaluating Accuracy in AI-Powered Serial Segmentation for CT, MRI, Visible Human, and Histological Sections

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Purpose: Three-dimensional reconstruction is a valid research method in biomedical sciences; however, it is time-consuming and labor-intensive due to segmentation work. This study aimed to evaluate the accuracy of the AI-based segmentation and tracking model, SAM-Track, for segmentation of anatomical or histological structures, and explore the potential of AI to improve research efficiency.

Methods: Images of CT, MRI, and anatomical sections of the Visible Korean Human, in addition to serial histological section images of knee joint and pancreases from cadavers, were utilized along with their manually segmented masks. Six structures (femur, rectus femoris, liver, stomach, aorta, inferior vana cava) in CT, MRI, and anatomical sections, and seven structures (tibia, articular cartilage, lateral meniscus, anterior cruciate ligament, pancreas, superior mesenteric artery, portal vein) in histological sections were segmented using SAM-Track and compared with the manually segmented data by calculating the Dice similarity coefficient. The segmented images were three-dimensionally reconstructed.

Results: The average Dice scores of CT and MRI results varied widely (0.13-0.83), while anatomical sections generally showed good accuracy (0.31-0.82). Soft tissue structures such as the rectus femoris and the stomach had variable accuracy (0.38-0.82), whereas clear-edged structures such as the femur and liver had high Dice scores (0.69-0.83). Histological sections showed high accuracy, especially for well-delineated tissues such as the tibia and pancreas (0.95, 0.90). For 3D reconstruction, high Dice scores were associated with accurate morphological representations.

Conclusion: The study showed that SAM-Track's AI-based automatic segmentation provided mostly accurate results for anatomical and histological images, hence their segmented images could be applied to biomedical research with only minor modifications, suggesting a reduction in the time and effort required compared to manual methods. AI segmentation is beneficial for biomedical studies involving 3D reconstruction.

Keywords: 3D reconstruction, Segmentation, AI, Segment Anything Model, Visible Korean Human

A-0316

AI-Empowered 3D Pathology Provides Novel Visualizations and Quantifications with Clinical Diagnostic Value

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Purpose: Conventional two-dimensional (2D) pathology has limitations in capturing the spatial complexity of tissues. This study aimed to evaluate the potential of AI-empowered three-dimensional (3D) tissue imaging technology for visualizing and quantifying biopsy and surgical specimens, and its potential impact on clinical diagnosis.

Methods: To enable comprehensive analysis of 3D histopathology in inflammatory bowel disease (IBD) and Hirschsprung's disease (HSD), we established a novel 3D tissue analysis pipeline, integrating a passive and electric tissue clearing technique for enhanced transparency and shortened time, immunohistochemistry for specific marker visualization, confocal microscopy for high-resolution imaging, and AI-powered 3D rendering and quantitative analysis software. This non-sectional approach was applied to biopsy tissues from patients with ulcerative colitis (UC) and Crohn's disease (CD), as well as surgical samples from patients with CD and HSD.

Results: A new method optimized tissue clearing and AI generated detailed 3D images from biopsies, revealing more information than traditional methods. The AI, trained on specific features, removed noise and enhanced weak signals for superior 3D reconstructions compared to traditional software. IBD biopsy images revealed quantitative indicators of inflammation-induced crypt distortion, neuronal fiber structural changes, neutrophil distribution, and interaction with nerves. Similarly, 3D images of full-thickness surgical tissues from CD and HSD patients allowed observation and quantitative evaluation of macroscopic neural structure and distribution changes in large-scale diseased tissues.

Conclusion: We established a 3D tissue analysis pipeline combining advanced cleared tissue 3D imaging and AI-powered quantitative analysis, enabling comprehensive assessment of inflammatory bowel disease and Hirschsprung's disease tissues architecture, including 3D morphology, spatial distribution, and density of diverse cellular components. Trained on 3D imaging data, the AI model facilitated precise quantification and comparison with traditional 2D methods, paving the way for novel 3D image-based pathology assessment approaches.

Keywords: Tissue clearing, AI-powered 3D imaging, 3D histopathology, 3D pathological quantification index

A-0335

A Validatory Study Exploring the Oral Sublabial and Sublingual Fossa as Reproducible Anatomical Sites for Measurement of Microcirculatory Function

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Purpose: The microcirculation is the junction where the capillaries meet the extracellular matrix and peripheral tissue. Its function provides nutritional constituents conducive to cellular maintenance to meet individual requirements for surrounding parenchyma. Degradation of the microcirculation has been extensively researched in the acute setting and has now been extended to chronic conditions. The purpose of this study was to explore the concurrent validity of measuring microcirculatory parameters at the sublingual and sublabial mucosal sites. Furthermore, exploring differences between novice and experienced examiners was also undertaken to determine the relative contribution to microcirculatory measures.

Methods: Sidestream Dark Field microscopy (Microscan, Micro Vision Medical, Amsterdam, the Netherlands) was used to measure the microcirculation of 15 otherwise healthy participants at both the sublingual and sublabial fossa. The microcirculatory parameters were calculated using semi-automated analysis techniques via Automated Vascular Analysis 3.2 software. Parameters that were explored at both anatomical sites and compared included total vessel density, perfused vessel density, portion of perfused vessel, microvascular flow index, and heterogeneity index. Furthermore, these parameters were compared between novice and experienced observers at one

anatomical site and explored the differences in results that were associated with tester experience using bland-Altman plots.

Results: The heterogeneity of an individual's microcirculation affects the microcirculatory parameters, influencing results to a larger degree than the anatomical site. Furthermore, the experience level of the tester was associated with different parameter measures for identical individuals.

Conclusion: Both the sublingual and sublabial fossa provide adequate sites to measure an individual's systemic microcirculation in the correct setting. Differences in the measures gathered by novice and experienced testers are pertinent and should be accounted for in data collection.

Keywords: Microcirculation, Microscopy, Sublacial, Sublingual

A-0364

BounTI (Boundary-Preserving Threshold Iteration) - A Novel Automated Hard Tissue Segmentation Tool

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Purpose: Manual image segmentation poses significant challenges as it can be intensive and time-consuming. The primary objective of this study was to develop an accessible and user-friendly automatic hard tissue segmentation tool, named BounTI. The tool was tested on various skeletal regions.

Methods: To achieve automatic segmentation, we introduced a novel algorithm based on threshold iteration. Sensitivity tests were conducted to assess the impact of input parameters on segmentation outcomes. The algorithm was then tested on craniofacial system scans from diverse species, including a snake, a lizard, an amphibian, a mouse, and two humans, one with craniosynostosis. This approach allowed us to evaluate the tool's performance across different anatomical structures and scan conditions. Lastly, the algorithm was tested on other skeletal regions.

Results: The results demonstrate the efficacy of BounTI in automatically segmenting various bony elements within and outside the craniofacial system. The algorithm successfully preserved boundaries between anatomically distinct elements, showcasing its versatility across different species and scan qualities. Notably, the study revealed that while high-resolution microCT images enhanced segmentation accuracy, BounTI remained effective even with significantly lower-quality clinical images, underscoring its robustness.

Conclusion: Our findings highlight the potential of BounTI as an automatic segmentation tool not limited to the craniofacial region. The algorithm's applicability extends to the segmentation of hard tissue scans in general. BounTI is made accessible to the anatomical community through different formats, including an Avizo/Amira Addon, a stand-alone Windows executable, and a Python library. By offering a time-efficient alternative to manual segmentation, we anticipate that this user-friendly tool will significantly benefit researchers in the anatomical field.

Funding: This work was supported by the Engineering and Physical Science Research Council (EP/W008092/1; EP/R513143/1 – 2592407 and EP/T517793/1 - 2592407).

Keywords: Automatic Segmentation, CT data, Craniofacial system, Bone analysis

A-0365

Navigating the Virtual Cadaver: A Constructivist Approach to Anatomical Learning

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Purpose: The realm of virtual anatomy (VA) is experiencing rapid growth, characterised by continuous advancements that captivate anatomists with the promise of versatile possibilities. Despite this exciting trajectory, a critical gap exists in the literature, offering little guidance on the integration of virtual anatomy technology into curricula based on pedagogic principles. This study aims to discern differences in student learning when using VA to dissect anatomical regions from the outside-in versus constructing them from the inside-out using virtual anatomy, thus testing whether Piaget's educational theory of constructivism can be applied to a virtual anatomy context.

Methods: The research adopts both asynchronous and synchronous mixed-methods data collection methods to compre-

hensively explore student interactions with virtual anatomy. Asynchronous data collection involves students choosing 'dissection' or 'construction' versions of activities during preparatory work, while synchronous data collection integrates in-class activities during anatomy sessions. Anonymised data will undergo statistical analysis and thematic coding to compare learning outcomes and perceptions, contributing valuable insights for evidence-based curriculum development in virtual anatomy education. Variables such as construction vs dissection, course of study, and year of study are considered.

Results: In this presentation, the authors will explain the key findings from statistical and thematic analysis of the data. By considering variables such as the method of engagement (construction vs dissection), course of study, and year of study, the findings offer a nuanced perspective that can inform educators in tailoring virtual anatomy learning activities for specific student groups.

Conclusion: This research aspires to contribute not only to the theoretical framework of virtual anatomy education, but also to the practical development of evidence-based curricula. By addressing the identified gap in the literature, this study strives to empower educators with the knowledge needed to optimise the use of virtual anatomy technology in teaching, thus fostering a more dynamic and engaging learning environment for anatomical education.

Keywords: Virtual anatomy, Digital anatomy, Virtual construction, Constructivism, Anatomy education

A-0382

Exploring the Influence of α-/β-MSH on Meibomian Gland Exocrine Secretion: Insights from a Novel 3D Organotypic Slice Culture Model

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Purpose: Meibomian glands (MG) produce a lipid-rich secretion crucial for the tear film's stability. Meibomian gland dysfunction (MGD) stands as the main cause of the increasing public health issue, dry eye disease (DED). Current pharmacological options for DED treatment are limited. Therefore, this study aims to establish a 3D organotypic slice culture model of mice and human MGs to mimic physiological conditions and investigates the impact of α-/β-MSH on exocrine secretion.

Methods: Over a 21-day cultivation period, tissue viability, lipid production, and morphological changes of the organotypic culture were analyzed. Immunohistochemistry and RT-PCR were conducted to verify MCR expression. The organotypic culture and ihMGECs were stimulated with α/β-MSH (MCR agonists) and JNJ-10229570 (MCR antagonist). The effects of α-/β-MSH on lipid production and MCR response were assessed through Oil Red O/Lipi Red staining and cAMP assay. FACS analysis and qPCR were performed to investigate the effects of α-/β-MSH on expression levels of MCRs and lipogenesis markers.

Results: The cultivation of the organotypic cultures were possible without impairment for at least seven days, while MCR expression was verified in meibomian glands. Stimulation with α- and β-MSH induced cAMP and lipid production dose-dependently, significantly reduced with simultaneous MCR antagonist incubation. The gene expression of lipogenesis markers significantly increased after α-/β-MSH treatment. Similarly, α-/β-MSH significantly upregulated gene expression of MCRs.

Conclusion: The newly established organotypic model is a promising approach to study the (patho-) physiological properties of MG/MGD while reducing animal studies, and may expedite the search for novel MGD/DED treatments. Adiitionally our data reveal, that stimulation/inhibition of MCRs alters their expression and influences meibum genesis, suggesting a positive impact of α-/β-MSH on meibum production. This potential effect should be considered in addressing glandular secretion changes in MGD and in exploring potential therapeutic interventions.

Funding: German Research Foundation grant PA738/15-1 (FP).

Keywords: Meibomian gland, Melanocortin receptor, Organotypic slice culture, Dry eye

A-0391

3D Printed Internal Fixation Plates From Computerized Tomography Data of Acromion Fractures in Cadavers

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Purpose: With the paradigm of tailored medicine on the horizon, physicians are ever increasingly in need to find individualized solutions for their patients. As such, the methods and materials with which surgeons repair damage must also be dynamic. Our goal was to develop a method for designing custom surgical fixation plates from CT scan data of acromion fractures for 3D printing and machining applications.

Methods: In order to design custom fixation plates, 14 cadaver upper limbs were procured from the Department of Anatomy, Second Faculty of Medicine, Charles University. The limbs were then taken to Motol University Hospital, Prague, to undergo CT scans. The first pass was performed on intact limbs to establish a relative anatomical baseline. Following the first scan, fractures were induced in the acromions. The fractured limbs were subsequently imaged again. CT data were analyzed and 3D models were reconstructed using 3D Slicer. Single plane images from Slicer were then imported into FIJI (ImageJ) for morphometric analysis. These parameters were then applied as boundaries for a surgical plate in FreeCAD, with the designed models printed on a Prusa SL1S 3D printer. Plates were attached to the cadaver scapulae with screws and a third CT scan was taken to assess anatomical position and plate fitment.

Results: All acromions returned to pre-fracture anatomical positions within 5% deviation of length and lateral curvature and 14% of superior curvature. From CT scan to finished print: 24 hours.

Conclusion: Custom fixation plate design from CT data can be a way to noninvasively plan and solve fitment issues in bone fractures. In the case of acromion fractures, having the ability to both create 3D models of the fractured bone and leveraging software to extract vital curvature information, a scaffold for a custom plate is easy to design and each instance is uniquely tailored to a specific patient.

Funding: This work was supported by the Grant Agency of Charles University (GAUK), Prague, Czech Republic [grant no.: 2120319].

Keywords: Computer Assisted Design, 3D Printing, Curvature, Acromion, Fracture

A-0474

Competent C's: Innovations in Anatomy and Histology with the Six Competencies of Twenty-First Century Skills

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Purpose: To appeal to new generations of digital learners, instructors within the Master of Science in Biomedical Sciences Program (MSBMSP) at the University of Mississippi Medical Center have incorporated into their curricula digital materials and the six twenty-first century competencies. This Competent C's initiative has been implemented to enhance students' learning experiences in the program and encourage them to transfer these skills to and adapt them for their future careers in the health sciences.

Methods: The MSBMSP includes over 100 students each year who enroll in professional development and biomedical science courses, such as anatomy and histology, incorporating the six competencies which include critical thinking, citizenship, critique, communication, creativity, and collaboration. Students' mastery of these competencies are evaluated using the VALUE rubrics published by the American Association of Colleges and Universities.

Results: Students' critical thinking and problem-solving skills are engaged during team-based learning (TBL) and virtual lab sessions in their histology course and during cadaveric laboratory and extension exercises in their anatomy course. Students' concepts of citizenship through heightened cultural awareness and humility are gained via incorporations of diversity, equity, and inclusion topics in their anatomy course. Instructors' critiques, effort-based praise, and self-regulatory study strategy tutorials are provided to their students in their histology and anatomy courses to promote and foster among them a growth mindset. In addition, students have practiced their written and oral communication skills via writing assignments and team interactions in their professional develop-

ment, histology, and anatomy courses. Furthermore, students have had the option to hone their creativity skills through enrichment activities incorporating art and poetry in anatomy and histology.

Conclusion: These experiences not only have made students' learning experiences in histology and anatomy more fun and stimulating but also have increased potentially their competencies in twenty-first century skills that can be carried with them into their future health professional careers.

Keywords: Innovations, Twenty-first century skills, Anatomy, Histology, Professional development

A-0562

The International Landscape of Public Engagement in Anatomy

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Purpose: The popularity of anatomy public engagement is growing, and anatomists must take the lead to ensure accurate information is delivered to support public knowledge of the links between anatomy and health. To support and direct this growth, this study explored the perceptions of anatomists of what "good" anatomy public engagement looks like, preferred engagement resources, and the outreach training needs of the international anatomy community.

Methods: An online survey in five languages was distributed to the International Federation of Associations of Anatomists' constituent associations. Using thematic analysis, the perceptions of anatomists were reviewed from global and regional perspectives.

Results: The survey was completed by 50 anatomists (across six continents) with a breadth of public engagement experience. A wide geographical spread of opinions highlighted areas of global consensus on effective outreach methods, as well as local considerations that could be applied more widely. Effective strategies predominantly focused on the resources used, rather than the skills and expertise of the presenter(s). However, essential training needs, such as communication skills development and the integration of technology in public engagement efforts were highlighted. Anatomical models and technology (e.g., virtual reality platforms) were consistently presented as good resources for public engagement, while the appropriateness of using animal tissue dissection was region-specific. There was notable controversy around using human tissue in a public setting, reflecting the ongoing debate within the anatomy community at the time of writing.

Conclusion: The study provides crucial insights into the international landscape of public engagement in anatomy, emphasizing both shared perspectives and diverse approaches influenced by region and individuals' preference. Moving forward, targeted initiatives can leverage these findings, fostering a community of anatomists who can communicate effectively and enhance public understanding of anatomy globally.

Funding: This study was supported by an Innovations grant from the American Association of Anatomy.

Keywords: Public engagement, Science communication, Outreach

A-0563

Digitization Protocol Implementation on the Gastrocnemius-Soleus Complex of Embalmed Neonatal Cadavers: Methodology for Creating High Fidelity Finite Element Models

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Purpose: The most prevalent motor disability observed in children is cerebral palsy (CP). The longer it takes to diagnose CP, the longer intervention is delayed. Little is known about neonatal development of non-pathologic gastrocnemius-soleus complex (GSC) and its functional architectural parameters. Therefore, the purpose of this study is to examine the use of novel digitization protocols to create high fidelity models, as in situ, of neonatal GSC.

Methods: The protocol developed at the University of Toronto involving dissection, digitization, and 3D modeling was adapted to study neonatal muscles. The specimen was stabilized and subcutaneous tissue and crural fascia removed. The superficial fiber bundles (FBs) of medial (MG) and lateral

(LG) heads of gastrocnemius were delineated and digitized. Digitized FBs were removed revealing underlying FBs. This process of dissection and digitization of FBs and aponeuroses was carried out throughout the entire muscle volume. The soleus was similarly digitized. The 3D models were constructed using Autodesk®Maya®(Autodesk Inc) with plugins developed in the laboratory. FB length and physiological cross-sectional area (PCSA) were computed in 3D space.

Results: FBs and aponeuroses of MG, LG and soleus were modeled in 3D enabling analysis of FB/aponeurotic architecture throughout the entire volume of each muscle. All three muscles had differing aponeurotic and FB arrangement. MG and LG had anterior and posterior aponeuroses, differing in extent, to which the majority of FBs attached. Soleus had three parts, posterior, anterior, and marginal, with three aponeuroses for FB attachment. FB length varied between soleus parts and the MG and LG. Soleus was found to have the greatest PCSA, followed by the MG and LG.

Conclusion: A highly detailed and anatomically accurate FB/aponeurosis model of the GSC has been constructed from in situ digitized data. The models provide the basis on which to carry out a comprehensive analysis of neonatal GSC architecture.

Keywords: Finite element modeling, Biomechanics, Neonatal anatomy, Gastrocnemius-soleus complex, Muscle architecture

A-0589

Scalability of Innovative Anatomy: Highlighting the Case of Ewha Medical Academy

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Purpose: Ewha Medical Academy, affiliated with Ewha Womans University Medical Center, aims to provide innovative medical education based on anatomical knowledge to healthcare professionals, corporations, and the general public, as well as tailored programs for various industries utilizing professional medical educational content, thereby maximizing business performance and growing as a leader in creating new value and medical convergence.

Methods: Ewha Medical Academy consists of three entities: Convergence Education Center, Medical Contents Center, and Human Information Application Center.

Results: The Convergence Education Center imparts anatomy education to medical and nursing students, and conducts anatomy and clinical workshops for corporates. Approximately 3,000 individuals are trained in this center annually. It also operates a human exploration school, similar to a mini-medical school, enabling students to explore career opportunities in the medical field. The Medical Contents Center produces illustrations and videos important for medical field-related papers, textbooks, and lecture notes through professional medical illustrators. In particular, the center has produced various material, including large number of anatomical drawings of each body part and 3D layered anatomical models. The Human Information Application Center is engaged in creating "human digital twins" - 3D human models containing anatomical information, for use in the field of medical engineering. It also undertakes development using artificial intelligence, virtual reality and augmented reality technologies. It is developing a virtual environment medical service platform centered on maternal-fetal care and a medical metaverse for remote outpatient care. In addition, it designs and conducts educational programs for employees in various industries based on human anatomy, demonstrating the potential for expanding anatomical education.

Conclusion: It is believed that the Ewha Medical Academy model could serve as a valuable reference for future applications in the field of anatomy. In this presentation, we aim to provide an overview of the outputs from the three Centers at Ewha Medical Academy.

Funding: This research was supported by a grant of the Korea Health Technology R&D Project through the Korea Health Industry Development Institute (KHIDI), funded by the Ministry of Health &Welfare, Republic of Korea (grant number : HI23C0170).

Keywords: Innovative anatomy education, Medical contents, Human model, Medical convergence

A-0592

Auto Segmentation Methods Based on Vision Transformer for Developing Precise Human Digital Twin

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Purpose: The medical industry is witnessing a groundbreaking innovation in the form of human digital twins. Human digital twins enable simulation of anatomical structures of human body and provide efficiency to doctors by easing the process of diagnosis and surgery. This study focuses on adapting transformer-based models for musculoskeletal segmentation using the Visible Korean dataset, potentially contributing to the development of human digital twin. The objective of this research is to experiment with transformer-based models for auto segmentation of bones and muscles by utilizing the Visible Korean dataset. Developed by KISTI for human anatomy research, the dataset encompasses comprehensive information including full-body serial sections of a Korean male and female, along with corresponding CT, MRI, and segmentation masks for various body elements.

Methods: Transformers have not only dominated in natural language processing but have also influenced in the area of computer vision. Recently, Transformers have been combined with U-Net model for accurate segmentation of medical images. We experiment with six transformer-based models including FCT, Swin-Unet, Trans-Unet, PVT-Cascade, Trans-Cascade and MERIT. We utilized body slices and musculoskeletal segmentation masks from the Visible Korean dataset. The Dice Similarity Coefficient (DSC) is used as evaluation metric.

Results: The result of our experiment shows that the Trans-Unet achieved the highest DSC score among all the other models which show comparable performance to each other. Overall, the transformer-based models are very effective in segmenting anatomical structures of human body and have potential to contribute to creation of human digital twins.

Conclusion: This study conducted research on the performance of segmentation models based on Transformer for musculoskeletal segmentation using Visible Korean dataset in order to develop a precise human digital twin. The results of this study are expected to contribute to the development of human digital twin.

Funding: This research was supported by KISTI under a major project (K-23-L01-C03-S02).

Keywords: Medical image segmentation, Human Digital twin, Vision Transformer, Deep learning, Visible Korean

A-0628

Histological Horizons: Bridging Tradition and Innovation in Medical Education through Inno-Anatomy Convergence

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Purpose: In the evolving landscape of medical education, integrating innovative learning methodologies is crucial for improving teaching effectiveness and student engagement. This study evaluates the impact of combining manual and virtual histology laboratories on medical students' learning outcomes and perceptions, highlighting the synergy between traditional hands-on techniques and digital tools in enhancing educational experiences.

Methods: A mixed-methods approach was adopted, involving quantitative surveys and qualitative interviews with medical students who experienced both manual (traditional microscopy) and virtual (digital simulations) histology lab sessions. The study measured student preferences, perceived effectiveness, and the impact of each method on their learning process.

Results: Findings revealed a high appreciation among students for both manual and virtual methods, with a significant preference for their integration. Students reported that the blended approach provided a more comprehensive understanding of histological concepts, offering the tactile depth of manual microscopy alongside the accessibility and versatility of virtual simulations. Notably, this integration facilitated a more flexible and engaging learning experience, aligning with diverse learning styles.

Conclusion: The integration of manual and virtual histology labs represents a promising educational strategy in medi-

cal training, combining the strengths of traditional and digital methodologies to improve student learning outcomes. This study underscores the potential of innovative teaching approaches to enhance the educational landscape, advocating for a balanced integration of manual and virtual practices in histology education.

Keywords: Histology education, Manual laboratory, Virtual laboratory, Hybrid learning, Medical education

A-0644

To Stent or Not to Stent? AI-Based Carotid Plaque Characterisation for Interventional Decision-Making

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Purpose: Stroke remains a significant cause of mortality and disability worldwide. Accurate diagnosis and risk assessment are crucial for effective management of carotid artery disease. In this context, non-invasive imaging plays a pivotal role in detecting and characterising carotid plaques. Accurate assessment of plaque stability is essential for determining the optimal intervention strategy. We present an AI-driven approach that automates plaque detection and quantification from carotid ultrasound images.

Methods: Our AI model detects and quantifies carotid plaque in vascular ultrasound imaging. The model also analyses key plaque parameters, including lipid content, fibrous cap thickness, juxtaluminal black area, distinct white areas, and overall plaque morphology. By characterising these features, we aim to provide clinicians with valuable insights into plaque stability.

Results: Preliminary results demonstrate the AI's ability to identify high-risk plaques. Lipid-rich, thin-capped, and extensively calcified plaques are associated with increased vulnerability. Conversely, stable plaques exhibit different characteristics.

Conclusion: Our AI-based approach holds promise for personalised intervention decisions. By answering the pivotal question—"to stent or not to stent?"—we empower clinicians to tailor treatment strategies based on individual plaque profiles.

Keywords: Stroke, Carotid Artery, Plaque, Artificial Intelligence, Imaging

A-0650

Digital Innovation in Virtual Learning of Macroscopic Anatomy at Universidad de los Andes in Santiago, Chile

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Purpose: In 2024, the School of Medicine of Universidad de los Andes made a change in the curriculum, reducing the medical career to twelve semesters, associated with a substantial change in the educational model. The educational model focuses on the student and applies numerous learning resources, where the main one lies in direct, in-person cadaveric practice in the laboratory. The purpose of this study is to convert the anatomical laboratory into a blended activity, complementing the prosection with virtual indirect study. The face-to-face classroom will be virtually transferred to the self-instructional digital format through study guides and 3D digital design cadaveric material of the same laboratory demonstration pieces and the preparation of virtual tasks, self-study and self-assessment.

Methods: To create the models, the photogrammetry technique was used, based on the use of a professional mobile photography studio and latest generation computer software. Specifically, the material used was a Nikon D850 camera, with Nikon 50 and 105mm lenses, and the Agisoft Metashape program. Firstly, photographs of the cadaver preparations were obtained on all sides, using a rotating turntable to obtain their entire spatial orientation, resulting in approximately 500-1000 images per preparation. Subsequently, these were processed and revealed digitally using the Adobe Lightroom program, and then imported into Agisoft Metashape and began the digital creation of the 3D models, in a series of sequential steps that allow modeling. Finally, once the models were obtained, they continued to be uploaded to the Sketchfab web platform, where they were post-processed to finally allow their digital visualization and direct online interaction.

Results: Improvements in results of formative assessments, summative assessments and excellent results in student satisfaction surveys.

Conclusion: Excellent instrument that enhances self-study and face-to-face activities. Increases independence, autonomy

and imagery, improving anatomical knowledge based on preserved and dissected material.

Keywords: Gross Anatomy, Virtual Learning, Video 3D, Education, Innovation

A-0658

Structural and Functional Brain Connectivity Predicts Thalamotomy Outcome in Parkinson's Disease

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Purpose: Magnetic Resonance-guided Focused UltraSound (MRgFUS) thalamotomy is effective in alleviating tremor symptoms in Parkinson's disease (PD), with emerging evidence suggesting that treatment outcomes may be influenced by brain connectivity rather than the choice of anatomical target alone. However, it remains unclear whether brain connectivity can predict clinical outcomes in tremor-dominant PD patients. We aim to characterize structural and functional connectivity associated with successful MRgFUS ablation of the Ventral intermediate thalamic nucleus (Vim) and assess its potential to predict treatment outcomes.

Methods: Twelve tremor-dominant PD patients underwent unilateral MRgFUS thalamotomy. Treatment outcome was measured as the percentage change in motor score of the UPDRS-III one week post-treatment. Different standard ablation and anatomical features were tested for correlation with clinical outcome. We then combined our PD dataset with normative human connectome data (diffusion tractography and resting state functional connectivity) to identify connectivity patterns associated with clinical improvement. Structural and functional connectivity profiles were then independently employed to predict clinical outcome in a leave-one-patient-out cross-validation (LOOCV) design.

Results: No significant correlations were found between standard ablation and anatomical features and clinical outcome. However, connectivity between the ablation site and a network of brain regions, including structural connectivity to pre-supplementary motor area, supplementary motor area, superior frontal gyrus, and cerebellum, correlated with clinical improvement. Similar patterns were observed in functional connectivity, with anticorrelation between the ablation area and primary somatosensory cortex and the most lateral part of primary motor cortex. LOOCV demonstrated that both structural ($R2 = 0.53$; $R = 0.73$; $p = 0.002$) and functional connectivity ($R2 = 0.23$; $R = 0.48$; $p = 0.007$) fingerprints predicted clinical improvement.

Conclusion: Both target structural and functional connectivity are independent predictors of clinical improvement in tremor-dominant PD patients undergoing MRgFUS thalamotomy. This study suggests the potential for brain connectomics surgical targeting while warranting further validation in independent cohorts.

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Keywords: Connectome, Computational Neuroanatomy, Functional MRI, Neuroimaging, Tractography

A-0659

Computer Vision for Automatic Segmentation of Anatomy during Explorative Laparoscopy

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Purpose: Computer vision appears promising in anatomical structure recognition during laparoscopy. Despite the availability of various deep-learning models for intra-abdom-

inal anatomy, these models often target specific organs within surgical contexts. Furthermore, the classification process faces challenges due to intra-patient variability in organ morphology and texture, limiting model applicability and standardization. This study aimed to construct automated computer-based models for identifying topographic anatomy across the entire abdominal cavity, independently of surgical steps.

Methods: A comprehensive checklist of anatomical structures was developed. The checklist included 28 anatomical structures comprising detailed definitions of topographical characteristics based on their anatomical features observed during laparoscopy. The checklist was developed by three surgical experts. A total of twenty-seven videos of explorative laparoscopic surgeries were collected and pixel-wise segmented by six annotators. Each video underwent critical review by two surgeons, with discrepancies resolved through consensus. Detection (Yolov7-e6e) and segmentation (Segformer) models were built for identifying the 28 anatomical structures. Split was done based on the frames with a ratio of 80:20:20 for the training, validation, and test sets.

Results: The dataset comprised a total of 1984 annotated frames (training: 1290, validation: 297, test: 397). The detection model showed a mean average precision (mAP0.5) for all structures of 66.9 (range 30-91.8). The best recognized structures were uterus (92.8), right hemidiaphragm (88.3), left liver lobe (87), gallbladder (84.7), bladder (83.2) and sigmoid colon (83.2). For the segmentation model, the Intersection-over-Union (IoU) was on average 53.8 (range 16.5 -89.6), with the best recognized organs being transverse colon (89.6), greater omentum (81.0), stomach (74.2), left hemidiaphragm (73.0) and gallbladder (67.9).

Conclusion: The proposed deep-learning computer-aided approach for the automatic recognition of laparoscopic anatomy exhibits both a good performance and delineation in identifying anatomy. The next steps will involve validating the models and exploring their clinical and educational utility.

Keywords: Computer vision, Surgical Anatomy, Laparoscopy, Deep-learning, Automatic recognition

A-0668

Pilot Study: Exposing Gaps in Training and Identifying Essential Skills and Knowledge Areas Relevant to Gross Anatomy Laboratory Managers

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Purpose: This study aimed to identify essential skills and knowledge areas relevant to Gross Anatomy Laboratory Managers (GALMs).

Methods: Feedback from a panel of industry experts (n=5) through a one-hour virtual focus group using a semi-structured interview of eight questions and two probing questions was transcribed verbatim with Otter.ai.

Results: Experts identified five unique, essential skills for GALMs' success, including Laboratory Design, Standard Operating Procedures (SOP) Development, Organization, Technology Incorporation, and Technical Writing. Specific topics in these areas include optimizing the Gross Anatomy Laboratory (GAL) layout for multiple unique programs, maximizing teaching technology, and developing SOPs tailored to the GAL's specific operational and organizational needs. Experts identified five critical knowledge areas for effective GAL management. Whole Body Donation, Microbe Control, and Dissection Tools/Equipment are unique in these five areas. Specifically, the experts emphasized the importance of understanding cadaver upkeep, ethical procedures, and basic knowledge of standard tools and equipment. While the experts also identified Chemical Safety and Safety and Health procedures as important knowledge areas, these areas already exist in training programs. However, experts recommend the inclusion of more focused GAL topics, such as minimizing formaldehyde exposure, adhering to regulations and standards, and optimizing environmental conditions to provide comprehensive training for GALMs.

Conclusion: Existing laboratory management training programs focus on broad competencies with wide applicability. While these competencies provide guidance, individuals in niche areas like GALs require specialized training to prepare them for the role. Experts identified five essential skills GALMs must possess to meet the operational needs of the GAL. Experts also pinpointed five knowledge areas, three

unique to GALMs and two requiring incorporating focused GAL topics. The result of this study exposes the shortcomings of existing laboratory management training programs in adequately preparing GALMs. These findings will inform a specialized training curriculum that addresses the knowledge and skills unique to GALMs.

Keywords: Human gross anatomy laboratory manager, Laboratory manager, Specialized training programs, Whole body donation, Training

A-0898

Evaluation of Biomechanical Properties of Some Thigh Muscles According to Pelvic Axial Rotation Direction in Adolescent Idiopathic Scoliosis Patients

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Purpose: Pelvic asymmetry is one of the biomechanical changes that occur with deviation from normal in sagittal, transvers and frontal planes of vertebral column as a result of adolescent idiopathic scoliosis (AIS). When a deformity occurs in a joint, the disorder is not limited to that joint group, but also causes problems in surrounding joints, ligaments, and muscles. Therefore, as a result of pelvic asymmetry, muscles attached to pelvis are affected.This study aims to examine muscle myotonometric changes in thighs of AIS patients according to the direction of pelvic axial rotation (PAR) and to obtain information about biomechanical properties of muscles.

Methods: Approval was obtained from Gaziantep University Clinical Research Ethics Committee before the study (2023/295). Thirty-three individuals (mean age: 13.94±2.13, male: 10, female: 23) diagnosed with AIS were included in the study. PAR direction was determined on AP radiographs of individuals and groups was created accordingly. MyotonePRO is a device valid in the literature that can measure tone, stiffness, elasticity of myofascial tissues and does not cause complications in patients. Tone, stiffness, elasticity of rectus femoris, vastus lateralis, vastus medialis, semitendinosus, biceps femoris and patellar ligament were measured with MyotonePRO. Data analysis was carried out with SPSS 25 program.

Results: Tone, stiffness, elasticity; When the PAR direction was compared with patellar ligament and anterior thigh muscles in same direction and patellar ligament and anterior thigh muscles in opposite direction, a strong to moderate positive correlation was found. Similar results were found in posterior thigh muscles for tone and stiffness.

Conclusion: It has been determined that there is a relationship between tone, stiffness and elasticity of muscles in thigh of AIS patients according to PAR direction. According to the detailed literature review, we think it will contribute to the clinic and literature as it is the first study on this subject.

Keywords: Adolescent idiopathic scoliosis, Tone, Stiffness, Elasticity, Pelvic axial rotation

A-0900

Evaluation of Myotonometric Properties of Deltoid Muscle According to the Curvature of Scoliosis

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Purpose: Scoliosis, which is abnormal curvature and rotation of vertebral column, may be caused by medical causes or may develop idiopathically. The curvature resulting from scoliosis and direction of this curvature can change biomechanics of upper extremity as well as spine and lower extremity. In this study, before and after exercise sessions in patients with adolescent idiopathic scoliosis(AIS) according to convex-concave side of scoliosis curve. It was aimed to investigate changes in deltoid tone, stiffness, elasticity.

Methods: Thirty-nine individuals (male:11, female:28; mean age:14.1 years) with AIS, between ages of 10-18, who applied to Gaziantep University Faculty of Medicine, Department of Orthopedics and Traumatology, were included in study. In this study, using the MyotonePRO device, before exercise sessions and after 40-minute exercise sessions. Deltoid tone, stiffness and elasticity were measured. Data analysis was made with

SPSS 25.0 program, and $p<0.05$ was considered statistically significant. Approval number 2023/294 was received from Gaziantep University Clinical Research Ethics committee.

Results: Individuals participating in study were grouped as cervical region concave/convex according to curvature of scoliosis before and after exercise session, myotonometric measurement of deltoid was made. A moderate positive relationship was found between convex and concave sides in tone and elasticity values both before and after exercise session. While there was weak positive relationship between convex and concave sides in stiffness value before exercise session, no significant relationship was found after exercise session.

Conclusion: It has been determined that there are changes in muscle biomechanics in patients with scoliosis depending on direction of curvature. It has been determined that scoliosis, in addition to its known effects on lower extremities and trunk, also affects upper extremities. As a result of this study, quantitative values were obtained, and it is thought that they will be used as a resource for future studies.

Keywords: MyotonePRO, Deltoid muscle, Scoliosis curvature, Biomechanics

A-0942

Teaching Minimally or Non-Medical Trained Coaches a Modified Paediatric Ottawa Foot Ankle Rules Protocol Including Gait and Surface Anatomy Protecting Youth Athletes

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Purpose: Injuries of the foot & ankle (FA) are among the most common injuries in paediatric athletes. Sprained ankle is the most common soft tissue presentation of FA exposing youth to unnecessary radiation from a significantly overwhelming number of normal X-rays. Approximately 45 million children ages 6-18 years old participate in at least one organized sport annually. Paediatric athletes continue to increase in number while specializing in a single sport, leading to muscle imbalance and further FA injuries. The FA is undergoing constant change due to development affecting bone and physeal growth plates. Ottawa-foot-ankle-rules (OFAR) has been proven beneficial for paediatric athletes. Objective of this study was to create a teaching video of modified OFAR for paediatric athletes with novel terminology and new surface anatomy(SA) educating minimally medical trained coaches.

Methods: Literature search was conducted regarding paediatric modified-OFAR teaching videos. GAX-specimens(n=6;3-Male,3-Female) received innovative BriteVu-contrast(BVc) with MRI/CT scans and formalin-fixed cadavers-FfC(n=18;11-Male;7-Female=36 ankles) had subsequent SA of OFAR anatomy identified then dissected. Video storyboard was created and filmed with Gimbal stabilizer for smartphone, 3-axis phone Gimbal for iPhone 14 PRO, stabilizer for video recording with face/object tracking, 600 °auto rotation - hohem iSteady mobile plus.

Results: Literature search revealed no known modified paediatric OFAR videos for coaches. GAX-specimen allowed paediatric modified-OFAR regarding observations of SA palpation, measurements, imaging and dissection which demonstrated lifelike static and dynamic anatomy enabling novel terminology for ease of understanding and performing modified paediatric-OFAR for non-medical trainees. Chronologically, video demonstrated 8-step analysis for antalgic gait, triangular foot-ankle-palpation(T-FAP), distal third posterior fibular pressure and mid-tibia-fibular (MTF) squeeze test.

Conclusion: This pilot study integrated FA SA with GAX-Specimen dissections creating a modified paediatric-OFAR protocol viewed with video for non-medical trained coaches successfully identifying SA terminology consisting of T-FAP, MTF-squeeze test providing a useful tool for coaches, families and healthcare providers.

Keywords: Ottawa rules, Terminology, Anatomy, Surface

A-0961

Newly Termed Tibial-Soleal Groove (TSG) Provides Important Landmark for Great Saphenous Vein/Nerve

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Purpose: Great saphenous vein (GSV) has 3 clinical surgical associations (grafts, varicosities, cutdowns). In 1967 it became a life extending structure when Dr. Favaloro described an autologous vein graft for arterial bypass. High tie varicose

vein procedures and injections of GSV have helped sufferers for decades. Cutdowns for intravenous access are lifesaving. GSV is a consistent superficial vein with a dependable landmark which deserves further scrutiny regarding additional anatomical sites. Study objective is to analyze GSV from novel imaged prepared GAX-specimens (GAX) and formalin-fixed cadavers (F-FC) describing new terminology satisfying surgeons and anatomists.

Methods: Literature search of GSV anatomy was conducted. CT/MRI/ultrasound imaging and dissection of 6 GAX donors, 12 lower limbs (LL) and dissection of 33 F-FC (62 LL) was conducted and analysed.

Results: GSV analysis from atlasses, imaging and dissections revealed a consistent pattern of an undescribed unnamed specific location of the GSV. Dissection of 69 LL from 74 LL demonstrated 93% GSV's were within 3mm on either side of the intersection between the medial tibial bone and soleus muscle. Below knee, GSV ascends lying in the tibial-soleal groove (TSG) from the medial mid-tibial level up to the tibial tuberosity (approximately 10cm) formed between the anteromedial tibia and anterior medial soleus muscle. The author has provided a term for this consistent GSV location below the knee as the TSG.

Conclusion: This study revealed GSV has a consistent superficial anatomical location below the knee newly termed the tibial-soleal groove (TSG) which could contribute to anatomy and surgical descriptions.

Keywords: Terminology, GAX-specimen, Clinical landmark, Novel Anatomy

A-0964

Mixed Reality XR-4 Varjo System Allows Integrating Surface Anatomy Palpation with GE Vscan POCUS Probe Placement Enabling True Experiences and Assessment Feedback

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Purpose: During the Covid pandemic educators simply needed a decent delivery platform and high content expertise to provide acceptable online teaching/learning. Currently, online learning expectations are much higher and immersive mixed-reality(MR) platforms can create improved knowledge retention, engagement and interaction between live POCUS for life-like skills in real world settings. Adding autonomy by allowing individuals/groups to record their MR-experiences any time of day/night for assessment later, provides ideal environment for andragogical (adult) learners. The study objective was to create a learning platform whereby medical students could practice combining surface anatomy palpation with POCUS using MR technology while capturing learners' knowledge, skills and techniques with simultaneous audio/visual recording.

Methods: Literature search was conducted regarding learning/teaching experiences with MR technology during palpation and POCUS image acquisition of the neck region with recorded videos for assessing and providing feedback to medical students(n=9). XR-4(Varjo)headset, Base-Varjo and VH-Dissector software supported by Toltech was assembled as a mobile cart. Students were provided a recorded 8-minute video on POCUS central-line placement(CLP). They were asked to conduct palpation and POCUS with the XR-4 headset system using wireless handheld GE-Vscan air probe in one hand, palpating neck landmarks with opposite hand, then place probe to acquire short and long axis views of the internal jugular vein(IJV) for CLP.

Results: Literature search revealed no known studies using XR-4 Varjo MR-system during palpation and POCUS practicing IJV CLP skills. Each student successfully interacted with MR and viewed both their hands while palpating and conducting POCUS skills required for IJV CLP. Recordings were successfully saved, and feedback was delivered to students.

Conclusion: This pilot study revealed XR-4 Varjo MR-system supported by Toltech integrated with VH-dissector software allows novice medical students to learn and subsequently engage in peer-to-peer teaching acquiring POCUS techniques for IJV CLP real world skills.

Keywords: Mixed reality, Ultrasound, Innovative medical education

A-0966

Mll4 Regulates Palate Suture Development

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Purpose: MLL4, a.k.a. KMT2D, is a histone methyltransferase that acts as an important epigenetic regulator during various organogenesis programs. Mutations in the MLL4 gene is the major cause for Kabuki syndrome (KS), a human developmental disorder that involves various orofacial birth defects, such as cleft palate. The purpose of this study is to identify the function of MLL4 and the underlying mechanism in postnatal palate development and growth.

Methods: We generated a novel conditional knockout (cKO) mouse line with tissue-specific deletion of Mll4 in the palatal mesenchyme (Mll4fl/fl;Osr2-Cre). We examined the postnatal palate development by using micro-computed tomography (CT), histology, cell mechanism assays, and gene expression analysis. At least three biological replicates were examined for each experimental group; Student's t test was used for statistical analysis.

Results: Adult Mll4-cKO mice developed novel defects in the palate, including 1) disrupted rugae patterning in the palatal mucosa, 2) reduction in the overall width of the palatal skeleton, and 3) hypoplasia of soft palate appendages, including the minor mucous salivary glands. We discovered that the development of the palate suture was disrupted in the Mll4-cKO neonates, in which the midpalatal suture showed increased apoptosis and developmental delay in the formation of the growth-plate like secondary cartilage tissue. Genome-wide analysis of gene expression, using RNA-seq, revealed that Mll4 is essential for proper expression of major genes for chondrogenesis and endochondral ossification.

Conclusion: Our results show that Mll4 is essential for proper development of the midpalatal suture, a well-known but understudied structure in the context of midfacial growth and craniofacial development. Our findings also reveal the possible palate defects that may have been missed during examination and diagnosis for KS. Our future direction is to identify the epigenetic and gene regulatory mechanisms by which Mll4 regulates suture development and growth in the postnatal palate skeleton.

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Keywords: Palate, Suture, Chondrogenesis, Epigenetic, Regulation

Free Paper_Poster Presentation

[A. Gross Anatomy]

A-0020

Voluntary Body Donation Programme at AIIMS, Jodhpur India: A Decade of Challenges and Fortitude

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Purpose: In September 2012, AIIMS Jodhpur, India, faced challenges in medical education and research, notably the need for body donations for cadaveric dissection.

Conclusion: This remarkable program stands as a testament to the conquest of myriad obstacles. This effort transformed the landscape, enabling AIIMS Jodhpur to advance its mission as a premier government medical institution dedicated to education and research.

Keywords: Voluntary, Body Donations, Challenges

A-0032

A Unilateral Accessory Head of the Semitendinosus Muscle: An Unusual Variation

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Purpose: Various studies regarding the morphology of the muscles of the hamstring compartment have exhibited anatomical variations in terms of origin or insertion points. However variation in the semitendinosus muscle is uncommon. In this case, we report an accessory head of the semitendinosus muscle.

Methods: During routine dissection for medical teaching purposes, a unilateral morphological variant semitendinosus muscle was noted in an 82-year-old female.

Results: The accessory head of the semitendinosus muscle originated lateral to the midpoint of the semitendinosus muscle. Fibers of the accessory head originated from the medial border of the long head of the biceps femoris as well as the midpoint of the semitendinosus. The accessory head had a common insertion point with the semitendinousus muscle.

Conclusion: This case report adds to the existing body of knowledge about the semitendinous muscle, which is of anatomical and clinical value. Knowledge of the anatomical variants is essential for anatomists and clinicians and may avoid misinterpretation during diagnostic procedures.

Keywords: Hamstring compartment, Semitendinosus morphology, Variant semitendinosus

A-0054

The Relationship between Hyperplastic Changes of Myodural Bridge Complex and Chronic Headache

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Purpose: Myodural bridge complex (MDBC) is described as a functional anatomic structure in the suboccipital region which involves suboccipital musculature, ligaments and dense fibrous tissue connection called myodural bridge (MDB). Studies have proposed that MDB is a significant contributor to cerebrospinal fluid (CSF) circulation and may play an unknown role in headache production. The purpose of this study is to clarify that the pathological changes of the MDBC can induce chronic headache, and further provides the basis for the functional study of the MDB.

Methods: In present study, bleomycin (BLM), an antibiotic which induces the proliferation of fibroblasts, was injected into the posterior atlanto- occipital interspace of rats. After four weeks, histological staining was used for confirming hyperplastic changes of MDBC. Before sampling, the CSF secretion rate of rats was measured to determine whether CSF circulation was affected. Futhermore, immunohistochemical staining for headache- related neurotransmitt ers and behavioral observation about headache were examined.

Results: Histological staining and semi- quantitatively analysis demonstrated that BLM injection caused hyperplastic changes of MDBC within the posterior atlanto- occipital interspace of rats, including collagen fibers proliferation and muscle hypertrophy. The CSF secretion rate of rats in BLM group was higher than that of the other two groups, with statistical significance. Frequency of headache- related behaviors was significantly increased in BLM group than that in PBS and CTL groups. Meanwhile, the expression levels of CGRP in the

ventral posterior medial nucleus of thalamus, amygdala, parabrachial nucleus and spinal trigeminal nucleus, and 5-HT in anterior cingulate cortex, amygdala and dorsal raphe nucleus were also higher in the BLM group compared to that of the other groups.

Conclusion: The present study demonstrates that hyperplastic changes of the MDBC after BLM injections can cause occurrence of chronic headaches by affecting the normal CSF circulation. This study provides a new explanation for the pathogenesis of some chronic primary headache.

Funding: This work was supported by the Natural Science Foundation of China (Grant numbers: NSFC32071184, NSFC31871213 and NSFC32100928).

Keywords: Myodural Bridge Complex, Chronic Headache, Hyperplastic Changes, Cerebrospinal fluid, Neurotransmitter

A-0065

Anatomical Features of the Mandibular Macrorelief

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Purpose: analyze the relationship between the macoanatomical structure of the outer surface of the body of the lower jaw and the likelihood of fractures.

Methods: At the anatomical stage, on anatomically certified objects (n=50), a macroanatomical study of the relief features of the mandible was carried out in places most often associated with the fracture line. A clinical and radiological determination of weak zones was previously performed. Post-processing of images consisted of constructing multiplanar (MPR) and three-dimensional (3D) reconstruction.

Results: The projection of radiological diagnostic data of patients with fractures onto the material of an anatomical study of the outer surface of the body of the mandible shows areas vulnerable to the distribution of the fracture line: reference point for identifying active zones was the tooth root, divided into apical and middle parts. Cervical area is not taken into account. Thus, knowledge of the thickness of the cortical plate, the distance of the tooth apex to the mandibular canal and the thickness of the alveolar process play a key role not only at the diagnostic stage, but also in planning and carrying out treatment, and also serve as a marker for the rehabilitation period. Thus, in the central part adjacent to the apical projections of the roots of the teeth (n=21) these were single holes, the diameter of which varied from 1 to 1.4 mm (1.2±0.2 mm), and the smaller ones formed a network structure without separating into the main ones. In the area of the mental protuberance, there were practically no nutrient openings in all samples; single, slit-like nutrient openings with a diameter of 0.8 to 1 mm (0.8 mm±0.2).

Conclusion: An increased number of nutrient openings of the cortical plate increases the elasticity of bone tissue and can serve as guidelines during osteosynthesis.

Keywords: Fracture, Mandible, Clinical anatomy, Digital, Teeth

A-0067

Anatomical Variations of the Course of the Lingual Nerve and Its Implication in Oral and Maxillofacial Surgery

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Purpose: Most iatrogenic lingual nerve (LN) injuries occur during orthognathic surgery involving sagittal split osteotomy (0.3%-18%) and extraction surgery of impacted third molars (0.1%-22%). The aim of this research was to analyze the anatomical variations of the course of the lingual nerve and its implication in oral and maxillofacial surgery.

Methods: A multi-source database (PubMed, Cochrane Library and Web of Science) bibliographic search was performed regarding the location and course of the lingual nerve. 102 articles were found, of which 21 were selected according to title and abstract. Finally, with the complete reading of the 21 articles, 8 were included. Scientific articles in English published in the last 10 years related to the anatomical variations of the course of the lingual nerve and its implication in oral and maxillofacial surgery, systematic reviews and meta-analysis were selected and included.

Results: In relation to the course of the LN, it presents a normal course pattern in 84.9% of the cases, while in 15.1% of the cases the LN presents a variation in its course, passing

through the retromolar trigone in 8.8% and above the semi-erupted third molar in 6.3% of cases. The most common shape of the LN is round 40.96%, oval 37.98% and flat 25.16%.

Conclusion: During its course, the lingual nerve presents anatomical variations that must be considered in the extraction of the lower third molars and orthognathic surgery. The most frequent anatomical variations in its course are when it is located over the retromolar trigone and when it passes over the semi-erupted third molar. To avoid iatrogenic injuries, it is essential that the maxillofacial surgeon has a precise understanding of the course of the lingual nerve and its anatomical relationships. Knowledge of these variations can help the maxillofacial surgeon make appropriate clinical and surgical decisions.

Keywords: Lingual nerve, Anatomical variations, Surgery, Third molar, Anatomy

A-0088

Anatomical Features of Total Blockage of the Superior Mesenteric Artery and Its Impact on the Inferior Mesenteric Artery

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Purpose: In order to help students to understand collateral circulation, which is an alternate or "backup" blood vessels in the body that can take over when a primary artery or vein becomes blocked or damaged.

Methods: We utilized a 82-year-old female donor with a total blockage of the superior mesenteric artery (SMA). Due to the inferior mesenteric artery's (IMA) tremendous increase in size to accommodate the deficient blood supply of the SMA, students are able to visualize and understand the collateral circulation.

Results: SMA and IMA have communications through the marginal artery of the middle colic artery and the left colic artery of the inferior mesenteric artery, as well as the meandering mesenteric artery. In the general population, there is a significant difference in the diameter of the SMA (1.5687 mm diam) and the IMA (.6438 mm diam). The diameter of this donor's IMA and SMA was both 1.1 mm. Hardening, rigidity, and narrowing were observed in the SMA. An increase in the meandering mesenteric artery was observed. Due to severe calcification, the SMA is completely blocked. The narrowing of the arteries occurs most often at the beginning of the celiac or superior mesenteric arteries.

Conclusion: When introducing collateral circulation, medical students may not fully comprehend or visualize the mechanism of the circulation, even using radiographic images and illustrations. The collateral circulation between SMA and IMA is more visible than the other in the limbs due to their ease of observation. Atherosclerosis is the primary cause of chronic mesenteric ischemia. Clinical manifestations associated with mesenteric arterial disease are not common because of the collateral circulations in the region. Ischemia can cause Sepsis, bowel infarction, and death. Obtaining an angiography and knowing the blood circulation in the region is necessary to avoid ligating the collateral blood supplies.

Keywords: Collateral circulation, Superior mesenteric artery, Inferior mesenteric artery, Anatomy education, Cadaver study

A-0099

Frailty and Microcirculatory Impairment: Investigating Blood Biomarker Predictors

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Purpose: Frailty is a chronic condition characterised by reduced physiological reserve that escalates the risk of institutionalisation, hospitalisation, morbidity and overall poorer quality of life. A robust functional microcirculatory system plays a vital role in maintaining healthy tissue parenchyma. The impairment of the structure and function of the microcirculation has been hypothesised to contribute to physiological reserve loss experienced by frail individuals. Recognising this, the following study aimed to investigate potential blood biomarkers representative of microcirculatory health decline. This investigation encompassed two study populations: kidney transplant assessment clinic attendees (KTAC) and community dwellers without renal failure (NRF), representing a disease and ageing frailty aspect.

Methods: Both the KTAC and NRF groups comprised 44 individuals, all meeting predefined inclusion criteria. Micro-

circulation assessment was performed via the AVA MicroScan system in the sublingual region, while blood plasma analysis was performed using enzyme linked immunosorbent assay. Frailty was measured using the Rockwood frailty index (FI) questionnaire. Machine learning, specifically random forest plots, was employed to select blood biomarkers that best predicted microcirculatory parameters and determined if these markers were also predictive of the FI score.

Results: In both groups, predictive factors of the blood biomarkers were explored, focusing on the endothelial glycocalyx, the actin scavenging system, and the Nitric Oxide/ADMA pathway. Within the KTAC group, biomarkers associated with the endothelial glycocalyx emerged as the most accurate predictors of microcirculation, while the NRF group showed the actin scavenging system biomarkers as the best predictors.

Conclusion: To summarise, blood biomarker predictors of the sublingual microcirculation varied between the KTAC and NRF groups. This insight enhances our comprehension of the fundamental mechanisms underlying this decline and its potential contribution to the loss of physiological reserve in frail individuals.

Funding: Metro South Health Research Support Scheme.

Keywords: Frailty, Biomarker, Transplant, Glycocalyx, Ageing

A-0100

Biomechanical Assessment of External Fixators for the Treatment of Pelvic Injury Type AO61 C1.3a

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Purpose: The objective of this research was to examine the load-deformation behaviour of cadaveric specimens treated with external fixation for AO61 C1.3a pelvic injuries.

Methods: The load-bearing capacity of two, three and four external fixator pins was systematically evaluated using a biomechanical test setup developed after a comprehensive review of the existing literature. Human cadaveric pelves, provided by the Institute of Anatomy of the Medical University of Graz, were carefully dissected. Muscular, vascular and neural tissues, as well as the viscera were dissected, while the ligaments associated to the pelvic ring were intentionally preserved. To measure the stability of the pelvis under different pin configurations, mechanical parameters such as stiffness, peak-to-peak, valley-to-valley, fracture line and total displacement, deformation and maximum load were calculated.

Results: As the results of the study show, optimal biomechanical resistance to C1.3a pelvic fractures is observed when using an external fixation configuration with two pins on the injured side and one on the contralateral stable hemipelvis. This configuration exhibits superior biomechanical stability as evidenced by the least amount of displacement, emphasising its potential benefits for reducing C1.3a pelvic injury.

Conclusion: Nevertheless, it is noteworthy that no frame configuration could prevent displacement. The principal objective remains centred on the mitigation of complications, improvement of the overall quality of life, and optimization of functional status throughout the recovery and post-recovery phases. Addressing these objectives necessitates a comprehensive understanding of the biomechanical intricacies involved in order to develop more effective strategies that can contribute to minimizing displacement and fostering favourable outcomes during the recovery trajectory.

Keywords: Biomechanical properties, External Fixator, Pelvis, Cadaveric tissues, Type C injury

A-0119

Extensor Tendon Variations in the Wrist: A Cadaveric Study on the Korean Population

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Purpose: The wrist's extensor compartment is highly diverse due to multiple tendons and interconnections. Understanding the variation in extensor tendons is crucial for hand microsurgery, especially in cervical spinal cord injury cases. Previous studies lacked consistency in reporting extensor tendon variations. This study focuses on investigating the detailed arrangement and prevalence of extensor digitorum communis

(EDC), extensor indicis proprius (EIP), and extensor digiti minimi (EDM) tendons in the Korean population.

Methods: One hundred thirty eight upper extremities from 70 cadavers were dissected, and extensor tendon distribution was examined. Extensor retinaculum removal exposed tendons, and juncturae tendinum (JT) connecting them were analyzed, classifying JT into types 1 to 3 based on von Schroder's classification. Type 3, with the thickest tendinous fiber, was reclassified as a tendon.

Results: The study revealed patterns in tendon arrangements. EIP commonly started and ended with a single tendon (78%). EDC to the index finger showed a consistent single-to-single tendon pattern (99.3%). EDC to the middle finger often started single and ended double (33.3%), while EDC to the ring finger typically started single and ended double (26.9%). EDC to the little finger usually began and ended with a single tendon (39.1%), and EDM commonly had a double start and end (49.3%). Branching distribution between tendons varied, with EDC-L to EDC-R being the most frequent (69 cases), followed by EDC-R to EDC-M (50) and EDC-R to EDC-L (33).

Conclusion: This study provides insight into the extensor tendon arrangement in the Korean population, emphasizing the need for imaging evaluations before hand extensor microsurgery due to the diverse number of tendons in each finger.

Keywords: Extensor tendon, Wrist, Variation, Cadaver, Korean

A-0123

Morphometric Aspects of Fundiform Ligament of the Penis

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Purpose: Fundiform ligament (FL) is one of the ligamentous structures suspending the penis, located in the most superficial layer among them. FL's anatomy is clinically essential because of its relationship with penile surgery via dorsal approach. This study aimed to describe the morphometric aspects of the FL by correlation with anatomical landmarks for clinical applications.

Methods: Ten Korean male soft cadavers (mean age: 77 years) were dissected. Using anatomical landmarks such as the upper margin of pubic symphysis (PS), FL was measured in 7 metric items. Distances from the upper margin of PS to FL's proximal attachment (PA) and bifurcation point (BP) were measured respectively. FL's full length was taken. Widths at FL's PA and BP were measured respectively. Thickness on FL's BP and both lateral bundles (LBs) were measured. Angle between FL's both LBs was taken. And, FL was morphologically classified on its shape from PA to BP.

Results: From the upper margin of PS, the location of FL's PA was 46.1±5.7 mm above, and BP was 14.7±7.3 mm below. FL's full length was 63.3±12.6 mm. Widths at FL's PA and BP were 15.1±6.8 mm (5-24 mm), 18.9±12.0 mm (19-48 mm) respectively. Thickness on FL's BP was evenly 2.2±0.1 mm, and the angle between both LBs was 53.9±7.4°. They were asymmetrically divided, and the right bundle was generally thicker than the left side. Three types of FL morphology were observed, and the most common type was triangular shape (50%). In one cadaver, the pudendal neurovascular structures were notably found close to the FL.

Conclusion: These results will be helpful to pre-operatively determine the incision site by predicting the territory of the FL in the dorsal area of the penis. It is important to recognize a variety of FL morphologies, especially in cases where pudendal neurovascular structures are close to the FL, to minimize the risk of injuries during surgery.

Keywords: Fundiform ligament, Morphometric aspects, Penile surgery

A-0171

Facial Soft Tissue Thickness Related with Body Mass Index using Ultrasonographic Imaging

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Purpose: The facial soft tissue thickness (FSTT) is the thickness extending from the bare bone to the skin surface and is influenced by various factors. One significant factor impacting FSTT is the body mass index (BMI). Ultrasound (US) serves as one modality for FSTT measurement. This study aims to investigate fundamental data related to FSTT and to identify differences in FSTT between Thai individuals classified under underweight and normal weight body mass index groups.

Methods: The study includes 100 fresh Thai cadavers aged over 50 years. The cadavers who had edentulous, facial or skull anomaly, and history and evidence of facial trauma, skull fracture, facial surgery and facial aesthetic procedure were excluded. B-mode of superficial musculoskeletal mode of GE Logiq F8 ultrasound machine is performed on 53 landmarks, 11 midline and 42 bilateral landmarks.

Results: The parotid-masseteric area exhibits the highest thickness value and the highest standard, while the nose has the thinnest measurement. All landmarks measured in this study exhibit greater thickness in the normal weight group compared to the underweight group, and these differences are statistically significant.

Conclusion: It can be concluded that BMI is a crucial factor affecting FSTT. This finding is valuable for foundational anatomical knowledge, aesthetic procedure, and forensic facial reconstruction.

Keywords: Facial soft tissue thickness, Facial thickness, Ultrasonography, Body mass index

A-0174

Anatomical Variants of the Hepatic Portal Vein and Their Clinical Implication. A Systematic Review and Meta-Analysis of Prevalence

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Purpose: The hepatic portal vein (HPV) is the main vascular route responsible for collecting blood from the liver, spleen, pancreas, stomach, gallbladder and intestines, with the aim of metabolizing the components acquired from the blood. The objective of this study was to analyze the characteristics of HPV variants and understand the possible clinical considerations that arise with them.

Methods: The databases Medline, Scopus, Web of Science, Google Scholar, CINAHL and LILACS were searched until January 2024. Two authors independently performed the search, study selection and data extraction. Methodological quality was assessed with an assurance tool for anatomical studies (AQUA). Pooled prevalence was estimated using a random effects model.

Results: A total of 31 studies met the established eligibility criteria. In this study, 21 articles were included for the meta-analysis with a total of 51,244 subjects. Of these 21 articles, the topics studied came mainly from Europe and Asia, with 3 (n=554; 1.08%) and 11 articles (n=50,090; 97.75%) respectively, also having 6 articles from North America (n=442; 0.86%) and 1 from Africa (n=158; 0.31%), discarding the articles from Oceania and South America. South. For the HPV trifurcation variant, it was 8% (CI=7% to 10%). For the right posterior portal vein variant caused by primary HPV, it was 8% (CI=4% to 12%). For the right anterior portal vein variant originating from the left portal vein, it was 4% (CI=1% to 6%). Finally, the prevalence of the isolated variants was 2% (CI=1% to 3%).

Conclusion: Knowledge of HPV and its anatomical variants is of utmost importance for both medical professionals and anatomists, as it is one of the vessels that collects blood from many important viscera found in the abdominal cavity, any structural alteration could be crucial in diagnosis and surgical procedures.

Keywords: Hepatic portal vein, Anatomical variants, Clinical implications, Prevalence

A-0224

Anatomical Considerations and Safety Guidelines for Iliotibial Band Graft Harvesting

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Purpose: The Iliotibial Band (ITB) is a fibrous thickening of the fascia lata originating at the iliac crest and inserting at Gerdy's tubercle on the lateral tibia. Due to its size, tensile strength and easy access, it is widely used in orthopaedic surgery as an autograft. Although ITB harvesting may result in various complications, no safety margins or guidelines have been proposed for the procedure. Our aim was to determine the maximal safe length of an ITB graft, i.e. that does not harm the adjacent structures, and reduce the complication rate.

Methods: The study included 50 lower limbs of 25 human cadavers. The inclusion criterion was the lack of visible signs of surgical interventions in the study region. Forty lower limbs were included in the study: 16 female (mean age 83.1 ± 3.4 years) and 24 male (mean age 84.2 ± 6.8 years). Dissection was performed with a previously established protocol.

Results: The mean femur length was 404.83mm [Female(F)= 397,29mm, Male(M)=409,85mm, Standard Deviation(SD): F=23,75mm, M=24,07mm]. The mean ITB length was 318.89mm (F=309,42mm, M=325,20mm, SD: F=25,72mm, M= 33,71mm). Longer femurs were associated with longer ITB (p value < 0,05). The mean distance from insertion of the GM to the myofascial junction of TFL and ITB was 34,56mm (F= 34,45mm, M=34,63mm, SD: F=3,17mm, M=3,26mm).

Conclusion: ITB grafts longer than 21 cm may contribute to the greater risk of TFL rupture. Based on simple measurements of the femur length the surgeon may assess approximate ITB length, and thus assess the length of the maximal graft length. Moreover, to avoid harming the LCL the incision should be performed 5 cm proximal to the articular surface of the lateral femoral condyle or 13 mm proximal to the lateral femoral epicondyle. Such preparation and preoperative planning may greatly reduce the risk of complications during ITB harvesting.

Keywords: Iliotibial band, Orthopaedics, Autograft, Knee Surgery, Guideline

A-0226

Complex Variations in Branches of the Axillary Artery

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Purpose: The axillary artery is a continuation of the subclavian artery, transitioning into the brachial artery. Variations of the axillary artery were not uncommon.

Methods: During the dissection of the upper limb of a 95-year-old Korean female cadaver, various anatomical variations in the branches of the axillary artery were identified.

Results: On the right side, no branches emerged from the first part. From the second part, the thoraco-acromial artery (excluding the pectoral branch) and the subscapular artery arose. The subscapular artery gave origins to the lateral thoracic artery, thoracodorsal artery, circumflex scapular artery, and accessory posterior circumflex humeral artery. Additionally, the superior thoracic artery arose from the lateral thoracic artery. From the third part, the anterior and posterior circumflex humeral arteries, accessory acromial branch, and accessory thoracodorsal artery arose. On the left side, the thoraco-acromial artery (excluding the pectoral branch) and the superior thoracic artery arose from the first part. The subscapular artery arose from the second part, including the pectoral branch, lateral thoracic artery, thoracodorsal artery, circumflex scapular artery, accessory posterior circumflex humeral artery, and accessory lateral thoracic artery. From the third part, the anterior and posterior circumflex humeral arteries and accessory acromial branch arose.

Conclusion: This study presents various variations of the axillary artery, highlighting their rarity and emphasizing the importance of these anatomical variations not only for education but also for surgical and radiological purposes.

Keywords: Axillary artery, Branch, Variation

A-0231

A Structured Mastery-Learning Curriculum for Chest Tube Insertion Improves Residents' Skills

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Purpose: Chest tube insertions (CTI) are potentially life-saving procedures, but have a high complication rate. To avoid patient harm, we developed a Simulation-Based Mastery Learning (SBML) curriculum, in which residents train on a porcine model and Thiel bodies prior to patient contact. This randomized controlled trial compared the effect of the proposed curriculum with the standard residency program.

Methods: Junior residents from the departments of surgery, emergency medicine and pulmonology were baseline tested on Thiel bodies, and then randomized in an intervention or control group. The intervention group deliberately trained CTI on a porcine rib model until a predefined pass/fail score was achieved. The control group did not receive this training opportunity. Finally, both groups were summatively tested on Thiel bodies. Performances were rated live and based on anonymized recordings using the ACTION tool, a 17-item procedure-specific rating scale. Data was analysed using a mixed-method repeated measures ANOVA, with Group as between-groups factor, and Rater and Procedure as within-groups factors.

Results: A total of 17 participants (six emergency medicine residents, six surgical residents, and five pulmonology residents) were recruited. Following randomization, the control group consisted of three emergency medicine residents, two surgical residents, and four pulmonology residents. Analysis revealed a significant main effect for Group ($F(1,15)=35.14$, $p<0.001$), Procedure ($F(1,15)=76.71$, $p<0.001$), and Group*Procedure ($F(1,15)=13.29$, $p=0.002$). Between the baseline and summative assessment, both the control (25.5±7.4 vs. 36.2±5.9, $p=0.002$) and intervention group (30.8±6.4 vs. 56.6±7.3, $p<0.001$) significantly increased their scores, and the intervention group outperformed the control group at summative assessment (36.2±5.9 vs. 56.6±7.3, $p<0.001$).

Conclusion: By using a structured SBML program, residents improved their skills significantly more than those enrolled in traditional training programs, in a shorter period of time. Skills trained on the basic porcine model transfer to the highly realistic Thiel bodies, ensuring residents are prepared for the clinical setting.

Keywords: Chest tube insertion, Thiel embalmed bodies, Simulation-based medical education

A-0281

Morphometric Measurements of Neurovascular Structures of Pronator Quadratus Muscle

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Purpose: In surgical procedures commonly employed for distal forearm fractures and fractures of the proximal row of carpal bones, such as in the cases of distal forearm fractures and fractures of the proximal row of carpal bones, the incision and release of the pronator quadratus muscle play a significant role. Most studies on the anatomy of the musculus pronator quadratus are based on radiological imaging methods. Therefore, we found it necessary to conduct a cadaveric study to evaluate this muscle through morphometric measurements.

Methods: For the examination of the musculus pronator quadratus, we utilized the upper extremities of 22 human cadavers, which were preserved using a mixture of formaldehyde, phenol, ethanol, glycerin, and water between 2005 and 2018. Following the necessary dissections to expose the musculus pronator quadratus, morphometric measurements related to this muscle were taken using digital calipers.

Results: The distance between the entry zone of the anterior interosseus nerve to the pronator quadratus muscle and the lateral border of the radius, the distance between the entry zone of the anterior interosseus nerve to the pronator quadratus muscle and the medial border of ulna, and the distance from the proxi-

mal edges of the pronator quadratus muscle were measured and saved. The anatomy of pronator quadratus muscle, its arterial supply and the organisation of its neurovascular structures are examined. Side and gender analyses of all morphometric values obtanterior interosseus nerve were performed.

Conclusion: We believe that our cadaveric study, which evaluated the anatomy of the musculus pronator quadratus through morphometric measurements and morphological analysis, can serve as a valuable reference for practitioners in interventional radiological and surgical procedures involving this muscle and its surrounding area.

Keywords: Pronator quadratus, Anterior interosseus nerve, Anterior interosseus artery

A-0289

An Anatomical Investigation of the Relationship between the Buccomandibular Space and Adjacent Muscles

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Purpose: The buccomandibular space (BMS), despite being relatively unknown, holds significant clinical importance. This study aims to provide more precise morphological descriptions of the BMS both extraorally and intraorally, contributing valuable insights for the understanding and management of lower face treatment and rejuvenation.

Methods: In this study, we conducted dissections on 20 hemifaces obtained from 4 fixed Korean cadavers (three males and one female: mean age, 88.3 ± 3.40 years) and 6 fresh frozen Korean cadavers (six males: mean age, 83.3 ± 10.33 years) both extraorally and intraorally. To visualize the BMS, intraoral PLC filler injections were administered.

Results: The BMS was identified as a relatively compact area with specific anatomical boundaries. Anteriorly, it is bounded by the Mentalis muscle; posteriorly, by the anterior margin of the Masseter muscle; laterally, by the Depressor Labii Inferioris and the Depressor Anguli Oris muscles; and medially, by the lateral surface of the mandible. The BMS encompasses the lateral molar portion of the Buccinator muscle along its superior aspect. During the removal of the oral mucosa, it was observed that the Mentalis muscle attaches to the mucogingival junction on the front side, while the Buccinator muscle attaches on the back side, forming the ceiling of the BMS. The space below this ceiling is identified as the BMS, and it was noted that PLC filler had been successfully injected into this space.

Conclusion: To enhance clarity and comprehension, we defined the boundaries of the BMS by considering the positional relationships of muscles. Understanding the size and position of this space may prove beneficial in the diagnosis and treatment of lower face issues.

Keywords: Buccomandibular space, Mentalis muscle, Masseter muscle, Depressor Labii Inferioris muscle, Buccinator muscle

A-0296

Histologic Study of Poor Vascularity in the Lateral Meniscus

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Purpose: The body of the lateral meniscus (LM) is adjacent to the popliteal hiatus (PH), which has been reported to have poor vascularity. However, the cause is limited to explaining the course of the popliteus muscle tendon, and no histologic explanation. We have previously investigated the relationship between the pig knee meniscus and the joint capsules and found that blood vessels enter only between the attachments of the joint capsules, which we named the meniscus hilum, based on the idea that this area is a traffic route to the outside. In this study, we investigated the poor vascularity in the human LM in contact with the PH using the concept of the meniscus hilum.

Methods: Fourteen sides of seven cadavers (mean age death and standard deviation, 70.7±14.1) were employed. Gross anatomic analysis (n=12 sides) and histologic analysis (n=2 sides) were performed.

Results: Vascular entry into the LM was observed only between the femoral joint capsule (FJC) and tibial joint capsule (TJC) attachments. From the posterior horn to the body of the LM, the width of the FJC and TJC attachments narrowed superiorly along the popliteus muscle tendon, and from the anterior horn to the body of the LM, they narrowed inferiorly

to the body. There was no direct entry of blood vessels from outside on the surface of the LM in contact with the PH.

Conclusion: Since external traffic was observed only between the FJC and TJC attachments, this area can be referred to as the "meniscus hilum" as well as the pig knee meniscus. It was histologically confirmed that the poor vascularity of the LM in contact with the PH was due to the narrowing of the meniscus hilum as it approached the PH, and that the PH does not allow invasion from the outside.

Keywords: Lateral meniscus, Popliteal hiatus, Meniscus hilum, Joint capsule, Vascular

A-0299

Glioblastoma Visualization using Triple-Receptor-Targeting Fluorescent Complex

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Purpose: Fluorescence-guided surgery (FGS) plays a pivotal role, especially in challenging tumor resection cases. The heightened recurrence rates in glioblastoma (GBM) emphasize the need for enhanced surgical precision. In this study, the BSA-OXN-SIWV fluorescent complex signifies a significant advancement in GBM surgery precision. Addressing critical requirements such as fluorescence intensity, stability, GBM-targeting specificity, blood-brain barrier permeability, and biocompatibility, this innovative complex advances tumor resection methodologies.

Methods: In our analysis, OXN was selected for stability and two-photon excitability. Tetra-peptide (SIWV) precisely targets the caveolin-1 receptor, while bovine serum albumin (BSA) ensures dual targeting. This synergistic complex is designed to enhance stability, tumor specificity, and penetration capabilities.

Results: BSA-OXN-SIWV successfully imaged GBM cell lines and clinical tissues, demonstrating improvements in stability and specificity, and addressing fluorescent dye limitations.

Conclusion: Our study presents BSA-OXN-SIWV as an advanced FGS agent for precise GBM visualization, marking a significant breakthrough in fluorescence-guided surgery and highlighting the importance of overcoming dye limitations.

Keywords: Glioblastoma, Fluorescence-guided surgery (FGS), Cancer imaging, Fluorescent complex, Brain

A-0300

Glioblastoma Image-Guided Surgery using Bio-Thiol Responsive Fluorescent Probe

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Purpose: To address the limitations in current glioblastoma (GBM) surgeries, where distinguishing healthy tissue from tumor sites is challenging, a study focused on developing a non-toxic fluorescent probe for biothiols sensing. The goal is to enable real-time human glioblastoma visualization during surgery. A non-toxic fluorescent probe (NPO-o-Pyr) with high sensitivity, selectivity, and biocompatibility was specifically designed for GBM site visualization. This study indicates that NPO-o-Pyr can effectively and safely serve as a fluorescent probe for fluorescence-guided surgery in glioblastoma, contributing to advancements in the field of imaging agents.

Methods: Analyzing the biological toxicity of phenol and pyridine derivatives, we selected 2-hydroxy-pyridine as a biocompatible and thiol-responsive leaving group. NPO-o-Pyr, a fluorescence probe, was synthesized based on NBD. And we demonstrated the efficacy of the probe in GBM cell visualization with U87MG cells, confirming its selectivity to Cys/Hcy. Analysis in GBM-xenografted mice shows that NPO-o-Pyr in GBM is nontoxic and reports clinical applicability.

Results: Showcasing its selective fluorescence for GBM tumor sites, NPO-o-Pyr was tested on resected normal brain tissues and GBM tissues from the patient's clinical samples. NPO-o-Pyr exhibited negligible cellular toxicity, fast response time, and high selectivity/sensitivity for Cys/Hcy.

Conclusion: This study successfully demonstrated potential for real-time GBM visualization in preclinical and clinical settings, emphasizing its application in fluorescence-guided surgery.

Keywords: Fluorescence-guided surgery, Nontoxic fluorescent probe, Glioblastoma, Biothiols sensing, Real-time visualization

A-0305

The Association between Digital Device Usage Behaviours and the Incidence of De Quervain's Tenosynovitis among Medical Students

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Purpose: A vast majority of medical students utilise digital devices (smartphones, iPad, gaming controllers etc.) for educational and recreational purposes. Prolonged use of mobile and digital devices can lead to overuse and repetitive microtrauma in the thumb, raising concerns about the incidence of De Quervain's tenosynovitis. Aim of this study is to assess the relationship between digital device use, associated risk factors, and the occurrence of De Quervain's tenosynovitis among Atilim University students.

Methods: This study was performed as a cross-sectional pilot study, surveying students studying in the faculty of Medicine from Atilim University. Among the 130 students aged 18-25 years old, those with previous medical histories of the hand and wrist were excluded from the study. The survey consisted of demographic and 7 topic-related questions. De Quervain's tenosynovitis was diagnosed by conducting Finkelstein's test. SPSS 21 software was used to perform all statistical analyses and correlations.

Results: Most students (41.5%) spent 4-6 hours per day using digital devices, with the least frequent usage being less than 2 hours (3.8%). 43.1% of students had a positive Finkelstein's test result. A significant correlation was found between digital device usage and a positive Finkelstein's test result ($p<0.05$). 56.2%, 26.2% and 17.6% of students never, occasionally, and frequently engaged in stretching or relieving movements after digital device use, respectively. Among them, a positive correlation was found with never stretching and a positive Finkelstein's test result ($p<0.05$). 36.3% of students used their devices in an ulnar deviated position with 59% of them manifesting a positive rate of Finkelstein's test ($p<0.05$).

Conclusion: The results clearly indicate a significant correlation in the use of digital devices, its associated factors, and the incidence de Quervain's tenosynovitis. Prolonged digital device usage, not engaging in stretching or reliving movements and hand positioning were all associated with a higher risk of de Quervain's tenosynovitis.

Keywords: De Quervain's Tenosynovitis, Finkelstein's test, Digital device, Cross-sectional study

A-0312

A Novel Approach for Plantar Fasciitis Surgery: Evaluation of a Third Portal Technique

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Purpose: The treatment of plantar fasciitis, a common and debilitating foot condition, continues to evolve with advancements in surgical techniques. This study presents a novel approach involving the introduction of a third (vertical) portal on the plantar surface in addition to the conventional medial and lateral portals. The research aims to assess the anatomical relationships and potential advantages of this innovative surgical technique.

Methods: The investigation involved the examination of five fresh frozen cadaver feet. Initial procedures included the precise placement of portals under fluoroscopic guidance. Subsequently, dissection was carried out to expose the plantar nerves and analyze their spatial relationships with the newly introduced third portal, alongside the established medial and lateral portals.

Results: Some of the distances between these portals and the plantar nerves were measured by digital caliper and recorded as follows: distances between the3rd (new) portal and the lateral calcaneal nerve and inferior calcaneal branch were 14.16 mm and 10.07 mm, respectively. The shortest distance between the inferior calcaneal branch and the calcaneal bone was 8.36 mm, and the distance between the medial portal and the inferior calcaneal branch was 9.78 mm. The most significant result of the study was that the suggested third portal offers a clear visualization of the possible heel spur that in turn leads to better cleansing of it while minimizing the risk of

injuring the lateral plantar nerve.

Conclusion: In conclusion, this study presents a promising alternative to traditional plantar fasciitis surgery, providing valuable insights into the anatomical nuances associated with the proposed third portal technique. The findings contribute to the ongoing discourse on refining surgical approaches for plantar fasciitis and offer clinicians an informed perspective on balancing the benefits and challenges of implementing this innovative methodology.

Keywords: Plantar fasciitis, Novel technique, Plantar nerve, Heel spur

A-0322

The Suspensory Ligament System of the Penis: Implications for Phalloplasty

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Purpose: To investigate the macro and micro-anatomy of the suspensory ligamentous system of the penis for utilisation during successful penile reconstruction procedures.

Methods: A Total of 49 cadavers were utilised for gross anatomy dissection, MRI and histological analysis to elucidate the topography, dimensions and tissue composition of the suspensory ligaments.

Results: Three ligaments were observed forming the suspensory ligamentous system of the penis. Superficially placed is the fundiform ligament that consists of SBFL and DMBFL divisions that arise from the Scarpa's fascia and the linea alba of the anterior abdominal wall respectively. Both divisions inserted into the superficial fascia of the penis. The intermediately placed SPL arose from the pubic symphysis and inserted into the deep fascia (Buck's fascia) of the penis. The deeper arcuate ligament arose from the body of the pubis and pubic symphysis and inserted into the Buck's fascia. The DMBFL consisted of 43% adipose tissue, 43% collagen fibres, 13% elastic fibres and 13% reticular fibres. The SBFL had 53% adipose tissue, 21% collagen fibres, 23% elastic fibres and 14% reticular fibres. The SPL showed 53% adipose tissue, 23% collagen fibres, 23% elastic fibres and 12% reticular fibres.

Conclusion: The suspensory ligaments allow for the forward movement of the penis as a result of engorgement and simultaneously offering support. This is enhanced through the intricate association between the supesnsory ligament system of the penis and the fascial layers covering the root and shaft of the penis. The suspensory ligament proper is the main support ligament of the penis and any surgical enhancements and divisions must target and or restore the integrity of this ligament.

Funding: Netcare Hospital South Africa.

Keywords: Suspensory penile ligament, Fundiform ligament, Arcuate Ligament, Penis, Phalloplasty

A-0325

Unilateral Menisco-Meniscal Ligament of the Knee Joint, a Study from Embalmed Cadavers

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Purpose: The knowledge of menisco-meniscal ligament variants of the knee is essential during the magnetic resonance imaging. By tracing these ligaments along their entire course from origin to insertion, these variants can be correctly diagnosed and misinterpretations like meniscal tears could be avoided. In this context, the objective was to study the prevalence and morphology of the unilateral menisco-meniscal ligament of the knee joint in adult human embalmed knee joints.

Methods: The present study included 40 adult embalmed human cadaveric knee joints. The age and sex of the specimen was not taken into the consideration. The measurements were performed by using the digital Vernier calliper.

Results: The present study observed unilateral menisco-meniscal ligament in 2 knee joints (5%). Both of them were present over the left knee joint and had connection between the anterior and posterior horns of the medial meniscus. This ligament was not observed in the lateral menisci of our specimens. The length of this ligament was 27.87 mm and 26.34 mm in the observed specimens. The width of one ligament

was 2 mm, 2.13 mm and 2.25 mm at the anterior, middle and posterior ends. In the other ligament, the width was 2.9 mm, 2.3 mm and 2.5 mm respectively. The thickness was 1 mm, 1.2 mm and 1.5 mm in one ligament and 1.1 mm, 1.6 mm and 1.3 mm in the other ligament.

Conclusion: We believe that this manuscript offers detailed information about the unilateral menisco-meniscal ligament. The morphological knowledge of this ligament can help in the best management of the symptoms of the knee and prevent misinterpretations like double posterior cruciate ligament sign, unnecessary surgeries and subsequent iatrogenic complications.

Keywords: Meniscus, Menisco-meniscal ligament, Oblique meniscal ligament

A-0328

Fascial Thickening of the Soleus Muscle: A Mere Bystander or a Useful Predictor of Achilles Tendinopathy?

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Purpose: The Achilles tendon (AT) is one of the thickest, largest, and strongest tendons in the human body. Nevertheless, because it serves as the primary plantar flexing mechanism of the ankle, it is at the greatest risk of rupture, accounting for nearly 20% of all large tendon injuries. Although the AT has been studied quite well from a functional and clinical viewpoint, however, a moderate correlation exists between tendon structural abnormalities and clinical assessment of Achilles tendinopathy. At the same time, the onset of Achilles tendinopathy may be related to structural and biomechanical changes in other components of the suro-Achilleo-calcaneal-plantar complex of the superficial posterior compartment of the leg. Nonetheless, to the best of the author's knowledge, structural changes of the epimysial fasciae of the triceps surae muscle and the deep crural fascia, as well as their possible correlation with Achillodynia, have never been presented in current literature.

Methods: In the present study, a comparative US imaging evaluation of textural features of the suro-Achilleo-plantar complex was performed both in 15 healthy control and 15 symptomatic subjects with mid-portion Achilles tendinopathy. In addition, both groups underwent the Victorian Institute of Sport Assessment-Achilles (VISA-A) questionnaire administration.

Results: Our data demonstrate that, in symptomatic subjects, US alterations are not restricted to paratenon and intratendinous areas, but also affect upstream structures along the myofascial chain, resulting in thickening of the fascia interposed between medial gastrocnemius and soleus muscles. Moreover, positive correlations were found between soleus fascia thickening and abnormalities in AT, paratenon, and symptom severity.

Conclusion: Interestingly, suro-Achilleo alterations comparable to those occurring in the symptomatic group were also found in a subgroup of asymptomatic subjects, suggesting that US myofascial alterations may in turn represent better predictors of subsequent clinical outcomes.

Keywords: Achilles tendinopathy, Musculoskeletal ultrasound, Ultrasonography, Crural fascia, Triceps surae muscle

A-0334

Anatomical Analysis of Epicardial and Intramuscular Branches of the Coronary Artery in Korean

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Purpose: Among the various heart diseases, coronary arterial disease is the highest proportion. Most of coronary artery run through the epicardium and give several perforators entering into the cardiac muscles. The anatomical course of epicardial branch and its perforator have been overlooked, even though the coronary angiography showed the details of coronary artery. This study aims to provide a comprehensive analysis of the epicardial branch and its perforator of coronary artery for elucidating their detailed distribution of heart.

Methods: Twenty-embalmed hearts (mean age 66.1) were used in this study. Each coronary artery was carefully dissected after removing the epicardium. The course and patterns of branches of coronary artery and perforator into the muscles were recorded and analyzed.

Results: In the RCA, the SA nodal branch showed 1.47 perforators. The conus branch was showed 1 to 3 numbers and had

8.45 perforators. The perforators from the marginal branch were 10.68, from the posterior right ventricular branch were 7.67. All of RCA had the posterior interventricular branch, its septal perforator were 8.25. It had mostly ventricular branches with 2.65 perforators. 90% of RCA were extended the posterior left ventricle. 17.15 perforators from the posterior left ventricular branch were found. In the LCA, diagonal branch was found 1 to 3 numbers and was from the anterior interventricular branch in 86.1%. They sprouted 7.26 perforators. The anterior interventricular artery were divided into ventricular branch and septal branch, and gave 6.63 and 13.35 perforators, respectively. The atrial branches of the circumflex artery had 2.07 perforators. The ventricular branch distributed on 2/3 part of the posterior left ventricle and had 12.55 perforators.

Conclusion: In conclusion, our study provides a detailed elucidation of the perforator distribution of the coronary artery, presenting fundamental data crucial for the advancement of diagnostic, therapeutic, and preventive practices in heart diseases.

Keywords: Heart, Coronary artery, Epicardial branch, Intramuscular branch

A-0338

Association between the Size of the Sella Turcica with Sex and Skeletal Class. A Perspective on Chilean Individuals

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Purpose: Several studies have analyzed the association between variations in the skull base and other aspects of craniofacial development such as skeletal class. Despite this, there are no results in the Chilean population that contribute to the discussion. The aim of this study is to compare the dimensions of the sella turcica (ST) between sexes and skeletal classes in adult individuals from Temuco, La Araucanía Region, Chile, using lateral cephalometric radiographs.

Methods: The study was approved by the scientific ethics committee of the Universidad de La Frontera. 52 radiographic plates of individuals between 18 and 24 years old, with an equal number of male and female subjects, were studied. The radiographic plates were digitized, and the radiographic area of the sella turcica was calibrated and measured in each one. An intraclass correlation coefficient with a 95% confidence interval was used, yielding a value of 0.88 for the sella turcica area, 0.89 for the ANB angle, and 0.70 for the Wits value, demonstrating excellent observer reliability.

Results: The results shown in the radiographic plates were than the subjects were classified as 15 in class I, 7 in class II, and 30 in class III, with a median ST area in women (64.67 mm^2) higher than in men (60.9 mm^2). The Mann Whitney U test was used with a confidence level of 95%, showing no statistically significant differences between both sexes. The median was higher in class III (64.0 mm^2); however, the Kruskal Wallis H test showed no significant differences (p=0.550) in the median sellar area between skeletal classes.

Conclusion: Although there are dimensional differences between the studied groups, these were not statistically significant. Further studies with a larger number of cases in the current Chilean population are required.

Keywords: Sella turcica, Sex Characteristics, Skeletal Class, Anthropometry

A-0339

Relationship between the Orbicularis Oculi and Zygomatic Minor&Major by Ultrasonography and New Insight on Crow's Feet Injection

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Purpose: The orbicularis oculi muscle (OOc) acts in multiple facial expression functions owing to it overlaps with neighboring muscle of which they directly or indirectly connect with. The orbital part is strongly associated with the facial aging, as its contraction leads to the appearance of the crow's feet. Summarized in the guidelines for OOc botulinum neurotoxin injection and cosmetic surgery, the attention to the position relationship between the OOc and zygomatic minor(Zmi)&major(Zmj) is the main consideration. The aim of this study was to demonstrate an anatomical data and new insight for the botulinum neurotoxin injection on the OOc

by assessing the anatomical information of the OOc and Zmi&Zmj, and performing the sihler's staining on the orbital region specimen.

Methods: The positional relationship between the OOc and Zmi&Zmj, as well as the difference in distance from the epidermis were measured on 4 different perpendicular reference lines. The Sihler's stained specimens will seriously lose the normal morphology and undergo significant shrinkage and distortion. Therefore, in order to be able to accurately present the facial nerve topography, before removing the specimen, we marked three landmarks based on the bone by tying knots.

Results: The proportion of overlap between the OOc and Zmi&Zmj and mean depth on different reference lines was obtained by ultrasonography. Combined with landmarks. The transparent OOc and soft tissues were obtained, and the distribution and pathway of the nerves on the orbital region were visible up to the fine terminals with the naked eye. For a better understanding of the distribution of the nerves, the OOc was schematized on a semicircular model centred on landmark. Accordingly, the facial nerve concentrated interval was calculated.

Conclusion: Combining the muscle positional relationships shown on ultrasound images and the nerve distributions obtained by sihler's staining, we propose an injection method consideration to precisely injection and nerve density.

Keywords: Orbicularis oculi muscle, Ultrasonography, Sihler' staining, Facial nerve

A-0340

Common Palmar Digital Communicating Branch. Anatomical Analysis and Surgical Implications

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Purpose: The common palmar digital communicating branch (CB) establishes the connection among the common palmar digital branches (CPDB) in the human hand. Described with a prevalence over 60%, this CB is closely related to the flexor retinaculum (FR), which makes it vulnerable in carpal tunnel release surgery.

Methods: Our aim was to establish the relationship between the prevalence, biometry and topography of the CB with the hand laterality and sex. A descriptive-correlational, quantitative, nonexperimental and transectional study was conducted. Thirty adult human hands belonging to the cadaver donation program of Pontificia Universidad Católica de Chile were dissected. The samples were fixed in formalin and stored at 4°C.

Results: The CB appeared in 21 cases (70%), being bilateral in 11 (52%). In 18 cases (86%) the CB emerged from the IV CPDB and was added to the III CPDB. The average CB length was 17 mm. According to the Ferrari and Gilbert classification, Group III appeared in 11 cases (52%) and Group I in 9 (43%). A positive and moderate correlation was established (p=0.014; r=0.527) between hand length and the distance between the distal margin of the FR and the midpoint of the CB length.

Conclusion: The prevalence reported supports the CB being part of the normal anatomy. The classification of the CB differs from reports in other geographic areas. Given the prevalence of the CB and its close relation with the FR, this formation must be considered in hand surgery treatment planning.

Funding: ANID (Chile) national doctoral scholarship. Number 21181023.

Keywords: Hand, Carpal tunnel syndrome, Median nerve, Ulnar Nerve, Communicating branch

A-0345

Kinematics of the Joints of the Lower Limb in Women with Hallux Valgus

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Purpose: Hallux valgus deformity (HV) modifies the kinematics of the foot joints, while its effect on the other joints of the lower limb is less understood (Kim et al., 2020; Rosemberg et al., 2023). The purpose of the study is to assess the influence of an HV on the kinematics of the ankle (AJ) and knee (KJ) joints in women.

Methods: Forty-one women aged 40-65 took part in our study: 17 patients with an HV and 24 women without musculoskeletal diseases. The kinematic parameters of the AJ and

KJ were evaluated using Vicon motion capture cameras and analysis systems (Vicon, Oxford, UK); including 10 Vicon T40 infrared cameras, an AMTI dynamometer platform (OR6-5-1000, Watertown MA, USA), and Vicon Nexus and Vicon Polygon software (UK); for statistics, SPSS 27.0.1 software was used, with $p<0.05$ indicating a statistically significant difference.

Results: In HV patients, the angle of internal rotation of the AJ at 10% and 73% of the gait cycle increased (33±1.4° vs. 24±1.6° and 20.2±1.5° vs. 14.7±1.2 respectively), which might be explained by the response to pain and the attempt to limit the load on the medial region of the forefoot. Plantar flexion decreased in patients with an HV in the swing phase of the gait. In the stance phase, there was an additional dorsal flexion at the AJ in HV patients (34.6±1.3° vs. 23.1±1.5°). In HV patients, there was a decrease in the KJ flexion (58.9 ± 1.4° vs. 64.3 ± 1.6°) in the swing phase; a reduction in the angle of KJ physiological valgus was noted in the stance (-12.7±1.2° vs.-5.74±1.6°) and swing (-30.9±1.3° vs. -24.2±1.5°) phases respectively, which an increase in the angle of internal rotation of the foot can explain.

Conclusion: The changes in the kinematics of the AJ in HV patients interact with the impairment of KJ function, provoking the development of osteoarthritis.

Keywords: Hallus valgus, Lower extremity, Women, Motion capture, Kinematics

A-0349

Topographic Analysis of the Orbicularis Oculi Muscle Based on Ultrasonography Interpretation for Clinical Applications

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Purpose: Ultrasound examination of the head and neck area has not been widely applied, but the need has recently emerged and various research results have been produced. In the case of the facial region, very complex anatomical structures are mixed within the thin soft tissue, so it is very important to understand the structural characteristics of each region. In this study, ultrasound examination was applied to provide clinical guidance by providing information on the layer structure and soft tissue thickness of the eye area where the orbicularis oculi muscle (OOc) is located.

Methods: Twenty volunteers (35 males, 25 females; mean age: 24.3 y; age range, 21–36 years) participated in the ultrasonography examination. Seven reference points were designated and soft tissue thickness, including OOc, was measured through ultrasound examination on the obtained black-and-white images. We performed scans of only the left side of the face, using linear transducers (IO8-17, E-CUBE15, ALPINION MEDICAL SYSTEM, Seoul, Korea), and all the images were scanned in transverse placements. The thickness was measured using an image analysis program (Image J, National Institutes of Health, Bethesda, MD, USA).

Results: The mean thickness of OOc was 1.60±0.67 mm (range, 0.88-3.07 mm). The thickest part observed was the superomedial point of the orbit (point #1) at 3.07±1.07 mm, and the second thickest part was the inferolateral point of the orbit (point #9) at 2.33±0.70 mm, respectively. The mean depth of the OOc was 3.29±2.06 mm (range, 1.49-3.85 mm), and the most superficial point was 1.49±0.33 mm, at the lateral orbital rim point (point #5).

Conclusion: Clinicians can identify the structural layers of the orbital area and identify the target muscle layer, blood vessel location, and soft tissue thickness through ultrasound-guided injection procedures to maximize the efficiency of the procedure and minimize complications.

Funding: This work was supported by a National Research Foundation of Korea (NRF) grant funded by the Korean government (MSIP) (RS-2023-00279373).

Keywords: Ultrasonography, Orbicularis oculi muscle, Soft tissue thickness

A-0351

Anatomical Variations and Dimensions of the Cubital Tunnel and Ulnar Nerve in a South African Body Donor Sample

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Purpose: A potential site of entrapment of the ulnar nerve

(UN) occurs at the cubital tunnel (CT), through which the nerve passes. Although variations of the CT may influence the risk of developing cubital tunnel syndrome (CTS), few anatomical studies have been published. The size of the CT may vary and a muscle, namely the anconeus epitrochlearis (AE), may form the roof of the tunnel instead of the cubital tunnel retinaculum (CTR). This research compared the prevalences of the CTR and the AE and the range of dimensions of the CT roof and the UN between sides and sexes in a body donor sample.

Methods: Both upper limbs from 30 embalmed body donors (13 females; 17 males) were dissected. The prevalences of the CTR and the AE were documented. The length, width, and thickness of the CTR and the AE, the diameter of the cubital tunnel, and the UN diameter were measured and compared statistically between sides and sexes. Ethical approval was obtained from the institution (reference number U23/04/249).

Results: The CTR composed the roof of the tunnel in 57 (95%) of the elbows, and the AE was present in three (5%). The muscle was significantly thicker than the retinaculum ($p<0.001$) and the UN diameter was significantly larger in the presence of the AE ($p=0.002$). The roof of the CT was significantly wider on the right side when compared to the left ($p=0.014$), and longer in males than in females ($p<0.001$).

Conclusion: Differences in the anatomy of the CT were observed between sides of the body and between sexes. Although the prevalence of AE was low, the presence of this muscle may influence the size of the UN in the CT. These findings may have implications for UN release procedures in treatment of CTS.

Keywords: Anconeus Epitrochlearis, Cubital Tunnel, Cubital Tunnel Retinaculum, Cubital Tunnel Syndrome, Ulnar Nerve

A-0355

Absence of Most Variable Muscle in Rural Indigenous Community of Sabah, Malaysia

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Purpose: Variation in human anatomy is normal presentation of body structure though it plays substantial implication in clinical examination, diagnosis, investigation and therapeutic procedures. Palmaris longus muscle is the most variable muscle in the forearm and its commonest varition is the absence of muscle tendon. First report in 1559, palmaris longus muscle tendon absence was 17.2% in Indians and 12-24% in Caucasians. According to UKM study (2007), palmaris longus tendon absence was 11.3% in Malay, 10.7% in Indian and 6% in Chinese. The main objective of this study was to determine the palmaris longus tendon absence in rural indegineous community of sabah, malaysia.

Methods: Each participant was examined by using the standard Schaffer's test, if not seen on inspection and unpalpable, the four additional tests, Pushpakumar test, Thompson test, Mishra test I and II had been performed to comfirm the palmaris longus tendon absence.

Results: Total 651 of indeginous people (234 males and 417 females) from 20 villages were participated in this study. The overall absence of palmaris longus tendon was 208 (32.0%). Out of 417 female, absence of plamaris longus muscle tendon seen in 155 (37.2%) and bilateral absent was 80 (19.2%) and unilateral was 75 (18%). Out of 234 male, plamaris longus muscle tendon was absence in 53 (22.6%) and bilateral absent was 24 (10.3%) and unilateral absent was 29 (12.4%). When compared to lateralization, left sided absence was higher than right sided absence in both sexes (65.5% in male and 66.7% in female).

Conclusion: Both bilateral and unilateral absence of palmaris longus mucle tendon was more common in female and left side. Sabah indegineous people has much more higher absence of palmaris longus tendon than penisular malay people, based on UPM study, 2017 (11.7%).

Keywords: Absence, Muscle, Indigenous, Sabah

A-0369

Coexistence of the Aberrant Right Subclavian Artery (Arteria Lusoria) and Truncus Bicaroticus - Description of Anatomical Variations Base on Radiological Investigation

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Purpose: Variations of the origin of the branches which arise from aortic arch are common but extremely important to recognize in the diagnosis and treatment of patients suffering vascular and non-vascular disease.The aim of the study was detailed description of coexistence two anatomical vascular variations base on computed tomography investigation.

Methods: The description was performed based on retrospective analysis of scans from computed tomography angiography. Radiological investigation was carried out on computed tomography (256-row Revolution Apex computed scanner, GE Medical System).

Results: A 52-year-old male patient was admitted to the hospital for during Covid 19 infection which was complicated by pneumonia. Diagnostics was performed using radiological techniques. During computed tomography angiography two vascular variations of aortic arch were found: first was common trunk that was origin of right and left common carotid arteries (truncus bicaroticus) and second was aberrant right subclavian artery (ARSA) usually so called as "arteria lusoria". The dimension of common trunk of carotid arteries was 10x14 mm. Dimension of arteria lusoria had the biggest dimension at the point of origin from aortic arch - 20 mm.

Conclusion: Understanding the variations of the vessels is important for diagnosis and treatment, especially in endovascular intervention, and surgery.

Keywords: Aberrant right subclavian artery, Arteria lusoria, Truncus bicaroticus

A-0372

Development of Sphenoid Sinuses in Children from Birth to Four Years of Age in Computed Tomography

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Purpose: Sphenoid sinuses develop in the first years of life. Literature data differ as to the age range in which the sphenoidal sinuses are formed. The aim of the study was to evaluate the development of sphenoid sinuses in children from birth to four years of age.

Methods: The study was retrospective and was carried out based on the results of computed tomography of the head in children. The scans were made at the Department of Diagnostic Imagining, Polish Mother's Memorial Hospital - Research Institute (256-row Philips Brilliance computed CAT scanner). The analysis involved 88 scans of children from birth up to four years of age.

Results: The examined group involved 44 girls and 44 boys. In each analyzed year of life, the number of children was 22 and the number of girls and boys was equal. The presence of sphenoid sinus at least on one side in the first year of life (average age 0.67 ± 0.22 years) was observed in 38.6% of the children (36.4% - the right sinus, 40.1% - the left sinus). In the second year of life (1.50 ± 0.30 years), in 86.4% (81.8% and 90.1%) respectively. In the third year of life (2.40 ± 0.26 years), in 95.5% (95.1% and 95.1%) respectively. In the fourth year of life (3.53 ± 0.32 years), the sphenoid sinuses were developed bilaterally for all children.

Conclusion: The conducted study has shown that sphenoid sinuses begin to develop in the first year of life. In 86.4% of the examined children, they are already formed in the second year of life.

Keywords: Sphenoid, Sinus, Development, Children, Computed tomography

A-0377

A Rare Presentation of Infantile Mediastinal Mature Cystic Teratoma Leading to Progressive Respiratory Failure - A Case Series

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Purpose: Teratoma is a congenital tumour arising from one or more of the three germ cell layers in the embryo, with an incidence of 1.2-14.2 cases per 100,000 people per year. Mature cystic teratomas contain bone, cartilage, hair, nails, and cystic fluid filled spaces. Extragonadal teratomas are uncommon, and are usually detected incidentally in adults. Here, we report three cases of infantile mediastinal mature cystic teratomas presenting with impending acute respiratory failure.

Methods: Three previously healthy infants (two were boys) aged 5-6 months presented with worsening respiratory tract infection and impending respiratory failure despite medical management. A chest radiograph revealed a large anterior mediastinal mass. CECT chest demonstrated the mediastinal tumour suggestive of Teratoma with a mediastinal shift, cardiac and tracheal compression. None of them had features of local infiltration. It was decided to proceed with surgical excision after multidisciplinary discussions. Mediastinum was approached with muscle sparing posterolateral thoracotomy in two patients. And the other child underwent right anterolateral thoracotomy. Excision of the tumour relieved the airway obstruction and mediastinal shift.

Results: The symptoms improved rapidly following the tumour excision, and they were gradually weaned off from respiratory support. They received ITU care and recovered uneventfully with no surgical complications. The histology of the excised tumours confirmed mature cystic teratoma.

Conclusion: Mature cystic teratoma may rarely present in infancy with progressive respiratory failure, hence clinicians should have a high degree of suspicion. Complete excision is possible in most cases where there is a clear plane of dissection with the lesion and the surrounding structures with excellent clinical outcomes. Both anterolateral and posterolateral thoracotomy approaches could be used to access the mediastinum.

Keywords: Mediastinal teratoma, Thoracotomy, Surgical excision

A-0378

Exploring the Deltoid Ligament Complex from the Perspective of Fibre Arrangement

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Purpose: Ankle sprains and fractures are one of the most common musculoskeletal injuries, especially in athletes. The deltoid ligament complex, found on the medial aspect of the foot, is a crucial stabiliser of the ankle joint. Current diagnostic and surgical approaches have a high rate of complications, including chronic ankle instability and recurrent injuries. This may be due to the deltoid ligament complex being traditionally described as a planar structure. Previous descriptions present conflicting band morphology and don't consider fibre arrangement, leading to inconsistent understanding of its role in ankle biomechanics and pathology. This study aimed to reproducibly investigate the attachment sites and fibre arrangement of the deltoid ligament complex.

Methods: Embalmed foot specimens (n=4; mean age= 68.5±8.7 years; male=4; left=3; right=1) were dissected using the fascicular approach, where individual fibres of the deltoid ligament complex were traced to their precise attachment sites. Each ligament band was modelled and analysed in a virtual 3D space using a digital microscribe. The ligament bands were then superimposed onto an existing CT reconstruction of the ankle bones to create a 3D model of the medial ankle.

Results: Six distinct bands were identified in the deltoid ligament complex, with variability between individuals. In all specimens (n=4; 100%), the anterior bands displayed a corkscrew arrangement in a sagittal plane while the posterior bands were in a near coronal plane.

Conclusion: The deltoid ligament complex is multiplanar and thus its fibre arrangement may have other functional implications in ankle stability than previously understood, including providing stability in more diverse positions and actions. With further histological and biomechanical investigation, this may contribute to improving the treatments of ankle injuries by ensuring that deltoid ligament damage is diagnosed accurately and repaired adequately.

Funding: This project was approved by The University of Melbourne (Ethics Approval ID: 24827) and received no direct funding.

Keywords: Deltoid ligament complex, Ankle injuries, Dissection, 3D modelling

A-0385

An Anatomical Study of the Ulnar Nerve within the Ulnar Tunnel and Hand

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Purpose: Nerve compression is commonly caused by changes in the connective tissue overlying the nerve. In the case of the ulnar nerve, there are several possible points of compression along its course. This paper specifically focussed on the ulnar nerve as it courses through the ulnar tunnel and branches in the palmar aspect of the hand. Ulnar tunnel syndrome is a condition which may develop as the result of nerve compression within the ulnar tunnel. Variant branching within the ulnar tunnel may increase the chance of possible compression. Therefore, this study aimed to record the anatomy of the ulnar nerve in the hand (branching pattern and course through the ulnar tunnel) within a select South African population.

Methods: A sample of 80 adult cadaveric hands were dissected at the Department of Human Biology, university of Cape Town. The branching pattern of the ulnar nerve was reported according to the classification system proposed by Murata et al. (2004). The length of the ulnar tunnel was measured and any variations, such as anastomosis with the median nerve, was recorded.

Results: All 5 branching patterns of the ulnar nerve described by Murata et al. (2004) was observed: Type 1- 32.5%, Type 2- 48.75%, Type 3- 2.5%, Type 4- 8.75%, Type 5- 7.5%. Berrettini anastomosis was observed in 76.25% of cases, Riche-Cannieu anastomosis was observed in 5% of cases and Kaplan anastomosis was observed in 2.5% of cases. The mean length of the ulnar tunnel was found to be 45.67 mm.

Conclusion: Given the many variations recorded in this study and in previous studies of the ulnar nerve, it is emphasised that clinicians consider the variations of the ulnar nerve within the ulnar tunnel and hand when evaluating symptoms indicative of ulnar tunnel syndrome and when operating in this area.

Keywords: Ulnar nerve, Anatomical variations, Ulnar tunnel

A-0409

Prevalence, Location and Biometry of the Neural Loops of the Proper Palmar Digital Nerves in the Human Hand

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Purpose: The neural loop (NL) is formed when an artery passes through a nerve. In this regard, the presence of NL in the hand is relatively unknown. These NL are mainly established between the proper palmar digital nerves (PPDN) and the common palmar digital arteries (CPDA). Our aim was to determine the prevalence, location and biometry of NL in the PPDN of the hand.

Methods: Thirty adult human hands from the cadaveric donation program of the Pontificia Universidad Cattolica de Chile were dissected. These samples, which were fixed and stored at 4°C, were measured with a Mitutoyo®digital caliper and photographed with a Canon®Rebel-SL3 camera.

Results: The NL appeared in 26 cases (87%). 62% had one NL, however 38% had 2 or more. The average length of the 37 NL was 10.9 mm. 32% of NLs formed in the lateral PPDN of the ring finger, while 30% were established in the medial

PPDN of the middle finger. All NLs were related to CPDA.

Conclusion: Although this variant is little known, the reported prevalence exceeds 81%. The length of the NL presented a similar average to that reported. Various classifications have been proposed, without there being a unified criterion. The existence of NL with reduced length could be responsible for symptoms of pain and numbness of the fingers. NLs are frequently present in NDPP, knowledge of their location and biometry are important during hand surgical approaches.

Keywords: Hand, Neural loop, Proper palmar digital nerve, Common palmar digital artery

A-0415

Description of the Origin and Distribution of the Brachial Plexus of Leopardus Pardalis

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Purpose: To describe the origin and distribution of the brachial plexus in Leopardus pardalis.

Methods: Two specimens of L. pardalis were evaluated. Aside from the thoracic limbs, the cervical, the pectoral, and the thoracic regions were dissected in order to determine the origin and distribution of the brachial plexus.

Results: The brachial plexus of L. pardalis originates from four principal nerve trunks, formed by the confluence of the ventral branches of the nerves C6, C7, C8, and T1. The ventral branch of C6 emits the suprascapular nerve and the first two branches of the subscapular nerve; its second branch originates from the ventral branches of C6 and C7. The axillary nerve is located between the second branch of the subscapular and the musculocutaneous nerve, it derives from the ventral branches of C6 and C7, and enters caudally to the shoulder joint into the axillary hiatus. The musculocutaneous nerve stem from the ventral branches of C6 and C7, it gives off muscular branches and a communicating branch to the median nerve, which originates from the ventral branches of C7, C8, and T1. The ulnar nerve proceeds from the ventral branches of C8 and T1, also detaches a communicating branch to the median nerve, at the third half of the forearm. Four cranial pectoral nerves come from the ventral branches of C6 and C7. The caudal pectoral nerves rise from the ventral branches of C8 and T1. The thoracodorsal, long thoracic, and lateral thoracic nerves were recognized.

Conclusion: Despite some small differences, the origin and distribution of the brachial plexus of L. pardalis is very similar to what has been described about the brachial plexus of domestic felines. This resemblance is of great clinical importance, since it allows the adaptation of various interventional techniques used in domestic felines for their application in L. pardalis.

Keywords: Brachial plexus, Leopardus pardalis, Nerves

A-0425

Mapping Human Fetal Thalamus Development during the Second Trimester with 7.0T Magnetic Resonance Imaging

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Purpose: 7.0T high field MRI of fetal specimens was used to investigate the global volume growth and regional heterogeneity of morphological development of the thalamus during the second trimester.

Methods: Using 7.0-T MR images obtained in 34 fetal specimens ranging from 14 to 22 GW, we manually segmented and reconstructed the dorsal thalamus and metathalamus. Volume measurements and shape analysis were performed to quantitatively evaluate global and regional growth.

Results: The results of the global volume analysis showed that the absolute volume increased linearly with age, while the relative volume showed a quadratic growth. The shape analysis showed conspicuous growth in all parts except the anterior part of the dorsal thalamus and the terminal part of the lateral geniculate body. The dorsal thalamus showed a bidirectional growth pattern toward the dorsolateral and ventral medial sides. For the metathalamus, the medial geniculate grew faster than the lateral geniculate. Since the thalamus is a heterogeneous structure, the heterogeneity of morphological development may indirectly reflect the different developmental patterns of thalamic nucleus. The distribution of the development heterogeneity was consistent with the Y-shaped division of the thalamus nuclei groups. We found that the different morphological and developmental characteristics of thalamic nuclei may be related to their participation in brain system development and function. During the second trimester, the specific

relay nucleus developed faster, while the associated nucleus involved in complex functions developed slower.

Conclusion: The development pattern of the human thalamus shows rapid global growth and regional heterogeneity during the second trimester, which is consistent with the difference of thalamic nucleus in early development stage and the functional formations.

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Keywords: High-field MRI, Fetal brain development, Thalamus, Shape analysis, Regional heterogeneity

A-0430

Preparing Bone Specimens from Fresh and Embalmed Human Cadavers: Sous Vide as an Alternative Method for Warm Water Maceration

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Purpose: Sous vide, a cooking method, enhances heat flow and enables cooking at regulated temperatures in plastic pouches that have been vacuum-sealed. This procedure can be used as an alternative to bone maceration because of this property. This study describes how fresh and embalmed human specimens can be chemically macerated and cleaned using sous vide.

Methods: Eighth head and neck, seven upper, and five lower extremity specimens from 10 fresh and 3 embalmed cadavers at the Department of Anatomy of the KoçUniversity School of Medicine were used. Soft tissues were removed and specimens were vacuum sealed in plastic pouches filled with water and detergent solution. Every maceration session was done at 65 °C for three to four days with a commercial device. Blunt instruments were used to remove any leftover soft tissue in between sessions. After maceration, a concentrated acetone solution was used for further degreasing.

Results: Eighth sets of crania and cervical vertebrae, seven sets of upper extremity, and five sets of lower extremity skeletons were prepared. The method successfully cleaned all fresh specimens. While some embalmed specimens were completely cleaned, maceration of extremely dried out embalmed cadavers were suboptimal. It took three to five maceration sessions to completely clean small (vertebrae, carpals etc.) and large bones (crania, femora, humerii etc.). Degreasing in acetone baths lasted from three to seven days.

Conclusion: Using sous vide for chemical maceration might be a cheaper and effective alternative for preparation of human skeletal specimens from both fresh and embalmed cadavers. Further studies are planned for quantifying the soft tissue removal and degreasing capacity of sous vide method.

Keywords: Bone cleaning, Detergent, Embalmed cadaver, Fresh cadaver, Sous vide

A-0438

Histochemical Properties of the Iliocapsularis Muscle: Are There Implications for Hip Function?

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Purpose: Iliocapsularis muscle is an important anatomical landmark in anterior approaches to hip arthroplasty. Researchers proposed that iliocapsularis functions to stabilise the anterior hip joint and limit impingement of the hip capsule in hip flexion. This study aimed to determine the skeletal muscle properties of iliocapsularis and to compare these to that of iliacus and vastus lateralis.

Methods: Muscle samples from 11 recently deceased unembalmed bodies (83±9 years) were harvested and analysed for muscle fibre type distribution and fibre cross-sectional area (CSA) using fluorescent immunohistochemistry, while relative mitochondrial density was visualised histochemically using the NADH stain (ethical approval S21/04/058 and BM21/7/8).

Results: Iliocapsularis had predominantly type I fibres (63±12%), followed by type IIA (32±13%) and IIX (5±3%) fibres. Iliacus had a similar type I (61±8%), IIA (31±7%), and IIX (8±8%) fibre distribution. Vastus lateralis had equal amounts of type I (47±12%) and IIA (40±11%) fibres, and less type IIX

(13±10%) fibres. Iliocapsularis and iliacus observed higher relative mitochondrial density than vastus lateralis. Iliocapsularis had larger type I fibres (3607±1422 μm^2) than type IIA (1849±1306 μm^2) and IIX (1379±900 μm^2) fibres. Iliacus and vastus lateralis also had larger type I fibres (3320±1182 μm^2 and 4235±882 μm^2, respectively) than type IIA (1790±987 μm^2 and 2738±1650 μm^2, respectively) and IIX (1428±769 μm^2 and 2170±1355 μm^2, respectively) fibres. No difference in the CSA of fibre types were found when iliocapsularis was compared with iliacus and vastus lateralis. Mean fibre CSA of iliocapsularis and iliacus were similar in size, while vastus lateralis had larger fibres.

Conclusion: No preceding study has examined iliocapsularis on a muscle fibre level to assist with describing its implications for hip function. The predominant oxidative type I fibre distribution of iliocapsularis supports the proposed function. Conclusive knowledge of its function may allow for more informed decisions regarding patient rehabilitation following anterior approaches for hip arthroplasty.

Funding: Harry Crossley Foundation.

Keywords: Iliocapsularis muscle, Muscle fibre type, Cross sectional area, Relative mitochondrial density, Hip arthroplasty

A-0442

Clinical Anatomy of the Buccinator Muscle and Its Nerve Distribution Pattern

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Purpose: The buccinator muscle assumes a pivotal role in both mastication and deglutition, and serves as a pathway for surgical interventions within the oral cavity. This aim of the study was to describe the nerve innervation pattern of the buccinator muscle to provide an essential information for clinical applications.

Methods: Sixteen adult hemifaces from 8 Korean cadavers (2 males, 2 females; mean age, 75.6 years) with no history of trauma or surgical procedure on facial area were used for anatomical study. A meticulous dissection has been conducted to expose the buccinator muscle along with the associated nerve distribution. The locations of nerve entry point with reference to the plane passing through the cheilion and otobasion inferius were measured. A modified Sihler method was performed on the perioral area for the confirmation of the dissection results.

Results: The intramuscular neural distribution for the buccinator muscle had the largest arborization patterns in the inferior section of the muscle. The branches from buccal and marginal mandibular branch of the facial nerve were primarily converge inferior to the reference line. These nerves traversed superficially compared to the buccal fat pad.

Conclusion: The principal arborization area of the buccinator muscle is located inferior to the cheilion-otobasion inferius line. The outcomes of this study are expected to provide novel anatomical insights in clinical application where nerve distribution is crucial, including intraoral surgical approaches or botulinum toxin injection.

Keywords: Buccinator muscle, Sihler's staining, Facial nerve, Buccal fat pad

A-0450

Morphometric Study of Cutaneous Perforators of Lower Limb in Humans

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Purpose: Cutaneous perforators defined as any vessels that arises indirectly from branches of those source vessels that supply deep tissues, especially muscles and finally supplying the overlying subcutaneous tissue and skin. Anatomical investigation in area of skin vasculature will help surgeons eventually benefiting in reconstructive areas and harvesting perforator flaps.

Methods: The study was conducted on 15 lower limbs of adult fresh cadavers of either sex. After cannulation and dissection by standard techniques perforators of lower limb were located in relation to standard bony landmarks and their distance from main source vessels were measured.

Results: In a study of 15 lower limbs, 817 perforators were observed. Contributing arteries were SFA (13.7%), PFA (11.6%), LCFA (12.9%), MCFA (6.4%), POA (9.0%), MSA (5.4%), ATA (13.4%), PTA (17.3%), and PA (10%). The average number of perforators and their mean lengths were found as follows: -Superficial femoral artery 7.5 ± 1.7 perforators, mean length

of 42 ± 10 mm -Profunda femoris artery 6.3 ± 1.0 perforators, mean length of 64 ± 10 mm -Lateral circumflex femoral artery 7.0 ± 1.6 perforators, mean length of 48 ± 14 mm -Medial circumflex femoral artery 3.5 ± 1.1 perforators, mean length of 35 ± 10 mm -Popliteal artery 5.0 ± 0.7 perforators, mean length of 66 ± 16 mm -Medial sural artery 3 ± 0.8 perforators, mean length of 62 ± 6.0 mm -Anterior tibial artery 7.3 ± 2 perforators, mean length of 35 ± 10 mm -Posterior tibial artery 9.5 ± 2.6 perforators, mean length of 30 ± 10 mm -Peroneal artery 5.5 ± 1.1 perforators, mean length of 38 ± 10 mm.

Conclusion: The study was an attempt to delineate the perforators of lower limb after injecting methylene blue dye. The detailed understanding and knowledge of this vascular anatomy of perforators will benefit reconstructive surgeons in harvesting skin flaps.

Keywords: Cutaneous perforators, Lower limb, Skin flaps

A-0452

Morphological and Histological Assessment of Coronary Artery Bypass Grafting Conduits: A Comprehensive Study

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Purpose: Coronary artery bypass grafting (CABG) is a prevalent intervention for managing coronary artery disease, necessitating the selection of an optimal conduit for the procedure. This study aimed to identify conduits closely resembling coronary arteries in terms of morphological and histological characteristics.

Methods: The investigation involved measuring the length, luminal diameter, and wall thickness of various conduits, including the saphenous vein (SV), right and left internal thoracic artery (RITA/LITA), inferior epigastric artery (IEA), right gastro-epiploic artery (RGEA), and radial artery (RA). Additionally, the decision-making process of cardiothoracic surgeons before CABG surgery was surveyed, with ethical approval obtained in 2021 (HREC483/2021).

Results: Results demonstrated that the mean length and diameter of the right coronary artery differed between sexes, with the LITA surpassing the RITA in length for four out of five coronary arteries. The SV, a commonly chosen conduit, exhibited a mean wall thickness of 127.97±34.99μm. Survey findings revealed that the SV was preferred for its accessibility, while the LITA was favored for exclusive use.

Conclusion: In conclusion, conduit diameter, wall thickness, and length emerged as critical factors influencing graft patency and surgical handling. The appropriateness of RITA and RGEA conduits depended on the specific coronary artery being bypassed. The LITA and RA conduits closely resembled coronary arteries and were favored choices. Surgeons commonly preferred the SV due to its accessibility. This study enhances our understanding of conduit selection in CABG procedures, facilitating informed decision-making for cardiothoracic surgeons.

Funding: NRF (National Research Fund).

Keywords: Conduits, Coronary artery bypass grafting

A-0457

Double Vena Cava Inferior: A Case Report

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Purpose: Inferior vena cava (ICV) is the widest vein of the body and its variations are not very common. Knowing these variations provides guidance in radiology and surgical procedures. Classically ICV is formed by the union of the right and left common iliac veins on the right side of the aortic bifurcation, at the level of the L5 vertebra.

Methods: During the dissection period of 2021-2022 in our anatomy department, a double inferior vena cava was encountered during the dissection of the abdominal region of a 69-year-old male cadaver.

Results: While the structures of the posterior abdominal wall were being opened during the dissection of the abdominal region, it was observed that there was an inferior vena cava on both sides of the abdominal aorta at the kidney level in the lumbar region. The inferior vena cava on the left side was a continuation of the left common iliac vein and drained the left renal vein. The right inferior vena cava was a continuation of the right common iliac vein and drained the right renal vein. On the right side, the testicular vein was draining into the right renal vein instead of the inferior vena cava. Apart from the lumbar veins draining into the inferior vena cava, it was also seen that a branch draining the left-sided pelvic veins

drained into the right-side inferior vena cava.

Conclusion: Evaluation of the course of the inferior vena cava and its branches is important in making radiological definitions before surgical or endovascular interventions. Having knowledge about anatomical variations will minimize possible complications. Knowing these variations will increase the success rate of operational and interventional medicine practices and will also help prevent complications.

Keywords: Inferior vena cava, Anatomy, Variation, Duplication

A-0465

Developing an Interactive 3D Web with Patient-Specific Liver Anatomical Contents for Liver Cancer Patients before Liver Resection Surgery

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Purpose: First, in preoperative outpatient care, clinicians can use the content to explain the surgical plan more clearly and intuitively. Second, patients can intuitively understand their intrahepatic vascular structure through a 3D model before surgery, and based on this, they can visually understand where cancer occurred in their liver and how much the doctor plans to cut. This may help facilitate effective communication between clinicians and patients regarding liver cancer surgery.

Methods: 1. Downloaded DICOM data of a liver cancer patient from the Cancer Imaging Archive (TCIA) 2. 3D-reconstructed 5 main anatomical structure models: liver parenchyme, hepatic vein, portal vein, cancer, gall bladder, and bile duct, with a 3D slicer. The 3D reconstruction method was segmented manually after applying an AI-based automatic segmentation method with the powerful extension Total Segmentator. 3. Optimized 3D models and applied color material in Blender 3D before uploading to the web. 4. After uploading 3D models to Bezi3d, we built logical interaction nodes with Bezi3d (https://hq.bezi.com/) which enable 3D interaction according to the user's mouse or click interaction.

Results: The patient's liver 3D model is largely arranged in the center of the screen, and three large 3D buttons—Liver Transparency, Cancer Position, and Liver Resistance Planning—are arranged at the bottom of the screen. Each button is operated by clicking or touching, and its functions are as follows: 1) 3D model interaction (rotation, zoom-in/out) 2) Liver Transparency button: show the intrahepatic vascular structures 3) Cancer Position button: show the cancer location and size with automatic 3D model rotation. 4) Liver Resection Planning button: show the expected hepatic resection site.

Conclusion: This research propose web-based 3D interaction content displaying patient's intrahepatic vascular structures, cancer location, and resection site size as a clinical communication tool. Further user testing and refinement needed for clinical effectiveness.

Keywords: Liver cancer surgery, Patient education, Medical visualization, Interactive web 3D, 3D reconstruction

A-0469

Anatomical Variations of the Biliary Tree in Omani Population

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Purpose: Anatomical variances can affect patient's treatment options including surgery, as well as the investigation and clinical examination. Consequently, thorough understanding of the variability in human morphology is crucial for better diagnostic and interventional performance. Oman has launched the national liver transplant program where for the first time live donor transplants were possible in the country. Transplantation is a complex procedure that includes the investigation and preparation of both the patient as well as the donor. To improve transplantation outcomes, good understanding of the biliary tree variations is crucial. Hence, this study aims to determine the prevalence and type of anatomical variations of the biliary tree found in Omani patients who underwent MRCP in a tertiary care hospital.

Methods: This is retrospective cross-sectional study of patients admitted to Sultan Qaboos University Hospital (SQUH) for magnetic resonance cholangiopancreatography (MRCP). between 2021-2023 was used. Inclusion criteria is Omani nationals who underwent MRCP of all ages and genders. Demographic data as well as clinical variables including indication of imaging, co-morbidities, surgical history and complications

were recorded. Huang classification was used to categorize anatomical variations of the biliary tree.

Results: 63 MRCP studies were analysed. Model biliary tree anatomy (Huang type A1) was found in 56 (88.89%) patients and variants were seen in 7 (11.11%) patient. A2 variant was seen in 3 (4.76%) of patients while A3 was found in 4 (6.35%) of patients. Our results show higher prevalence of Huang type A1 than global prevalence (88.89% vs 62.6%). Similar results is seen with A3 variants while A2 variants was seen less in our population than global prevalence.

Conclusion: Biliary tree anatomy in Omanis shows higher prevalence of model anatomy in comparison to global data. However, larger sample is required to draw definitve conlcusion in this regard with in depth analysis.

Keywords: Biliary, Tree, Variant

A-0477

Description of the Transverse Canal of the Axis. Biometric Description and Clinical Implications

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Purpose: The Axis (C2) stands out as an atypical vertebra in the cervical region, characterized by its robustness. Like typical cervical vertebrae, the Axis has transverse foramina traditionally located on each side of the transverse processes, just below its upper articular facet. These openings typically house the vertebral artery, nerve, and veins and may vary in shape, number, size, etc. This study aims to obtain morphometric parameters of the transverse foramina of the Axis, creating a database to explain the anatomical characteristics of this bony landmark and provide quantitative data that may be useful for surgical approaches in the area.

Methods: A morphometric study of the transverse foramina of 30 Axis vertebrae was conducted using specimens from the osteotheque of the Pontifical Catholic University of Chile. The vertebrae were required to have an intact transverse foramen on each side. Each hole was molded in silicone to determine its features in terms of course, shape, length, and diameters, among other aspects.

Results: The average anteroposterior diameter of the upper and lower foramina was 5.62 mm and 6.4mm, respectively. The average transverse diameter of the upper and lower foramina was 5.6 mm and 7.5 mm, respectively. A canal was formed between both holes, with a lower arm averaging 7.41 mm in length, an elbow with an average angle of 98º, and an upper arm averaging 10.18 mm in length.

Conclusion: We observed that the studied Axis vertebrae exhibit a canal that runs laterally from inferior to superior, forming an elbow with medial convexity during its course. This suggests that vascular and nervous structures typically traversing this foramen would adopt a similar curved shape during their trajectory. Knowledge of the anatomy of this vertebra could help prevent iatrogenic actions.

Keywords: Axis vertebra, Transverse canal, Morphometric, Transverse foramina, Biometric

A-0497

Concurrent Variations of the Unique Course of the Azygos Vein, the Tortuous Right Common Carotid Artery, and the Branching Pattern of the Internal Iliac Arteries

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Purpose: Blood vessels are one of the structures of the human body that is prone to have variations. Since accurate awareness of vascular anatomy is important for diagnosis and treatment, the authors report on the concurrent variations in four regions in 98-year-old Korean female cadaver during the anatomy course at Eulji University School of Medicine.

Methods: We observed vascular variations out of 21 cadavers dissected from 2021 to 2023, it was the only case with multiple vascular variations in the same individual. The photos were taken using a digital camera and schematic illustrations were made using Adobe Photoshop.

Results: In the thorax, the main trunk of the azygos vein was bifurcated at L1 and reunited at T10 level. On the left side during ascending, the intercostal veins directly joined the azygos vein without forming the hemi-azygos vein or accessory hemi-azygos vein. Meanwhile, in the neck, the proximal part of the right common carotid artery was severely kinked. In the

pelvic region, the first branch of the right internal iliac artery was the obturator artery, not the umbilical artery. Furthermore, the right inferior gluteal artery and the right internal pudendal artery were bifurcated below the pelvic diaphragm. Lastly, we observed a looped artery connecting the posterior division of the internal iliac artery and the proximal part of the inferior gluteal artery in the left side.

Conclusion: Through the rarity and complexity of the present case, experts such as anatomists and surgeons should be aware that various vascular variations can be found in the same individual during dissection or complex surgery.

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Keywords: Variations, Azygos vein, Common carotid artery, Internal iliac artery

A-0498

Intramuscular Nerve Distributions of Abductor Hallucis Muscle and the Clinical Implications for Pain Management

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Purpose: The abductor hallucis muscle (ABHM) has been pinpointed as a potential target for botulinum neurotoxin administration in treating various foot-related symptoms. However, there remains a significant gap in the literature concerning the ideal injection site for managing ABHM-related pain. This study aims to elucidate the intramuscular nerve distribution pattern and pinpoint the concentrated location of nerve endings within the ABHM using modified Sihler's staining.

Methods: Twenty human cadavers (40 specimens) were used in this study. The medial and lateral plantar nerves were manually dissected to determine the nerve entry points. After verifying their entry points, all specimens were treated using the modified Sihler's staining.

Results: The ABHM was divided into four equal parts from anterior to posterior (labeled A, B, C, and D). The location of the nerve entry points was observed in the C area in all cases. The branches of the medial plantar nerves proceeded towards the origin and center of the ABHM and divided into 2-3 branches. We did not observe any visible branches near the insertion area, which contained a tendinous portion.

Conclusion: The nerve endings within the ABHM were mainly found to be within the areas C and D where the posterior 2/3 of ABHM. This means that the area C and D may be a potential trigger point of the ABHM. Our findings improve our understanding of the medial plantar nerve distribution and will aid in the management of foot-related symptoms.

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Keywords: Abductor hallucis muscle, Sihler's staining, Botulinum neurotoxin, Medial plantar nerve

A-0520

Topography of Corrugator Supercilii Muscle Relative to the Eyebrow and Its Clinical Application for Blepharospasm

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Purpose: The purpose of the present was to elucidate the topography of corrugator supercilii muscles (CSM) relative to the eyebrow with the aim of providing the topographic guidance for the botulinum toxin type A (BTX-A) injection in the treatment of blepharospasm.

Methods: Thirty-six hemifaces of 18 cadavers were dissected. Prior to dissection, four specific points on the eyebrow were marked to serve as reference points and photographed with scale bars. During the dissection, the layers beneath the

skin were carefully separated to expose the CSM. To analyze the position of the CSM in relation to the eyebrow, a superimposition method was utilized. We overlaid an image showing the dissected CSM onto a pre-existing image that contained reference lines marking the eyebrow landmarks.

Results: The CSMs had limited extension both above and below the medial end of the eyebrow. Significantly, the central part of the CSM's width was positioned just above the upper point of the eyebrow, aligning closely with the midpupillary line. On the lateral side, the overlap of the CSM beyond the midpupillary line was minimal, indicating that the muscle's presence diminishes or becomes less distinct as it extends laterally from the midpupillary line.

Conclusion: For effective targeting of the CSM, it is recommended to administer botulinum toxin injections precisely at the center of the medial end of the eyebrow and just above the midpupillary line. Considering, minimal presence of the CSM beyond the midpupillary line, injecting BTX-A into the CSM in this lateral region are typically considered unnecessary.

Keywords: Blepharospasm, Corrugator supercilii muscles, Topography, Botulinum toxin, Superimposition

A-0548

Anatomical Analysis of Thalamus in Multiple Sclerosis and the Effect of Interferon Beta-1 Treatment in Modulating the Structure of Thalamus

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Purpose: The thalamus is a group of large, gray masses that act as an evolved sensory and motor gateway to the cortex. We measured and compared the size of thalamus and interthalamic adhesion in healthy and multiple sclerosis (MS) patients. We also assessed the effect of interferon beta-1b (IFN beta-1b) on the thalamus and interthalamic adhesion measurements and the possible association with thalamus size improvement.

Methods: This prospective study used brain magnetic resonance images (MRI) to measure the anteroposterior, transverse and vertical length of the thalamus and the interthalamic adhesion for both healthy subjects and patients with MS. The internal skull surface was also measured to calculate the thalamus/internal skull surface ratio. For the MS patients on regular IFN beta-1b, the measurements were taken at baseline and after treatment, from the last available MRI scan.

Results: The thalamus and interthalamic adhesion size was significantly smaller in MS patients compared to healthy controls. There was no correlation between gender or right-left sides and the dimensions of the thalamus and interthalamic adhesion within the same disease group. Regular treatment with IFN beta-1b lead to an improvement in the thalamus size in MS patients.

Conclusion: Gender and right-left sides did not affect the dimension of the thalamus and the interthalamic adhesion within the same group. Patients with MS showed significant reduction in the thalamus size, which appears to be reversed in patients treated with interferon beta-1b from diagnosis.

Keywords: Thalamus, Morphology, Magnetic resonance images, Multiple sclerosis, Interferon beta-1b-β

A-0549

Morphometric Analysis of Oblique Popliteal Ligament and Its Significance on Stability of Knee Joint

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Purpose: The oblique popliteal ligament (OPL)is a broad flat, fibrous band derived from the tendon of the semimembranosus passing from the back of the medial condyle of the tibia obliquely upwards and lateral to the back of the lateral condyle of the femur. It reinforces the posterior portion of knee joint capsule thus helps in maintaining stability of knee The aim of the study is to find the length, width, shape and type of oblique popliteal ligament.

Methods: The study is done on 20 cadaveric knee joint specimens, the length of the oblique popliteal ligament is measured from the origin to the insertion, width of the oblique popliteal ligament is measured at its origin and midpoint, shape and nature of the oblique popliteal ligament is observed, all measurements are done using vernier calliper.

Results: In the present study band shaped OPL is most commonly found in 45% of cases. Average length of the oblique popliteal ligament from the origin to insertion is width

of the oblique popliteal ligament at the origin is the width of oblique popliteal ligament at mid point is

Conclusion: Based on the result the length, width, shape and nature of the band we are able to determine the role of oblique popliteal ligament on maintaining the stability of knee joint and map out location of important nerves and feels located in the oblique popliteal ligament. This knowledge will help knee surgeons while operating on the posterior aspect of the knee to optimize functional outcome after surgery.

Keywords: Oblique popliteal ligament, Knee joint, Popliteal fossa

A-0573

Can Sural Nerve Injury Be Avoided in the Sinus Tarsi Approach for Calcaneal Fracture? A Cadaveric Study

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Purpose: There is no consensus regarding the references to determine the exact location of the skin incision to minimize iatrogenic sural nerve injury in the sinus tarsi approach for calcaneal fracture. The purpose of this cadaveric study was to describe the anatomical course of the sural nerve in relation to easily identifiable landmarks during the sinus tarsi approach and to provide a more practical reference for surgeons to avoid sural nerve injury.

Methods: Twenty-four foot and ankle specimens were dissected. The bony landmarks used in the following reference points were the tip of the lateral malleolus (point A), lateral border of the Achilles tendon on the collinear line with point A (point B), posteroinferior apex of the calcaneus (point C), inferior margin of the calcaneus on the plumb line through point A (point D), and tip of the fifth metatarsal base (point E). After careful dissection, the distances of the sural nerve to points A and B in the horizontal direction (lines D1 and D2), points A and C in the diagonal direction (lines D3 and D4), points A and D in the vertical direction (lines D5 and D6), and points A and E in the diagonal direction (lines D7 and D8) were measured.

Results: The median ratio of D1 to D1+D2, D3 to D3+D4, D5 to D5+D6, and D7 to D7+D8 were 0.37 (range, 0.26–0.50), 0.23 (range, 016–0.33), 0.35 (range, 0.25–0.45), and 0.32 (range, 0.20–0.45), respectively. There was no significant difference in all ratios by sex (P=.17 [R1], .47 [R3], .84 [R5], and .23 [R7], respectively).

Conclusion: The distance ratios from this study can be helpful to avoid sural nerve injury during the sinus tarsi approach for calcaneal fractures. Established standard incision may have to be modified to minimize sural nerve injury.

Keywords: Cadaver, Calcaneus, Sural nerve, Fracture, Sinus tarsi approach

A-0600

Sesamoid Bones of the Hand: A Radiographic Study in South Indian Population

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Purpose: Sesamoid bones of the hand are frequently involved in the pathological conditions like osteoarthritis. In this context, the purpose of this present study was to determine the prevalence, topography and dimensions of sesamoid bones of hand in South Indian population.

Methods: The present cross-sectional study included 98 plain radiographs (antero-posterior and lateral views) of the hand. The number of sesamoid bones and their exact topography was observed in the hand radiographs. The length and breadth of the sesamoid bones were measured by using the software 'Radiant Dicom Viewer (Poland, version 4.2.1.17555, 64-bit).

Results: The present study observed the sesamoid bone at the first metacarpophalangeal joint in 99% of hands, medially and at the lateral side in 80.6% cases. The length and breadth of the medial sesamoid was 0.49±0.07 mm and 0.40±0.07 mm respectively. The same dimensions for the lateral sesamoid bone was 0.52±0.10 mm and 0.37±0.08 mm respectively. The second metacarpophalangeal joint exhibited single sesamoid bone and this was seen only in 25.5% cases. Its length and breadth were 0.46±0.10 mm and 0.36±0.07 mm respectively. The third metacarpophalangeal joint exhibited single sesamoid bone and this was seen only in 3.1% cases. Its length and

breadth were 0.42±0.14 mm and 0.34±0.17 mm respectively. The fifth metacarpophalangeal joint exhibited single sesamoid bone and this was seen in 46.9% radiological films. Its length and breadth were 0.38±0.06 mm and 0.33±0.04 mm respectively.

Conclusion: The prevalence, topography and morphometric data of the sesamoid bones of hand, which are determined in this study can be used as a morphological database for the South Indian population. The data will help the operating hand surgeon and radiologist in their clinical practice.

Keywords: Sesamoid Bone, Hand, Osteoarthritis

A-0619

How Much Calcaneal Tendon Is Slender & Twisted in Koreans? A Cadaveric Study

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Purpose: The purpose of this study is to classify the twisted types of the calcaneal tendon in Korean cadavers to present the anatomical characteristics of Koreans and provide basic anatomical data applicable to clinical medicine.

Methods: The length, width, and thickness of the calcaneal tendon were measured in 101 formalin-fixed feet (64 men, 37 women/average age 79.27 ± 11.59 years). In addition, the twisted form of the calcaneal tendon was classified into three types by the Edama's classification (2016), which observed the tendon arrangement at the insertion site.

Results: As a result of the study, twisted types of the calcaneal tendon appeared in the following order : moderate twist (55.4%), least twist (22.8%), and extreme twist (21.8%). The average length of the calcaneal tendon was 50.64 ± 16.95 mm, the average width was 14.80 ± 3.34 mm, and the average thickness was 6.61 ± 1.67 mm. The calcaneal tendon was narrowest at the middle point and thinnest at the proximal point.

Conclusion: In conclusion, this study presented anthropological characteristics by classifying the twisted types of calcaneal tendons of Korean cadavers, and is expected to serve as basic anatomical data helpful in the diagnosis and treatment of ankle diseases.

Keywords: Calcaneal tendon, Twist, Classification, Korean cadaver

A-0622

Foramen Magnum and Occipital Condyle Analysis for Sex and Stature Determination

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Purpose: The purpose of this study is to know the morphological analysis and correlation of foramen magnum (FM) and occipital condyle (OC) according to sex and stature. Through this, sex and stature can be determined and can help with human identification.

Methods: The study utilized Post mortem computed tomography (PMCT) data from the National Forensic Service, involving 40 subjects. Skull reconstruction was conducted using Mimics (Version 21.0, Materialise, Leuven, Belgium) software, with measurements classified based on Bahsi et al.'s method into eight types. Additionally, six measurements and descriptions for sex and stature determination were as follows; Foramen magnum anterior-posterior diameter (FMAPD), Foramen magnum transverse diameter (FMTD), Anterior intercondylar distances (AID), Posterior intercondylar distances (PID), Occipital condyle length (OCL), Occipital condyle width (OCW).

Results: The results based on the 8 classifications of the FM were as follows; it had the 9 (22.5%) ovals, 7 (17.5%) rounds, 10 (25%) tetragonals, 1 (2.5%) pentagonals, 2 (5%) hexagonals, 1 (2.5%) egg, 4 (10%) overturned eggs, 6 (15%) irregulars. The mean and standard deviation are as follows; FMAPD: 33.80 (2.35), FMTD: 28.59 (1.97), AID: 23.31 (3.49), PID: 40.76 (3.71), OCL: 20.06 (3.78), OCW: 12.45 (2.81). Among the six results for the measured values of sex and stature, only two showed differences in FMAPD (P=0.001) and OCW (P=0.000). Correlation analysis for measurements according to sex and stature was also performed, showing significant in FMAPD (P=0.000), FMTD (P=0.000), AID (P=0.038), PID (P=0.002), OCW (P=0.001).

Conclusion: In this study, we classified the types of FM, compared the measurement values of FM and OC according to sex and stature, and also performed correlation analysis. In conclusion, significant results were shown. This underscores the utility of skull reconstruction as baseline data for predicting sex or stature.

Keywords: Foramen magnum, Occipital condyle, Sex determination, PMCT, 3D reconstruction

A-0636

Availability using the Location of the Fibular Tunnel for Reconstruction of the Lateral Ankle Ligament in Korean Population : A Cadaveric Study

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Purpose: We aimed to find out the location of fibular footprint of each anterior talo-fibular ligament (ATFL) and calcaneo-fibular ligament (CFL), as well as their common origin in relation to bony landmarks of the fibula in order to determine the location of the fibular tunnel.

Methods: In 105 ankle specimens, the center of the footprints of the ATFL and CFL (cATFL and cCFL, respectively) and the intersection point of their origin (intATFL-CFL) were investigated, and the distances from selected bony landmarks (the articular tip (AT) and the inferior tip (IT) of the fibula) were measured. Forty-two (40%) specimens had single-bundle ATFL, and 63 (60%) had double-bundle patterns.

Results: The distance between intATFL-CFL and IT was 12:0±2:5 mm, and a significant difference was observed between the two groups (p=0.001). Moreover, the ratio of the intATFL-CFL location based on the anterior fibular border for all cadavers was 0.386.

Conclusion: The present study suggests a reference ratio that can help surgeons locate the fibular tunnel for a more accurate reconstruction of the lateral ankle ligament. Also, it may be necessary to make a difference in the location of the fibular tunnel according to the number of ATFL bundles during surgery.

Keywords: Korean cadaver, Lateral ankle ligament, Anterior talofibular ligament, Calcaneofibular ligament, Reconstruction

A-0637

Investigating Scapular Nutrient Foramina: A Topographic Examination in Dried Skeletons

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Purpose: Our study aims to investigate the prevalence and anatomical characteristics of scapular foramina (SF) and scapular nutrient foramina (SNF) in dried skeletons sourced from the Northeastern Thai population.

Methods: A total of 150 dried scapulae were scrutinized. SF and SNF were identified using a 0.36 mm metal wire. The study recorded the number, locations, lengths, and diameters of SF. Subsequently, SNF were identified using the same method. Two observers conducted the evaluations and measurements.

Results: SF were present in 78.0% of scapulae, exhibiting up to five openings across eighteen types. Males displayed longer SF on average (21.7 ± 5.0 mm) than females (19.45 ± 4.6 mm), with significantly greater mean diameters in females ($p < 0.01$). SNF were present in 100% of scapulae, distributed in the supraspinous fossa (36.7%), subscapular fossa (31.3%), infraspinous fossa (22.8%), and peri-glenoid area (10.0%).

Conclusion: Contrary to prior studies, our findings indicate that SF are common anatomical features, detected in 78.0% of the scapulae examined. Surgeons should consider both SNF and SF in surgical procedures and radiological interpretations.

Keywords: Scapula, Nutrient foramen, Scapular foramen, Anatomical variations

A-0641

A Dissection and Angiographic Study of Anatomical Variations in the Anterior Communicating Artery Complex in a South African Sample

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Purpose: The anterior communicating artery complex (ACAC) consists of the A1 and A2 segments of the anterior cerebral artery (ACA) and the anterior communicating artery (ACoA). The ACAC is said to be the most frequent site of aneurysms and anterior cerebral circulation variations. A clear correlation between cerebral arterial circulation variations and aneurysm development has been reported. Cerebrovascular diseases play a significant role in the causes of morbidity in South Africa. This study aims to report the prevalence of variations in the anterior communicating artery complex and their link to the prevalence of cerebral aneurysms.

Methods: For the dissection sample, a total of 68 (35 female and 33 male) adult formalin-fixed brains were included. For the angiographic sample, a total of 208 (151 female and 57 male) adult MRA scans were included.

Results: The occurrence of variations across the dissection and angiographic samples of this study was significant, 67,6% and 43,5% of the brains respectively, presented with ACAC variations. Additionally, variations in the ACoA were the most frequent in this study. Furthermore, a newly described 'anastomosed' was the most common A2 segment variation in the dissection sample. Whereas in the angiographic sample, triple ACA was the most common A2 variation. X-shaped and hypoplasia were among the most common ACoA variations found in this study. The morphometric parameters of the ACAC measured in this study were within similar ranges that were reported in previous international and national studies. In the angiographic component, 23,9% of the MRA images presented a history of ACAC aneurysms. No association was found between the prevalence of ACAC variations and the history of ACAC aneurysms.

Conclusion: Understanding ACAC anatomy, variations, and their potential link to the prevalence of ACAC aneurysms is vital to clinicians and neurosurgeons for the diagnosis of

cerebral conditions and could advance the efficacy of interventional procedures.

Funding: UCT Financial Aid Masters Funding.

Keywords: Anterior communicating artery complex, Anterior cerebral artery, Segment, Variation, Anatomy

A-0645

The Establishment of New Anatomical Classification for Tibialis Posterior Tendon Insertion in Koreans: A Cadaveric Study

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Purpose: The variations in the tibialis posterior tendon (TPT) could not be defined by previous classification; thus, this study used a larger-scale cadaver with the aim to classify the types of TPT insertion based on the combination of the number and location of TPT insertions.

Methods: A total of 118 feet from adult formalin-fixed cadavers were dissected (68 males, 50 females). The morphological characteristics and measurements of TPT insertion were evaluated.

Results: Four types of TPT insertions were classified, wherein the most common type was type 4 (quadruple insertions, 78 feet, 66.1%), which was divided into four new subtypes that were not defined in the previous classification. The second most common type was type 3 (triple insertions, 25 feet, 21.2%) with three subtypes, including the new subtype. Type 2 was found in 13 feet (11%), and the rarest type was type 1 (2 feet, 1.7%), wherein the main tendon was only attached to the navicular bone and the medial cuneiform bone.

Conclusion: We suggest high morphological variability of the TPT in relation to the insertion location, along with the possibility of significant differences according to race and gender. Moreover, this classification will help clinicians understand adult flatfoot deformity-related posterior tibial tendon dysfunction (PTTD).

Keywords: Classification, Tibialis posterior tendon, Korean, Cadaveric study

A-0652

The Anatomical Basis for Six Easy-to-Miss Intracranial Hemorrhages on Clinical Neuroimaging: A Pictorial and Educational Review

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Purpose: • To review the anatomical basis of six common but easily missed intracranial hemorrhages (ICHs) on clinical neuroimaging. • To describe how defining anatomical features contribute to the pathogenesis, clinical significance, and implications for patient management of these diagnostically elusive ICHs. • To discuss optimal neuroimaging modalities/sequences and key imaging features for enhanced detection and characterization of each ICH type.

Methods: Rapid neuroimaging detection/assessment of ICHs is critical. However, some can be challenging to identify owing to small size, low conspicuity, and evolving temporal imaging characteristics. We review six ICH types that are frequently overlooked/misdiagnosed on neuroimaging: small sulcal subarachnoid hemorrhage (SAH), isodense/isointense extra-axial hemorrhage, small dependent intraventricular hemorrhage (IVH), perimesencephalic SAH, pre-brainstem cistern hemorrhage, and small smear subdural hemorrhage (SDH).

Results: For small SAHs located exclusively in sulci, if there is doubt on computed tomography (CT), magnetic resonance imaging (MRI) sequences (FLAIR, GRE, SWI) are useful as additional tests to post-contrast, ASL and MRA in establishing cause. Isodense/isointense extra-axial hemorrhages can occur weeks after initial bleed when hemoglobin degradation products appear similar to normal cortex. Clues include sulcal effacement, midline shift, and frontal horns 'rabbit-ears' sign. As blood is heavier than CSF, for tiny dependent IVHs, CT may be superior to T1/T2-MRI, but FLAIR-MRI hyperintensity and GRE-MRI increased susceptibility are most helpful. Perimesencephalic venous SAH may be seen on CT as a tiny volume of blood in the interpeduncular fossa. Pre-brainstem cisterns SAH/SDH may be difficult to see on CT owing to ar-

tefact from adjacent bones. Lastly, SDHs as small smears (thin films) along the brain surface may need wider CT window settings and coronal images to improve detection, although MRI is more sensitive.

Conclusion: Awareness of neuroanatomical features, potential diagnostic imaging pitfalls, characteristic imaging findings, timeline of hemoglobin degradation on neuroimaging, and optimal MRI sequences can improve detection of challenging and easy-to-miss ICHs.

Keywords: Intracranial spaces, Subdural space, Subarachnoid space, Intraventricular, Hemorrhage

A-0654

Venous Angle of Pirogov: Do Morphometric Variations Contribute to Etiology of ASL-MRI Hyperintensity at the Skull Base? A Computational Fluid Dynamic Analysis of Internal Jugular Vein Flow Rates

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Purpose: The etiology of arterial spin-labeling (ASL)-magnetic resonance imaging (MRI) signal hyperintensity at the left jugular bulb (JB) is unknown, but in principle is owing to either fast or slow blood flow. It is often erroneously ascribed to a dural arteriovenous fistula. As an alternative, we hypothesize that unfavorable morphometric features in left greater than right venous angles of Pirigov (VAP, i.e. internal jugular (IJV), subclavian (SV), and brachiocephalic (BV) vein intersection) might contribute to relative outflow obstruction and slow IJV flow.

Methods: On CT-angiograms of 100 healthy individuals we recorded bilateral coronal SV-IJV and IJV-BV angles, and diameters of all three VAP vessels. We selected results from 15 individuals for computational fluid dynamic (CFD) simulations. Venous geometry was translated into a computational model to produce a Cartesian trimmed mesh. For simulations, we resolved steady-state incompressible Navier-Stokes equations, and applied the Herschel-Bulkley model to mimic non-Newtonian blood behavior. We held constant pressure losses between the inlets (IJV and SV) and the domain outlet across different configurations, allowing for derivation of flow rates under varying anatomical configurations. We statistically assessed accuracy of CFD predictions using regression analysis, comparing simulated versus predicted velocities to calculate R^2.

Results: All IJV flow velocities remained within a relatively narrow band: 20.8-22 cm/s on the left and 26.9-28.9 cm/s on the right. Extreme obtuse SV-IJV angles and acute IJV-BV angles did not consistently result in lower IJV flow velocities. For left-sided angles, the highest velocity recorded (22 cm/s) occurred at both low (30°) and high (51°) SV-IJV angles; model coefficients were small (-0.018 for SV-IJV, and 0.0025 for IJV-BV); and R^2 was 0.896. Overall, there was a modest dependence of IJV flow velocity on VAP geometry bilaterally.

Conclusion: Spatial morphometry of VAP only modestly influences IJV blood flow and is therefore unlikely to significantly contribute to development of artifactual JB hyperintensity on ASL-MRI.

Keywords: Venous angle, Internal jugular vein, Arterial Spin Labeling MRI, Computational Fluid Dynamics, Flow rate

A-0656

A Landmark for Lumbar Spine Enumeration: Lumbar Transverse Process Lengths Associated with Lumbosacral Transitional Vertebrae

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Purpose: This study was undertaken to identify at which vertebral level within the lumbar spine, above a lumbosacral transitional vertebra (LSTV), demonstrated the longest transverse process (TVP) lengths.

Methods: This was a prospective exploratory quantitative osteological cohort study. Dried human cadaveric lumbar spinal columns were utilised for linear measurements of the lumbar (TVPs), using a digital Vernier calliper. Each TVP was measured in horizontal length bilaterally. Data collection was conducted at the Raymond A. Dart Collection of Modern Human Skeletons housed in the School of Anatomical Sciences at the University of Witwatersrand, Johannesburg and at the Pretoria Bone Collection housed in the Department of Anatomy, University of Pretoria, Pretoria, within South Africa. The experimental group consisted of 110 LSTV-containing indi-

viduals and the control group consisted of a sex-balanced randomised selection of 60 individuals, 30 females and 30 males.

Results: The general trend was that the TVPs of third lumbar vertebra (L3) were the longest in the setting of LSTV. There were no statistical differences in TVP length within the LSTV cohort when comparing all levels (p=…). Furthermore, the LSTV cohort demonstrated longer TVPs for every vertebral level, especially at L3, while the left side demonstrated longer TVPs overall. The general trend was that the TVPs of L3 had the longest mean length for both the left and right sides in both males and females in both cohorts.

Conclusion: The L3 TVP can be used as an alternate bony landmark by which the lumbar spine can be enumerated in the setting of LSTV. This is of value for radiograph appraisal and may aid with correct-level intervention, both conservative and surgical.

Keywords: Lumbosacral transitional vertebra, Sacralization, Lumbarization, Transverse process, Radiographs

A-0664

Monitoring Intracranial Cerebral Hemorrhage using High Resolution Imaging Magnetic Particle Imaging

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Purpose: Magnetic particle imaging (MPI) is new technology with the potential to overcome some limitations of established imaging modalities. It is an innovative and radiation-free imaging technique with high sensitivity, specificity, and superior temporal resolution. MPI enables imaging and diagnosis of stroke and other neurological pathologies such as tumors, and inflammatory disease. Nonetheless, MPI can visualize the reduction in blood flow and cerebral ischemia, it is unclear whether MPI works in intracranial hemorrhage.

Methods: In this study, our aim was to investigate the of MPI to detect intracranial cerebral hemorrhage in a mouse model. We induced intracranial cerebral hemorrhage (ICH) through the intraparenchymal injection of 0.075 U collagenase into the striatum of Balb/C mice. 3 days After the injection of superparamagnetic iron oxides.

Results: We imaged MPI. We conclude that MPI can be used for real time diagnosis of intracranial hemorrhage.

Conclusion: In this work, we have demonstrated that magnetic particle imaging reliably and quickly detected intracranial hemorrhage in a mouse model. This work is an essential step toward achieving the clinical translation of MPI for point-of-care monitoring of different stroke subtypes.

Funding: Electronics and Telecommunications Research Institute (ETRI) of Republic of Korea, grant number 23YS1110.

Keywords: Magnetic particle imaging, SPION, MRI, Nanoparticle, Hemorrge

A-0666

Multiple Major Osteo-Skeletal and Visceral Malformations Concordant with Caudal Regression Syndrome (CRS) Associated with Uncontrolled Maternal Type 2 Diabetes Mellitus (DM2): We Can Prevent It

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Purpose: To analyze clinical history, imaging, genetic and anatomopathological studies performed on a 12-day-old newborn child of a 32-year-old woman, with untreated DM2 and unknown pregnancy up to 18 weeks, in addition to a COVID episode, occasional alcohol intake, use of antibiotics and anti-inflammatories during the first trimester.

Methods: Review of clinical records, imaging examinations and anatomopathological study.

Results: The newborn had cardiology controls for total situs inversus, dextroversion, dilated cardiac chambers, patent ductus arteriosus (PAD), tricuspid-mitral insufficiency, wide aortic arch, interventricular and atrial septal defect. Genetics reported 46 XY karyogram and negative FISH for Trisomies 21, 13 and 18. Nephrourology concluded male phenotype sexual differentiation disorder and CRS. Imaging confirmed abdominal ultrasound situs inversus and absence of testes, lumbar pelvis-spine X-ray showed lumbar vertebral bodies with a triangular appearance and absence of some, bilateral hip dislocation and acetabular dysplasia. The newborn died at

12 days of age, and a necropsy was performed, which reported multiple major structural malformations: total Situs inversus, findings suggestive of airway malformation (CPAM type 3), SDR (bilateral botfoot, hemivertebra at lumbar level, pelvic anteversion, micropenis, microorchidism) and cardiac (DAP and aortic arch stenosis).

Conclusion: CRS is characterized by deficient development of the distal half of the body and variable involvement of other systems, the most frequent being anomalies of the vertebral column, spinal cord and lower extremities. It constitutes a spectrum that ranges from isolated anorectal malformations to sirenomelia at its extreme. An interaction between genetic and environmental factors is suspected, with mutations of the VANGL1 gene and there is a prominent participation of diabetes mellitus as a risk factor, which is why preconception control is undoubtedly essential, especially metabolic control before and during pregnancy.

Keywords: Caudal regression syndrome, Diabetes mellitus, Situs inversus

A-0672

A Predicting Formula for the Length of Plantaris Tendon using Leg Length in Koreans: A Cadaveric Study

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Purpose: The purpose of this study is to analyze the correlation of leg length with plantaris tendon (PT) and to present a model that can predict PT length with respect to leg length.

Methods: A total of 50 cadavers (32 males and 18 females) embalmed with a 10% formalin mixture were included in the study. The length of PT was measured from the junction of the belly and tendon to the point where it is inserted into the calcaneus. Leg length was measured from the anterior superior iliac spine to the medial malleolus tip. Simple correlation analysis and multiple regression analysis were used to determine the correlation between PT and measured variables. The leg length showed a high correlation, and the regression equation for predicting the PT length was written through linear regression analysis.

Results: The mean age was 76.04 ± 11.22 years old, the stature was 161.98 ± 8.76 cm, and the leg length was 81.10 ± 4.91 cm. The belly of Plantaris was 8.78 ± 1.64 cm, and the tendon was 32.73 ± 2.70 cm. PT length showed a high positive correlation with leg length (Pearson correlation r = 0.721). In multiple regression analysis, the PT showed a significant relationship between leg length ($p<0.001$). The linear regression equation for the PT length (y, in centimeters) as a function of leg length (x, in centimeter) can be expressed as PT length = 0.605+0.396 leg length.

Conclusion: In conclusion, PT showed a high correlation with leg length, and the regression equation that predicts PT length using leg length can serve as basic reference data for surgeons planning tendon graft in clinical practice.

Keywords: Plantaris tendon, Leg length, Tendon graft, Predicting formula, Cadaveric study

A-0676

Clinical Anatomy of the Malar Region Focusing on Zygomaticus Major Muscle

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Purpose: The zygomaticus major muscle (ZMM) has a significant impact on both facial expression and the aging process. To improve clinical applications such as rhytidectomy and botox treatment in the malar region, it is necessary to obtain more specific anatomical data regarding the ZMM. Therefore, the purpose of this study was to comprehensively report the results of histomorphological analysis of the malar region focusing on ZMM in Korean through this poster presentation.

Methods: Thirty five hemifaces were used (24 males, 11 females, mean death age 64.3 years). First, the skin and subcutaneous tissue of 27 hemifaces were removed, and then the origin location of ZMM was confirmed using hard and soft tissue landmarks, and statistical analysis was performed. Then on 8 hemifaces, tissue specimens from the malar region including the ZMM's origin were prepared by routine histologic preparation technique and analyzed histological characteris-

tics between the ZMM and orbicularis oculi muscle, and the retaining ligament.

Results: The distances from the lateral canthus, tragus, and alare to origin of the ZMM were 34.6±4.56, 54.9±5.55, and 59.6±7.14 mm, respectively. The origin of the ZMM was located at 20.0 ± 4.48 mm laterally from the lateral orbital wall and 7.00 ± 2.81 mm below the F-H plane. The only statistically significant difference was found in the distance from the tragus on gender. Additionally, compared to the results of previous studies, there were differences in the location of origin of ZMM according to race based on measurement landmarks. Histological findings, especially posterior aspects of the malar region were showed typical multilinked fibrous support system including retaining ligament and the orbicularis oculi muscle covered the origin of ZMM in 3 out of 8 posterior aspects of tissue samples.

Conclusion: These histomorphological results of the malar region focusing on ZMM are expected to provide critical information for the plastic surgery.

Funding: This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (No. 2016R1D1A1B02008797).

Keywords: Zygomaticus major muscle, Orbicularis oculi muscle, Histomorphological analysis, Plastic surgery

A-0678

Morphometric of the Styloid Process of the Temporal Bone: An Osteological Study

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Purpose: To study the morphometry of the styloid process of the temporal bone in human bones to establish more precise measurements and understand their clinical correlation.

Methods: 79 bones were selected, obtained from the osteological collection of the Department of Anatomy and Legal Medicine of the University of Chile, with conditions to be included in the study. Samples with incomplete or broken styloid were not considered, so as not to alter the real measurement values. Measurements were taken in three areas: from the base to the vertex, diameter of the base and diameter of the vertex, distinguishing between right and left. IBM SPSS Statistics 27.0 was used for statistical analysis.

Results: The results showed an average length of the styloid process of 26.05 ± 2.0 mm, with an average base of 4.70 ± 0.4 mm and an apex of 2.0 ± 0.2 mm. 40 right (50.6%) and 39 left (49.4%) temporal bones were identified. Which allows us to recognize the elongation of the anatomical detail from these measurements.

Conclusion: The morphometry of the styloid process of the temporal bone is varied. With the extracted data, an analysis was made regarding the average length of this anatomical landmark, in addition to establishing an average of its base and vertex. This is relevant due to the presence of clinical manifestations that result in certain syndromes and pathologies that require early and even surgical intervention, because they affect the quality of life. In addition to being one of the only studies in Chile that determine these values, it is intended that these measurements can be used as parameters in the study of anatomy.

Keywords: Styloid process, Temporal bone, Ossification, Osteology, Morphometry

A-0681

Convergence of the Lateral Abdominal Muscles and Diaphragm around the Costal Arch

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Purpose: The internal oblique and transversus abdominis muscles are generally thought to function as respiratory assist muscles during expiration. However, there are few detailed reports describing the specific movements of these muscles and their relationship to diaphragmatic movements. These muscles originate or terminate at the rib cartilage and have rigid surrounding connective tissue, however, the role and function of that connective tissue remains unexplored. The purpose of this study is to clarify the connection between the lateral abdominal muscles and the diaphragm, including the role of the connective tissue.

Methods: his study involved four specimens (three preserved in formalin and one prepared using the Thiel method) that had been donated for education and research at the university. Tissue from the upper abdomen, extending from the area above the umbilicus to the thorax at the level of the xiphoid process, was removed from the abdominal and thoracic walls. The tissue was then frozen and cut into 7-mm-wide sections by sagittal sectioning. After being fixed to a platform, the sections were observed using the stretched tissue dissection method.

Results: The internal oblique and transversus abdominis muscles were partially folded within the area in which they originated and stopped at the costal cartilage. Around the costal arch, hard fibrous tissue was present between the internal and external abdominal oblique muscles with several layers of fibers overlapping in a mesh-like manner, pulling part of the internal oblique muscle outward. This caused the muscle to thicken near the costal arch and assume a slightly folded position.

Conclusion: The contraction dynamics of the internal oblique and transversus abdominis muscles revealed that the thickness of the musculature increased near the costal arch during expiration. Because the diaphragm is relaxed in the expiratory phase in the donor, there remains an opportunity for in vivo research into the mechanical effects on the diaphragm.

Keywords: Diaphragm, Internal abdominal oblique muscle, Transversus abdominis muscle, Respiratory assist muscle

A-0690

The Estimation of Stature Based on Sternal Length using Post-Morterm Computed Tomography (PMCT) in Korean Population

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Purpose: Stature estimation using a skeleton is important for the medico-legal investigation of unidentified human remains. The aims of this study were to identify a correlation between stature and sternal length using post-mortem computed tomography(PMCT) images and derive regression equations for stature estimation in the korean population.

Methods: Measurements were conducted on 270 Korean subjects who underwent PMCT with subsequent forensic autopsy in 2022-2024. For assessment, PMCT cross-sections through the mid-point of the first costal facets were chosen. SPSS ver 25.0 was used to estimate the relationship between the sternal length and height, and the height estimation equation was derived by linear regression analysis.

Results: The average height was 163.03 ± 10.30 cm, the average length of the sternum was 142.03 ± 15.34 mm. In all measurements, the correlation coefficient between real stature and sternum length was statistically significant($p<0.001$). It showed the strongest correlation between stature and combined length of the sternum. The following is the appropriate regression equation: Height= 97.51+(0.46 X Sternum length).

Conclusion: In conclusion, we suggested a Korean-specific regression equation for estimating stature using sternal length could be used as a forensic medicine.

Keywords: Forensic science, Korean population, Sternum, Stature estimation, PMCT

A-0698

Complete Transverse Basilar Cleft Associated with Hemifacial Microsomia

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Purpose: Transverse basilar cleft (TBC) is an extremely rare variation of the clivus or the basilar part of the occipital bone. It is seen as a coronal fissure dividing the basiocciput at the level of the pharyngeal tubercle. Its exact etiology remains uncertain. In this report, a unilateral transverse basilar fissure was found at the clivus in a head computed tomography of an 18-year-old female patient diagnosed with hemifacial microsomia (HFM).

Methods: During a retrospective study of anatomical variations in the clivus on computed tomography (CT), TBC was observed in an 18-year-old female patient, who had previously been diagnosed with HFM.

Results: Three-dimensional (3D) reconstruction revealed that the ramus of the right mandible was shortened, and there was medial displacement of the mandibular fossa and the temporomandibular joint. The right maxilla was also hypoplastic and the zygomatic arch of the temporal bone was misplaced inferiorly. The orbits and nasal septum appeared normal. In addition to these skeletal deformities, the 3D image revealed a cleft between the basioticum and basioccipital bones at the level of the pharyngeal tubercle, dividing the right side of the clivus into two. This cleft was identified as an incomplete TBC.

Conclusion: In conclusion, we report for the first time a TBC associated with HFM. Further studies are needed to explain the coexistence of these two conditions. Surgeons and radiologists should be aware of TBC as well as other clival variations or defects when presented with unfamiliar radiological findings.

Keywords: Craniofacial abnormalities, Congenital abnormalities, Anatomic variation

A-0701

Anomalous Extensor Digitorum Longus Muscle with Great Toe Slip and Associated Osseous Variations: A Case Report

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Purpose: There have been various reports of accessory tendons of the extensor hallucis longus muscle. However, there are no reported cases of the extensor digitorum longus (EDL) slip extending to the great toe.

Methods: This case report details a rare anatomical variation of the EDL muscle, in which an additional slip was observed extending to the great toe in the right foot of a 78-year-old male cadaver.

Results: Notably, the variation was accompanied by distinctive osseous changes in the proximal metatarsal region, suggesting a developmental interplay between muscular and skeletal anatomy.

Conclusion: The presence of this tendinous slip may have clinical significance in foot mechanics and could be a potential source of confusion in surgical procedures involving the extensor tendons. This report expands the understanding of EDL variations and emphasizes the importance of considering such anomalies during clinical assessments of the foot.

Keywords: Extensor digitorum longus, Great toe, Metatarsal

A-0704

An Unusual Presentation of Chordoma in a Young Child? A Case Report

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Purpose: Chordomas are rare malignant tumors of the skull base and axial skeleton. Chordoma develop from the

remnants of the notochord, a structure present in the spine during embryonic development. Incidence is less than 0.1/100,000 per year. It affects adults with peak incidence at 5th decade of life. Paediatric cases represent less than 5% of cases. Advanced chordoma has a poor prognosis causing destruction of surrounding bone and soft tissue.

Methods: Three-year-old girl presented with constipation for 6 months. Child was complaining of a lump at buttock. Child had fever, pain on defecation and refusal to bear weight. Examination revealed hard tender lump at right buttock with poorly defined margins. There were no focal neurological deficits. AFP and Beta HCG were normal. MRI abdomen, pelvis and spine revealed a sacrococcygeal tumour infiltrating bilateral gluteus maximus without intraspinal extension. Infiltrative lesion in right sided of body of S3 vertebrae.

Results: First biopsy revealed malignant soft tissue tumour and was treated as Ewings Sarcoma with neoadjuvant chemotherapy. Child underwent bulk resection surgery at 3.5 years of age. Post chemotherapy biopsy revealed irregular friable mass measuring 300 g. Sections showed a tumor composed of epitheliod cells with vesicular nuclei, prominent nucleoli and moderate eosinophillic cytoplasm. Diagnostic imunohistochemistry revealed Brachyuri positivity. A diagnosis of poorly differentiated Chordoma was made within one month of admission. Tumour was poorly responded to chemo-radio therapy. Child had developed features of lung metasasis. Unfortunately child succumbed at the age of four years.

Conclusion: The diverse anatomical locations of chordoma can result in varying presentations. Histology plays a major role in arriving at a definitive diagnosis. Early diagnosis and multidisciplinary interventions help improving the outcome. Clinicians need to be aware of this rare type of tumour. Chordoma can occasionally present in an unusual manner, resulting in prolonged constipation as a rare symptom.

Keywords: Chordoma, Buttock Lump, Constipation, Notochord

A-0712

Morphometric Analysis of the Laryngeal Skeleton in Thiel-Embalmed Cadavers in a Scottish Population

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Purpose: The development of new surgical approaches and devices require a thorough understanding of the dimensions and proportions of the human laryngeal anatomy. The Thiel-embalming method is shown to be a valuable resource in surgical education due to its retention of tissue properties and colour. To date, there is no literature confirming whether the laryngeal skeleton is affected by Thiel-embalming. This study aims to characterise the morphometry of the Thiel-embalmed laryngeal skeleton in a Scottish population.

Methods: Ten larynges (6 male and 4 female) were excised from Thiel-embalmed donors at the University of Dundee. Twenty-eight measurements across 15 landmarks on the unpaired thyroid, cricoid and epiglottic cartilages were taken using digital callipers and a hand-held goniometer. These measurements include lengths and widths of various key anatomical points on each cartilage and the angle of the thyroid. Results were analysed for sexual dimorphism and side differences and compared results of published literature.

Results: The results demonstrate the expected sexual dimorphism in the laryngeal skeleton and no differences between side. Cricoid arch height, epiglottis width, distance between the superior horn of the thyroid cartilage and the thickness of the superior and inferior thyroid horns demonstrated no sexual dimorphism. A comparison of Thiel-embalmed measurements to published data showed greater measurements in males, except for the thyroid angle and distance between superior horn. Epiglottic height was greater in both sexes of Thiel-embalmed larynges compared to the published data. It was noted that the Thiel-embalmed thyroid angle was lower in males compared to CT measurements.

Conclusion: The findings suggest that the Thiel-embalming method does not greatly alter the dimensions of the laryngeal skeleton and can be confidently used in surgical training. However, future work should include larger sample sizes and a statistically match control to confirm our findings.

Keywords: Laryngeal skeleton, Thiel-embalming, Thyroid, Cricoid, Epiglottis

A-0731

The Shape of Lymphoid Nodules in the Mucous Membrane of the Bladder in Postnatal Human Ontogenesis

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Purpose: To study the shapes of lymphoid nodules of the bladder on longitudinal sections of the organ in postnatal ontogenesis.

Methods: The study used biological preparations and tissues taken from 37 corpses of people of various ages from early childhood (1-3 years) to 76 years old, who died from diseases not related to diseases of the urinary tract and immune system. The study was approved by the local Ethical Committee. A macroscopic description was carried out, histological sections were stained with hematoxylin-eosin, Azur II - with eosin. The number, size and shape of lymphoid formations of the bladder were determined using an ocular micrometer and an Avtandilov ocular measuring grid.

Results: On longitudinal sections of the mucous membrane of the bladder, lymphoid nodules of round, oval, elongated (ribbon-like) and irregular shape were found, the percentage ratio between which changes significantly with age. In the second childhood, round and oval nodules predominate (30.24% and 30.32% of the total number of nodules), in adolescence their percentage decreases to 20.14%. In the 1st period of adulthood, the percentage of such forms of nodules decreases by 2.03 times ($p<0.05$), and in old age – by 2.44 times ($p<0.05$). There are slightly more oval nodules and the difference with round ones is 2-5%. The percentage of elongated lymphoid nodules in the bladder remains almost unchanged and decreases slightly in old age (1.08 times, $p>0.05$). Irregular lymphoid nodules appear in the second childhood (7.3% of all lymphoid nodules). Their number in the 1st period of adulthood increases by 5.9 times ($p<0.05$), and in old age – by 6.91 times ($p<0.05$).

Conclusion: The lymphoid apparatus of the bladder changes noticeably with age, which is expressed in a decrease in the size and number of lymphoid nodules.

Keywords: Lymphoid nodules, Mucous assosiated lymphoid tissue, Urinary bladder, Postnatal ontogenesis

A-0738

Optimal Preservation for High Fidelity Ultrasonography in Regional Anaesthesiology Training

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Purpose: Soft-embalmed human donors are used for procedure training in ultrasound (US)-guided regional anesthesia. High quality sonograms are important for conducting complex procedures but are highly dependent upon tissue echogenicity. Critically, tissue properties vary based on embalming solutions and there are no studies reporting on image quality changes over time. This study thus aims to 1) compare the sonographic quality of tissues preserved with two common, high-performing embalming solutions at key clinical sites and 2) observe changes in sonographic quality over four months.

Methods: Six human bodies will be embalmed with either a Saturated Salt Solution (SSS, n=3) or an Ethanol-Phenol solution (EP, n=3). Sonograms will be obtained by two anesthetists blinded to the embalming solution, using a GE Logiq P5 Ultrasound machine. Sonograms will be acquired ipsilaterally in seven common nerve block sites, following a standardized protocol. Imaging and evaluation will occur immediately before and after embalming, and at 1-, 2-, and 4-months post-embalming.

Results: Throughout the study, 375 sonograms will be collected. Sonograms will be examined for image quality, resolution, detail, and clinical interpretability using artificial intelligence (AI) software and by experts blinded to tissue preparation. The McMaster Embalming Scale will also be used to quantify visual/tactile information regarding tissue realism. Data analysis will be conducted using MANOVA. AI acquired metrics will be compared against human-expert evaluators as

a control, and then between embalming solutions, as well as longitudinally to evaluate temporal change.

Conclusion: Overall, the results of this study will quantify the effectiveness of SSS and EP solutions for US-guided regional anesthesiology in five anatomical regions critical to resident training. Identifying the comparative ability of embalming solutions to preserve sonographic image fidelity is critical in optimizing the practical aspects necessary for efficacious postgraduate medical skills training and for optimal use of body donors.

Keywords: Embalming Solutions, Regional Anesthesia, Ultrasound Guided Needle Procedures, Image Quality, Surgical Skills Training

A-0747

Lymphoid Formations of Transition Zones of the Large Intestine in Prenatal Ontogenesis

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Purpose: The purpose of the work is to study the formation of lymphoid tissue in the transition zones of the large intestine in the middle fetal period.

Methods: The study used samples of the mucous membrane of the area of the ileocecal valve and the anal canal of 29 fetuses of the middle fetal period (21-28 weeks), obtained as a result of abortion for medical reasons. The work was approved by the institutional Ethics Committee. Macropreparations of the intestinal mucosa stained with hematoxylin using the Hellman's method were studied by counting the number of lymphoid nodules and determining their sizes. Microscopic examination was carried out on histological sections stained with hematoxylin-eosin and by Van Gieson's method. Flow cytometry of a suspension of mucosal cells was performed to determine lymphocyte populations.

Results: In the area of the ileocecal valve, macroscopic examination revealed an increase in the number of lymphoid nodules compared to adjacent areas of the mucous membrane by 1.2 times ($p < 0.05$). Lymphoid nodules had a round shape, small size, the average size of lymphoid nodules was 118.3±17.2. In the anal canal area, lymphoid nodules were located along the anal columns and anorectal line. On microscopic examination, lymphoid tissue is represented by diffuse lymphoid tissue, lymphoid prenodules and lymphoid nodules without light centers. The cellular composition of lymphoid nodules is dominated by small lymphocytes. A study of lymphocyte populations using flow cytometry revealed the presence of a large number of immature cells and a predominance of B lymphocytes.

Conclusion: Lymphoid tissue of the mucous membrane of the area of the ileocecal valve and anal canal in the middle fetal period is represented by lymphoid nodules and diffuse lymphoid tissue, which indicates the active formation of the immune system in the fetus. The cellular composition of lymphoid formations is dominated by B-lymphocytes.

Keywords: Lymphoid nodules, Mucous associated lymphoid tissue, Prenatal ontogenesis

A-0760

Terminologia Anatomica of the Groove for Vertebral Artery: Pros and Cons

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Purpose: The groove for vertebral artery (GVA) is an anatomical structure in the posterior arch of the atlas, and the vertebral artery (VA) travels along the GVA. The aim of the present work was to investigate if the terminologia anatomica (TA) of GVA is accurate or not.

Methods: High-resolution head and neck computed tomography angiography (CTA) data from 564 individuals and a designated atlas specimen were used for study. The relationships among the GVA, VA, and the venous plexus (VP) were investigated using CTA image postprocessing techniques. In total, 551 valid participants were used for study.

Results: A prevalence of 13.97% (154/1102) showed bony multiformity in the posterior arch of atlas, and the bony spur and bridge were the most occurred bony structures. And a rate of 42.92% (473/1102) suggested that the VA did not run directly with the GVA. Rich VP drained the venous blood from different layers: the superficial layer (the occipital region, the mastoidal region) and the deep layer (the condylar emissary VP, the VP from the intracranial region, the posterior internal vertebral VP, the vertebral VP, and the deep cervical VP).

Conclusion: The VA does not always run directly contacting the GVA, which some space was left for the condylar emissary VP to pass between the VA and the GVA. We suggest that the TA of vertebral neurovascular groove/canal is better to conclude the structures travelling through the groove, and the TA from present study could give the clinic more thinking to improve the operation techniques.

Keywords: Groove for vertebral artery, CTA, Vertebral artery, Terminologia anatomica, Venous plexus

A-0768

Effect of Self-Crosslinking Hyaluronic Acid Filler as a Skin Booster in a Miniature Pig Model

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Purpose: The advances of self-crosslinked hyaluronic acid (SC-HA) represent a biocompatible innovation aimed at easing injections by reducing pressure and enhancing safety. However, the effectiveness of SC-HA as a skin booster has not been conclusively established. This study aims to uniformly inject SC-HA into the dermal layer of a miniature pig model for skin boosting, observe tissue changes, and confirm suitability through histological examination.

Methods: The molecular weight of the SC-HA filler was fixed at 200 kDa, with storage moduli of 261 Pa for G' (G250) and 450 Pa for G' (G500). Using the Hycoox multi-suction injector, G250 and G500 SC-HA were injected into the dermal layer of the lateral side of six miniature pigs (3 males, 3 females) with 80, 100, and 120 shots. Visual and ultrasonography (US) examinations were conducted immediately after injection, and histopathological evaluations were performed at 1 month and 3 months post-injection.

Results: After injection, none of the six pigs exhibited any signs of immune or adverse reactions during the tracking periods immediately post-injection, at 1 month, and at 3 months. G500 showed slight swelling compared to G250, and the swelling was more pronounced with a lower number of injection shots. US results indicated that SC-HA was uniformly positioned in the dermal layer. Histological staining results, one month later, all SC-HA fillers had uniformly spread to the papillary dermis. The G500 was observed to persist in the papillary dermis even after 3 months.

Conclusion: The SC-HA, administered with a small gauge needle or an automatic injector, minimizes pain, ensures uniform dermal layer injection, and provides sustained effects lasting up to three months without inflammation. Higher G' values contribute to prolonged effectiveness and injecting low G' SC-HA with more shots reduces facial lumps, supporting its effective clinical application. This study suggests SC-HA fillers are a safe choice for skin boosting.

Keywords: Skin booster, Self-crosslinked, Hyaluronic acid, Miniature pig

A-0769

Relationship of the Gastroduodenal Artery and the Common Bile Duct

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Purpose: The relation between the gastroduodenal artery (GDA) and the common bile duct has to be known. And it is especially important to realize the detailed variations of GDA to the first part of duodenum in operation.

Methods: In this study, the distance between the GDA and the pylorus were measured. And we used the Prudhomme's classification to group the variational relationships of GDA and bile duct encountered. Besides, the origins of the gastroduodenal artery were also recorded.

Results: The relation of the GDA and the bile duct could be divided into four anatomic types according to Prudhomme's classification. In our studies, there were 22 (42%) samples belonged to the Type 1 which the GDA originated to the left of the bile duct progressively separating from it throughout its course. There were 10 samples (19%) belonged to the Type 2 which the two structures were close together without crossing. There were 14 samples (27%) belonged to the Type 3 which the course of the GDA was oblique below and to the right. It

crossed in front of the bile duct at the posterior surface of the first part of the duodenum. In 8 samples of Type 3, there was about 8 ± 2 mm thickness of pancreatic tissue between the GDA and the bile duct. There were 6 samples (12%) belonged to Type 4 which the GDA originated near to the convergence of the hepatic ducts, crossed the bile duct below the first part of the duodenum and then ran along its right border.

Conclusion: To avoid bile duct injury during hemostasis of a bleeding duodenal ulcer, one should identify the bile duct when the GDA has a course of the Type 3 and Type 4.

Keywords: Gastroduodenal artery, Common bile duct

A-0770

Variation of the Arterial Supply of Adrenal Gland in Chinese Adult

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Purpose: The findings of the general circulation of the adrenal gland.

Methods: The series herein reported upon consist of forty adrenal arteries in each side from specimens in the gross anatomy laboratories of the National Defense Medical Center. The specimens were from 40 adult Chinese, mostly male (32 males, 8 females). Only specimens with complete dissection of the adrenal artery were included.

Results: The arterial supply arose from three pedicles: superior, middle, and inferior, Each pedicle had branches up to three or none and most commonly had one. The superior pedicle arose from ip-silateral inferior phrenic artery, and the inferior pedicle arose from ipsilateral renal artery. The middle pedicle was the most irregular and could arise from three vessels: inferior phrenic artery, aorta, and celiac trunk, and aorta was dominant. There was no significant difference of arterial variation of superior and inferior pedicles between the left and right adrenal glands (paired t tests, $p > 0.05$), but the middle pedicles showed asymmetrical character ($p < 0.05$).

Conclusion: The present study provided detailed information about anatomical variation of arterial circulation to the adrenal gland in Chinese adult.

Keywords: Variation of the Arterial Supply, Adrenal Gland

A-0771

Distribution of the Superficial Temporal Artery in the Chinese Adult

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Purpose: Superficial temporal artery (STA) is an end division of the external carotid artery. In head and neck surgery such as rotational scalp flaps for the treatment of baldness, the superficial musculoaponeurotic system procedures for the aging face, and the excision of parotid gland tumor, STA injury should be avoided. Therefore, a comprehensive evaluation of STA distribution is important.

Methods: In this study, we evaluated the variations of STA in the Chinese adults. We measured the bifurcating location of STA, the diameter of the vessels, and the relationship of STA to the nearby structures. A total of 26 cadavers with 52 STAs were examined in three consecutive years.

Results: STA ran 1.14 cm anteriorly to the bony external auditory canal. The average diameters of the STA, frontal, and parietal were 2.14 mm, 1.61 mm, and 1.68 mm, respectively. In 45 of 52 cases (86.5%), the bifurcation of STA occurred well above the zygomatic arch.

Conclusion: The present study demonstrated that the STA in the Chinese adult differs from that of the Caucasian and has provided a detailed anatomical distribution analysis of STA in Chinese adults which should benefit the clinician in dealing with operation procedures related with the STA.

Keywords: Superficial temporal artery, Zygomatic arch

A-0778

Examining the Variability of Flexor Digits Minimi Brevis Muscle in Both Extremities

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Purpose: The flexor digitimi minimi brevis (FDMB) muscles have distinctive variations and anomalies in both hand and foot due to delayed developmental process of the blastema or alterations in genetic regulatory pathways. Therefore, this study demonstrated disparities of FDMB by consolidating existing research on this topic.

Methods: We employed a comprehensive methodology involving systematic literature searches and data extraction and evaluated various parameters to assess variations of FDMB. The following databases used for data acquisition included Scopus, Web of Science, Science Direct, JSTOR, PubMed, and iCITE.

Results: Anatomical variations of the FDMB muscle have been observed, including absence, additional palmar belly, attachment to the metacarpal bone and fusion with the abductor digiti minimi muscle that originated from distinctive structures; antebrachial fascia, hook of the hamate bone, flexor retinaculum, opponnens digiti minimi (ODM), fibromuscular arch, and medial condyle in the hand. Additionally, the muscle's dimensions were correlated with sex, occupation and hand dominance. According to the lower extremity, accessory FDM muscles originate from various sites, such as the tendon of the tibialis posterior, the fourth and fifth metatarsal bones, and the tendon of the peroneus longus. They insert into the fifth toe, the anterior frenular ligament, and the ODM of the foot. The FDMB muscles have deviated with variable arrangement of fibers. The underlying cause of these; could be genetic factors. The potential existence of this muscle provides support for protecting the lateral longitudinal arches of the foot and the palm of the hand, or it may serve as a compensatory element for the absent segment.

Conclusion: Consequently, the anatomical variations of FDMB should be taken into account to reduce potential leading symptoms such as; compression neuropathies, joint movement in both hypothenar region of the hand and plantar aponeurosis of the foot, accurate diagnosis and treatment of

related pathologies.

Keywords: Flexor Digiti Minimi, Flexor Digiti Minimi Brevis, Flexor Digiti Minimi Longus, Anatomy, Variations

A-0787

Biometry of the Intertendinous Connection of the Dorsum of the Human Hand

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Purpose: The objective of the present study was to establish the biometrics of the Intertendinous Connection (IC).

Methods: The investigation was carried out on 24 upper limbs (4 right, 20 left), 83% corresponded to left upper limbs. These corpses were subjected to a fixation protocol with 10% formaldehyde for subsequent conservation in a cold chamber at 4ºC. All samples included in the study did not present macroscopic signs of previous dissections, pathologies or surgeries on the dorsum of the hand.

Results: 69 IC found, 39% presented a transverse disposition and 61% an oblique one. In relation to the morphological classification of IC, 29% were identified as type 1; 39% of type 2. In the case of type 3, 20% presented the "r" form and 12% the "y" form. Regarding their location, it was established that in the second EIMC, 18% of the IC were located in the distal third of the back and 82% in the middle third. In the third EIMC, 96% of the IC were located in the distal third and 4% in the middle third. In the fourth EIMC, 96% were located in the distal third and 4% in the middle third.

Conclusion: We consider that the descriptions of the IC are of interest for the planning of surgeries of the dorsum of the hand, mainly those that involve tenolysis or the performance of tendon transfers.

Keywords: Intertendinous connections, Anatomy, Biometry, Extensor digitorum muscle, Juncturae tendinum

A-0789

Construction of Digital Three Dimensional Model of Hepatopancreatic Ampulla

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Purpose: The distribution and spatial location of closely related arteries, veins, sympathetic nerves, and lymphatic vessels around hepatopancreatic ampulla were identified.

Methods: Consecutive human hepatopancreatic ampullary tissue sections were prepared, and each group had 3 sets. Each set was stained with hematoxylin-eosin, and anti-LYVE1, or anti- tyrosine hydroxylase- neuronal marker. And PS was used for fine registration. Mimics 21.0 was used for 3D reconstruction of overlapping slice data, and the 3D structures were located, segmented, and labeled. The distribution and anastomosis of the muscular layer, arteries, veins, sympathetic nerves, and lymphatic vessels of t hepatopancreatic ampulla were analyzed by tissue sectioning and continuous reconstruction.

Results: The muscular layer of the ampulla of liver and pancreas was divided into two layers, which were clearly distinguished. The canal was surrounded by a layer of connective tissue. The blood vessels, nerves, and lymph nodes around the ampulla of the liver and pancreas mainly exist in or on the periphery of this connective tissue layer. The arteries and veins start from the gallbladder side of the hepatopancreatic ampulla tissue and spiral around the hepatopancreatic ampulla and gradually extend to the duodenal side. The sympathetic nerve bundles were wrapped around hepatopancreatic ampulla, and the nerves deeply dominated the muscle movement of hepatopancreatic ampulla. The distribution of lymphatic vessels followed the direction of blood vessels, extending lymphatic vessels around the hepatopancreatic ampullary canal.

Conclusion: Serial sectioning and staining methods can accurately locate the tissue and show its microstructure, which makes up for the shortcomings of clinical examination. After the reconstruction of human hepatopancreatic ampulla in serial sections, we can see clear muscle stratification, the branches and distribution of vessels, the course and spatial distribution of sympathetic nerve bundles, and the distribution of lymphatic vessels.

Keywords: Micro reconstruction, Three-dimensional model, Hepatopancreatic ampulla

A-0800

Mesenchymal Stem Cell-Encapsulated Hydrogels Alleviate Mechanical Allodynia and Promote Tissue Hydration in a Rat Model of Intervertebral Disc Injury

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Purpose: The intervertebral disc (IVD) degeneration involves an imbalance in extracellular matrix homeostasis, leading to reduced water content, increase of inflammation and innervation, contributing to discogenic LBP. This study focuses on the use of biomaterials such as hyaluronic acid (HA)/type II collagen (COLII) hydrogel with Wharton Jelly derived mesenchymal stem cells (WJ-MSCs) for IVD regeneration strategies.

Methods: We grouped a total of 60 Sprague Dawley rats into six with n=10 for each group includes control, un-treated injury, injury treated with hydrogel (2 mg/ml), injury treated with hydrogel (3 mg/ml), injury treated with hydrogel (2 mg/ml) with MSCs, and injury treated with hydrogel (3 mg/ml) with MSCs. The MSCs were preconditioned in hydrogels before implanting them in coccygeal discs following a surgically induced disc injury in the rat tail. We determined the pain behaviors using von Frey test for mechanical allodynia in rats up to 29 days of recovery. We used MRI to post-operatively determine T2 mapping for disc hydration.

Results: When compared with control, we observed a reduction of 50% withdrawal threshold in untreated injury group. In contrast, it was increased in all hydrogel groups of 2 mg/ml and 3 mg/ml with/without MSCs. For MRI analysis, we revealed the T2 value was reduced when compared to untreated injury group, however; an increase trend was observed in the treatment groups.

Conclusion: Our results indicates that the treatment of hydrogel with MSCs alleviates mechanical allodynia and restores disc hydration, which may imply the potential treatment for degenerative disc disease associated with LBP.

Keywords: Intervertebral disc (IVD) degeneration, Low back pain, nucleus pulposus, Wharton jelly mesenchymal stem cells, Collagen Hydrogel, Pain test

A-0803

Epithelium-Lined Lumen within the Adult Human Median Umbilical Ligament-Prospects of Harvesting Pluripotent Stem Cells

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Purpose: The median umbilical ligament (MUL) is a midline fibrous cord between the umbilicus and the apex of the urinary bladder derived from the embryonic urachus. Urachal cyst, sinus, fistula and rarely cancers can arise from it. The microanatomical structure of the human MUL is still variably and poorly described.

Methods: In eighteen, donated, formalin-fixed cadavers of both genders (13 males and 5 females), aged between 63 and 82 years the MULs were identified, dissected out and collected. None of the specimens had any visible deformities. The proximal portion of the 10 MULs were processed at first for paraffin embedding, sectioning and staining with Haematoxylin and Eosin (H&E) and Masson's trichrome (MT), separately.

Results: Five MULs out of initial 10 processed samples revealed single or multiple profiles of epithelium-lined lumina that contained proteinaceous material. The transverse sections showed that the MUL had four definite layers from within outwards viz. mucosa, submucosa, muscularis and adventitia. The epithelium of the lumen was either pseudostratified columnar epithelium or stratified cuboidal. The other five MULs were mainly made of fibrous tissue and contained some profiles of blood vessels- arterioles, venules and capillaries.

Conclusion: A luminal MUL can harbour embryonic epithelium and this lumen can be identified by using advanced high-resolution magnetic resonance imaging (MRI) and optical coherence tomography (OCT). The epithelium can become an important source of pluripotent embryonic stem cells. This may be a convenient way forward in finding reliable pluripotent stem cells for therapy in at least 50% of the population.

Keywords: Median umbilical ligament, Stem cell, Urachus

A-0804

Surgical Anatomy of the Recurrent Laryngeal Nerve in Chinese Adults and Its Clinical Applications

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Purpose: In removing the thyroid gland, great care must be taken to avoid damaging the recurrent laryngeal nerves (RLN). The present study aims at presenting a clear picture of certain anatomical features of the RLN, as related to the inferior thyroid artery, the tracheoesophageal groove, the Berry's ligament and the inferior cornu of thyroid cartilage in Chinese adults.

Methods: One hundred-twenty recurrent laryngeal nerves were removed from 60 Chinese mostly male adults (52 males, 8 females). The course and relation of the RLN on both sides were meticulously determined and recorded.

Results: The incidence of the RLN found in the tracheoesophageal groove was 78.3% on the right and one on the left side was 91.3%. The incidence of the laryngeal nerve lay posterior to the inferior thyroid artery both on right side was 80% and the one on left side was 91.7%. Most of the RLN was found within 3 mm of the Berry's ligament. The RLN's laryngeal entry point was approximately 0.8 cm below and just anterior to the thyroid cartilage's inferior horn.

Conclusion: The inferior cornu of the thyroid cartilage was a reliable landmark in identifying the recurrent laryngeal nerve. Racial variations between the Caucasian and the Chinese should be taken into consideration for an explanation of the differences.

Keywords: Thyroid gland, recurrent laryngeal nerves, Tracheoesophageal groove (TE), Berry's ligament, thyroid cartilage

A-0805

Anatomic Study of Vaginal Width in Male-to-Female Transsexual Surgery

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Purpose: Despite the recent improvement in the design of male to female sex reassignment operations to enlarge the vaginal vault and depth, the size of the neovagina remains somewhat limited and the exterior of the neovagina maybe compressed by the bony structure of pubic rami. The purpose of this study was to determine by anatomic study the possible cause of this limitation.

Methods: 18 male and 10 female cadavers were dissected to measure the distance between the bilateral bony pubic rami (interramic distance) at a level that corresponds to the same level in the vaginal canal of females.

Results: At the same level of the vaginal canal in the female, which corresponds to the lower border of the prostate in the male, empirically 3 cm below the bony symphysis pubis, the mean value of the interramic distance was 3.95 ± 0.25 cm in the male and 5.20 ± 0.36 cm in the female ($p = 0.000$). The interramic distance in the male and female is significantly different.

Conclusion: In those who have undergone the male-to-female transsexual operation, the newly structured vagina may be ventrolaterally limited. Several factors cause narrowing of the vaginal orifice in male-to-female transsexuals. On the basis of this study, it seems that the bony structure of the pubic rami compresses the vagina ventrolaterally.

Keywords: Vagina, Pubic rami, Male-to-female transexual surgery

A-0806

Anatomical Variations of the Genital Branch of the Genitofemoral Nerve in Open Inguinal Hernia Repair

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Purpose: The ilioinguinal and iliohypogastric nerves lie between the internal and external oblique abdominal muscles. These nerves are easily identified during open inguinal hernioplasty. So they are seldom injured. Many papers have been published about anatomical variations of the ilioinguinal and iliohypogastric nerves. But little has been written about anatomical variations of the genital branch of the genitofemoral nerve in the inguinal canal. We therefore undertook a study to investigate these variations.

Methods: We dissected the inguinal region on both sides of 58 adult Chinese cadavers (52 male and 6 female) in the gross anatomy laboratory of the National Defense Medical Center.

Results: All the genital branches passed through the ventral aspect of the internal ring. Almost all these branches entered the ring and continued within the spermatic cord between the fibres of the cremaster and the internal spermatic fascia. In 59% the nerve was related to the inferior fibres and in 38% it was in relation to the lateral or medial fibres. In only 3% did the genital branch run outside the spermatic cord.

Conclusion: To avoid damage to the genital branch of the genitofemoral nerve, suturing should be done over the dorsal aspect of the internal ring. The cremaster should be incised longitudinal rather than transversely and the genital branch of the genitofemoral nerve should be identified before repair of the posterior wall.

Funding: This study was sponsored by grants from Taipei Veterans General Hospital (V111C-167, V111D61-003-MY2), the Ministry of Science and Technology (MOST 107-2314-B-010-056-MY3, MOST 108-2314-B-010-053, MOST 110-2314-B-A49A-501 -MY3, MOST 111-2320-B-016-006-MY3).

Keywords: Genital branches, Genitofemoral nerve, Open inguinal hernioplasty

A-0815

The Anatomical Variations of the Palmar Cutaneous Branch of the Median Nerve in Chinese Adults

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Purpose: In a detailed analysis of the palmar cutaneous branch of median nerve (PCN) in the Chinese adults, we tried to evaluate its anatomic variation and clinical significance.

Methods: Observations were described in all the 60 specimens of the PCN at the wrist.

Results: The PCN was present in all 60 specimens and in most cases (88.3%) it originated from the radial side of the median nerve and the average length from the palmaris longus was 1.4cm; ulnarward (11.7%); only 5 cases (4.1%) were located at ulnar side and extended beyond the palmaris longus, the average distance being 0.3cm. Its mean point of origin was 3.2cm proximal to the distal wrist crease and the variations of the PCN in Lanz classification were: group 0 (31.7%), group 1 (40%), group 2 (15%), group 3 (0%) and group 4 (13.3%).

Conclusion: Longitudinal incision located 1cm on the ulnar side from palmaris longus could avoid injury to the PCN during decompression of carpal tunnel syndrome.

Keywords: Palmar cutaneous branch of median nerve, Anatomic variation, Carpal tunnel syndrome

A-0841

Aging Pattern of the Brainstem Based on Volumetric Measurement and Optimized Surface Shape Analysis

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Purpose: To measure the volume and surface area of the brainstem and assess the effects of age and gender on the morphology of the brainstem and its sub- regions.

Methods: Volumetric measurement and optimized surface shape analysis were performed to investigate age- and sex- related differences in global, regional and local structure of the brainstem using the structural MRI data of 187 healthy adults (ranging in age from 18 to 70 years).

Results: Our results showed a significant negative age effect on the volume of the two major components of the brainstem: the medulla oblongata and midbrain. The shape analysis revealed that atrophy primarily occurs in specific structures, such as the pyramid, cerebral peduncle, superior and inferior colliculi. Surface area and shape analysis showed a trend of flattening in the aging brainstem. There were no significant differences between the sexes or sex-by-age interactions in brainstem structural measures.

Conclusion: These findings provide a systematic description of age associations with brainstem structures in healthy adults and may provide a reference for future research on brain aging and neurodegenerative diseases.

Keywords: Magnetic resonance imaging, Brainstem, Aging, Morphometry

A-0843

The Fibularis Quartus Muscle: A Cadaveric Case Report with Embryological, Molecular and Clinical Considerations

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Purpose: The fibularis quartus (FQ) or peroneus quartus (PQ) is a supernumerary muscle occasionally encountered in the lateral compartment of the human leg with a prevalence of 2.9-22%. It is a weak evertor and has a role in pronation and lateral stabilization of the foot. FQ arises from the fibularis brevis and distally gets inserted to either the base of the fifth metatarsal or the calcaneus bone. The muscle has been implicated in clinical problems ranging from ankle pain to peroneal tendon tear and ankle joint subluxation. We aimed to report this rare bitendinous variant of FQ which might provide new insight to clinical problems related to the presence of this muscle. Moreover, it can be used in reconstructive surgeries to fix peroneal tendons.

Methods: Institutional guidelines for use of human cadaver were followed. Routine dissection was performed on a 71-year-old male donated cadaver in both the lower limbs. Gross anatomical features were meticulously noted, photographed and measurements were recorded with digital Vernier callipers.

Results: A bitendinous muscle was observed in the lateral compartment of the left leg proximally attached to the peroneus brevis and the interosseous membrane which formed a flat fusiform muscle belly and eventually terminated through a rounded tendon getting attached to the peroneal trochlea of the calcaneus. The dimensions of the proximal tendon, muscle belly and the distal tendon were 4.2×0.7 cm, 5.6 cm×1.9 cm and 2.6×0.3 cm respectively.

Conclusion: FQ develops and differentiates from the embryonic dorsal muscle mass formed from myotomes migrating to limb buds during 5th week of intrauterine life. Variant fibularis muscles are believed to be due to deletion of Meox2 homeobox gene which warrants detailed genetic work up in a larger sample size.

Keywords: Fibularis quartus, Peroneus quartus, Peroneal compartment, Anatomical variation

A-0844

Aberrant Right Subclavian Artery (ASDA). Finding of a Case

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Purpose: Describe the origin, course and direction of the anatomical variant found in the right subclavian artery, in a specimen used for teaching Human Anatomy at the Universi-

dad Catolica Boliviana "San Pablo" Cochabamba.

Methods: The present work is carried out with a descriptive method, based on the finding in a routine dissection where a variant in the origin of the right subclavian artery could be observed, which begins 3 cm below the aortic arch at the level of the thoracic vertebrae 4 and 5. Similarly, a comparative method was used, according to the classification of variants of the Aortive Arch by Vucurevic et al. (2013) and the Adachi classification (1928).

Results: The variant found of the aberrant right subclavian artery (ASDA), has its origin 3cm below the aortic arch, at the level of the descending aorta and not the brachiocephalic trunk. From this origin, the right subclavian artery runs behind the esophagus to the height of the thoracic vertebrae 4-5 and the fourth rib on the right side, and then resume its journey towards the base of the neck and make its interscalenic journey.

Conclusion: The anatomical variant found does not correspond to the classifications of Vucurevic and Adachi regarding its origin, however, according to the path (Rodriguez A.) it corresponds to 80% of the cases described by the aforementioned authors. Anatomical dissection on cadavers allows us to examine and study the structure of the human body in greater depth, but also provides us with a source of investigation into possible anatomical variables.

Keywords: Anatomy, Right subclavian artery, Dissection, Anatomical variant, Aortic arch

A-0848

Morphometric and Morphologic Examination of Flexor Digiti Minimi Brevis in Human Fetuses

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Purpose: Flexor digiti minimi brevis (FDMB), located on the ulnar side of the hand, is one of the hypothenar muscles. Variations of FDMB have been reported frequently in the literature. It has been reported that FDMB is more advantageous in opponensplasty because it is located on the radial side compared to abductor digiti minimi. In the current study, it is aimed to type FDMB according to its origins and insertions and to examine the morphometric properties of this muscle.

Methods: Thirty-six sides of 18 fetuses (mean age: 24.55± 4.19 weeks, 4 boys, 14 girls) in the laboratory of Gaziantep University Faculty of Medicine, Department of Anatomy, were dissected. Dissection was performed using a surgical microscope (Carl Zeiss Meditec AG, Opmi Pica Model S100, Germany) at x10 magnification and photographed. The origin and insertion of FDMB were determined. The length, width, and area of the muscle were measured. Descriptive statistics of the findings were made with the SPPS 22 package program. The study was conducted under the ethical rules of the Declaration of Helsinki and its later amendments.

Results: It was found that FDMB started from the flexor retinaculum and hook of hamate bone on the 34 sides, and most frequently ended at the base of the proximal phalanx of the fifth finger (23 sides). FDM was absent on the 2 sides. The mean FDMB width, length, and area were 2.30±0.75 mm, 12.66±3.74 mm, and 21.90±9.77 mm^2 respectively.

Conclusion: Knowing the sizes and variations of FDMB may help clinicians reduce complications in opponensplasty procedures and surgical procedures to the flexor retinaculum and in treating Guyon's canal syndrome. Our typing of fetuses according to origin and insertion is the first in the literature and is thought to be useful in surgeries performed in the hypothenar region.

Funding: The present study was supported by TUBITAK (BIDEB) 2209-A University Students Research Projects Support Program (project no: 1919B012220235).

Keywords: Fetus, Dissection, Flexor digiti minimi brevis, Hypothenar region

A-0849

Analysis of Variant Morphology of Suprascapular Notch in Human Cadaveric Scapulae

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Purpose: Suprascapular notch (SSN) is present along the

superior border of the scapula. The superior transverse scapular ligament converts the notch into an osteo-fibrous foramen. The suprascapular nerve passes below the superior transverse scapular ligament which may undergo calcification resulting in suprascapular nerve entrapment syndrome. This results in shoulder pain with limitation of movement involving muscles supplied by this nerve. The purpose of this study was to analyze the variations in morphology of suprascapular notch in cadaveric scapulae with possible clinical relevance.

Methods: It was an observational study conducted in the cadaveric bone museum of the Anatomy Department at CMH LMC & IOD after ethical approval. All available human cadaveric scapulae of indetermined sex of both right and left sides were included. A total of 75 human cadaveric scapulae were observed. Thirty-six scapulae belonged to the right side and 39 to the left side. These scapulae were retrieved and saved from cadavers that could not be used for study purpose any longer. The shape and morphological parameters of suprascapular notch were observed, and they were categorized according to Rengachary classification, I to VI types.

Results: Overall Type-1(28%), type-II (8%), Type-III (35%), Type-IV (24%), Type-V (2.6%) and Type-VI (2.6%) suprascapular notches were observed. Out of 75 scapulae, only two had completely ossified suprascapular ligament and both were on the left side. Independent Samples t-test showed a statistically significant difference between superior transverse (P value=0.001), middle transverse (P value=0.002), and vertical diameters (P value=0.048) of type-III and type-IV suprascapular notches.

Conclusion: Our study showed an overall predominance of types III & IV suprascapular notches in comparison to other studies performed locally and in other ethnicities. This finding is important for surgeons as ossification of the suprascapular ligament, though rare, can predispose patients to nerve entrapment.

Keywords: Morphology, Suprascapular notch, Cadaveric scapulae

A-0855

Anatomical Study of Phrenic Nerve Course in Related with the Anterior Scalene Muscle and Its Clinical Significance

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Purpose: The aims of this study were to determine the topographical relationships between the phrenic nerve (PN) and the anterior scalene muscle (ASM), and to further the current understanding of temporary paresis of the PN after interscalene nerve block or ASM trigger point injection.

Methods: Sixty sides of necks from 30 embalmed cadavers were dissected for this study.

Results: The PN originated mainly from both 4th and 5th cervical nerves (65% of the specimens). The PN formed at the upper part of the lateral border of the ASM, and descended almost vertically behind the prevertebral fascia on the anterior surface of the ASM. The point where the PN met the lateral border of the ASM was 18.4±12.2 mm superior to the level of the inferior margin of the cricoid cartilage (CC) in 50% of the specimens. The point where the PN met the medial border of the ASM was found below the level of the inferior margin of the CC except only one case. The length of the PN running on the anterior surface of the ASM, was 35.5±9.1 mm. The horizontal distance of the PN from the midpoint of the inferior margin of the CC, was 41.9±5.9 mm. The PN and the ascending cervical artery ran parallel with each other in 65% of the specimens. At the lower part of the medial border of the ASM, the PN traversed in front of the internal thoracic artery in 71.7% of the specimens. The accessory PN was observed in 11.7% of the specimens, which originated from the 5th cervical nerve except only one case.

Conclusion: These results are expected to improve the knowledge about the PN course in related with the ASM, and provide helpful information for clinical management in this region.

Keywords: Anterior scalene muscle, Ascending cervical artery, Cricoid cartilage, Internal thoracic artery, Phrenic nerve

A-0860

Comparative Mechanical Analysis of the Cervical Facet Joint in Adult and Macaques Based on Finite Element Technique

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Purpose: Based on the finite element analysis technique, we explored the force characteristics of the Cervical facet joint in adult and macaques, and analyzed the change rule of the mechanics between the two by comparing, so as to provide the theoretical basis for the construction of cervical spondylosis animal model.

Methods: One case of adult and one case of rhesus macaques were selected, and the raw data were obtained by 64-row spiral CT scanning, and the three-dimensional finite element models of C0-T1 cervical vertebrae of adult and rhesus macaques were constructed by simulation with Mimics, and Abaqus, etc., and the finite element method was used to analyze the mobility of the models and the stresses of Cervical facet joint in comparison with the models. Comparative analysis of cervical mobility and Cervical facet joint stress was performed using the finite element method.

Results: 1. The stress and displacement values of the Cervical facet joint of adults and macaques increased with increasing vertebral sequences, with the maximum value located at C6, and the stress and displacement values of the Cervical facet joint differed significantly between right and left lateral flexion conditions ($P<0.05$); the stress values of the Cervical facet joint differed between different vertebral sequences and different conditions; 2. In the comparison of the stress and displacement values of adults and macaques, the trends of the Cervical facet joint showed a similar trend.

Conclusion: In this study, we found that the Cervical facet joint of macaques and adults are not in alignment; the stress concentration point of the Cervical facet joint of both adults and macaques is located at C6; and we found that the trends of the stress changes of the two are similar, which provides a theoretical basis for the establishment of the ideal cervical spondylosis animal model and artificial vertebral body replacement.

Keywords: Cervical facet joint, Cervical spine, Macaca, Finite element analysis

A-0866

Development of a Convolutional Neural Network Based on RTMpose for Measuring Sagittal Parameters of Cervical Spine X-ray Images

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Purpose: Development of a deep learning algorithm for automatic measurement of sagittal plane parameters on cervical spine X-ray images.

Methods: In this retrospective study, 520 lateral cervical spine x-ray images from three hospital databases were collected. The data were divided into 320 training set, 100 internal test set and 100 external test set. 5 measures and 34 anatomical locations were measured and labeled by human examiners and used as gold standard. A convolutional neural network (CNN) model was built to train on 320 images and test on 200 images. Statistical analysis was performed to detect labeling differences between AI and human examiners and to evaluate the performance of AI.

Results: Statistical analysis confirmed that for the identification of critical points, the mean difference of the algorithmic model for labeled Landmarks in the internal and external test sets was 1.09±0.99 mm and 1.26±1.27 mm, respectively. For the 5 cervical spine sagittal plane parameters, the ICCs of the algorithmic model in the internal validation set and external validation set, respectively were 0.972 ($p<0.001$) and 0.964 ($p<0.001$), which were in good agreement with the gold standard. The Mean Absolute Error (MAE) values for Borden, C0-C7 Cobb, C1-C7 Cobb, and C2-C7 Cobb for the internal and external test sets were 1.05 mm, 2.17°, 2.13°, 2.67°, and 2.29 mm, 2.58°, 2.86°, and 2.93°, respectively; and the Symmetric Mean Absolute Percentage Error (SMAPE) values were 7.45%, 3.02%, 2.19%, 8.94%, and 14.31%, 3.66%, 3.09%, and 11.53%, respectively.

Conclusion: Our deep learning algorithmic model has high accuracy in recognizing key points of the cervical spine; the algorithmic model has high sensitivity and accuracy in automatic measurement of cervical spine related parameters, which can help radiologists to improve their diagnostic efficiency.

Keywords: Deep learning, Cervical spine, X-ray, Artificial intelligence

A-0871

"ABO Fixation Technique" in Blepharoplasty Base on Fascial Anatomy and Fasciology, an Alternative for Jung I. Park's "Orbicularis-Levator Fixation Technique"

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Purpose: The formation mechanism of double eyelids in Asians is still controversial, many techniques for double- eyelid plasty have been developed. However, the removal of large amounts of pretarsal tissue and the obvious scars in those techniques make patients dissatisfied with the appearance. Thus, we have devised a novel surgical approach named "ABO Fixation Technique" to avoid the complication of Jung I. Park's "orbicularis-levator fixation technique". The method is to create a physiological doubleeyelid fold on the basis of the formation mechanism of double-eyelid creases.

Methods: From January 2016 to March 2024, the novel blepharoplasty was performed on 456 Chinese patients (862 eyes) in our department. Patients were evaluated at 3-24 months after surgery. Point B is the upper edge of the tarsal, point O is the projection point of the tarsal corresponding to the designed skin width, and point A is the lower lip of the double eyelid design line of the skin. OB is an intermittent suture of the levator aponeurosis complex that runs vertically up to the upper edge of the tarsal through point O, while OA is a U-shaped suture of the composite tissue that horizontally passes through the tarsal and the deep and superficial fascia of the lower lip. OB suture: The levator palpebrae muscle vertically contracts and pulls the meibomian plate and anterior plate tissue. OA suture: Horizontal suture of the lower lip composite tissue to counteract the circular contraction of the orbicularis oculi muscle and the gravitational prolapse of the anterior plate tissue. AB is a slice diagram of the physiological double eyelid, directly related. The length of AB will change during the pathological and physiological recovery process due to the contraction force of the orbicularis oculi muscle and the gravity of the anterior plate tissue. To obtain an ideal stable conduction length of AB, there is uncertainty, which leads to variables in the immediate fixation and medium- to-long-term effects of the double eyelid! We use OB fixation and OA fixation to obtain a stable AB length through the congruence of the triangle OAB, thereby obtaining more accurate results for stable physiological double eyelid.

Results: The general satisfaction rate was 97.5%. The satisfaction rate was 100% after secondary adjustment. The edema period for most patients ended within 2 weeks. The scars became unnoticeable after 3 months. Disappearance of the fold was not found in any case.

Conclusion: "ABO Fixation Technique" is a simple and effective method, which can not only create a natural double crease but also reduce the complications of double-eyelid surgery.

Funding: The paper was supported by Grants from the National Basic Research 973 Program (no.2007CB512705) and the National Natural Science Foundationof China (no.30801464).

Keywords: Blepharoplasty, Fascial Anatomy, Double eyelids, Fasciology, Pretarsal extension of the aponeurosis

A-0873

Case Report: Distended Right Colonic Flexure

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Purpose: The transverse colon and right colonic flexure are parts of the large intestine. Right colonic flexure is the connection between the ascending and transverse colon. This manuscript will discuss the location of colonic distension and its possible causes to provide an overview for clinicians in treating similar cases.

Methods: An observation and dissection was done on one cadaver.

Results: Localized distension was found in the right colonic flexure without any volvulus or intussusception that could cause the distension. The distal part was denser than the proximal part which can be caused by obstruction.

Conclusion: This is an ongoing research which has not been concluded.

Keywords: Distension, Right Colonic Flexure, Obstruction

A-0883

The Role of Facial Aesthetic Zoning in Reconstruction Design: A Systematic Review and Recommendations

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Purpose: Facial aesthetic zoning and reconstructive design are critical for restoring anatomic structure, basic function, and acceptable appearance. This article reviews up-to-date literatures and explores innovative approaches to facial zoning and reconstructive techniques to enhance postoperative outcomes. By providing practical recommendations from our practice, the article illustrate the practical guide to the preoperational design of the face, from the aspects of functionality and aesthetic.

Methods: We conducted a systematic review of literature from the recent ten years through PubMed, CNKI, and Wanfang Database by using keywords "facial zoning"," facial aesthetic zoning", "facial anatomy", "facial trauma", "facial injury", and "reconstruction". Articles were then sorted by facial subunit and analyzed for: author(s), year of publication, study design, sample size, type of injury/defect, evaluation technique, type of operation, type of implantation, time to follow-up, and complications. Descriptive statistics were performed.

Results: 459 citations were identified by our search. There are 6 studies discussed the reconstruction about upper face (including forehead), while 105 articles mentioned about midface. A total number of 50 studies were heighted that they focused on the reconstruction of eyes, including orbit. What's more, there were 34 studies investigated the structure of nasal damage and reconstruction. Flap designs were also deeply discussed in 49 studies as it takes an important role in surgery design. The remining articles are about lower face reconstruction, nerve damage and recovery, ear injury. Our findings underscore the necessity for a systematic approach to facial reconstruction which is practical even for junior plastic surgeon. We propose a set of clinical recommendations that emphasize the use of aesthetic zoning as an easy guide for achieving ideal reconstructive results for better psychosocial well-being.

Conclusion: By customizing preoperational design, surgeons can achieve not only acceptable appearance but also with superior function, thereby enhancing the quality of life of patient.

Keywords: Facial Aesthetic Zoning, Facial Reconstruction Design, Systematic Review in Facial Surgery, Innovative Reconstructive Techniques, Aesthetic and Functional Facial Surgery

A-0884

The Prevalence of Termination Variations of the Basilar Artery: A Systematic Review and Meta-Analysis

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Purpose: Understanding the vascular anatomical variations of the termination pattern of the basilar artery is crucial for both neurosurgical and interventional radiological procedures. Recent evidence indicates that variant bifurcation patterns of the basilar artery, differing from the classical textbook description, are increasingly encountered. This study aims to provide a comprehensive summary of the prevalence of termination anomalies related to the basilar artery.

Methods: This systematic review included human cadaveric and imaging studies on basilar artery termination patterns. PubMed, Ovid MEDLINE, and Scopus databases were systematically searched in accordance with PRISMA guidelines, using the terms "(basilar OR vertebrobasilar OR (posterior AND circulation)) AND (anatomy OR termination OR trifurcation OR quadfurcation OR pentafurcation OR hexafurcation OR nonfurcation OR variation OR variant)". A meta-analysis of proportions was conducted to assess the prevalence of each variation using a random intercept logistic regression model, following logit transformation of the proportions.

Results: From 845 initial hits, 4 articles were eligible for the quantitative analysis. The estimated pooled proportions of bifurcation, trifurcation, quadfurcation, pentafurcation, hexafurcation, and non-furcation in the artery, under the random effects model, were 62.22% (95%CI [34.48%; 83.75%]), 6.08% (95%CI [2.60%; 13.58%]), 5.27% (95%CI [2.17%; 12.27%]),

2.06% (95%CI [0.96%; 4.35%]), 0.49% (95%CI [0.08%; 2.90%]), and 0.10% (95%CI [0.0%; 17.07%]), respectively. Heterogeneity analysis revealed significant variability among the studies (I^2 up to 93.6%, p<0.0001).

Conclusion: More than one-third of basilar artery terminations exhibit anatomical variations other than bifurcation. Trifurcation and quadfurcation are the most commonly reported variations, each accounting for over 5% of cases. These variations might carry significant implications for regional neurosurgical and interventional radiological procedures.

Keywords: Basilar artery, Termination Variation

A-0890

Prevalence of Accessory Maxillary Ostium Associated with Chronic Maxillary Sinusitis in Thai Population

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Purpose: To evaluate the prevalence of an accessory maxillary ostium (AMO) and its clinical correlation with/without the chronic maxillary sinusitis in Thai population using Computed Tomography (CT) due to the AMO is the anatomical variation and can impair the mucociliary clearance of maxillary sinus leading to maxillary disease.

Methods: The retrospective data of 355 CT scans were collected from PACS between September 2017 and December 2023. All patients were encompassed individuals over 13. This study was excluded the patients with evidence of sinus wall destruction, sinonasal polyposis, severe nasal polyps, a history of functional endoscopic sinus surgery (FESS), inverted papilloma, choanal atresia, paranasal sinus mucocele, severe nasal septal deviation and acute nasal sinusitis. AMO and chronic maxillary sinusitis was studied by radiologist and anatomist. All results were statistical analyzed by Pearson's chi square test with significant p-value<0.05.

Results: The results showed 41.1% of AMO and 62.5% of chronic maxillary sinusitis diagnosed by the mucosal thickening (>2mm) and bone thickening of maxillary wall. Statistical analysis showed no statistically significant difference between males and females regarding the presence of AMO (p=0.708). However, AMO distribution across age groups was statistically significant (p=0.034), indicating a potential age-related difference in the prevalence of AMO. The analysis found no statistically significant age-related difference in prevalence of chronic maxillary sinusitis (p=0.255). The comparison of AMO distribution and chronic maxillary sinusitis, it presented a statistically significant association (p=0.017) but the pattern of AMO localization was not significant different between positive and negative chronic maxillary sinusitis groups, p-value=0.063.

Conclusion: AMO may be the secondary development effect due to rupture of 2 thin layers of fontanelles and probably resulted from the recurrence or long term of maxillary sinusitis. The cohort study, however, would be the important future study to answer how AMO occur and its clinical correlation with chronic maxillary sinusitis.

Keywords: Accessory maxillary ostium, Computed Tomography, Maxillary sinusitis, Chronic rhinosinusitis

A-0893

Characterization of Anatomical and Morphological Features of Densities Located in the Subcutaneous Connective Tissue

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Purpose: A number of scientific sources describe the possibility of the occurrence of areas of greater palpable density and cohesion within the subcutaneous connective tissue (with particular emphasis on adipose tissue). Over the years, various authors have managed to describe the relationships between zones of subcutaneous tissue density and pathologies of the musculoskeletal system and internal diseases The aim of the research is to attempt to identify and describe the anatomical location of the system of thickened fat formations at the level of subcutaneous tissue throughout the human body.

Methods: 20 upper limbs and 20 lower limbs from bodies belonging to the Department of Anatomical Preparation and Donation were examined. Upon dissection the morphometric measurements were collected, along with description of initial

and final attachments of fat formations which were found.

Results: In all cadavers the thickened fat formations were found in the same anatomical localization, with the same pathway and attachments. Upper limb, lateral fat formation and its attachments: proximal to acromioclavicular joint and distal to lateral epicondyle. Upper limb, medial fat formation and its attachments: proximal to infraspinous fascia and distal to medial epicondyle. Lower limb, lateral fat formation and its attachments: proximal and distal parts of fascia lata. Lower limb, medial fat formation and its attachments: proximal to fascia lata and distal to medial condyle of femur.

Conclusion: We observe the presence of characteristic densities located in subcutaneous connective tissue both in upper and lower limb. This type of description may facilitate understanding of the importance of the presence of a system of densities in the subcutaneous tissue, which in the long run may translate into improved clinical practice of specialists, especially those dealing with diseases closely related to disorders of the physiological functioning of the autonomic nervous system.

Keywords: Subcutaneous tissue, Fat tissue, Upper limb, Lower limb

A-0894

The Prevalence of the Sphenoid Emissary Foramen and Its Clinical Relevance in a Selected South African Population

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Purpose: The sphenoid bone is an intricate bone with several features such as sphenoid emissary foramen (SEF). The SEF serves as a passage for the veins of Vesalius that connects the pterygoid plexus to the cavernous sinus, which acts as a means of transferring extracranial thrombosis to the cavernous sinus. SEF and its content are usually absent in individuals, and it mostly varies in morphology, laterality, and age if present. Notably, the prevalence of SEF regarding sex, laterality, and age remains underexplored. Therefore, this study aims to document the prevalence of SEF about sex, age, and laterality in a selected South African (SA) population.

Methods: 135 skulls were bilaterally analysed. The middle cranial fossa of each skull was observed for the presence and absence of the SEF. The patency of the SEF was confirmed by inserting a bristle through each probable foramen, and only patent foramina were used for this study.

Results: Out of 135 skulls that were analysed, the SEF was found present in 49 (35.5%) skulls with a high incidence in the White SA population and the lowest incidence amongst the Black SA population. 29.6% were unilateral (right 17.8%; left 11.8%), while 6.7% were bilateral. A high prevalence of the SEF was noted in males on the right side. A statistically significant association was obtained between the presence and absence of the foramen about age, $p = 0.004$. In addition to age, SEF was commonly observed in Older adults, Young adults, and Adolescents age groups, but was least observed among the Adults' age group (36-64 years).

Conclusion: SEF was highly prevalent in SA population particularly the White SA sample, especially on the left side of male older adults, a finding which may prevent pitfalls during surgical procedures of unusual cerebral venous thrombosis among this population.

Funding: This work was supported by the National Research Foundation.

Keywords: Sphenoid emissary foramen, Sphenoid emissary veins, Foramen Vesalius, Middle crania fossa

A-0902

Anatomical Variations in Origin, Morphology, and Innervation of Lumbrical Muscles: A Cadaveric Observational Study in a South African Population

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Purpose: The lumbrical muscles, despite their small size, are crucial for the intricate movements of the fingers. Variations in their origin and morphology, commonly documented in literature, can notably contribute to conditions like carpal tunnel syndrome and sub-chronic ischemia by compressing nerves and vessels in the carpal tunnel. This study aimed to

investigate variation in origin, morphology and innervation of the lumbrical muscles within a South African population.

Methods: This was a cadaveric observational study of an adult South African population (≥18 years). The sample consisted of 40 embalmed cadaveric hands (6 male, 34 female), dissected bilaterally following Grant's Dissector guidelines. The morphology, origins and innervation of the lumbricals on left and right sides were observed and recorded.

Results: Statistically significant variations of the lumbrical muscles were observed in the South African population (47.5%). A bipennate second lumbrical was observed in 17.5% cases, a unipennate third lumbrical in 35% cases, and a unipennate fourth lumbrical in 12.5% cases of the dissected specimens. In a single case (2,5%), the fourth lumbrical originated from an accessory flexor digitorum profundus (FDP) tendon. Hypertrophy of the first lumbrical was observed in 12.5% cases and atrophy of the third and fourth lumbricals observed in a single case (2.5%). Variations were more prevalent on the right side. No variations were observed in the innervation of the lumbricals in all the studied specimens.

Conclusion: The results of the study revealed notable variations in the origin and morphology of the lumbrical muscles within the South African population. These variations hold clinical importance, potentially impacting conditions such as carpal tunnel syndrome and chronic sub-ischemia. It's imperative for clinicians and surgeons to recognize these variations to enhance patient outcomes across diverse surgical scenarios.

Funding: National Research Foundation (NRF).

Keywords: Lumbrical muscles, Carpal Tunnel

A-0903

Comparison of Double Eyelid Techniques. Overview of Outcomes of Double Eyelid Blepharoplasty Techniques. Systematic Review

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Purpose: The double eyelid technique is one of the most common operations in South Korea and China. More than half of Asians have single eyelid anatomy. Nowadays, there are various techniques for performing Double Eyelid Blepharoplasty. Each surgeon selects the most appropriate technique for a specific case. Unfortunately, there are still a large number of patients who are dissatisfied with their results and may require secondary blepharoplasty. Our objective is to evaluate the evidence on the aesthetic effect and complications of different asian upper blepharoplasty.

Methods: A systematic search was conducted using four search engines (PubMed, EBSCO, and Ovid) to identify any study on the aesthetic outcome of Asian upper blepharoplasty; these studies were subjected to quality assessment for possible inclusion. A total of 4463 studies were evaluated, with 27 of them being included. Patient-reported outcome measures, satisfaction with results, upper eyelid crease stability, and scarring were among the aesthetic outcomes studied. Meta-analysis was not an option.

Results: 24 study was total of 735 eyes (95.6%) showed good fold curves.17 study showed six-month follow-up results revealed that the double-eyelid shape was natural looking.19 study showed: No one lost the supratarsal crease completely. Four (1.01%) patients were not satisfied with the height of the supratarsal fold. Three (0.76%) patients showed a mild degree of asymmetry of the formed folds, but were not reoperated on their request.

Conclusion: It is reasonable to conclude that the use of modern technology has no significant effect on patient satisfaction with the outcomes. Surgeons, on the other hand, must decide how to handle each patient's unique situation.

Keywords: Upper blepharoplasty, Double eyelid blepharoplasty, Oculoplasty, Blepharoplasty

A-0911

Hypoplastic and Congenital Absence of Coronary Arteries and Its Correlation with Clinical Implications of Cardiac Circulation. A Systematic Review and Meta-Analysis

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Purpose: The coronary arteries originate from thethis first portion of the aorta, emerging from right and left aortic sinuses. They traverse through the subepicardium and the coronary sulcus to supply the myocardium during diastolic function.

Methods: The databases Medline, Scopus, Web of Science, Google Scholar, CINAHL and LILACS were researched until January 2024. Methodological quality was evaluated with an assurance tool for anatomical studies (AQUA). Pooled prevalence was estimated using a random effects model.

Results: A total of 3 studies met the established selection criteria In this study for meta-analysis. For the prevalence of the variants of the coronary arteries, it was 3% (CI = 2% to 8%), a heterogeneity of 77%, The other studies have been analyzed descriptively and with their respective clinical considerations in the presence of the variant.

Conclusion: Although hypoplasia and agenesis of the coronary arteries are accidental findings, knowledge of these variants is crucial to avoid differential diagnosis and in addition to being very careful when faced with possible surgical management of hearts with these variants.

Keywords: Anatomy coronary artery, Hypoplastic coronary artery, Agenesia coronary artery, Clinical anatomy, Variations anatomical

A-0920

Utilizing Anatomical Landmarks to Access the Pudendal Nerve in the Gluteal Region

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Purpose: Understanding the anatomy of the pudendal nerve and its surrounding landmarks is of great importance when considering a pudendal nerve block, which is important in the management and treatment of pelvic floor dysfunction.

Methods: As part of a multi-campus study, the gluteal region of embalmed human cadavers were dissected to identify the pudendal nerve, superficial anatomical landmarks, and nearby structures, including the: sacrotuberous ligament, sacral foramina, coccyx, ischial spine, ischial tuberosity, and internal pudendal artery.

Results: Seventy-five hemigluteal dissections (48 right, 30 left) were completed on 48 human cadavers. Measurements were useable from 72 of the 75 dissections. The average distance from the coccyx upward to the marker line was 6.5±1.4 cm. Then moving laterally at the level of the marker line, at a distance of 4.8±0.90 cm, Point A was reached. Taking the distance from the marker line at an angle of 36±8.8°and inferior at a distance of 3.8±1.3 cm, the location of the pudendal nerve was revealed. All measurements exhibited normal, with p-value for Shapiro Wilk test > 0.05. Affirmation measurements were then performed om reverse, using the average obtained estimates on 10 previously unmarked hemiglutei (5 right, 5 left), and in all 10 (100%) dissections, the needle traversed the STL, and dye was observed at the location of the pudendal nerve.

Conclusion: This cadaveric study demonstrates the accuracy and feasibility of a landmark-based transgluteal anatomic approach to approximate the location of the pudendal nerve. Future work will investigate the translation of this method further with applications in live human subjects.

Keywords: Pudendal Nerve, Anatomical Landmarkss, Transgluteal Approach, Pelvic Floor, Pelvic Floor Dysfunction

A-0932

Ten Concurrent Systemic Variations in a Female Cadaver: A Case Report

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Purpose: Case reports detailing anatomical variations are typically derived from cadaver dissections. From a single cadaver, multiple variations across various anatomical regions were observed. Given their significance and extensivity, documenting these variations is imperative as it can provide a novel guideline for future cadaver dissections and surgical procedures. This report aims to delineate the anatomy of observed variations by comparing them to standard anatomical structures and previously reported variation types. Embryological considerations are explored to elucidate the origins of these variations, followed by a discussion of their clinical implications.

Methods: Variations were identified during routine cadaver dissections conducted as part of the anatomy course at Eulji

University School of Medicine in 2023. The dissection of a 60-year-old female cadaver revealed ten systemic variations.

Results: This case report documents ten distinct variations: the accessory pectoral muscle, the extensor carpi radialis intermedius, bilateral absence of the plantaris, the superior thoracic artery arising from the second part of the axillary artery, the persistent median artery and bifid median nerve, the right gastroepiploic artery originating from the superior mesenteric artery, the iliolumbar artery branching from the common iliac artery, the inferior gluteal artery piercing the tibial nerve, early bifurcation and altered course of the sciatic nerve, and the posterior femoral cutaneous nerve piercing the piriformis muscle.

Conclusion: This report underscores the significance of anatomical variations in terms of both their frequency and diversity. These findings not only contribute to the advancement of anatomical knowledge in educational settings but also provide valuable insights for clinicians in diagnosis, treatment, and surgical interventions.

Keywords: Variations, Asymmetric sciatic nerve, Posterior Femoral Cutaneous Nerve, Inferior gluteal artery, Extensor Carpi Radialis Intermedius

A-0936

Examination of Pterygoid Hamulus with Cone Beam Computed Tomography

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Purpose: The aim of this study was to investigate the morphology and morphometry of the pterygoid hamulus (PH) in cone beam computed tomography images.

Methods: In this study, CBCT images of 100 individuals between the ages of 13-88 years, which were taken by Planmeca ProMax 3D Mid (Planmeca Oy, Helsinki, Finland) between 2015 and 2018 in the archive of Gaziantep University Faculty of Dentistry, Department of Oral and Maxillofacial Radiology, were analyzed. These images were reconstructed in three dimensions using RadiAnt DICOM VIEWER program. On three-dimensional images, the length and width of the PH in the coronal plane and the angles in the coronal and sagittal planes were measured. The analysis of the data included in the study was performed with SPSS (Statistical Program in Social Sciences) 25 program. $P<0.05$ was accepted as statistical significance.

Results: Right and left side images of 100 individuals (41.21 ± 18.78 years, male: 53, female: 47) were analyzed. No significant difference was found in the measurements related to PH according to the sides, but significant differences were observed in other parameters except for length according to gender (p=0,002-p=0,007-p=0,001). We found a low correlation between age and measurements (p=0,018 r=0,268-p=0,001 r=0,262).

Conclusion: Knowing the morphology and morphometry of PH is important in the differential diagnosis and prevention of diseases in the region. Therefore, it is thought that it may be useful for the clinician to include changes in the features of PH among the diagnostic hypotheses of craniofacial disorders in order to alleviate the patient's painful symptoms.

Keywords: Pterygoid hamulus, Cone beam computed tomography

A-0944

Developing a Modified Paediatric Ottawa Knee Rules Protocol with Novel Surface Anatomy Terminology using a Video to Teach Non-Medical Trained Coaches When to Seek Healthcare Advice and Improve Youth Experience

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Purpose: Globally, youth (5-16 yrs) sports injuries create health concerns regarding physical and mental well-being. Reportedly, most common joint injured in youth sports is the knee. Loss of participating with peers has acute concerns while long term decrease in exercise and physical activity due to diminished joint mobility can manifest in chronic systemic diseases. Boys presented at 11.9 years versus girls 12.3 years. Leading mechanisms of injury were on level surfaces at 58.1%. Number of knee injuries and severity increased with age. Ottawa knee rules (OKR) has been found useful with adolescence.

Objective of this study was to create a teaching video with modified OKR for adolescence integrating novel terminology and new surface anatomy (SA) for minimally medical trained coaches.

Methods: Literature search was conducted regarding modified adolescence OKR videos. GAX-specimens (n=6;3-Male,3-Female=12 knees) received innovative BriteVu-contrast (BVc) with MRI/CT scans and formalin-fixed cadavers-FfC (n=18;11-Male;7-Female=36 knees) had subsequent SA of OKR, then dissected. Video storyboard was created and filmed with Gimbal stabilizer for smartphone, 3-axis phone for iPhone 14 PRO, stabilizer for video recording with face/object tracking, 600 °auto rotation-hohem iSteady mobile plus.

Results: Literature search revealed no known modified adolescence OKR videos. GAX-specimen/FfC allowed modified-OKR observations of SA palpation, measurements, imaging, and dissection demonstrating lifelike static and dynamic anatomy enabling novel terminology for ease of understanding and performing modified-OKR for non-medical trainees. Chronologically, video demonstrated 8-step gait analysis, active knee flexion beyond 90 degrees, and triangular knee region palpation of Tibial tuberosity-Patella-Fibular head (TPF). Tibial-soleal-groove (TSG) terminology provided blueprint for TPF palpation.

Conclusion: This pilot study integrated knee SA with GAX-Specimen/FfC dissections creating a modified adolescent OKR protocol viewed with video for minimally medical trained coaches successfully identifying novel SA terminology consisting of TSG, TPF and knee positioning to provide a useful tool for healthcare providers, coaches, and families.

Keywords: Surface anatomy, Sport medicine, Terminology, Education

A-0945

Assessing the Efficacy of an Innovative Airway Device Delivering Supplemental Oxygen during Intubation with GAX-Specimen

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Purpose: Up to 6% obstetric intubations fail from multifactorial conditions. Death occurs every 90 failed intubations. An ingenious designed Turbo O_2 Cap (TO_2Cap) facilitates oxygen delivery via vocal cords (VC) beyond primary bronchi during endotracheal (ET) placement. Study objective assesses TO_2Cap with GAX-specimen cadavers measuring 3 separate oxygen flowrates from 2 distances measuring when 90% oxygen saturation is achieved at carina.

Methods: Surgical clam shell technique on GAX-specimen provided access to thorax. Horizontal incision via right bronchial bifurcation allowed secure fit of GOX-100 oxygen-sensor (Greisinger-Electronics). Extending cervical spine facilitated Eagle-Vision-video-laryngoscope (VL) and ET-placement. VL of VC allowed accurate ET positioning during trials. TO_2Cap has universal ET attachment and port access for oxygen. Oxygen flowrate and ET placement was evaluated with oxygen sensor. A baseline of 21.2±1% oxygen saturation, varying flowrates of oxygen were administered (4, 10, 15 L/min) and time was measured reaching 90% oxygen saturation. Maxillary incisor landmark ensured accurate proximal (18cm-mark on ET) and distal (21 cm-mark on ET) placement of ET to VC.

Results: Literature search revealed no known studies assessing oxygen delivery with GAX-specimens. Comparison of flowrates demonstrated 10 L/min improved oxygen saturation time to 90% by 7.8-seconds proximal to VC, and 3.6-seconds distal to VC compared to 4 L/min. 15 L/min of oxygen had no significant difference on time to 90% saturation compared to 10 L/min. Each trial finished following 90-seconds of delivered oxygen recorded by oxygen-sensor reaching maximum oxygen-saturation at approximately 94% regardless of ET placement and/or flowrate. TO_2Cap delivered oxygen during intubations practiced on GAX-specimen suggesting an optimal flowrate of 10liters to reach 90% oxygen saturation.

Conclusion: This pilot study suggests supplemental oxygen during normal or difficult intubations occurring in obstetrics can be delivered at varied flowrates using an innovative TO_2Cap. A 10-L/min rate was ideal compared to 4-L/min (saturation was prolonged) and 15-L/min (saturation not significantly different then 10-L/min, thus wasting oxygen supply) regarding time to achieve 90% oxygen saturation.

Keywords: Innovative, Turbo cap, Movel, Airway, Intubation

A-0946

Learning POCUS Musculoskeletal Basics and Sonoanatomy using GAX-Specimen vs Formalin-Fixed Cadaver Dissection of Gluteal-Piriformis-Sciatic Region with 3-Week Mixed on-Line Course

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Purpose: Low back pain is most common musculoskeletal complaint presenting to family practice and/or emergency departments. Sciatica or lumbar radiculopathy refers to a range of symptoms from pain to numbness from compression of sciatic nerve(SN) or its nerve roots(L4-S3). MRI is the gold standard demonstrating herniated discs causing sciatica. Piriformis syndrome(PS) affecting SN has been reported between 5-35% and treated with musculoskeletal ultrasound(MSKus) injection. Objective of this study was to identify and/or create a basic MSKus teaching protocol of the gluteal-piriformis-sciatic-region(GPSR) with anatomy dissection for PS.

Methods: Literature search was conducted on dissection and MSKus teaching protocols of GPSR with GAX-specimens and formalin-fixed cadavers(F-Fc). GAX-specimens(n=6;3-Male,3-Female) receiving MRI/CT scans with BriteVu-contrast(BVc) and FFC(n=20;11-Male;9-Female) had GPSR surface anatomy(SA) and deep dissection performed. GE-VscanAir handheld probe was used for a 3-week basic MSKus scanning regime of neck, shoulder, wrist, knee, and GPSR. Three two-hour tutorials(two via zoom and one in-person) occurred at one-week intervals. Student was given MSKus videos of GPSR one-week prior to assessment addressing SA, bony landmarks and sonoanatomy locating piriformis and SN for injections.

Results: Literature search revealed no known GAX-specimens versus F-FC's for MSKus or GPSR dissection or protocol studies. GPSR MSKus procedures existed, but no training protocols. GAX-specimen GPSR dissection was significantly more lifelike regarding multiple parameters versus F-FC's. Lateral gluteal region(LGR) revealed three gluteal muscles superficial to deep. Medial gluteal region(MGR) demonstrated gluteus maximus superficially with piriformis deep. Bony landmarks (posterior superior iliac spine-PSIS, sacrum, iliac and greater trochanter) on palpation and with MSKus were identified from GAX-Specimens but diminished or absent from F-FC's. Student assessment demonstrated basic MSKus skills and sonoanatomy of GPSR.

Conclusion: This pilot study integrated SA with GAX-Specimen dissections and MSKus training regime of GPSR enabling novice healthcare students to successfully identify sonoanatomy for PS injection as differential for herniated disk for sciatica pathology.

Keywords: GAX specimen, GE Vscan, Ultrasound, Sciatica

A-0949

Parotid Gland Serves as the Key Equator Landmark Maintaining Patency Integrity of Veins Draining from the Scalp, Infratemporal Fossa and into the Neck

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Purpose: Although the parotid gland(PG) represents a mine-field of critical structures lying within its two recognized lobes enveloped by a relatively strong fascial capsule, the facial nerve is overwhelmingly emphasized with vasculature being much less so. PG consists of superficial and deep lobes(S-lobe & D-lobe) often divided by the facial nerve(FN) and posterior facial vein. Fatty tissue between lobes facilitates mandibular movement. S-lobe typically lies lateral to FN and D-lobe lies medial to the FN. PG occupies the retromandibular fossa which can be considered lying at an approximate midpoint between vertex and the clavicle. Surgeons and radiologists are aware of venous network within PG, however, describing it and/or depicting it appears inconsistent causing issues for medical students. The study objective investigates PG venous network, function and landmarks between GAX-specimens and formalin-fixed cadavers (F-fC).

Methods: Literature search was conducted on contemporary texts (CTxts) and atlases (CAtls) for venous content and function. Dissection comparing 6 GAX-specimens=12-sides with BriteVu-contrast for CT/MRI and 31 F-fC=57sides. PG appeared to provide infrastructure preventing venous collapse during dissection.

Results: No known GAX-specimen versus F-fC PG studies were identified. Majority of CTxts discussed retromandibular

vein (RV) formation within gland but lacked mentioning other associated veins. Approximately 50% of CAtls revealed RV formation within PG and 50% revealed RV deep to PG with majority excluding associated veins within PG. GAX-specimen and F-fC revealed superficial temporal (STv), maxillary (MAXv), RV, anterior/posterior divisions of RV and transverse facial noted with PG 55/57 sides.

Conclusion: PG surgery is key training for different subspecialties and has extremely poor side-effects if performed without caution and solid fundamental anatomical knowledge. This study revealed both CTxts and CAtls could modify their descriptions and depictions to represent more consistent venous network within PG and highlight PG function as maintaining venous patency while being a key midpoint landmark for veins to form and provide clinically important tributaries.

Keywords: GAX specimen, Surgical, Anatomy, BriteVu contrast

A-0953

POCUS for Great Saphenous Vein Cut Down, Consistent New Distal Landmark Terminology with Crural Fascia Reinforcement

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Purpose: Venous access (VA) is paramount during resuscitation of traumatic, surgical and medically compromised patients. Successful VA enables fluid repletion, drugs administration, blood monitoring and transfusions. Traditional VA can fail in conditions causing hypovolemia, thready or nonpalpable veins in paediatric patients and obese conditions, variable anatomy etc… Venous cutdown exposing the great saphenous vein (GSV) is an important skill set for todays healthcare provider. GSV forms from the confluence of the dorsal vein of the first digit and dorsal venous arch of the foot and ascends anterior to the medial malleolus in the distal tibial-soleal groove. The study objective was to dissect and analyze GSV from novel GAX-specimens with MRI and innovative contrast CT imaging versus formalin-fixed cadavers (FFC).

Methods: Literature search was conducted regarding GSV cutdowns. Novel GAX-specimens (n=6,12sides) with innovative contrast CT/MRI imaging and FFC (n=31:58sides) were dissected and analysed.

Results: Literature search revealed no known GAX-specimen studies. Contemporary anatomy texts describe the ascending GSV within the ankle/leg region using anterior and medial which is vague with invasive procedures. GAX-specimens (12:12 sides) and FFC (58:62-4 sides had procedures) revealed GSV lying in a groove termed the distal tibial-soleil groove (DTSG). FFC revealed GSV lying within 2mm of the DTSG with dehydarted crural fascia. GAX-specimens (12:12) demonstrated crural fascia 'tents' acting protective and functional.

Conclusion: This study revealed a consistent landmark during venous cutdowns of GSV termed the distal tibial-soleil groove-DTSG which would help clinicians palpate and conduct more successful cut downs. It also demonstrated crural fascia GSV support morphology.

Keywords: Novel Anatomy, Innovative Contrast

A-0954

Demonstrating an Innovative Modified Clamshell Technique for Either Single or 2-Person Users on Novel Embalmed Imaged Cadavers Training Non-Cardiothoracic Surgeons to Successfully Perform Emergency Thoracotomy for Realistic Life-Saving Skills

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Purpose: Emergency thoracotomy conducted in emergency/trauma departments has notoriously been associated with poor outcomes. Trauma experts claim timing of decision and procedural difficulty leads to poor outcomes. Conventional thoracotomy for non-cardiothoracic surgeons is left anterolateral approach. Study objective was to provide modified clamshell technique revealing critical anatomy enabling non-cardiothoracic surgeons to conduct life-saving thoracotomy for cardiac tamponade and cross-clamping descending thoracic aorta.

Methods: Novel GAX-specimens (n=6) and traditional embalmed (n=33) cadavers (total n=39), had modified clamshell approach conducted for ease of procedure (required tools,

skill of tool use and degradation of technique), rapid efficient access, and working visibility. Required tools were scalpel, trauma scissors and Finochietto retractor for single user.

Results: With assistant, scalpel and trauma scissors enabled modified clamshell thoracotomy approach. Maintaining 5th intercostal space resulted in consistent optimal exposure of thoracic structures for emergency procedures. GAX-specimens possessed superior lifelike tissue compliance vs traditional embalmed. This technique allowed ideal anatomy exposure conducting a vertical incision of pericardial sac anterior to the phrenic nerve evacuating pericardial effusions and more easily enabled cross clamping of the descending thoracic aorta for non-cardiothoracic surgeons while avoiding the oesaphagus. Procedure affords satisfactory suture closing technique, avoiding higher infection rates associated with midline sternotomy procedures.

Conclusion: Modified clamshell technique is not sophisticated, easily and rapidly performed, provides optimal anatomy exposure, and can be closed satisfactorily. The technique can be done as a single user with 3 tools or 2 users with 2 tools which can be taught in anatomy labs prior to chest dissection.

Keywords: Novel Anatomy, Novel Anatomy

A-0958

Distal Semimembranosus Attachment into the Posterior Horn of the Medial Meniscus using Novel GAX Prepared Specimens with Innovative Contrast and Formalin-Fixed Cadavers

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Purpose: Detailed descriptions of distal semimembranosus tendon (DST) bony attachments include 3-5 separate dominant arms which impressively attach to the posterior, medial and anterior aspects of the knee region. Contemporary anatomy texts do not emphasize the impressive arsenal of attachments, however, atlases are significantly better. DST attachment into the posterior horn of the medial meniscus (PHMM) is not represented in atlases. DST may be poorly appreciated regarding knee stability. The study objective was to dissect and analyze DST attachments into the PHMM from novel GAX-specimens with MRI and innovative contrast CT imaging versus formalin-fixed cadavers (FFC).

Methods: Literature search was conducted regarding DST attachments into the PHMM from GAX-specimen and FFC studies. Novel GAX-specimens (n=6,12 sides) with innovative contrast CT and MRI imaging and FFC (n=15,26 sides) with knee replacement exclusion criteria were dissected.

Results: Literature search revealed no known GAX-specimen studies. GAX-specimens allowed full range-of-motion of the knee joint unlike FFC. DST attachments could be analyzed during movement before, during and post dissection. Contrast CT and MRI revealed detailed vessels and associated soft tissue structures. Gax-specimen tissues were notably compliant and lifelike vs FFC. GAX-specimens (12/12 sides) and FFC (22/26 sides) revealed DST PHMM attachments. FFC (4/26 sides) were difficult to dissect and analyze due to dehydated tissue and diminished size. Interestingly, GAX-specimens also demonstrated DST attachment into posterior horn of lateral meniscus.

Conclusion: This study revealed GAX-specimen knee tissues are lifelike, provide full range-of-motion and demonstrating consistent attachment into the PHMM. This may improve biomechanic knowledge of the meniscus.

Keywords: Novel Anatomy, Innovative Contrast

A-0971

Single-Cell Analysis Reveals Fibroblast Heterogeneity and Myofibroblast Conversion in Ligamentum Flavum Hypertrophy

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Purpose: The ligamentum flavum (LF) is a crucial structure in maintaining spinal stability; however, hypertrophy of the LF is a significant contributor to lumbar spinal canal stenosis (LSCS). However, the mechanisms linking LFhypertrophy to the exacerbation of LSCS remain incompletely

understood. In this study, we investigated the cellular proportions and signaling pathways observed in the hypertrophied LF using single-cell RNA sequencing (scRNA-seq).

Methods: The LF tissues were obtained from three patients undergoing decompressive surgery at the lumbar level. These patients had been diagnosed with LSCS prior to surgery and had an LF thickness exceeding 4 mm. After single-cell dissociation of the LF tissues, scRNA-seq was performed.

Results: Fibroblasts accounted for 75% of the total cells, followed by endothelial cells, T cells, macrophages, and B cells. Among heterogeneous types of fibroblasts, we identified that a subset of fibroblasts trans-differentiated into myofibroblasts. Two types of macrophages that exhibited phenotypic plasticity akin to M1 and M2 states were observed. We also identified novel signaling pathways involved in fibroblast and immune cell interaction in the hypertrophied LF, such as GAS and GRN, as well as known signaling pathways, such as TGF-β, PDGF, CXCL, and ANGPTL.

Conclusion: Our study highlights the transdifferentiation process from fibroblasts to myofibroblasts in the hypertrophied LF through intrinsic changes in and extrinsic influences of fibroblasts.

Keywords: Ligament flavum, Hypertrophy, Fibroblast, Myofibroblast, Single-cell RNA sequencing

[B. Neuroanatomy and Neuroscience]

A-0098

Oxytocin Increases Itch Sensitivity of Mice in Late Pregnancy and Its Peripheral Receptor Mechanism of Itch-Promoting Effect

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Purpose: Oxytocin (OXT) is secreted in a large amount during the middle and late pregnancy. Except for the regulation of functions related to childbirth, OXT is involved in the regulation of cognition, social behavior, addiction, pain and so on. Our aim is to confirm the increase of OXT content in mice in late pregnancy is the main cause of itch during pregnancy and observe whether exogenously administered OXT can induce or increase itch sensitivity.

Methods: By using morphological, behavioral pharmacological, and ELISA methods.

Results: The results showed that itch sensitivity of mice increased significantly in late pregnancy and basically returned to normal one day after delivery. The number of OXT-positive neurons in PVN and the content of OXT in serum of the late pregnant mice increased significantly, and decreased sharply after delivery. Intradermal injection of low concentration of OXT (0.2 nmol/L) could not induce scratching behavior in mice, but high concentration of OXT (5 nmol/L, 10 nmol/L) could induce scratching behavior and in a dose-dependent manner. Low concentration of OXT could significantly increase the itch sensitivity of histamine. Intradermal injection of oxytocin receptor (OXTR) or arginine vasopressin-1a receptor (AVPR1A) antagonist did not affect histamine-induced scratching behavior, but both could reverse the increase of itch sensitivity in late pregnant mice or the facilitated itch sensitivity by OXT.

Conclusion: Our study suggests that both endogenous and exogenous increases in OXT can increase the body's sensitivity to itch, and even induce itch directly. Pruritus during pregnancy is closely related to the increase of OXT content in vivo. In the periphery, the itch-promoting effect of OXT is mediated by OXTR and AVPR1A.

Funding: This work was supported by the National Nature Science Foundation of China (32171137).

Keywords: Oxytocin, Itch, Late pregnancy, OXTR, AVPR1A

A-0162

Analysis of Olfactory Dysfunction and Associated Non-Coding RNAs in the Olfactory Bulb of High-Fat Diet-Fed Mice

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Purpose: Metabolic imbalance contributes to cognitive impairment, anxiety, depressive behavior, and impaired olfactory perception. As the synaptic signal from the olfactory bulb is directly transmitted to memory consolidation-related brain regions, recent studies have focused on the study of olfactory dysfunction in patients with obesity and diabetes accompanied by cognitive dysfunction.

Methods: In this study, we investigated the transcriptomic change of olfactory bulb in high-fat diet-fed mice compared to that of normal diet-fed mice. We sampled olfactory bulb from high fat diet mice, and performed RNA sequencing, and measured protein levels and mRNA levels in olfactory bulb tissue. Also, we tested cytokine secretion in blood plasma of high fat diet mice.

Results: We found differences in the expression of protein-coding mRNAs and non-coding RNAs involved in insulin, lipid metabolism, neurogenesis, serotonin, dopamine, and gamma-aminobutyric acid-related signaling in the olfactory bulb of high-fat diet-fed mice compared to control mice.

Conclusion: Our analyses suggest diverse targets for the treatment of olfactory dysfunction related to various neuropathologies in patients with metabolic syndrome.

Keywords: Olfactory bulb, High fat diet, RNA sequencing, Non-coding RNAs, CircRNAs

A-0164

Analysis of Lung Cancer and Lung Fibrosis Related Genes in the Lung of High-Fat Diet Mice

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Purpose: Obesity is increasing all over the world and is associated with the incidence of diverse metabolic diseases including diabetes, cardiovascular disease and cancer etc. Recently, many studies have focused on the progression of lung fibrosis and lung cancer in obesity patients. In addition, high-fat fed diet animal studies demonstrated the small airways, reduced nasopharyngeal volume, and pulmonary inflammation, leading to pulmonary dysfunction.

Methods: Therefore, we screened and compared genetic patterns in lung tissue of mouse fed a high fat diet (common obesity mimic mouse model) and those fed a normal diet to investigate the relationship between obesity and lung fibrosis.

Results: Through the RNA sequencing analysis, we found the differences in the expression of lung cancer related genes, and lymphocyte activation related genes. In GO and KEGG pathway data, we found upregulations in the nitrogen compound metabolic process, VEGF signaling, Notch signaling, non-small cell lung cancer and NK-cell mediated cytotoxicity.

Conclusion: In summary, the increased inflammation and lung fibrosis were observed in lung tissue of high fat diet mouse model. Our results may provide the basic information to find critical genetic factors associated with pulmonary dysfunction in obesity.

Keywords: High fat diet, Lung fibrosis, Lung cancer, RNA sequencing, Immune response

A-0236

The Potential of S100B and GFAP as Molecular Biomarkers for Predicting Severity and Progression of Traumatic Brain Injury

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Purpose: Traumatic brain injury (TBI) occurs as a result of a severe head injury caused by an external force during a vehicle accident, fall, domestic violence, or explosion. The existing data shows that approximately 69 million individuals per year will sustain TBI worldwide. In sub-Saharan Africa, the prevalence of TBI is 150–170 per 100 000 individuals. TBI is evaluated clinically according to the Glasgow Coma Scale (GCS), associated with Computed Tomography and Magnetic Resonance Imaging. However, there are many limitations associated with GCS. Therefore, the aim of this study was to investigate the potential of serum S100 calcium-binding protein B (S100B) and Glial Fibrillary Acidic Protein (GFAP) as biomarkers for detection and diagnosis for TBI.

Methods: This pilot study utilized purposive sampling of serum fluid of 78 adult patients with moderate to severe TBI. S100B and GFAP concentrations were determined by multiplex immunoassay technique (ELISA). The data generated were analyzed using Graph pad prism software version 9.00 with P value < 0.05.

Results: There were no significance differences ($P < 0.2162$) between the concentrations of S100B in the moderate TBI compared with control. However, a significant increase in the concentration of S100B was observed in the severe TBI compared with the control ($P< 0.0002$) and moderate ($P< 0.0011$) TBI. The concentrations of GFAP were significantly increased

in the moderate ($p<0.0015$) and severe ($p<0.0083$) categories of TBI as opposed to the control. However, there was no significance difference ($p<0.9999$) between the concentrations of moderate and severe TBI categories.

Conclusion: This finding confirms the significant increased concentration of S100B and GFAP increase the severity and aggravate the progression of TBI. Hence, they can be utilized as biomarkers for better prediction of severity and progression of TBI from moderate to severe categories, combination of these two biomarkers and the GCS system may provide better diagnostic results.

Keywords: TBI, S100B, GFAP, GCS

A-0241

Chlorogenic Acid as a Promising Therapeutic for Multiple Sclerosis: Evidence from an Experimental Autoimmune Encephalomyelitis Model

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Purpose: Chlorogenic acid (CGA), a phenolic compound, is well-documented for its antioxidative, anti-inflammatory, and free radical scavenging properties. Multiple sclerosis (MS), a chronic autoimmune disorder, affects the central nervous system and is characterized by demyelination and neuroinflammation. This study investigated the therapeutic potential of CGA in experimental autoimmune encephalomyelitis (EAE), an animal model that simulates MS.

Methods: We induced EAE in C57BL/6 mice via immunization with myelin oligodendrocyte glycoprotein (35–55) peptide and conducted daily monitoring to record clinical signs, including paraparesis and body weight changes. We performed histological and molecular analyses on spinal cord tissues to evaluate neurodegeneration and neuroinflammation.

Results: Intraperitoneal CGA administration significantly reduced the incidence and severity of EAE paraparesis. Histological analysis showed a significant reduction in inflammatory cell infiltration within the spinal cord parenchyma following EAE induction. CGA treatment substantially downregulated mRNA levels of interleukin (IL)-1β, IL-6, tumor necrosis factor-alpha, and interferon-gamma in the spinal cord tissues. Additionally, CGA treatment resulted in a significant decrease in astrogliosis and microglial/macrophage activation in the spinal cords of EAE mice.

Conclusion: Our findings demonstrate that CGA has a therapeutic effect on EAE by modulating pro-inflammatory cytokines. These results position CGA as a promising pharmacotherapeutic candidate for MS treatment.

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Keywords: Chlorogenic acid, Experimental autoimmune encephalomyelitis, Multiple sclerosis, Neuroinflammation, Pro-inflammatory cytokine

A-0261

Claustral Subregions of Mice Are Preferentially Arborized with the Dendrites and Axons of Parvalbumin- and Somatostatin-Positive GABAergic Neurons

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Purpose: The claustrum is a subcortical nucleus located between the insular cortex and the striatum and is composed

of the core and shell subregions. Although the claustrum coordinates the activities of individual cortical areas through abundant reciprocal connections with the cerebral cortex, the contribution of GABAergic neurons to the circuitry in each subregion remains unclear. We examined the distribution of GABAergic neurons and their dendritic and axonal arborizations within each subregion of mouse claustrum.

Methods: Combining in situ hybridization with immunofluorescence histochemistry, we first investigated the distribution of neuronal nuclei (NeuN)-positive cells expressing glutamic acid decarboxylase 67 kDa isoform (GAD67) mRNA in each subregion. We also examined the proportion of parvalbumin (PV)-, somatostatin (SOM)-, or vasoactive intestinal polypeptide (VIP)-positive neurons in GAD67-expressing neurons. Further, we selectively visualized PV or SOM neurons by injecting recombinant adeno-associated virus vectors into the claustrum of PV- or SOM-Cre knock-in mice. After acquisition of three-dimensional image stacks of optically cleared 1-mm-thick brain slices with confocal microscopy, we reconstructed their dendrites and axons at the single-neuron level.

Results: We demonstrated that about 10% of NeuN-positive cells expressed GAD67 mRNA in both claustral core and shell regions and that PV-, SOM-, or VIP-positive neurons consisted of 20%, 30%, and 10% of claustral GAD67-expressing neurons, respectively. Furthermore, single neuronal reconstruction of PV and SOM neurons revealed that the dendrites and axons of PV and SOM neurons were preferentially localized to their respective subregions where their cell bodies were found. We also showed the axons were preferentially extended in a rostrocaudal direction, whereas the dendrites were relatively isotropic.

Conclusion: PV and SOM neurons preferentially localize the neurites to the claustral subregions, which might contribute to separate information processing within the subregions.

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Keywords: Adeno-associated virus, Claustrum subregion, GABAergic, Single-neuron reconstruction, Tissue clearing

A-0327

Very Low Intensity Ultrasound (VLIUS) Promotes Glymphatic System Clearance to Treat Subacute Phase Intracranial Hemorrhagic Mouse Model

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Purpose: Intracranial hemorrhage (ICH), a common neurological emergency with high mortality, can generate neurotoxic waste, leading to secondary neuronal damage. Unsatisfactory therapeutic outcomes in subacute intracranial hemorrhage are often attributed to challenges in effectively clearing brain waste. Based upon previous findings demonstrating that Very Low Intensity Ultrasound (VLIUS) could promote glymphatic system circulation in normal mice. Therefore, we hypothesis that VLIUS can also enhance ICH mice glymphatic clearance, thereby mitigating secondary neural damage.

Methods: To elucidate our hypothesis, we employed a collagenase-induced intracranial hemorrhage mouse model, divided the mice into three groups: (1) sham; (2) ICH; (3) ICH treated with VLIUS. The mice received VLIUS treatment from day 7 post-ICH induction until day 13 and were sacrificed on day 14. Subsequent analyses involved vibratome sectioning, western blotting, and ELISA to examine glymphatic system drainage, pathological changes, and inflammation cytokines.

Results: From our preliminary observations, impaired glymphatic function, progressing with accumulated iron ions, leading to gliosis, AQP4 depolarization, and microglial activation could be found in the ICH mice. Furthermore, utilizing a fluorescent CSF tracer, we noted a significant increase in glymphatic influx in the VLIUS treated groups. In general, injecting a tracer in sham groups, it usually moves both forward and backward. However, in the VLIUS treated group, there is a tendency for forward flow of the tracer. The free iron precipitation and surrounding astrocyte activation exhibited were also observed at trauma area. Additionally, our results indicated a gradual reduction in the necrotic area with staining of Luxol fast blue. The current findings suggest that Very Low Intensity Ultrasound (VLIUS) can indeed modify the direction of glymphatic system influx and efflux, and gradually mitigating the damage caused by neuroinflammation.

Conclusion: This study presents a potential strategy for

future ICH treatments and simultaneously demonstrates the alteration of the glymphatic system circulation through ultrasound stimulation.

Funding: NTSC 112-2320-B-002-036 from National Science and Technology Concil, Taiwan.

Keywords: Intracranial hemorrhage (ICH), Glymphatic system, Ultrasound treatment, Neuroinflammation

A-0346

Febrile Seizure in Infants Underlies Endophenotypes of Autism Spectrum Disorder in Rats

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Purpose: Febrile seizure (FS), which occurs as a response to fever, is the most common seizure that occurs in infants and young children. FS is usually accompanied by diverse neuropsychiatric symptoms, including impaired depression, anxiety, sleep disturbances, attention deficit, cognitive impairment; however, research on neuropsychiatric disorders and hippocampal inflammatory changes following febrile seizure occurrences is very limited. Here, we pro-vide evidence linking FS occurrence with ASD pathogenesis in rats.

Methods: We inducted febrile seizures through a mercury vapor lamp using infantile rats (postnatal 11 days). At 3 weeks after FS induction, we examined behavioral tests and immunostaining to identify the association of ASD-like phenotype development with inflammatory damage.

Results: We developed an FS juvenile rats model and found ASD-like abnormal behaviors including deficits in social novelty, repetitive behaviors, and hyperlocomotion. In addition, FS model juvenile rats showed enhanced levels of gliosis and inflammation in the hippocampal CA2 region and cerebellum.

Conclusion: These findings suggest that the inflammatory response triggered by febrile seizures in young children could potentially serve as a mediator of social cognitive impairments akin to autism spectrum disorder.

Funding: This research was supported by the National Research Foundation of Korea (NRF) funded by the Korea government (NEST) (NRF-2017R1D1A1B05036195 and RS-2023-00245605).

Keywords: Hyperthermic seizure, Epilepsy, Autism-like behavior, Inflammation, FEPSP

A-0408

Potential Neural Substrates of Parkinson's Disease and Clinical Outcomes

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Purpose: We aimed to investigate functional differences in spontaneous brain activity between Parkinson's disease (PD) and healthy control (HC). Then, we sought to identify the neural substrates that distinguish PD from HC by conducting seed-based functional connectivity (FC) analysis. Finally, we attempted to identify specific symptom-related brain regions using clinical outcome.

Methods: We compared the zfALFF maps between 50 PD patients and 24 HC groups, adjusting for age and sex. Then, we created a sphere of 3 mm radius centered on the significant regions from previous zfALFF analysis to conduct seed-based FC analysis. We compared the zFC of seed regions maps between two groups. We performed logistic regression analysis to distinguish PD from HC using zFC values, age, and sex as predictors. Finally, we conducted voxel-wise correlation between zfALFF maps and clinical outcomes (All significance level was Gaussian Random Field (GRF) corrected voxel $p<0.001$, cluster $p<0.05$).

Results: In the zfALFF analysis, the right cerebellum Crus2 areas are significant regions between two groups. Then, zFCs of the cerebellar regions with right parahippocampal gyrus, parietal and frontal regions showed significant differences between the two groups. In the logistic regression model, the accuracy of 0.93, a specificity of 0.88, a sensitivity of 0.96 and the AUC of 0.98 was shown. The zfALFF values in the right precentral gyrus showed a significant positive correlation with mean DCL, while the zfALFF values in the left precuneus showed a significant negative correlation with mean DCL. The zfALFF values in the right superior temporal gyrus showed a significant positive correlation with the mean EPE.

Conclusion: The connectivity between right cerebellar regions with parahippocampal gyrus, right parietal, and left frontal areas could be the potential neural substrates of PD.

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Keywords: Parkinson's disease, Postural instability and gait disturbance, FMRI, Functional connectivity, FALFF

A-0418

Exercise Alleviates Cognitive Dysfunction and Neurological Deterioration following Transient Global Cerebral Ischemia Reperfusion in Mongolian Gerbils

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Purpose: Stroke is one of the leading causes of death and disability worldwide. Ischemic stroke occurs when blood vessels are blocked that is the most common type of stroke. Global ischemia causes neuronal cell death in the CA1 region of the hippocampus. These damage can lead to cognitive impairment in rodents, primates, and humans. Exercise is known to have neuroprotective and cognitive benefits, particularly pertaining to memory and learning related processes. In this study, we investigated the potential therapeutic effects of exercise on cognitive impairment and nervous system damage following transient global ischemic reperfusion.

Methods: Exercise of gerbil was performed for 2 hours every day for 4 weeks before surgery. Gerbil performed behavior test 4 days after transient global cerebral ischemia reperfusion (tGCI/R).

Results: Through novel object recognition tests, Y-maze, and Barnes maze assessments, cognitive phenotypic outcomes revealed a decrease in cognitive function in the tGCI/R gerbils, whereas an improvement in cognitive function was observed in the exercise gerbils. In tGCI/R gerbils, there was an increase in the expression of positive glial cells for glial fibrillary acidic protein and S100 calcium-binding protein B, whereas in exercise gerbils, the expression of glial cells decreased. These histological changes demonstrate that exercise has cognitive and neuroprotective effects following tGCI/R.

Conclusion: Therefore, these results indicate that regular exercise may prevent cognitive and neurological deterioration and sequelae following global cerebral ischemia.

Funding: This research was supported by the National Research Foundation of Korea (NRF) funded by the Korea government (NEST) (NRF-2017R1D1A1B05036195 and RS-2023-00245605).

Keywords: Ttransient global ischemia, Exercise, Ischemic reperfusion, Cognitive sequelae, Neuroprotection

A-0429

Alpha-Lipoic Acid Reduces Iron-Dependent Ferroptosis Caused by Ultrafine Particulate Matters in the Mouse Substantia Nigra Pars Compacta

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Purpose: Recent studies have raised a potential link between exposure to fine particulate matter and an increased risk of Parkinson's disease (PD) through mechanisms including iron accumulation and ferroptosis in dopaminergic neurons. This study aims to further understand these mechanisms by investigating the effects of ultrafine diesel exhaust particles (ufDEPs) on iron accumulation and ferroptosis in the substantia nigra pars compacta (SNc), and the potential protective role of alpha-lipoic acid (ALA).

Methods: We nasally exposed ufDEPs (20 ul, 0.4 mg/ml) to mice twice a day at 12 h intervals for 7 consecutive days and intraperitoneally injected ALA solution (70 mg/kg) once a day for 7 consecutive days.

Results: Immunohistochemistry and Western blot analyses revealed a significant decrease in TH-positive neurons and TH expression in the SNc following ufDEP exposure, which was ameliorated by ALA treatment. Iron reactivity was significantly increased in the SNc but was reduced to control levels with ALA treatment. Furthermore, levels of malondialdehyde, 4-hydroxynonenal, and 8-hydroxy-2'-deoxyguanosine, indicators of reactive oxygen species generation and lipid peroxidation were significantly elevated in the SNc of the DEP group. These effects were notably mitigated in the DEP+ALA group. Exposure of ufDEPs reduced total antioxidant capacity and

glutathione peroxidase 4 levels, which were significantly improved with ALA treatment.

Conclusion: These results collectively suggest that ufDEP exposure leads to iron-dependent ferroptosis of dopaminergic neurons in the SNc, exacerbating PD pathology. ALA's ability to attenuate these changes by restoring TH expression, reducing iron accumulation, and improving antioxidant capacity provides evidence for its potential therapeutic value in mitigating ufDEP-induced neurodegeneration.

Funding: This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (2020R1I1A3073717, 2021R1I1A3043435).

Keywords: Parkinson's disease, Ultrafine diesel exhaust particle, Ferroptosis, Alpha-lipoic acid

A-0482

Intermittent Fasting Attenuates Neuroinflammation and Cognitive Impairment in High-Fat Diet-Fed Diabetic Mice

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Purpose: Intermittent fasting (IF), an alternating pattern of dietary restriction, reduces obesity-induced insulin resistance and inflammation. However, the crosstalk between adipose tissue and the hippocampus in diabetic encephalopathy is not fully understood. Here, we investigated the protective effects of IF against neuroinflammation and cognitive impairment in high-fat diet (HFD)-fed mice.

Methods: For address this study, we measured metabolic parameters and performed histological analyses, Western blot, immunofluoresence, and Morris Water Maze test.

Results: Histological analysis revealed that IF reduced crown-like structures and adipocyte apoptosis in the adipose tissue of HFD mice. In addition to circulating lipocalin-2 (LCN2) and galectin-3 (GAL3) levels, IF reduced HFD-induced increases in LCN2- and GAL3-positive macrophages in adipose tissue. IF also improved HFD-induced memory deficits by inhibiting blood-brain barrier breakdown and neuroinflammation. Furthermore, immunofluorescence showed that IF reduced HFD-induced astrocytic LCN2 and microglial GAL3 protein expression in the hippocampus of HFD mice.

Conclusion: These findings indicate that HFD-induced adipocyte apoptosis and macrophage infiltration may play a critical role in glial activation and that IF reduces neuroinflammation and cognitive impairment by protecting against blood-brain barrier leakage.

Keywords: Intermittent fasting, Neuroinflammation, Cognitive impairment, High-fat diet

A-0528

The Potential of S100B and GFAP as Molecular Biomarkers for Predicting Severity and Progression of Traumatic Brain Injury

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Purpose: Traumatic brain injury (TBI) occurs as a result of a severe head injury caused by an external force during a vehicle accident, fall, domestic violence, or explosion. The existing data shows that approximately 69 million individuals per year will sustain TBI worldwide. In sub-Saharan Africa, the prevalence of TBI is 150–170 per 100 000 individuals. TBI is evaluated clinically according to the Glasgow Coma Scale (GCS), associated with Computed Tomography and Magnetic Resonance Imaging. However, there are many limitations associated with GCS. Therefore, the aim of this study was to investigate the potential of serum S100 calcium-binding protein B (S100B) and Glial Fibrillary Acidic Protein (GFAP) as biomarkers for detection and diagnosis for TBI.

Methods: This pilot study utilized purposive sampling of serum fluid of 78 adult patients with moderate to severe TBI. S100B and GFAP concentrations were determined by multiplex immunoassay technique (ELISA). The data generated were analyzed using Graph pad prism software version 9.00 with P value < 0.05.

Results: There were no significance differences ($P < 0.2162$) between the concentrations of S100B in the moderate TBI compared with control. However, a significant increase in the concentration of S100B was observed in the severe TBI com-

pared with the control (P< 0.0002) and moderate (P< 0.0011) TBI. The concentrations of GFAP were significantly increased in the moderate (p<0.0015) and severe (p<0.0083) categories of TBI as opposed to the control. However, there was no significance difference (p<0.9999) between the concentrations of moderate and severe TBI categories.

Conclusion: This finding confirms the significant increased concentration of S100B and GFAP increase the severity and aggravate the progression of TBI. Hence, they can be utilized as biomarkers for better prediction of severity and progression of TBI from moderate to severe categories, combination of these two biomarkers and the GCS system may provide better diagnostic results.

Keywords: TBI, S100B, GFAP, Serum, Biomarkers

A-0529

Evaluating Olive Flounder By-Product Prozyme2000P Hydrolysate for Ferroptosis Inhibition and Retinal Protection in Age-Related Diseases

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Purpose: This study explores the potential of olive flounder by-products (OFBP) as an eco-friendly and novel strategy to inhibit ferroptosis in the aging retina, addressing retinal degeneration associated with aging. Ferroptosis, characterized by iron-dependent lipid peroxide accumulation and cellular membrane damage, significantly contributes to the deterioration of retinal cells. The study aims to uncover the therapeutic potential of OFBP in combating this form of cell death, offering implications for environmental sustainability and healthcare.

Methods: Utilizing robust in vitro and in vivo models, this research investigated the efficacy of OFBP in restoring key ferroptosis-related markers. The study specifically examined the effects of OFBP on ARPE-19 cells treated with Sodium iodate (SI) to induce ferroptosis, focusing on markers such as cell death, lipid peroxidation, iron accumulation, and ferritin protein expression. Additionally, the research assessed the impact of oral administration of OFBP in an aged mouse model to evaluate its potential in mitigating age-related pathophysiological characteristics.

Results: The administration of olive flounder by-products (OFBP) notably reversed markers associated with ferroptosis in retinal pigment epithelial (ARPE-19) cells and alleviated age-dependent pathological features in aged mouse. This evidence indicates that OFBP, obtained through the sustainable processing of aquaculture waste, possesses promising capabilities as an active component in medical formulations, especially targeting the prevention of retinal degeneration via the inhibition of ferroptosis.

Conclusion: The study provides valuable insights into the role of ferroptosis in retinal degeneration and introduces OFBP as a promising therapeutic approach for its prevention. Highlighting the dual benefits of environmental sustainability and health improvement, this research paves the way for future studies to further explore the mechanisms behind OFBP's protective effects and its application in other ferroptosis-characterized conditions.

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Keywords: Ferroptosis, Olive flounder by-products, Retinal pigment epithelial cells, Aging

A-0546

Phase 1 Clinical Trial: Safety and Feasibility of Thrombin-Preconditioned Wharton Jelly-Derived Mesenchymal Stem Cells (Th. WJ-MSCs) for Prophylactic Therapy in Neonatal Brain Injury (HIE and IVH)

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Purpose: Stem cell research holds promise for alleviating neonatal brain injury, particularly in Hypoxic-Ischemic En-

cephalopathy (HIE) and Intraventricular Hemorrhage (IVH) treatment. Our prior findings demonstrated the therapeutic potential of thrombin preconditioned human Wharton jelly-derived MSC cells (Th. WJ-MSCs) in animal models of IVH and HIE. To translate these results, we conducted a phase 1 clinical trial to assess the safety and feasibility of Th. WJ-MSCs prophylactic therapy in newborns with HIE/IVH-related brain injuries.

Methods: Approval for a phase 1 clinical trial (KCT0004851) was obtained to assess the safety and feasibility of Th. WJ-MSCs in treating two neonatal brain disorders, HIE and IVH, due to their similar injury mechanisms. For HIE, neonates with moderate to severe HIE, undergoing hypothermia therapy within 6 hours of birth, gestational age ≥36 weeks, and birth weight >1,800 grams were included. After 72 hours of hypothermia therapy, a single intraventricular injection of Th. WJ-MSCs (5×10^6 cells/kg - 1×10^7 cells/kg) was administered within 72 hours post-treatment. For IVH, neonates diagnosed within 7 days post-IVH, with gestational age between 23 and <34 weeks, and grade 3-4 IVH were included. Primary outcomes, evaluating safety and feasibility, were assessed at NICU discharge and through short-term follow-ups at 12 weeks and 6 months.

Results: The intracerebroventricular transplantation of Th. WJ-MSCs via an anterior fontanelle tap in 9 newborns within the first 2 weeks after birth was well-tolerated. No serious adverse events or dose-limiting toxicity related to Th. WJ-MSCs were observed. One patient experienced CSF leakage after a fontanelle tap, which resolved within a day without infection. Importantly, no infants died in this phase 1 clinical trial, and no dose-limiting toxicity, defined as death within 6 hours or anaphylactic shock, was recorded.

Conclusion: Intracerebroventricular transplantation of allogeneic Th. WJ-MSCs in the newborn infants including preterm infants was safe and feasible.

Keywords: WJ-MSCs, Phase 1 Clinical Trial, HIE, IVH

A-0582

High-Fat Diet Impaired Microglial Metabolism and Phagocytic Activity in the Brains of AD Mice and Aggravated Disease Progression

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Purpose: Alzheimer's disease (AD) is a neurodegenerative disease, and there are reports that high-fat diet (HFD) may be one of its causes, but specific mechanism remains to be explored. Microglia are thought to play a protective role in the AD brain by engulfing its disease-causing protein Aβ. Previous studies showed that excessive accumulation of lipid droplets (LDs) in aging microglia leads to impairment of their phagocytic activity, suggesting a correlation between microglial metabolism and function. Therefore, this study aims to explore the effect of HFD on the metabolism and function of microglia in the AD brain.

Methods: In vivo, we fed APP^{NL-G-F} knock-in AD model mice with a HFD or a ND, and took the cerebral cortex for lipidomic analysis. We also performed immunostaining to analyze Aβ plaque formation, microglia aggregation and lipid droplets accumulation. And, isolated microglia were used to study the expression of the phagocytosis-related gene Trem2. In vitro, we used OA-treated microglia for phagocytic activity assay and RNA sequence.

Results: We found that HFD feeding significantly increased the deposition of Aβ plaques in the cerebral cortex and hippocampus of APP mice, and significantly reduced the dense plaques formed by microglia compression and the number of microglia gathered around the plaques. Moreover, the results of lipid composition analysis and staining results showed that HFD significantly increased esterified cholesterol in the cerebral cortex and stored it in the form of lipid droplets in microglia. Finally, we found that in vitro OA treatment led to excessive accumulation of LD in microglia and down-regulated the expression of a series of genes related to immune response, phagocytosis, and lipid metabolism.

Conclusion: A HFD may alter the lipid metabolism of microglia in APP mice brain and impair their phagocytic function, thereby aggravating the pathological manifestations of AD.

Keywords: Alzheimer's disease, Microglia, Metabolism, Neurodegenerative disease, Fatty acids

A-0583

Structural Plasticity of the Synaptic Elements Associated with C Afferent Terminals in the Medullary Dorsal Horn in a Rat Model of Craniofacial Inflammatory Pain

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Purpose: The nociceptive C afferents and their target neurons in the spinal dorsal horn exhibit extensive functional changes in the pathologic pain state. However, little is known about the structural remodeling of synapses of C afferents that may underlie long-term maintenance of these functional changes.

Methods: To address this issue, we used a model of inflammatory pain following injection of complete Freund's adjuvant (CFA) into the rat vibrissa pad. After 4 days (CFA 4-day group) and 21 days (CFA 21-day group) when the thermal hyperalgesia is severe and has recovered, respectively, we examined calcitonin gene-related peptide (CGRP)-immunopositive (+) and isolectin-B4+ (IB4+) axon terminals (boutons) and their postsynaptic dendrites and presynaptic endings in the medullary dorsal horn, using quantitative immuno-electron microscopy of serial sections.

Results: In both CGRP+ and IB4+ boutons, 1) frequency of boutons forming synapse with dendritic spine, 2) the ultrastructural parameters correlated with synaptic strength including bouton volume and mitochondrial volume, and spine head volume and postsynaptic density area increased significantly in the CFA 4-day group, compared to control. The fraction of IB4+boutons receiving axoaxonic synapses and the number density of the GAD65/67+ boutons, which are implicated in pre- and post-synaptic inhibition, decreased significantly in the CFA 4-day group, compared to control. All the structural changes in the synapse of CGRP+ and IB4+ boutons in the CFA 4-day group were no longer present in the CFA 21-day group.

Conclusion: The structural changes following inflammation may represent the morphological basis for the development and long-term maintenance of craniofacial inflammatory pain.

Keywords: C afferent synapse, Pathologic pain, Structural change

A-0621

Analysis of Ia Afferent Projections and Perineuronal Net Formation on Motoneurons and Chx10-Positive V2a Interneurons after Complete Spinal Transection in Neonatal and Juvenile Rats

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Purpose: Complete spinal transection (ST) at the thoracic level in adult rats results in poor recovery of hindlimb motor function, whereas spontaneous recovery can occur after ST in neonates, in which primary afferent projections to the lumbar cord are enhanced after ST. However, the precise mechanisms have yet to be known. In the present study, rats that underwent ST on postnatal day 5 (P5ST group) and day 20 (P20ST group) were used to examine parvalbumin-positive Ia afferent terminals on motoneurons, and on Chx10-positive V2a interneurons, a part of the center pattern generator (CPG), and the perineuronal net formation around these neurons 2 weeks after ST.

Methods: Neonatal (P5) and juvenile rats (P20) received spinal transection at 10th thoracic level under isofluran anesthesia. The rats were perfused with 4% paraformaldehyde 2 weeks after ST. Cryosections of 5th lumbar cord were performed for immunohistochemistry.

Results: The number of parvalbumin-positive terminals on motoneurons significantly increased in both the P5ST and P20ST groups. The number of parvalbumin-positive terminals on Chx10 neurons tended to increase in both the P5ST and P20ST groups. PNN formation around Chx10 neurons was significantly increased in the P20ST group, but not in the P5ST group.

Conclusion: These findings suggest that increased Ia afferent projections to both motoneurons and Chx10 neurons contribute to the recovery of hindlimb motor activity in the

P5ST group, while increased PNN formation around the CPG causes failure of motor recovery in the P20ST group.

Keywords: Spinal cord injury, Perineuronal nets, Primary afferent, Motoneurons, Central pattern generator

A-0626

Isolated Microvessels from Aged Brain Show Age-Related Cerebrovascular Alteration

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Purpose: Normal aging is accompany by cerebrovascular alteration such as reduced cerebral blood flow (CBF) and changes in molecular and morphological vasculature. Small vessels such as microvessels also altered during aging mainly known for a reduction in their number. Reduction of microvessel density decreases the level of microcirculation, which plays a major role in degenerative cerebrovascular diseases including normal aging. In this study, we show that age-related decreased CBF and alterations of vasculature from the pial to the microvessel.

Methods: In this study, we analyzed cerebral blood flow (CBF) and morphology of brain pial vasculature using indocyanine green (ICG). Three-dimensional vascular analysis was conducted to evaluate vasculature and density using microfil. We evaluated cerebrovascular alteration at the level of single microvessel using isolation method. Isolated brain microvessels were analyzed at histological and molecular levels using immunofluorescent staining and western blotting.

Results: In aging mice, a decrease in CBF and an increase in morphological alterations compared to young mice. In particular, we observed string and atrophic vessels at the level of internal small vessels and decreased in microvascular density in aging mice. In aging mice decreased in the total proteins and density of brain microvessels and increased in morphological alterations of atrophic and string vessels as shown by decreased diameter. At the molecular level, vascular stability-related proteins eNOS and Tie2 expression decreased in aged microvessels.

Conclusion: Our study shows that age-related morphological alteration increases at the level of single microvessels and is associated with decreased expression of microvascular eNOS and Tie2 as related underlying molecular mechanisms.

Funding: This work was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) [Grant no. NRF-2022R1F1A1061216].

Keywords: Aging, Microvessel, Cerebrovasculature, Brain

A-0660

Simvastatin Had a Barrel-Specific Neuroprotective Effect Against Alcohol-Induced Damage of the Somatosensory Posterior Medial Sub-Field Barrels of Adolescent Mice

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Purpose: Alcohol is commonly used and abused by adolescents. The rising prevalence of alcohol-related diseases and disabilities and governmental costs, necessitates investigating interventions that could protect neurons against alcohol-related damage. Alcohol causes neurodevelopmental, neurobehavioral, neurocognitive, and social problems due to the negative effects of chronic use on the structure and function of neurons. The antioxidant properties of Simvastatin, an FDA–approved drug for lowering blood cholesterol levels, seem promising in preventing neurodegeneration. We evaluated the effect of Simvastatin on the sizes of the posterior medial barrel sub-field (PMBSF) of the somatosensory cortex and on the morphometry of the sciatic nerve of adolescent mice that were administered alcohol.

Methods: Four–week old C57BL/6J male and female mice were administered 20% alcohol (i.p.), 5 or 10 mg/kg Simvastatin orally followed by 20% alcohol (i.p.) or the controls (i.e. 5 mg/kg Simvastatin only or non-treated) for 28 consecutive days. The sizes of the 27–PMSBF barrels and the morphometry of the sciatic nerve were assessed.

Results: Alcohol did not significantly reduce the mean areas of the PMBSF barrels, enclosure, or septal portion in both sexes. However, the barrel-to-barrel comparison revealed alcohol toxicity on specific barrels in specific rows and arcs of the PMBSF barrels. Both concentrations of Simvastatin were effec-

tive against alcohol–induced damage on those specific barrels. For the sciatic nerves, the axonal density and myelination were significantly affected by alcohol in both sexes and Simvastatin was also effective against the onset of alcohol nerve damage.

Conclusion: These observations may explain the reasons for the sensory-motor delays often seen in alcoholics owing to the delay in sensing, relaying, processing, and interpreting sensory information. Simvastatin seems to have the ability to protect against the damaging effect of alcohol and this may be beneficial in reducing the prevalence of alcohol-related diseases or disabilities, especially in adolescents that are prone to abusing alcohol.

Funding: South African Medical Research Council (SAMRC) National Research Fund (NRF).

Keywords: Alcohol, Simvastatin, Somatosensory cortex, Barrel cortex, Sciatic nerve

A-0671

Exploring Human Brain Stem Cytoarchitecture using Scanning Acoustic Microscopy

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Purpose: The Scanning Acoustic Microscope (SAM) presents a superior imaging capability compared to conventional sonograms. This study delves into exploring the cytoarchitecture of the human brain stem utilizing SAM technology.

Methods: Brain stems from eight cadavers donated to Korea University College of Medicine were procured for the study after IRB approval. Sections of 5 mm thickness were meticulously prepared, with a focus on representative slices from the midbrain, pons, and medulla oblongata. These slices were subjected to SAM (KSI-SAM V8, Kramer Sonic Industries, Germany) imaging under conditions set at 50 ns and 1000 px. The acquired data underwent reconstruction by amalgamating the sharpest parts from 3-5 images using Panfocal 3D software.

Results: SAM revealed the cytoarchitecture of each slice by leveraging differential diffraction characteristics based on the slice components, such as the ratio of white matter to gray matter and the object's orientation about the ultrasound. Notable structures identified included the cerebral peduncle, substantia nigra, red nucleus, medial lemniscus, periaqueductal gray matter, and CN III in the midbrain; the locus coeruleus, pontine nucleus, and corticospinal tract in the pons; and the inferior cerebellar peduncle, inferior olivary nucleus, pyramid, and CN X/XII structures in the medulla oblongata.

Conclusion: SAM's ability to capture time-lapse images facilitates three-dimensional reconstruction of relatively thick specimens without the need for pre-treatment or sectioning, as is customary in light microscopic investigations. This underscores its potential for conducting in-depth analyses of the cytoarchitecture of the brain stem.

Funding: This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT).

Keywords: Scanning Acoustic Microscopy, Brain Stem, Cytoarchitecture, Panfocal 3D software

A-0783

Physical Exercise Improves Working Memory in Early-Life Adversity Mice

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Purpose: The formation of working memory relies on neuronal structures and synaptic function. Based on early-life adversity (ELA) mice, we investigated the effects of physical exercise on working memory in the prelimbic cortex (PrL).

Methods: During P2-P9, a sensitive developmental period, we utilized restricted materials interfering with dam-pup interactions to construct ELA mice. They were trained to voluntary wheel running for 5 months with a frequency of 1 hour per day and 5 days per week. After the running, working memory was assessed through T-maze-based tasks including spontaneous and reward alternation tasks. The better-performing mice were used Golgi staining, western blotting, immunohistochemistry, and fluorescent immunostaining to detect neuronal structures and synaptic function.

Results: Running prevented ELA-induced loss of thin and mushroom-type spines of prelimbic pyramidal cells in layers II-III and V-VI. Reduced postsynaptic density protein 95 (PSD-95) in ELA mice supports the selective loss of spines in

PrL, and this effect can be prevented by physical exercise. Importantly, consistent results were observed between working memory performance and loss of spines as well as the expression of PSD-95 in the prelimbic cortex by ELA or physical exercise.

Conclusion: Prolonged running may improve working memory by increasing the number and function of synapses.

Keywords: Physical exercise, Prelimbic cortex, Working memory, Early-life adversity, Dendritic spines

A-0784

Physical Exercise Improves Hippocampal Spatial Memory in 3xTg-AD Mice

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Purpose: Physical exercise improves cognitive function in AD patients, but the exact mechanism is poorly understood. We investigated the effects of long-term physical exercise on memory performance and potential synaptic mechanisms in 3xTg-AD mice.

Methods: 6-month-old male 3xTg-AD and C57 mice were trained to run wheels for 5 months (5 times per week and 1 hour each time). We tested the mice's memory via object recognition and novel location recognition tasks. Morphometric analysis of hippocampal pyramidal cells was performed using the Golgi impregnation test to verify the changes of dendritic and dendritic spines. Additionally, we investigated the correlation between spatial memory performance and dendritic spines, synapses, synaptic proteins as well as beta-amyloid (Aβ) plaque deposition.

Results: The consistent results were observed between improved memory performance and increased dendritic spine densities, upregulated expression of synaptic proteins as well as downregulated the processing of the amyloid pathology. In 3xTg-AD mice, physical exercise delayed regression of dendritic spine on CA1 neurons including thin and mushroom-type spines. Nevertheless, the effects of physical exercise were limited to thin spines in C57 mice.

Conclusion: Prolonged physical exercise effectively improved memory in preclinical AD patients by slowing down the deposition of amyloid beta and preserving synaptic connections.

Keywords: Physical exercise, Hippocampal, Memory, AD, Dendritic spines

A-0785

Microglia-Derived C1q is Essential for Myelination in the Central Nervous System (CNS)

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Purpose: Myelination in the central nervous system (CNS) is orchestrated by oligodendrocytes. It provides essential insulation for axons and is critical for efficient action potential conduction. Disruptions in myelination have been implicated in neurological disorders such as leukodystrophies and multiple sclerosis. Although microglia, the CNS-resident macrophages, are believed to influence myelin development, their specific contributions remain ambiguous. This research aims to elucidate the role of microglia-derived C1q in myelin development.

Methods: We developed a microglia-free in vitro myelination system and a C1q conditional knockout mouse model to test the role of C1q in myelination.

Results: In a microglia-free cell culture model, we demonstrated that oligodendrocytes could not myelinate axons. In contrast, adding a microglia-conditioned medium to the cell culture induced substantial myelination. We found that removing C1q from the microglia-conditioned medium resulted in a myelination failure while adding a native C1q protein was sufficient to induce myelination. Notably, the expression of C1q in the mouse brain coincided both temporally and spatially with myelination during brain development. Further observation in the conditional knockout mice (C1qa FL/FL: Cx3cr1 CreER) revealed that the C1q deficiency decreased myelin thickness and increased g-ratio during initial myelination. Interestingly, the C1q deficiency did not impact the production of myelin but disrupted the association between myelin and axons.

Conclusion: Microglia-derived C1q is essential in CNS myelination. This discovery could potentially offer novel insights into the treatment of demyelinating diseases.

Funding: Canadian Institute of Health Research.

Keywords: C1q, Microglia, Myelination, Oligodendrocyte, Axon

A-0792

The Function of Enteric Glial Cells in Intestinal Homeostasis: Activation of GABABR Mediates Enteric Glial Cells Polarization and Autophagy to Exert Anti-Inflammatory and Anti-Bacterial Effects

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Purpose: Enteric glial cells (EGCs) exhibit plasticity to maintain intestinal homeostasis by regulating cellular functions in pathological conditions such as inflammation or bacterial infection, but the exact mechanisms remain to be further elucidated. The γ- aminobutyric acid (GABA) signaling system attenuates brain damage by regulating glial cell polarization and autophagy. However, little is known about the roles of GABAB receptor (GABABR) signaling in intestinal injury. The present study aimed to investigate the effects and mechanisms of EGCs polarization and autophagy mediated by GABABR in intestine inflammation.

Methods: We established lipopolysaccharide (LPS)- or Enterotoxigenic Escherichia coli K88 (ETECK88)-induced inflammation models in mice intestine and EGCs to explore the role of EGCs in the regulation of intestinal homeostasis.

Results: We found EGCs were GABAergic and GABAceptive cells. EGCs exposed to LPS expressed immune-related molecules including CD80, MHC II, and iNOS acting as E1 phenotype, whereas GABABR activation strongly promoted EGCs polarization into E2 phenotype, mainly expressing Arg1 and CD206. Notably, activation of GABABR mitigated intestinal damage through facilitating EGCs to transform into E2 phenotype and inhibiting NF-κB pathway in LPS- induced mice. Next, we observed alterations of EGCs phenotype and autophagy in both mice intestine and EGCs infected with ETECK88. Moreover, activating autophagy of EGCs significantly depressed bacterial burdens, whereas inhibitors pretreatment showed contrary tendency. Interestingly, GABABR activation notably increased Beclin 1 and LC3 levels, thus promoting autophagy activation and enhancing antimicrobial responses for EGCs against ETECK88 infection. Furthermore, myeloid differentiation factor 88 (MyD88) was indispensable for the activation of EGCs autophagy, which was proved on the base of inhibition or overexpression of MyD88.

Conclusion: These data indicate that EGCs could maintain intestinal homeostasis by attenuating inflammatory responses and resisting bacterial infection via polarization and autophagy pathways, and GABABR involves in the regulation of EGCs function, which offer important targets for developing new treatments of intestinal diseases.

Funding: National Natural Science Foundation of China (31772686) and Beijing Municipal Natural Science Foundation (6232021).

Keywords: Intestinal inflammation, Enteric glial cells, GABABR, Polarization, Autophagy

A-0840

First Glimpse! A Novel Method for Postmortem Dissection and Macroscopic Viewing of the Newly Discovered Meningeal Layer in the Human Brain

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Purpose: A recent study demonstrated the presence of an additional leptomeningeal layer in mice and human brains using advanced microscopic methods. This new layer is described as a thin but impermeable membrane between the arachnoid and pia mater, thus dividing subarachnoid space (SAS) containing cerebrospinal fluid (CSF) in two functional compartments. Despite having substantial clinical importance, the neuroanatomical approaches and macroscopic viewing of

this meningeal layer, especially in the human brain, are still a lacuna in the literature.

Methods: The fresh postmortem (n=23), 10% formalin-fixed cadaveric (n=5), and fetal (n=5) human brain specimens were retrieved using standard operative procedures and dissected in situ. The step-by-step dissection procedure was video recorded. In addition, postmortem/cadaveric and fetal specimens of the human spinal cord were also examined. Further tissue samples were retrieved from the fresh postmortem brains for histological analysis, immunohistochemistry, and scanning electron microscopic (SEM) viewing.

Results: A standard dissection protocol was devised to approach the new meningeal layer in postmortem human brains. The presence of an intermediate leptomeningeal layer between the arachnoid and pia mater was confirmed in all dissected specimens. It appeared as a thin, translucent, glistening membrane. It entered into major cerebral sulci and seemed to create a perivascular sheath around the passing vessels. The histological, immunohistochemical, and SEM analysis validated the new meningeal layer's nonporous and predominantly cellular structure. An intermediate leptomeningeal layer was also noted in the spinal cord.

Conclusion: The study enables neuroanatomical approaches and macroscopic viewing of the newly discovered meningeal layer in the human brain. The findings may help develop new neurosurgical diagnostic/operative procedures and train medical graduates.

Funding: AIIMS-Patna.

Keywords: Subarachnoid space, CSF, Human brain, Spinal cord, Intermediate leptomeningeal layer

A-0845

QDs-ADSC-Exos Exhibit Metabolic Differences in Different Peripheral Nerve Injuries

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Purpose: To investigate the metabolic differences of adipose-derived stem cell exosomes labeled with quantum dots (QDs-ADSC-Exos) in repairing different peripheral nerve injuries using the second near-infrared (NIR-II) fluorescence imaging.

Methods: A NIR-II fluorescence imaging strategy based on glucose-conjugated quantum dots (QDs- Glu) was employed to target and track ADSC- Exos in rat models of femoral nerve injury and sciatic nerve injury. The femoral and sciatic nerve crush injury model were created in SD rats. An equal dosage of QDs- ADSC-Exos was administered near the proximal site of the injury, with subsequent NIR-II imaging conducted at different time points postoperatively: immediately, and at 1, 3, 5, and 7 days. Additionally, the labeled exosomes were injected subcutaneously into the backs of nude mice for a 21-day continuous NIR-II imaging period.

Results: The QDs-ADSC-Exos have been demonstrated to be stable in vivo for over 21 days. Distinct spatiotemporal distribution patterns of the QDs-ADSC-Exos were observed in the repair of femoral and sciatic nerve injuries. Compared to sciatic nerve crush injury, a significant decrease in fluorescence intensity postoperatively was noted in the femoral nerve crush injury, indicating a disparity in the metabolism of exosomes involved in the repair process of these nerves.

Conclusion: The study suggests that QDs-ADSC-Exos exhibit different metabolic behaviors in different peripheral nerve injuries, which may be attributed to the distinct neural metabolic environments. This finding implies that the efficacy of exosomes in nerve repair could vary depending on the specific nerve injury, highlighting the need for personalized treatment approaches tailored to different types of peripheral nerve injuries.

Funding: National Natural Science Foundation of China (82371373).

Keywords: Exosomes, Peripheral nerve injury, NIR-II, In vivo imaging, Real-time imaging

A-0846

Disfunction of Dorsal Raphe Nucleus-Hippocampus Serotonergic-HTR3 Transmission Results in Anxiety Phenotype of Neuroplastin 65- Deficient Mice

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Purpose: Anxiety disorders are the most common psychiatric condition, but the etiology of anxiety disorders remains largely unclear. Our previous studies have shown that neuroplastin 65 deficiency (NP65-/-) mice exhibit abnormal social and mental behaviors and decreased expression of tryptophan hydroxylase 2 (TPH2) protein. However, whether a causal relationship between TPH2 reduction and anxiety disorder exists needs to be determined.

Methods: After hippocampal injection of AAV-NP65, 5-HT and HTR3 agonist SR57227A, NP65-/- mice were followed to do a serial of anxiety behavioral tests. In addition, after injection of AAV-TPH2 in dorsal raphe nucleus (DRN) for 4 weeks, NP65-/- mice were performed by behavioral test and by electrophysiological recordings. Immunostaining, western blot qRT-PCR and Elisa analyses were used to observe the effect of NP65 on 5-HTergic neurons.

Results: In present study, we found that replenishment of TPH2 in dorsal raphe nucleus (DRN) enhanced 5-HT level in the hippocampus and alleviated anxiety-like behaviors. In addition, injection of AAV-NP65 in DRN significantly increased TPH2 expression in DRN and hippocampus, and reduced anxiety-like behaviors. Acute administration of exogenous 5-HT in hippocampus decreased anxiety-like behaviors in NP65-/- mice. Moreover, replenishment of TPH2 in DRN partly repaired the impairment of long- term potentiation (LTP) maintenance in hippocampus of NP65-/- mice; HTR3 agonist SR57227A mitigated anxiety-like behaviors in NP65-/- mice. Finally, we found that loss of NP65 lowered transcription factors Lmx1b expression in postnatal stage and replenishment of NP65 in DRN reversed the decrease in Lmx1b expression of NP65-/- mice.

Conclusion: Together, our findings reveal that NP65 deficiency induces anxiety phenotype by downregulating DRN-hippocampus serotonergic-HTR3 transmission. These studies provide a novel and insightful view about NP65 function, suggesting an attractive potential target for treatment of anxiety disorders.

Keywords: Neuroplastin 65, Dorsal raphe nucleus, tryptophan hydroxylase 2, Anxiety-disorders, Serotonergic transmission

A-0862

Transcription Factor Nfat5/ TonEBP Regulates Photoreceptor Degeneration by Controlling the Inflammatory Signal in Retina

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Purpose: Photoreceptor degeneration (PD) is a serious irreversible condition that leads to blindness in retinal diseases (RD). Many studies tried to reveal the photoreceptor degeneration mechanism to overcome it, but still exact mechanism and treatment method for retinal disease are still limited to delay the disease progression. Here, we demonstrated that Nfat5 is expressed in the retinal cells to control inflammation and cell death, thus we suggest that Nfat5 could be a strong candidate for the control tower of PD.

Methods: Using Nfat5 (+/-) mice, we induced RD by $NaIO_3$ injection and performed qPCR array and real-time PCR to evaluate expression change of the inflammatory genes. The photoreceptor cell death was examined via the Western blot method. To identify the Nfat5 role in the glial cells, we cultured microglial cells and Müller glial cells to measure the inflammatory genes in each cell type depending on the expression of the NFAT5. Lenti-Nfat5 shRNA was used to knockdown the Nfat5 in the retinal glial cells.

Results: The RNA SEQ results indicated that the Nfat5 signal was increased during RD development and was in the top 10% of upregulated gene signals. Nfat5 (+/-) (low expressing) mice were more prone to RD development as evidenced by caspase-3 activity in retina tissue, accompanied by higher Tnf and Fasl signal. Through the PCR results from the retina and in-vitro retinal glial cell culture, we found that Nfat5 promoted the transcription of inflammatory (IL-1, IL-6) and anti-inflammatory cytokines (IL10).

Conclusion: Nfat5 is a pivotal inflammatory gene regulator

in the retinal glial cells. We suggest that NFAT5 is important for photoreceptor survival, via the controlling the inflammatory process of the glial cells during RD.

Keywords: Nfat5, Transcription, Inflammation, Retina, Photoreceptor cell death

A-0875

A Histological and Immunohistochemical Study of Mesenteric Development and Its Role in the Autonomic Innervation of the Developing Rat Gastrointestinal Tract

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Purpose: Knowledge of mesenteric structure and development has changed in recent years, and it is now accepted that the mesentery is a continuous, rather than fragmented structure. This has prompted a need to re-examine its anatomical relationships with the developing gastrointestinal tract (GIT) and investigate its potential role as a facilitator of neural crest cell and axon migration during enteric nervous system development and innervation of the GIT. The research aims to describe the development of the mesentery, gut, and enteric nervous system independently and subsequently determine how these components relate to each other during development. Of particular interest is unravelling the manner in which autonomic nerve fibres traverse the mesentery and ultimately innervate the gut and enteric nervous system.

Methods: Histological and immunoflourescent analysis of semi-serially sectioned rat embryos at embryonic days (E) 12, 14 and 16 is being undertaken to illuminate these processes. Immunohistochemical analysis of markers of the developing peripheral autonomic nervous system including Sox10, Phox2B, Beta III tubulin, Slit2, BDNF, NTF3 and VAChT is providing insight into the developmental mechanism by which the axons path-find and populate the gut wall.

Results: No neural elements are evident in the developing mesenteric tissue at E12, but at E16 there is clear evidence of mesenteric innervation. This suggests that the mesentery may facilitate the early innervation of the gut between these stages and that E14 may be an important stage for GIT nerve development that requires further investigation.

Conclusion: Despite advances in understanding of mesenteric anatomy, its role during development has yet to be clarified. Advances in our understanding of the innervation of the developing mesentery and gut has implications for advancing our knowledge of normal anatomy as well as relevant pathological states and diagnostic and therapeutic approaches. Animal procedures were in accordance with Republic of Ireland Department of Health and Children license.

Keywords: Mesentery, Autonomic nervous system, Development, Nerual crest

A-0877

Morphological Heterogeneity of CNS Border-Associated Macrophages after Photothrombotic Stroke

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Purpose: CNS border-associated macrophages (BAMs) constitute a small population of macrophages located in the meninges, choroid plexus, and perivascular spaces (PVS). Their unqie anatomical position between the periphery and the brain parenchyma has sparked significant interest in exploring their roles in both normal CNS function and disease.

Methods: Photothrombotic stroke was induced in 8-week-old, C57BL/6 mice by injecting Rose bengal (10 mg/mL) intraperitoneally and illuminating above skull with cold light source (Bregma AP 0.05 mm and ML –0.18 mm). Double or triple immunohistochemistry, immunoEM and correlative light-and electron microscopy was performed.

Results: At 7 days after the ischemia, the number of BAMs, identified by expression of CD206, Lyve1, and Iba1 increased compared to contralateral cortex. They were primarily distributed along the meninges and PVS within the lesion core, while their presence within the extravascular parenchyma was limited. Notably, a subset of BAMs lacked Lyve1 expression in both meninges and PVS. Triple-label immunohistochemistry revealed heterogeneous BAM morphology and marker expression, with meningeal BAMs showing amoeboid morphology

and expressing both CD206 and Lyve1, whereas subpial BAMs lacked Lyve1 expression. A subset of PVS BAMs lacked Lyve1 immunoreactivity and displayed elongated morphology. BAMs in the extravascular parenchyma exhibited variable morphologies and expressed both CD206 and Lyve1. ImmunoEM and CLEM analyses further supported these findings, revealing CD206(+) macrophages abluminal and adluminal to the PDGFR-β(+) fibroblasts, while Lyve1(+) macrophages were detected only abluminal to the PDGFR-β(+) fibroblasts.

Conclusion: We explored the heterogeneity of border-associated macrophages (BAMs) following ischemic stroke. Their marker expression and morphological characteristics varied based on their location and interaction with PDGFR-β positive fibroblasts. Collectively, our findings suggest distinct morphological characteristics and spatial dynamics of BAMs in response to ischemic stroke.

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Keywords: Stroke, Border-associated macrophages, Microglia, Fibroblast, CLEM

A-0880

Microglial PCGF1 Alleviates Neuroinflammation Associated Depressive Behavior in Adolescent Mice

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Purpose: Epigenetics plays a crucial role in regulating gene expression during individual adolescent brain maturation. In the condition of adolescent depression, microglia-mediated chronic neuroinflammation may contribute to cellular signaling cascades and cause central synapse loss. However, the exact mechanisms of epigenetic regulation of neuroinflammation leading to adolescent depression remain unclear. In this study, we will detect the role of polycomb group factor 1 (PCGF1) in adolescent depression.

Methods: In this study, we investigated the expression levels of Pcgf1 in the plasma of major depressive disorder (MDD) adolescent patients and in the microglia sorted by flow cytometry of adolescent depression mice. Behavioral tests, including sucrose preference test, forced swimming test, tail suspension test, were performed to analyze the depressive-like behaviors. The phenotypic changes were explored by observing changes in microglial markers, inflammatory factors, synaptic structure. The molecular mechanisms were explored by RNA-seq and ChIP-seq.

Results: In this study, we found that PCGF1 is declined both in the plasma of MDD adolescent patients and in the microglia of adolescent depression mice. By using virus transfection to regulate the expression of Pcgf1, we demonstrated that PCGF1 alleviates neuroinflammation mediated by microglia in vivo and in vitro, reducing neuronal damage and improving depression-like behavior in adolescent mice. Mechanistically, PCGF1 inhibits the transcription of MMP10 by upregulating RING1B/H2AK119ub and EZH2/H3K27me3 in the MMP10 promoter region, specifically inhibiting microglia-mediated neuroinflammation.

Conclusion: These results provide valuable insights into the pathogenesis of adolescent depression, highlighting potential links between histone modification, neuroinflammation and nerve damage, and providing potential drug targets for the treatment of MDD.

Keywords: Microglia, Pcgf1, Adolescent depression, Neuroinflammation

A-0891

The Lifestyle and Environmental Factors Influence the Cranial Capacity (Brain Size) and Mental Ability (Intelligence Quotient-(IQ)) among School Children between 6- and 16-Years Age, a Study in Malaysia

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Purpose: Introduction: Cranial indices serve as an indicator of brain size which is a determinant of the intelligence of a population. Intelligence quotient (IQ) is widely used to as-

sess different aspects of mental ability. Various environmental factors affect IQ. Objectives: 1. This study aimed to assess the craniofacial indices of children and adolescents in Malaysia. 2. To evaluate and correlate the cranial capacity (brain size) with the mental ability of Malaysian school students.

Methods: This cross-sectional study was conducted on healthy primary and secondary school children. Anthropometric measurements including the weight and height of the subjects were measured and Cephalometry for each subject was performed. 419 subjects (203 male and 216 female) participated in this study. The mean age of the participants was 12.51 ± 2.82 years.

Results: Male subjects were significantly taller (p=0.04) and had greater head height (p=0.004) and breadth (p<0.001) as well as greater face length (p<0.001) when compared with female subjects. Only facial length significantly differed between genders in the age groups (p=0.001). Age (0.04), paternal education level (p=0.03), and block design ability (p=0.03) had a significant effect on cranial capacity after adjusting for BMI for age.

Conclusion: This study, apart from exploring the quite interesting aspects of brain size and mental ability, it has also revealed that lifestyle as well as environmental factors have an important role in determining the head size of children and adolescents which in turn influences their Intelligence Quotient (IQ).

Keywords: Children, Cephalometry, t, Cranial capacity, Intelligence quotient

A-0922

A Useful Model of Retinal Degeneration Induced by Flickering Blue LED Light Exposure in Pigmented Mouse

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Purpose: We previously established a retinal degeneration (RD) model induced by blue LED light exposure in albino mouse. Given the genetic variation and experimental utility of pigmented mice, there has been a need for a pigmented mouse RD model. To develop and establish this, we investigated the structural and functional changes in C57BL/6 mouse retina after exposure to flickering blue LED light.

Methods: To track retinal functional and structural changes in a non-invasive way, spectral domain optical coherence tomography (OCT) and electroretinography (ERG) were used to monitor and assess those changes in flicker blue LED-damaged pigmented mice. Flickering was set to 20 Hz of the visible range, which resulted in an efficiency of 20% compared to maximum illuminance. The progression of retinal degeneration was monitored on days 3, 7 and 14 after injury.

Results: The scotopic and photopic ERG responses were reduced on day 3 post-injury. The non-flickering and flickering groups showed different structural and functional changes on day 7. The ERG responses of the flickering group were further reduced, while those of the non-flickering group showed no reduction or slightly increased by day 7. The difference in the scotopic ERG a-wave amplitude increased from 7 days and was most significant at 14 days, which was corroborated by the normalized amplitudes at 0, 0.5, and 1 log cd s/m^2 ($p < 0.05$). Quantitative and qualitative OCT assays revealed more severe and progressive retinal degeneration in the flickering group throughout the study.

Conclusion: Taken together, our previous findings in non-pigmented BALB/c mice were replicated in pigmented C57BL/6 mice, confirming the effectiveness of flickering blue light exposure in inducing retinal damage. The results of the present study in flickering blue light-stimulated pigmented mice provide compelling evidence that flickering blue light, even at frequencies as low as 20 Hz, may be a risk factor for retinal degeneration.

Keywords: Flickering Blue Light, Pigmented Mouse, Retinal degeneration, Electroretinography, Optical coherence tomography

A-0925

Functional Anatomy of the Insula and of the Von Economo Neurons

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Purpose: The human insula is hidden in the depth of the cerebral hemisphere by the overlying frontal and temporal opercula, and consists of three cytoarchitectonically distinct regions: the anterior agranular area, posterior granular area, and the transitional dysgranular zone; each has distinct histochemical staining patterns and specific connectivity. Even though several studies report the functional connectivity of the insula with the cingulated cortex, its relationships with other brain areas remain elusive in humans. From the functional point of view, it is involved in interoception. von Economo's neurons (VENs) are large, spindle-shaped projection neurons in layer V of the frontoinsular (FI) cortex, and the anterior cingulate cortex. The phylogenetic distribution may suggest a correlation among the VENs, brain size and the "social brain."

Methods: We decided to use resting state functional connectivity to elucidate in details its connectivity, in terms of cortical and subcortical areas, and also of lateralization. We investigated correlations in BOLD fluctuations between specific regions of interest of the insula and other brain areas of right-handed healthy volunteers, on both sides of the brain.

Results: Our findings document two major complementary networks involving the ventral-anterior and dorsal-posterior insula: one network links the anterior insula to the middle and inferior temporal cortex and anterior cingulate cortex, and is primarily related to limbic regions which play a role in emotional aspects; the second links the middle-posterior insula to premotor, sensorimotor, supplementary motor and middle-posterior cingulate cortices, indicating a role for the insula in sensorimotor integration. The clear bipartition of the insula was confirmed by negative correlation analysis.

Conclusion: We have recently shown that the salience network is altered in patients affected by schizophrenia compared to healthy controls, i.e. VEN-enriched cortical areas are associated with an altered resting-state brain activity in people with SZ.

Keywords: Insula, Von Economo neurons, Resting state, Interoception, Cingulate cortex

A-0929

Focused Ultrasound-Assisted Blood-Brain Barrier Opening Enables Targeted Microglia Modulation for Ischemic Stroke Therapy

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Purpose: Ischemic stroke remains challenging to treat beyond its initial stages, and research on mitigating secondary damage after stroke is underrepresented. Novel avenues for stroke intervention have emerged which is focused on control of brain inflammation, particularly microglial activation, as a potential strategy to address secondary damage. However, an effective means of regulating microglia activation has yet to be established.

Methods: In this study, we explore a promising approach to mitigate stroke-induced damage by utilizing advanced blood-brain barrier (BBB) permeable nanoparticles designed to target microglia. Leveraging ultrasound/microbubble (US/MB) technology, we comparatively assess intracranial nanoparticle drug delivery in a photothrombotic ischemic stroke model.

Results: Our experimental results demonstrate the successful localization of Evans Blue staining in the cerebral cortex through the application of US/MB. Green fluorescent protein (GFP) vector-loaded nanoparticles are administered via intravenous (IV), intrathecal (IT), and US/MB-assisted IV routes (US/MB/IV) respectively. The US/MB/IV administration exhibits a significantly increased distribution of GFP, compared to those of IV delivery only. And the microglial distribution of the GFP-nanoparticles was similar to those of IT route administration. Nanoparticles loaded with mir146a-5p, a regulator of microglial inflammatory responses, and their administration via the IV route with ultrasound/microbubble assistance were performed. mir146a-5p nanoparticle with US/MB/IV approach shows smaller cerebral infarct volume and reduction of

inflammatory factors.

Conclusion: This study suggest that focused ultrasound-mediated BBB disruption increase localized drug delivery of miR146a-5p-loaded nanoparticles. And this new targeted intervention can be used as a neuroprotective strategy with therapeutic implications for ischemic stroke treatment.

Funding: This study was supported by National Research Foundation of Korea (NRF 2021-0278-01).

Keywords: Blood-brain barrier, MiR-146a-5p, Ischemic stroke, Ultrasound, Nanoparticle

A-0930

MiRNA-146a-5p Nanoparticles Reduce MIA-Induced Pain Behaviors and Sensory Peripheral Innervation

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Purpose: Osteoarthritis (OA) is a degenerative disease that worsens over time, often resulting in chronic pain. Following the progression of OA, a calcitonin gene-related peptide (CGRP)-positive sensory nerves innervate the synovial membrane, meniscus, and subchondral bone of the knee joint in rodents, deteriorating OA pain. Thus, we performed to reduce OA pain by regulating the distribution of differentiated sensory nerves in the subchondral bone through miRNA-146a-5p encapsulated PLGA nanoparticles (miR146a-5p NPs) in a monoiodoacetate (MIA)-induced OA model.

Methods: miR146a-5p expression of human OA chondrocytes and synoviocytes and the knee joint tissue of MIA-induced arthritis were evaluated. MIA-induced arthritic model using Sprague-Dawley rats (7 week-old-male) were treated with miR146a-5p NPs, and evaluated with behavioral test, immunohistochemistry, and quantitative PCR.

Results: MIA induced OA pain behaviors were measured 10 days and confirmed that the CGRP+ sensory nerves are increased in subchondral bone with the upregulation of neuroninflammatory cytokines, including (TNF)-α and MMP13. Appling miR146a-5p NPs into the knee joint of the MIA model showed the significant reduction of OA pain relate mRNA genes, distribution of CGRP+ sensory nerves, and pain behavior. As joint nociceptors terminated in the dorsal horn of the spinal cord, we also found that the decrease of microglia activation in miR146a-5p NPs group compared to MIA-induced rats.

Conclusion: Injection of miR-146a-5p NPs can effectively down-regulate sensory nerve innervation in subchondral bone by reducing OA pain. Therefore, it is suggested that modulation of sensory innervation may be a new target in OA pain.

Keywords: Osteoarthritis, Pain, Calcitonin gene-related peptide (CGRP), PLGA nanoparticles, Sensory peripheral innervation

A-0935

Oxcarbazepine-Loaded Nanoparticles Provide Analgesic Effects in Neuropathic Pain Model Induced by Spinal Nerve Ligation (SNL)

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Purpose: Neuropathic pain is typically caused by dysfunction or pathological changes in the nervous system, but there remains no clear treatment. Oxcarbazepine (OXB), a voltage-gated sodium channel blocker, is primarily utilized as an antiepileptic drug and has been reported to have analgesic effects in various neuropathic pain conditions. However, clinical outcomes remains unsatisfactory, and the molecular mechanism are unclear. Therefore, we investigated the development of a neuropathic pain treatment based on OXB encapsulated in poly (D, L lactic acid-co-glycolic acid) (PLGA) nanoparticles

(OXB NPs).

Methods: A spinal nerve ligation (SNL) model was used to confirm the analgesic effect of OXB NP, and the analgesic effect was confirmed using von Frey filament evaluation and immunohistochemistry.

Results: Microglial activation is known to be associated with the development and persistence of neuropathic pain. In this study, oxcarbazepine nanoparticles were used to confirm the inhibition of microglial activation and analgesic efficacy. Additionally, we observed that the analgesic effects were significantly prolonged in the OXB NP-injected rats compared to the OXB-injected rats.

Conclusion: This study showed that OXB NPs can regulate microglial activation and provide long-term analgesic effects. Therefore, these data suggest that OXB encapsulated PLGA nanoparticle efficiently relieves neuropathic pain and has therapeutic value.

Keywords: Neuropathic pain, Oxcarbazepine, PLGA nanoparticles

A-0938

HMGB1 Contribute to NETosis Induction in the Photothrombosis Stroke Model, Both in the Initial Thrombus Formation and Subsequent Damage Progression

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Purpose: In various brain pathologies, neutrophils infiltrate damaged tissue soon after injury, worsening inflammation. In the permanent MCAO model, neutrophil extracellular traps were detected both in brain tissue and within blood vessels, playing a critical role in aggravating damage by triggering delayed immune cell infiltrations and vascular injury. Danger-associated molecular pattern (DAMP) molecules have been reported to induce NETosis following cerebral ischemia. This study investigated the role of High mobility group box 1 (HMGB1), a well-known DAMP molecule, in NETosis induction, particularly in neutrophil-platelets interactions.

Methods: We employed the photothrombotic stroke (PTS) model, where thrombi consists primarily of aggregated platelets and neutrophils.

Results: TTC staining revealed rapid and progressive infarct formation in the PTS model. Notably, progressive NETosis, especially intravascular NETosis, was prominent, as evidenced by increased levels of citrullinated histone $H3^{+}$ (a NETosis marker) and NE-DNA complex in neutrophils isolated after PTS. Functional inhibition of HMGB1 by intranasal administration of a MGB1 A box significantly reduced infarct volume and improved neurological deficits in the PTS model. Importantly, neuroprotection was achieved by both pre-administration and administration 2 h after stroke, suggesting that suppression of intravascular NETosis is crucial for mitigating ischemic brain damage in this model. Platelet activation in PTS model was confirmed by increased expression of CD41 and GPIbb (platelet activation markers) and surface HMGB1. These activated platelets can induce neutrophil activation and intravascular NETosis, with platelet-derived HMGB1 plays a key role. Notably, TLR4 and RAGE signaling pathways appear to be involved in platelet-derived HMGB1-mediated neutrophil activation.

Conclusion: Our findings demonstrate that HMGB1 contribute to NETosis induction not only during initial thrombus formation but also in subsequent damage progression in the PTS animal model. Therefore, NETosis may serve as a valuable prognostic maker in acute ischemic stroke. Targeting NETosis by modulating HMGB1 offers a promising multipotent therapeutic strategy to mitigate ischemic brain damage.

Keywords: HMGB1, Photothrombosis, NETosis, Platelets

A-0948

The Effect of Platelet-Rich Plasma (PRP) on Motoric Nerve Regeneration of Sciatic Rat Model. Focus on Neuron Density and S100B Expression

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Purpose: Trauma to the ischiadicus nerve is a peripheral nerve injury that results in morphological and cellular changes in neurons and axons. Post-injury recovery of the ischiadicus nerve is often not functionally optimal. Currently, Platelet-rich

plasma (PRP) has been developed as an alternative therapy option to surgery. This is because PRP contains cytokines and neurotrophins that play a role in nerve regeneration. This study aims to look at the role of PRP in motor nerve regeneration of sciatica model rats with crush injury.

Methods: This experimental study used stored biological blocks of the spinal cord and nervus ischiadicus from male Wistar rats treated with control, sciatica and sciatica with PRP terminated on days 7 and 42 . PRP as much as 0.2 ml was given to the crush injury area using absorbable gelatin sponge. Assessment of nerve regeneration was performed by looking at the density of neurons in the spinal cord using toluidine blue special staining and immunohistochemistry of S100B protein in the cytoplasm of schwann cells of the ischiadicus nerve.

Results: There were significant results in the examination of neuron density on days 7 and 42 between the sciatica group and the sciatica + PRP group and significant results in the examination of S100B protein expression on day 7 in the control group and the sciatica group with the sciatica + PRP group. Compared to controls, allogenic PRP significantly enhances nerve regeneration. Treatment with PRP increases NGF expression, demonstrating its significance in nerve healing. By modulating S100B expression and reducing inflammation, allogenic PRP may hasten nerve regeneration.

Conclusion: This study shows that PRP administration can increase schwann cell proliferation and play a role in neuron survival. Allogenic PRP requires clinical trials to demonstrate its safety and effectivene.

Keywords: Nervus ischiadicus, Sciatica, nerve regeneration, Platelet-rich plasma, Motor neuron

A-0965

Optogenetic Inhibition of Inflammasome in Microglia to Relieve Neuropathic Pain

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Purpose: Microglia-mediated inflammatory process is recognized as a target in the treatment of neuropathic pain. Increased Nod-like receptor protein 3 (NLRP3) inflammasome has been observed in activated microglia and plays crucial role to exaggerate neuroinflammation by releasing IL-1β. In this study, we develop optic system to regulate NLRP3 inflammasome and apply to neuropathic pain mouse model.

Methods: A powerful tool for the inducible control of protein-protein interactions is created using modified CRY2-mRuby3 and CIBN-NLRP3. When CRY2-mRuby3 and CIBN-NLRP3 are transfected in various ratios in HEK293T cells, efficient and reversible clustering is observed upon blue light stimulation.

Results: We evaluate the anti-inflammatory effect of CIBN-CRY2 upon stimulation, suggesting that CIBN-CRY2 efficiently traps NLRP3, inhibiting NLRP3 inflammasome activation in BV2 microglial cells. Then, CIBN:CRY2(1:3) PLGA NPs (C/R2 NP) are synthesized and injected into a spared nerve injury (SNI) mouse model. On day 3 of injury, light stimulation is conducted with different durations (0.5, 1, and 2 hour) and pain behavior is improved and analgesic effect is sustained for 2 days. The results are repeated with second stimulation. Moreover, we use an advanced tool, CRY2(E281A) PLGA NPs (CRY2(A9) NP), for non-invasive optic control with high light sensitivity.

Conclusion: The optimization of optic control conditions through CIBN-CRY2 in a mouse neuropathic pain model reveals insights into the light-inducible inhibition of the NLRP3 inflammasome in spinal microglia. This dual approach, combining PLGA nanoparticle delivery and optogenetics, provides a comprehensive understanding of NLRP3 inflammasome regulation, opening avenues for potential clinical trials in the treatment of neuropathic pain.

Keywords: Neuropathic pain, Optogenetic, Microglia, NLRP3 inflammasome, PLGA nanoparticles

[C. Development, Cell Biology and Tissue Engineering]

A-0038

Sodium-Glucose Cotransporter SGLT2 in Kidneys of Chicken in Different Ages

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Purpose: The primary energy source in all living organisms is glucose, uptake of which is carried out by facilitated-diffusion glucose transporter and Na+-dependent glucose transporter families. As kidneys have major role in body's homeostasis, knowledges about glucose transporters' localization in kidney tissue are essential. Although quite extensively researched in mammals' kidneys, sodium-dependent glucose transporters localizing in kidneys of birds in different ages are relatively less studied. The aim of the current research was to immunolocalize Na+-dependent glucose transporter SGLT2 which is responsible for most of glucose uptake across apical membrane into renal tubular cells, in kidneys of hen chicken in different ages.

Methods: In the study 32 domestic hen chickens (Gallus gallus domesticus) participated divided equally into four age groups – 3, 7, 14 and 20 days old chicken. Tissue sections 0.5–1.0 cm in diameter were removed from renal cortex and medulla, fixed in 10% formalin, dehydrated, and embedded in paraffin. 6 μm thick sections were cut, deparaffinized, followed by immunohistochemical staining with polyclonal primary antibody Rabbit anti-SGLT2 (Abcam, UK) according to manufacturer's instructions (IHC kit, Abcam, UK).

Results: The results of the immunohistochemical study of SGLT in kidney tissue revealed immunolocalization of SGLT2 similarily to mammals, in the apical part of the epithelial cells of the proximal renal tubules. The localization and staining intensity occurred to be similar in all four studied age groups.

Conclusion: The similar localization and staining intensity of SGLT2 found in all four studied age groups shows that the excretion of urine, glucose transport and filtering of glucose is ready immediately after hatching in hen chickens.

Funding: Financed on the basis of the EEC performance agreement (state funding).

Keywords: Chicken, Immunohistochemistry, Kidney tubules, Glucose transport, SGLT2

A-0051

Seasonal Expression for the IL-2, -4, -17A and TGFβ1 and Milk Microbiota in the Healthy Dairy Cows and Such with Mastitis

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Purpose: The innate immune factors of mammary gland in the protection against infectious diseases are associated with secreted cytokines. Recently the selective changes of cytokines were described in dairy cows' milk, while the seasonal changes of interleukins (ILs) in correlations to milk microbiota was not researched yet. The purpose was the detection of IL-2, -4, -17A and TGFβ 1 in correlation to most common microflora of cow's milk in spring and autumn.

Methods: The examinations of milk in 30 cows (10 healthy, 10 with subclinical, 10 with clinical mastitis) in disease days 1-7 were performed in spring and autumn. The somatic cell count (SCC), bacteriology, and cytokines immunocytochemistry was developed.

Results: S.uberis and S.aureus prevailed in the milk without seasonal preference. Seasonlack were rarely detected E.coli and S.agalactiae, while Klebsiella, Enterobacter, Citrobacter spp. were seen mainly in the spring milk. ILs showed high positive SCC in all days of both seasons. In subclinical mastitis positive milk cells for ILs decreased 10-15% less in spring with the main decrease of IL-4. In clinical mastitis IL-2 and IL-17A milk cells were seen equally in both seasons, while IL-4 and TGFβ 1 increased from 70% in spring to almost 100% positive cells in autumn.

Conclusion: Klebsiella, Enterobacter, Citrobacter spp found in a small number appear more in the spring. All ILs positive cells in milk are mostly in healthy animals. The number of ILs-positive cells in the milk of cows with subclinical mastitis has the greatest variation and decrease in spring, indicating the beginning of summer as a possible time of exhaustion of the immune system, and autumn as one in which tissue local immunity is restored. In milk from cattle with clinical masti-

tis, the most cells are Il2-positive, followed by IL-17A cells, but IL-4 and TGFβ1 reveal seasonality, increasing in autumn milk.

Funding: This ERA-NET ICRAD project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 862605.

Keywords: Microbiota, Cytokines, Milk, Mastitis, Cows

A-0053

Antimicrobial Defence System in Cleft Soft Palate of Mixed Dentition Age Children

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Purpose: Cleft palate is one of the most common and still not enough studied congenital anomaly, and the role of protective local tissue factors in its pathophysiology is still debated. Especially absent are data about the palatal tissue. The aim of study was to evaluate interleukin and antimicrobial peptide appearance and distribution in cleft palate of mixed dentition age children.

Methods: Eight soft palate samples were obtained during veloplasty procedure from 6-12 years old children (5 boys, 3 girls). The control material was obtained from postmortem tissue in 2 male and 3 female subjects without orofacial clefts and any inflammation. Immunohistochemical staining was applied to detect HBD-2, HBD-3, HBD-4, LL-37, IL-10 and CD-163 positive cells through light microscopy. Results were evaluated semi-quantitatively. For statistical evaluation Mann-Whitney U test and Spearman's rank correlation coefficient was used.

Results: Significant difference between study groups was observed for epithelial HBD-2 and IL-10, as well as HBD-4 in connective tissue. HBD-3 positive cells were moderate in patients and few in controls. LL-37 varied from moderate to numerous positive cells in both study groups, whilst CD-163 marked moderate positive cells in patients and few to moderate in controls. A very strong positive correlation in epithelium was detected: between HBD-2 and IL-10, HBD-3 and HBD-4; between HBD3 and HBD4, HBD3 and IL-10, as well as HBD-4 and IL-10 in connective tissue. Epithelial defensins correlated very strongly with connective tissue defensins and IL-10. A strong positive correlation was noted in connective tissue between defensins as well as LL-37 and IL-10.

Conclusion: The increase of antimicrobial peptides HBD-2 and HBD-4 and anti-inflammatory cytokine IL-10 suggests the wide compensatory elevation of local immune system against the cleft-raised tissue changes. The correlations between the studied factors prove synergistic involvement of common local defence factors (HBD-2, HBD-3, HBD-4, LL-37, IL-10) into postnatal cleft soft palate morphopathogenesis.

Keywords: Defensins, Interleukins, Mixed dentition, Cleft, Children

A-0105

Analysis of Biomarkers and Lipid Composition by Comparing Human Meibomian Glands with Other Free and Hair-Associated Sebaceous Glands

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Purpose: Meibomian gland dysfunction is the main cause of dry eye disease. To better understand the physiological function of human meibomian glands (MG), the present study compared MG with other free sebaceous glands (SG) and with hair-associated SG of humans morphologically, immunohistochemically, and with respect to lipid composition.

Methods: Eyelids with MGs, nostrils, lips and external auditory canals with free SG, and scalp with hair-associated SG of body donors were probed with antibodies against cytokeratins, stem cell markers, cell-cell contact markers, and a tight junction protein. In addition, Oil Red O staining (ORO) was performed. Secretions of MGs as well as of SG of nostrils, external auditory canals, and scalp were collected from healthy volunteers, analyzed by LCMS, and statistically analysed. Serial sections of MGs, free SGs, and hair-associated SGs were 3D reconsted.

Results: CK1 was expressed differently in hair-associated SG than in MG and other free SG. The expression of CK8, CK10, and CK14 in MG was different from that in hair-associated SG and other free SG. KRT15 was expressed differently

in hair-associated SG. ORO staining showed that lipids in MG were more highly distributed and had larger lipid droplets than lipids in other free SG. Hair-associated SG had a smaller number of lipid droplets. LCMS revealed that the distribution of meibum levels were far from the sebum levels of the nostrils, external auditory canals, and scalp. The 3D reconstructions of the different glands revealed different morphology of the glands with MG being the largest gland type.

Conclusion: In humans, MG differ in their morphological and secretory composition and show significant differences from other free and hair-associated SG. The composition of meibum differs significantly from that of sebum from free SGs and from hair-associated SG. Therefore, MG can be considered as a highly specialized type of SG.

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Keywords: Meibomian gland, Ocular surface, Tear film, Dry eye disease, Meibomian gland dysfunction

A-0170

Chitosan Oligosacharide Enhances the Anti-Cancer Effects of 5-Fluorouracil on Colorectal Cancers in Vitro and in Vivo

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Purpose: Chitosan oligosaccharide (chitooligosaccharide, COS) is the major degradation product of chitosan via enzymatic processes. COS with complete water solubility shows various biomedical implications, which endowed it with significant biological properties including anti-cancer effects. We investigated the anti-tumor effects of COS on colorectal cancers since there is a lack of effective therapeutic methods with low side effects.

Methods: COS was obtained from low molecular weight chitosan by the enzymatic method and the effects were measured by MTT assay, flow cytometry analysis, Western blotting, and xenograft.

Results: COS suppressed the proliferation of SNU-C5 cells compared to other colorectal cancer cells, but required higher concentrations in xenograft model. When co-treated with 5-fluorouracil (5-FU), COS enhanced anti-cancer effects of 5-FU on SNU-C5 cells in vitro and in vivo. Flow cytometry revealed that COS induced cell cycle arrest at G0/G1 phase, but did not affect cell death pathways. COS increased phosphorylation of ERK with or without 5-FU, while 5-FU treatment increased phosphorylation of p53. Low-dose ERK inhibitor suppressed COS-induced ERK activation, and resulted in higher proliferation.

Conclusion: These results suggest that COS might enhance the anti-cancer effects of 5-FU on SNU-C5 colorectal cancer cells via activation of ERK.

Funding: This research was supported by the Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (2021R1F1A1063023 and RS-2023-00270936).

Keywords: Chitosan Oligosaccharide, Colon cancer, 5-Fluorouracil, ERK

A-0229

Effects of Autologous Bone Marrow Aspirate Concentrate Administration and Personalized Physiotherapy in Children with Cerebral Palsy

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Purpose: Cerebral palsy (CP) is a condition that results in permanent, motor disability and impairment of cognitive functions. We used autologous bone marrow aspirate concentrate (BMAC) transplantation to treat children with CP to improve their motor and cognitive functions.

Methods: This study included 42 patients (ages from one to twelve years) with CP. The intervention included three intrathecal administrations of BMAC per subject. The patients' examinations were 1, 3, 6, and 12 months after BMAC intrathecal administrations. After stem cell transplantation, children had extensive rehabilitation programs, which included personalized physiotherapy, and occupational and speech therapy. The improvement of motor and cognitive functions was evaluated using the gross motor function classification scale (GMFCS), the modified Ashworth scale (MAS), and the Learning accomplishment profile-diagnostic scale (LAP-D).

Results: Six months after cell transplantation and rehabilitation, the GMFCS score of children with CP significantly improved ($p<0.01$) compared with the baseline score. On the MAS score, the muscle spasticity was reduced considerably ($p<0.001$). Reduction of spasticity was observed in 58% of patients. According to the LAP-D score, the average developmental level of the CP patients after the intervention was 23 months for cognition, 21 months for fine motor skills, and 22 months for speech skills. The cognitive function assessment revealed significant improvement in 35% of patients. In general, 12 months after the intervention, 93% of patients showed mild, moderate, and significant improvements, and 7% of patients did not show any improvement, but they remained stable.

Conclusion: This study's outcome indicates that treatment combining stem cell therapy with physiotherapy provides an opportunity for improvement for patients with CP.

Keywords: Cerebral palsy, Bone marrow aspirate concentrate, Intrathecal applications

A-0242

Lectin Histochemistry of the Periosteum of the Hip Joint during the Postnatal Period

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Purpose: Lectin histochemistry of the periosteum was studied using tissue sections of the hip joint of intact laboratory rats (from the first to the 90th day).

Methods: Samples were stained with lectins conjugated with horseradish peroxidase (HRP): peanut (PNA), soybean (SBA), Helix pomatia (HPA), wheat germ (WGA), Perca fluviatilis (PFA), Sambucus nigra (SNA), Lens culinaris (LCA), and Vicia sativa (VSA). Staining intensity was evaluated semiquantitatively (from 0 to ++++).

Results: Until the 14th day, the acetabulum, caput femoris, and collum femoris constituted a cartilaginous tissue with the beginning of ossification; the periosteum was not discerned. From the 30th day, all zones of the periosteum could be distinguished. Osteoid revealed robust (++++) expression to the HPA, PNA, SBA, LCA, VSA, and PFA; but no affinity to the SNA and WGA. The inner cambial layer (zone I) was lectinhistochemically indistinguishable from the deep fibrous layer (zone II), except for the WGA: it showed a moderate (++) expression in the zone I. The deep fibrous layer (zone II) revealed moderate staining for the HPA, PNA, SBA, and PFA; weak (+) reaction for the LCA, VSA, and WGA; no reaction for the SNA. Capillary walls and cells revealed no lectin affinity. The outer fibrous layer (zone III) showed strong (from +++ to ++++) expression to the HPA, PNA, SBA, LCA, VSA, and PFA; moderate expression to the WGA and weak expression to the SNA. The substantial difference in lectin-binding affinity between the femoral head and the acetabulum was not observed.

Conclusion: The strongest lectin affinity could be seen in the osteoid and outer fibrous layer, and the lowest lectin expression was found in the deep fibrous layer.

Keywords: Periosteum, Lectin histochemistry, Laboratory rats, Hip joint

A-0262

Nuclear Translocation of Lactate Responsive Protein, LRPGC1, Regulates Lactic Acid Metabolism through ERRγ-Mediated Transcription

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Purpose: The metabolism of lactic acid (LA) in the liver is essential to prevent lactic acidosis, which is frequently accompanied by metabolic disorders, organ failure, and severe infection. However, the molecular mechanism through which

LA regulates its own metabolism is largely unknown. We identified a LA-responsive protein, named LRPGC1, which is a putative constitutive form of metabolic regulator PGC1α, and report that LRPGC1 particularly mediates LA response to activate liver LA metabolism.

Methods: Subcellular dynamics of LRPGC1 was monitored by living-cell imaging and confocal FRET microscopy. PGC1 gene knockout cells were generated in the HepG2 hepatocarcinoma cell line and analyzed. To elucidate in vivo role for LRPGC1, survival rates were measured using a mouse model of lactic acidosis which received liver-targeted siRNA or selective agonist for ERRγ.

Results: Following LA stimulation, LRPGC1, but not PGC1α, translocated from the cytoplasm to the nucleus through deactivation of nuclear export signals, and thereby interacting with the nuclear receptor ERRγ and upregulated TFAM, which ensures mitochondrial biogenesis. Knockout of PGC1 gene in HepG2 cells decreased LA consumption and TFAM expression, which were rescued by LRPGC1 expression, but not by PGC1α. These LRPGC1-induced effects were mediated by ERRγ, concomitantly with mitochondrial activation. The response element for LRPGC1/ERRγ pathway when stimulated by LA was identified in TFAM promoter. Interestingly, liver-targeted silencing of Lrpgc1 reduced the survival rate of a mouse model of lactic acidosis, whereas pharmacological activation of ERRγ significantly ameliorated the survival rate of the mouse model.

Conclusion: Present findings demonstrate LA-responsive transactivation via LRPGC1 that highlights an intrinsic molecular mechanism for LA homeostasis. We further suggest the novel therapeutic avenue to reverse life-threatening lactic acidosis via activation of LRPGC1/ERRγ/TFAM signaling pathway.

Funding: JAPAN MEXT Grant no. 26860852, 17K10188, 20K08186, 23K07340.

Keywords: ERRγ, Lactic acid, LRPGC1, Nuclear translocation, TFAM

A-0267

Therapeutic Potential of Adult Human Neural Stem Cells in Ischemic Stroke: Insights from Pre-Clinical Efficacy and Mechanistic Studies

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Purpose: Today, many people suffer from strokes, leading to infarction of nervous tissue and causing death and disability worldwide. Specifically, more than 80% of stroke patients are diagnosed with ischemic stroke, which is the most common type. Adult human neural stem cells (ahNSCs) play crucial roles in the therapeutic effects of ischemic stroke treatment.

Methods: This study reports on the efficacy of treating ischemic stroke using ahNSCs derived from temporal lobe surgical samples (to avoid ethical and safety issues) and middle cerebral artery occlusion animal models. A total of 5×10^5 ahNSCs were directly transplanted into the lateral ventricle of the contralateral brain hemisphere in immune-suppressed rat stroke models during the subacute phase of stroke.

Results: The ahNSCs injection group exhibited a significant decrease in brain tissue atrophy and a loss of neurological sensorimotor and memory function compared to the mock-treated group. Neuroprotective and pro-angiogenic functions of ahNSCs were demonstrated in various ways. Tissue analysis verified that therapeutic effects were mediated by the activities of ahNSCs, preserving neurons in ischemic brain areas and reducing reactive astrogliosis and microglial activation. Moreover, in vitro stroke models were used to confirm the neuroprotective and pro-angiogenic effects of ahNSCs. As a result, paracrine factors excreted by ahNSCs induced these activities of ahNSCs. When AG490 was used as a specific inhibitor of the JAK2/STAT3 signaling pathway, the paracrine neuroprotective and pro-angiogenic effects of ahNSCs were reversed.

Conclusion: Taken together, this pre-clinical study closely imitated a clinical setting and contributed to understanding the treatment mechanisms of ahNSCs for ischemic stroke. It may aid in the progress of protocols for subsequent clinical trials of ahNSCs. Based on this research, studying pre-clinical stem cells may lead to next-generation therapeutic approaches.

Keywords: Ischemic stroke, Adult human neural stem cells

(ahNSCs), Neuroprotective, Pro-angiogenic, JAK2/STAT3

A-0268

Advancing Stem Cell-Based Therapy for Lung Cancer Brain Metastasis: Targeting CES1 and sTRAIL through Wharton's Jelly-Derived Mesenchymal Stem Cells

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Purpose: The study explores the potential of Mesenchymal stem cells (MSCs) as an innovative therapy for lung cancer brain metastases, a condition affecting a substantial portion of patients. Initial diagnosis reveals brain metastases in 10% of cases, with 40% of lung cancer patients developing them during the disease course, posing challenges due to the blood-brain barrier. Despite advancements in systemic lung cancer therapies like chemotherapy, targeted therapy, and immunotherapy, their effectiveness is limited within the central nervous system. MSCs, known for their broad cancer tropism and potential for autologous transplantation, emerge as promising candidates.

Methods: In previous research, MSCs were genetically manipulated using Lipid Nanoparticle (LNP) technology. This induced the secretion of tumor necrosis factor-related apoptosis-inducing ligand (sTRAIL) and integration of the carboxylesterase (CE) enzyme. The genetic modification enabled the conversion of the prodrug CPT-11 into its active form, SN-38. This approach leverages TRAIL's selective cytotoxicity to cancer cells, binding to death receptors DR4 and DR5, offering a targeted strategy for cancer cell elimination while minimizing harm to normal cells. Researchers developed highly migratory and brain tumor tropic stem cells capable of continuously secreting substantial amounts of functional, stable, full-length CE and sTRAIL without compromising stem cell characteristics. To avoid immunological side effects, human CE and sTRAIL sequences were utilized.

Results: In vivo experiments involved injecting human lung cancer cells into the right-brain hemisphere of immunodeficient mice, with stem cells injected into the left-brain ventricle. Both in vitro and in vivo, stem cells expressing CE ± sTRAIL demonstrated robust therapeutic effects against lung cancer brain metastases.

Conclusion: The findings suggest that non-viral transient single sTRAIL gene transfer to autologous stem cells holds promise as a therapeutically applicable stem cell-based gene therapy for lung cancer brain metastases, offering therapeutic benefits and safety.

Keywords: Lipid Nanoparticle (LNPs), Stem cell, Carboxyl esterase, STRAIL

A-0283

Investigating Regeneration Mechanisms of Murine Lacrimal Gland Acinar Epithelial Cells: Implications for Aqueous-Deficient Dry Eye Therapy

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Purpose: Dry eye is a complex condition affecting the ocular surface and tear film, impacting over 344 million individuals globally. Symptoms include itching, persistent foreign body sensation, recurrent conjunctivitis, and visual impairments, with severe cases leading to blindness. Hypovolemic dry eye, linked to lacrimal gland insufficiency, exhibits the most severe disease progression. Although animal models illustrate the lacrimal gland's regenerative capacity after acute damage, the underlying mechanisms are unclear. This study aims to unravel the intrinsic regeneration mechanisms of the lacrimal gland, with potential therapeutic implications for aqueous-deficient dry eye (ADDE) patients.

Methods: Primary lacrimal gland acinar epithelial cells (LGEC) were obtained from neonatal mice explants. Characterization involved confirming lacrimal gland-specific markers, excluding fibroblastic and myoepithelial markers through PCR, immunocytochemistry, and transcriptome analysis. The murine LGECs' (mLGEC) secretory capacity was assessed using a β hexosaminidase assay, indicative of lysosomal exocytosis. Transcriptome analysis elucidated intrinsic regeneration mechanisms, analyzing pathways according to KEGG, and further investigating promising proteins.

Results: While maintaining LGEC markers (FOXC1, PAX6, LTF) and acinar cell markers (AQP5, SOX10) in mLGECs, the concentrations of fibroblast and myoepithelial cell markers

corresponded to native tissue. Stimulation with carbachol and dbcamp, inducing secretion in mLGECs, revealed their secretory potential. After injury, initial signs of regeneration were observed within one hour. Transcriptome analysis highlighted the responsiveness of the TNF, IL-17, and MAPK signaling pathways, with upregulated growth factors.

Conclusion: The study successfully established an in vitro lacrimal gland injury model, demonstrating spontaneous regeneration. Key pathways involved in intrinsic regenerative mechanisms of LGECs were revealed. Subsequent experiments with identified growth factors will elucidate their impact on lacrimal gland regenerative potential, potentially informing therapeutic options for ADDE patients.

Funding: German Research Foundation grant PA738/15-1 (FP), Ernst and Berta Grimmke Foundation 6/21 (JD).

Keywords: Lacrimal gland, Regeneration, Dry eye, Pathways

A-0301

Effects of Enamel Matrix Derivatives on Cementoblast Cell Fate Determination

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Purpose: Cementum, which covers the tooth root surface, is a calcified connective tissue incorporated into the periodontal apparatus. Cementoblasts, which are responsible for cementum formation, play a pivotal role in the recovery and regeneration of periodontal tissue damaged by prevalent periodontitis. Despite the widespread use of Enamel Matrix Derivatives (Emdogain®, EMD) in periodontitis treatment, the precise mechanistic underpinnings of its therapeutic action remain elusive.

Methods: This study investigates the effect of EMD on cementoblast differentiation and its molecular mechanisms in human periodontal ligament (PDL) cells.

Results: Treatment of PDL cells from healthy teeth with EMD significantly upregulated cementum protein 1 (CEMP1) and cementum attachment protein (CAP) expression at both mRNA and protein levels. The dose-dependent increase in CEMP1 expression during EMD-induced cementoblast differentiation was reduced by IWP-2, an inhibitor of the Wnt/β-catenin signaling pathway. The CEMP1 promoter region containing the TCF binding site was identified as an EMD-mediated regulatory site, confirmed by luciferase reporter assay. Results demonstrated that a dose-dependent increase in CEMP1 promoter activity in response to EMD, was attenuated by IWP-2. While EMD induced a slight increase in mRNA levels of Osterix and Runx2, early cementoblast differentiation markers, no significant change in Alkaline phosphatase (ALP) was observed. Additionally, there was a decrease observed in Osteocalcin and Osteopontin. In the other hand, ALP and Alizarin Red-S staining revealed no effect or a decrease in the maturation phase, indicating little potential effect on the late stage of cementoblast differentiation.

Conclusion: These findings suggest that EMD may influence early cell fate determination in PDL-derived cementoblasts, with limited involvement in later maturation stages, possibly mediated, at least partially, through the Wnt/β-catenin signaling pathway.

Keywords: Emdogain, Cementoblast, CEMP1

A-0303

Role of FOXO3a on LPS-Induced Inflammatory Condition in Human Dental Pulp Cells

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Purpose: Pulpitis is one of the most prevalent dental disorders in humans. The Forkhead transcription factors of the O class (FOXOs) are a group of transcription factors pivotal to diverse cellular functions, including cell survival, differentiation, and apoptosis. Among them, FOXO3a emerges as a key regulator influencing the immune response. This study delves into the involvement of FOXO3a in the context of lipopolysaccharide (LPS)-induced inflammatory conditions within primary human dental pulp cells (HDPCs).

Methods: HDPCs, isolated from donors undergoing tooth extraction for orthodontic purposes, were cultured with or without 1 μg/ml LPS at various time intervals. The localization of FOXO3a was verified through immunofluorescence in

HDPCs. The pro-inflammatory cytokines, such as interleukin (IL)1β, IL6, and IL8, along with their underlying mechanisms, were assessed by observing gene and protein expressions through quantitative real-time polymerase chain reaction (qRT-PCR) and western blot analyses.

Results: LPS treatment enhanced the expression of IL1β, IL6, and IL8 in HDPCs, concurrently activating NFκB. Furthermore, FOXO3a expression increased in LPS-stimulated HDPCs, substantiated by immunofluorescence localization. Employing loss/gain-of-function approaches affirmed the regulatory role of FOXO3a in inflammatory HDPCs. Knockdown of FOXO3a attenuated pro-inflammatory cytokine expression, while its overexpression augmented their levels. FOXO3a demonstrated inhibitory effects on retinoic acid receptor-related orphan receptor alpha expression, thereby inactivating NFκB.

Conclusion: Taken together, our findings suggest that FOXO3a potentially contributes to the homeostasis in HDPCs by modulating the expression of pro-inflammatory cytokines.

Keywords: FOXO3a, LPS, Inflammation, Pulp

A-0337

Col1a1 and Osteonectin Expression Patterns during Tooth Root Development in Xenopus Laevis

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Purpose: After completion of the crown, the ameloblasts are continuous to Hertwig's epithelial root sheath cells (HERS) without distinct borders. In mammals, HERS is a transient tissue, transforming into the epithelial cells rest of Malassez (ERM) during root development. HERS is involved in odontoblast differentiation, and then HERS undergoes a fragmentation process, and follicular cells intervene between the fragmented HERS to contribute to the formation of cementum on the root surface. However, in non-mammalian vertebrates HERS covers the whole root or four-fifth root surface without any fragmentation, and the root becomes fused to the alveolar bone. Collagen fibers are the major components of the predentin, periodontal ligament, and cementum and promote mineralization of the matrix by providing gaps for mineral deposition in the striations of collagen fibrils. During tooth root development in non-mammalian vertebrates, fibrogenesis remains unclear.

Methods: We performed hematoxylin-eosin (H-E), trichrome staining, in situ hybridization for col1a1 and osteonectin, and scanning microscopy to confirm fibrillar distribution during tooth root development of the first tooth row in Xenoups laevis.

Results: We confirmed that collagen fibers are accumulated in the predentin and on the root surface underlying HERS, and Col1a1 and osteonectin are expressed in the odontoblasts and HERS of the first row tooth.

Conclusion: We suggest that HERS could be implicated in fibrogenesis on the root surface during tooth root development in Xenopus laevis.

Keywords: Xenopus laevis, Root development, HERS, Col1a1, Osteonectin

A-0360

Fucoxanthin Attenuates Oxidative Stress-Induced Apoptosis on Placenta-Derived Mesenchymal Stem Cells

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Purpose: Osteoporosis is a bone disease that causes bone fragility. Oxidative stress increases osteoblast apoptosis which plays an important role in pathological osteoporosis. Fucoxanthin, a marine carotenoid extracted from brown seaweeds, has antioxidant activity. Our previous study showed that fucoxanthin protects and rescues placenta-derived mesenchymal stem cells (PL-MSCs) from oxidative stress damage through increased cell viability and decreased intracellular ROS production. However, the effect of fucoxanthin on cell apoptosis remains unknown. This study aims to explore the effect of fucoxanthin on PL-MSC apoptosis under oxidative stress conditions.

Methods: PL-MSCs were isolated from a pregnant woman after normal delivery. After characterization, PL-MSCs were cultured in fucoxanthin (1-5 μM) and 750 μM H_2O_2 for 24 h. Apoptosis was measured using Annexin V/propidium iodide staining. The expression of apoptosis-related markers was in-

vestigated using real-time PCR and western blot analysis.

Results: Fucoxanthin inhibits the apoptosis of H_2O_2-treated PL-MSCs. The expression of pro-apoptotic genes was decreased in fucoxanthin-treated PL-MSCs compared to control without fucoxanthin. In contrast, fucoxanthin treatment increased the expression of anti-apoptotic genes compared to control. Furthermore, fucoxanthin decreased the cleaved forms of caspase 3, -7, -9 and PARP compared to control.

Conclusion: Fucoxanthin decreases apoptosis of oxidative stress-induced PL-MSCs. The finding might lead to the future development of fucoxanthin as a treatment for osteoporosis.

Keywords: Fucoxanthin, Mesenchymal Stem Cells, Placenta, Oxidative stress, Apoptosis

A-0399

Essential Roles of β-Catenin in the Dental Epithelium during Molar Root Growth

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Purpose: Wnt/β-catenin signaling plays multiple roles in both the dental epithelium and mesenchyme during various stages of tooth development. Previously, we reported that Wnt/β-catenin signaling is required in odontoblasts for tooth root formation. However, it remains unclear whether Wnt/β-catenin signaling is required in dental epithelium, Hertwig's epithelial root sheath (HERS), for tooth root formation and growth.

Methods: To investigate the functional significance of Wnt/β-catenin signaling in dental epithelium during tooth root formation, we generated transgenic mice with inducible β-catenin activation or inactivation in dental epithelium, respectively.

Results: The inactivation of β-catenin in HERS led to interrupted root growth due to premature disruption of HERS. This phenotype was accompanied by reduced cell-cell adhesion and decreased expression of junctional proteins, as well as increased epithelial-to-mesenchymal transition of HERS cells upon β-catenin depletion. In contrast, following induction of β-catenin stabilization in HERS at the moment of its breakdown, HERS failed to dissociate into the epithelial cell rests of Malassez (ERM). HERS with stabilized β-catenin was altered into a multicellular layer enveloping elongated root dentin with higher expression of junctional proteins. Importantly, this impairment of HERS breakdown led to arrest of further root growth. In addition, the portion of root dentin enveloped by the undissociated HERS remained in a hypo-mineralized state.

Conclusion: Taken together, Wnt/β-catenin signaling is essential for maintaining the structural integrity of HERS during molar root growth. However, optimal regulation of Wnt/β-catenin signaling is also required in the transition of HERS to ERM for molar root growth and mineralization.

Keywords: Wnt, Dental epithelium, Root growth, HERS, ERM

A-0411

Myristoleic Acid Ameliorates Fine Particulate Matter-Induced Dermal Papilla Cell Growth Inhibition via the Activation of Wnt/β-Catenin and Autophagy

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Purpose: Air pollution is globally recognized as a serious issue, with 4.2 million deaths reported in 2016. Fine particulate matter (PM2.5, particles with an aerodynamic diameter of 2.5 μm or less) is a major health concern. It has been reported that PM2.5 infiltrates various organs in the human body, leading to conditions such as lung, respiratory, cardiovascular, and skin diseases. However, its effects on alopecia remain unclear. In this study, we investigated the impact of PM2.5 and the protective role of myristoleic acid (MA) on dermal papilla cells (DPCs), central regulators of hair growth.

Methods: Cell proliferation was determined by trypan blue assay. The protein expression levels were examined by western blots with the relevant antibodies.

Results: PM2.5 inhibited the growth of DPCs. To investigate the mechanism by which PM2.5 inhibits DPCs growth, we examined the effect of PM2.5 on Wnt/β-catenin signaling and autophagy. PM2.5 impairs the Wnt signaling pathway, which is important for hair follicle regeneration, by reducing the phosphorylation of GSK3β and β-catenin. Furthermore, PM2.5 suppressed autophagy by increasing mTOR phosphorylation

and p62 expression while decreasing the expression of beclin 1, Atg-3, -5, -7, and LC3. MA is an omega-5 monounsaturated fatty acid derived from the seeds of plants from the Myristicaceae family, which is already known to promote the growth of DPCs. MA restored the proliferation of DPCs inhibited by PM2.5 through the activation of Wnt/β-catenin and autophagy.

Conclusion: Our results provide insights into the mechanisms underlying the adverse effects of PM2.5 on hair follicles and suggest that MA could restore of PM2.5-induced hair follicle damage.

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Keywords: Fine particulate matter, Myristoleic acid, Dermal papilla cells, Wnt/β-catenin, Autophagy

A-0414

Fine Particulate Matter Inhibits Proliferation of Human Dermal Papilla Cells through Activation of Autophagy and TGF-β Signaling Pathway

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Purpose: Fine particulate matter causes adverse effects on the human body by affecting the respiratory system and skin. However, the action of fine particulate matter on hair loss is unclear and its mechanism of action is not understood. In the study, we investigated the effect of fine particulate matter (PM2.5, particles with a diameter of 2.5 μm or less) on primary human dermal papilla cells (hDPC), a main regulator of the hair growth.

Methods: The effect of PM2.5 on the proliferation of hDPC was evaluated by WST assay. Changes in cell-cycle and autophagy-positive cells were analyzed by FACS after staining with PI or Cyto-ID fluorescence dye, respectively. The action mechanisms of PM2.5 in hDPC were investigated by immunoblotting using specific antibodies.

Results: PM2.5 significantly inhibited the proliferation of hDPC. PM2.5 induced cell cycle arrest by decreasing CDK2 and cyclin A levels and increasing p27 levels. To elucidate the mechanism by which PM2.5 inhibits hDPC proliferation, we investigated the effects of PM2.5 on autophagy and TGF-β signaling pathway. PM2.5 not only increased the levels of p62, beclin 1, Atg-3, -5, -7, and LC3 but also increased the number of autophagy-positive cells in hDPC. PM2.5 also activated TGF-β signaling by increasing the levels of phospho-Samd2 and phospho-Smad3.

Conclusion: These results indicate that PM2.5 can induce cell-cycle arrest and inhibition of cell proliferation in hDPC through activation of autophagy and TGF-β signaling pathway.

Funding: This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (RS-2023-00270936) and by the Korea government (MSIT) (2023R1A2C1007234).

Keywords: Particulate matter, Human dermal papilla cells, Cell-cycle arrest, Autophagy, TGF-β

A-0419

Anti-Cancer Effects of Boehmeria Nivea Extract in Human Pancreatic Cancer Cells

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Purpose: Pancreatic cancer is one of the most fatal solid tumors due to poor prognosis. Boehmeria nivea exhibits anti-inflammatory and antioxidant against a variety of diseases. However, little is known about its anti-cancer effects in human pancreatic cancer cells. In the present study, we aimed to investigate the anti-cancer potential of Boehmeria nivea extract against human pancreatic cancer cells and define its molecular mechanism of action.

Methods: Anti-cancer effects of Boehmeria nivea extract were determined by WST-1 assay, colony formation assay, western blot analysis, Annexin V/PI staining, and animal experiments using xenograft mouse model.

Results: Boehmeria nivea extract significantly suppressed the growth and colony formation of pancreatic cancer cells.

Boehmeria nivea extract also induced apoptosis in pancreatic cancer cells by enhancing the expression levels of cleaved PARP and cleaved caspase-3 as well as inhibiting oncogenic signaling such as MAPK and PI3K/AKT pathway. In addition, Boehmeria nivea extract suppressed tumor growth and induced apoptosis in xenograft mouse model using human pancreatic cancer cells.

Conclusion: Our findings provide crucial evidence that Boehmeria nivea extract may be a potential therapeutic drug for pancreatic cancer.

Funding: This study was supported by the Basic Science Research Program through the National Research Foundation of Korea (NRF), funded by the Ministry of Education (RS-2023-00270936).

Keywords: Pancreatic cancer, Boehmeria nivea, Apoptosis, Natural product

A-0423

Iron Overload May Promote Amyloid Beta Aggregation in the Aging Mice Brains

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Purpose: Iron is an essential mineral for maintaining human health. It transports oxygen and is involved in a variety of metabolic processes, including those involving neurotransmitters. And it plays a role in maintaining normal nervous tissue function. Iron maintains homeostasis, but excessive amounts cause iron accumulation. Iron accumulation in the brain is known to be related to various neurodegenerative diseases, such as dementia. However, the relationship between aging, neurodegenerative diseases, and iron remains undetermined. The purpose of this study is to determine the causal relationship between aging and iron overload.

Methods: An acute iron overload model was designed by IP-injecting iron-dextran into young and old mice, and the brains were then obtained.

Results: Iron was not deposited in most brain parenchyma and was observed only in some vascular endothelial cells. Aggregation of amyloid-β peptides was observed in the aged brain but not in the young brain. These aggregates tended to increase more in iron-overloaded brains than in control brains, and the aggregates co-localized with iron storage proteins. Iron also affected exploration behavior and cognitive function. The exploratory tendency towards new environments in the aged iron overload group was shown to decrease compared to both the control and iron overload young groups and the aged control group.

Conclusion: These results suggest that iron overload in aging may promote aggregation of amyloid-β and potentially contribute to neurodegenerative disease risk.

Funding: This work was supported by the National Research Foundation of Korea NRF-2021R1C1C1008860.

Keywords: Brain, Aging, Iron Overload, Dementia, Amyloid-β

A-0434

Combination Therapy with Telomerase Inhibitor and NK Cells Enhanced Apoptosis on AML Cells

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Purpose: The trend to develop new therapeutic approaches to malignancies has highlighted the utilization of immune cells, especially Natural Killer (NK) cells as an efficient approach. Despite significant anti-tumor effects, the mono utilization of the effects produced by NK cells are limited. The purpose of this study was to determine the effect of BIBR1532, a human telomerase reverse transcriptase (hTERT) inhibitor, in enhancing the cytotoxic function of NK cells against Acute Myeloid Leukemia (AML) cells.

Methods: Primary AML cells and Kg-1a cell lines were cultured and treated with the IC50 values of BIBR1532 for 48 h and then treated with NK cells. cytotoxicity, cell proliferation, and apoptosis results were analyzed using Annexin-V/7AAD, Ki-67 assay, flow cytometry, and Real-time PCRassay.

Results: Telomerase Inhibition (TI) of primary AML and Kg-1a cells with IC50 values (38.75 and 57.64 μM) sensitized AML cells and enhanced anti-proliferative effects of NK cells.

furthermore, TI enhanced the cytotoxic effects (IFN-γ and CD107-a) of NK cells on AML cells and significantly increased the induction of apoptosis. Moreover, BIBR1532 and NK cells upregulated the expression levels of Bax and Bad genes and Bax/Bcl-2 ratio, and downregulated mRNA expression levels of Bcl-2 and Bcl-xl.

Conclusion: Overall, BIBR1532 and NK cells, in a combinative form, induced apoptosis and decreased proliferation by targeting apoptosis-related genes such as Bax and Bcl-2.

Keywords: Telomerase, Natural killer cell, Acute myeloid leukemia, Apoptosis

A-0460

Localization of Thioredoxin in Sea Cucumber Holothuria Atra

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Purpose: Sea cucumbers have long been utilized in the food and folk medicine systems of Asian and Middle Eastern communities. They have been well recognized for their high commercial value and effectiveness against hypertension, asthma, rheumatism, cuts and burns, impotence, and constipation. In Thailand, Holothuria atra, commonly known as black sea cucumber, is one of the most economically important aquaculture species, mainly distributed in the Gulf of Thailand and the Andaman Sea. Considerable amounts of phenolics and free radical scavengers have also been determined in sea cucumbers. As one of the most important antioxidant enzymes, thioredoxin (Trx) plays a crucial role in fighting against excess reactive oxygen species (ROS).

Methods: The localization of Trx was investigated by immunohistochemical staining with rabbit antiserum raised against the recombinant Faciola gigantica thioredoxin protein (rFgTrx) on H. atra sections of both the body wall and the intestine.

Results: In the body wall, rFgTrx immunoreactivity was observed in collagenous fibrils in the body wall dermis but not found in the longitudinal and circular smooth muscles, compared with the body wall control sections. In the intestine, a high intensity of rFgTrx immunoreactivity was observed in the cytoplasm of the cells in the digestive epithelium and some but not all coelomocytes. Moderate-intensity immunoreactivity was found along the connective tissue fibers and the cytoplasmic rim of fibroblast-like cells, compared with the intestine control sections.

Conclusion: This finding confirmed that Trx has shared an evolutionary conserved gene that was found from the parasite to the echinoderm sea cucumber tissues that could play an important role as antioxidants acting against oxidative stresses. Thus, Trx may be one of the factors that have a protective effect on the sea cucumber Holothuria atra.

Keywords: Thioredoxin, Immunohistochemistry, Sea cucumber, Holothuria atra

A-0461

Histological Analysis of the Plantar Adipose Body

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Purpose: The objective was to describe the histological organization of the plantar adipose body (PAC) and a comparative analysis between its medial and lateral compartments.

Methods: 7 feet without pathologies associated with the heel were used; coronal cuts were made and processed using the current histological technique, stained with Hematoxylin and Eosin. The variables studied were structure, organization and content of the CAP.

Results: The CAP is organized in the form of adipose compartments (AC) of white fat with adipocytes of a preserved size, and between them a fine framework of loose fibrous connective tissue and capillaries. In addition, thick fibrous septa arranged parallel to the superficial and deep fasciae, being continuous from medial to lateral. Structurally, they presented a compact and ordered center of collagen fibers, with variable development, associated with a loose connective tissue with fine collagen fibers and others with a wavy and refractive profile (elastic fibers). The fibrous septa in a vertical arrangement (TFV) to the fascia, a structure similar to the previous one, presented variations in its thickness, branching and amount of associated loose connective tissue. Content: In the medial

compartment of the PDA there was a predominance of fibrous tissue such as thick TFVs, generally with little-short branching, and its well-defined ACs presented variation in size depending on the characteristics of the TFVs. The lateral compartment of the CAP had a predominance of TFV of smaller thickness and with a greater degree of branching, in addition to a greater number of AC, with smaller size and greater spatial extension.

Conclusion: The descriptive histological analysis of the CAP showed differences between the medial and lateral compartments, with predominance in the medial distribution of fibrous tissue with thicker septa associated with a greater number of adipose compartments, while in the lateral adipose tissue predominated in panicles divided by fine TFV.

Keywords: Plantar fat pad, Plantar adipose body, Adipose pad of heel, Heel fat pad

A-0533

Comparison of Biocompatibility of Ceramic and Titanium in Micropig Ankle Joint Replacement Arthroplasty

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Purpose: Ankle arthritis is a disease characterized by degeneration of the tibiotalar joint of the ankle. There are various treatment methods, among which total joint replacement arthroplasty is performed for severe ankle arthritis. Artificial joints made of titanium are commonly used in total joint replacement arthroplasty, and these have proven to be biocompatible and robust. However, these artificial joints have the disadvantage that titanium can spread to tissues other than the bone joint. Accordingly, the newly emerging material for artificial joints is ceramic. However, in the case of ceramics, biocompatibility has not yet been clearly proven. Therefore, this study was conducted to compare the biocompatibility of existing titanium materials and new ceramic materials using micropig, a commonly used animal model. In addition, it was confirmed whether it was suitable for use in total ankle joint replacement arthroplasty.

Methods: In this study, six micropigs were used to remove half of the talus of the ankle joint, and an artificial joint was inserted into the corresponding location and fixed with a screw. Afterwards, post-surgical evaluations such as weight changes were conducted, and tissue changes were also confirmed.

Results: When comparing the most results, including weight change, blood tests, and tissue tests, titanium and ceramic materials showed similar biocompatibility. However, titanium material was confirmed to have bony erosion in immune and tissue reaction tests.

Conclusion: In conclusion, artificial joints using titanium and ceramics both have excellent biocompatibility, and ceramic materials can also be used in artificial joints. However, since ceramic is lesser than to titanium in terms of strength, additional research is needed to compensate for this.

Keywords: Ankle arthritis, Micropig, Ankle arthroplasty, Biocompatibility

A-0539

The Inhibitory Effect of Chaenomeles Sinensis Extract on Ovalbumin-Induced Allergic Rhinitis

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Purpose: Chaenomeles sinensis has traditionally been used as an herbal medicine due to its characteristics that protect against inflammation, hypertension, and mutagenesis. However, the effect of Chaenomeles sinensis extract (CSE) on allergic rhinitis (AR) and its underlying mechanisms have yet to be thoroughly investigated. Here, an OVA-induced AR mouse model was established to evaluate the anti-inflammatory effects and possible mechanisms of CSE.

Methods: BALB/c mice were sensitized by injecting 50 μg OVA into the peritoneal cavity and challenged with 20 μL OVA solution (10 mg/mL). Mice were orally administered various doses of CSE once daily (50, 100, 200 mg/kg) or dexametha-

sone (Dex; 2.5 mg/kg) or saline 1 h before the OVA challenge. The cell infiltrated in the nasal lavage fluid was analyzed; levels of OVA-specific immunoglobulins in serum, and cytokines in the nasal lavage fluid were measured, and nasal histopathology was evaluated.

Results: CES administration suppressed the production of OVA-specific IgE, the imbalance of Th1/Th2 cytokines, the alteration of nasal histology and the activation of IL-33/ST2 signaling pathway. Subsequently, CES improved the OVA-induced epithelial dysfunction and upregulated E-cadherin, thus indicating that CES plays a protective role in epithelial barrier integrity.

Conclusion: Collectively, the results show that the supplementation of CSE at different doses effectively regulated AR, thus suggesting the therapeutic efficiency of CSE in ameliorating airway diseases.

Keywords: Allergic rhinitis, Airway inflammation, Chaenomeles sinensis, Cytokines, Immunoglobulins

A-0565

Lectin Histochemistry of the Subchondral Bone of the Hip Joint during the Postnatal Period

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Purpose: Aberrant glycosylation of the articular cartilage, in particular subchondral bone, plays one of the key roles in the pathogenesis of joint damage. The lectin-binding patterns in the intact subchondral bone remain not fully understood.

Methods: Lectin histochemistry of the subchondral bone was studied using tissue sections of the hip joint of intact Wistar rats (from the first to the 90th day). The samples were histologically processed and stained with lectins conjugated with horseradish peroxidase (HRP): peanut (PNA), soybean (SBA), Helix pomatia (HPA), wheat germ (WGA), Perca fluviatilis (PFA), Sambucus nigra (SNA), Lens culinaris (LCA), and Vicia sativa (VSA). Staining intensity was evaluated semiquantitatively (from 0 to ++++).

Results: Till the 14th day, the primary spongiosa showed no lectin affinity. The calcified cartilaginous spicule revealed strong (+++) expression to all studied lectins till the 90th day. From the 30th day, the epiphyseal and metaphyseal bone matrix showed no lectin affinity to the SNA, PFA, WGA, and VSA; and a weak (+) expression to the HPA, PNA, SBA, and LCA. The matrix fibrils also revealed strong (from +++ to ++++) affinity to the HPA, PNA, SBA, WGA, and LCA. The endosteum and subchondral bone cells showed a robust expression (++++) to all studied lectins, except for the SNA (+, weak staining). The bone marrow cells expressed different affinity (from + to +++) to all studied lectins. The expression of lectins in the epiphyseal bone matrix was generally similar to that seen in the matrix of the middle zone of the articular cartilage. The substantial differences in lectin-binding patterns of the subchondral bone between the acetabulum and the femur were not observed.

Conclusion: The strongest lectin affinity was found in the cartilaginous spicule, endosteum, fibrils, and osteocytes; the lowest expression showed the bone extracellular matrix.

Keywords: Hip joint, Lectins, Laboratory rats, Subchondral bone

A-0575

The Medaka Mutant Deficient in Eyes Shut Homolog Exhibits Opsin Transport Defects and Enhanced Autophagy in Retinal Photoreceptors

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Purpose: Eyes shut homolog (EYS) encodes a proteoglycan and the human mutation causes retinitis pigmentosa type 25 (RP25) with progressive retinal degeneration. RP25 most frequently affects autosomal recessive RP patients with many ethnic backgrounds. Although studies using RP models have facilitated the development of therapeutic medications, Eys has been lost in rodent model animals.

Methods: Here we examined the roles for Eys in the maintenance of photoreceptor structure and function by generating eys-null medaka fish using the CRISPR-Cas9 system.

Results: Medaka EYS protein was present near the connecting cilium of wild-type photoreceptors, while it was absent

from the eys-/- retina. The mutant larvae exhibited a reduced visual motor response compared with wild-type. In contrast to reported eys-deficient zebrafish at the similar stage, no retinal cell death was detected in the 8-month post-hatching (8-mph) medaka eys mutant. Immunohistochemistry showed a significant reduction in the length of cone outer segments (OSs), retention of OS proteins in the inner segments of photoreceptors, and abnormal filamentous actin network at the base of cone OSs in the mutant retina by 8 mph. Electron microscopy revealed aberrant structure of calyceal processes, numerous vesiculation and lamellar interruptions, and autophagosomes in the eys-mutant cone photoreceptors. In situ hybridization showed an autophagy component gene, gabarap, was ectopically expressed in the eys-null retina.

Conclusion: These results suggest eys is required for regeneration of OS, especially of cone photoreceptors, and transport of OS proteins by regulating actin filaments. Enhanced autophagy may delay the progression of retinal degeneration when lacking EYS in the medaka retina.

Keywords: Autophagy, Cone photoreceptor, Eyes shut homolog, Retinitis pigmentosa

A-0598

Exploring the Distinct Metabolic Responses to Short-Term and Long-Term PCB153 Exposure: Bridging in Vivo and in Vitro Insights

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Purpose: Polychlorinated Biphenyl (PCB)153, one of the endocrine disrupting chemicals persisting in the environment, accumulates in large quantities in humans and causes various diseases, including obesity. In this study, the systemic and cellular effects of PCB153 to understand its contribution to metabolic health deterioration were studied.

Methods: For in vivo studies, C57BL/6 mice were subjected to intraperitoneal injections of either corn oil or PCB153 (50 mg/kg) over a period of four weeks (at weeks 2, 3, 4, and 5) within a total study duration of six weeks, and we examined adiposity and whole-body insulin action. The molecular mechanism was investigated by treating 3 μM of PCB153 to the two groups of 3T3-L1 mouse adipocytes. One group was subjected to a short-term exposure while the other group was subjected to long-term exposure.

Results: In our mouse model, administration of PCB153 specifically increased fat mass in epididymal white adipose tissue and precipitated metabolic disorders, notably insulin resistance and inflammation within adipose tissues. Interestingly, 3T3-L1 cells treated with a single dose of 3 μM PCB153 (short-term exposure) demonstrated a significant enhancement in adipocyte differentiation and an increase in lipid droplet size, compared to cells that received the same total concentration of PCB153 distributed over multiple low doses throughout the differentiation process (long-term exposure). Following the observed differences in adipocyte differentiation and lipid droplet size, analysis revealed that adipogenic and insulin sensitivity mRNA levels were elevated in the short-term treatment group. Conversely, the long-term treatment group exhibited an increase in the expression of inflammatory mRNAs, indicating a shift towards a pro-inflammatory state.

Conclusion: These findings highlight the critical role of exposure duration in mediating the metabolic effects of PCB153, with implications for understanding the mechanisms through which environmental pollutants contribute to metabolic diseases.

Funding: This work was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (No. RS-2023-00248268).

Keywords: Polychlorinated Biphenyl 153, Obesity, Adipogenesis, Insulin resistance, Inflammation

A-0602

The Deltoid Muscle: A Proposed Classification System on Human Fetuses

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Purpose: The origin of the deltoid muscle is located on the lateral third of the clavicle, the lateral border of the acromion and the spine of the scapula. The insertion of the deltoid muscle is the deltoid tuberosity. In the most popular approach, the

deltoid muscle is divided into three parts. Our research shows that each part of the deltoid muscle consists of up to three bellies during prenatal life.

Methods: During the research 80 upper limbs of 40 spontaneously-aborted human fetuses (32 male, 48 female), 18–38 weeks of gestation at the time of death, from the Central European population were studied. All measurements were made with an electronic digital calliper. The study protocol was approved by the Bioethics Committee of the Medical University of Lodz (RNN/1337/20/KE).

Results: All of the studied deltoid muscles consisted of three parts. Each part had one (Type I), two (Type II) or three (Type III) bellies. The most common form was Type I in all parts: it occurred in 57.5% of cases in the spinal part, 73.75% in the acromial part and 81.25% in the clavicular part. Type III was the rarest form in all parts: it was present in 7.5% of cases in the spinal part, 12.5% in the acromial part and 3.75% in the clavicular part. The fusion between the clavicular part of the deltoid muscle and the pectoralis major muscle occurred in 26.25% of cases.

Conclusion: The deltoid muscle is characterised by morphological variability, even in fetuses. These variations can have an impact on the shoulder biomechanics in the early stages of postnatal life. Fusion of the deltoid muscle with the pectoralis major muscle can even eliminate the deltopectoral triangle. Knowledge of the frequency of the population rate (26.25%) of this fusion can be important for surgeons.

Keywords: Deltoid muscle, Human fetuses, Morphological variations

A-0608

Effect of Metabolic Acidosis on Kidney Collecting Duct Cells

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Purpose: Renal collecting duct cells play an important role in regulating acid-base balance. These cells are composed of several different types including principal cells and intercalated cells. Specifically, intercalated cells secrete acid or alkali through H^+-ATPase and can be further divided into various cell types. The purpose of this study was to examine the effect of metabolic acidosis on intercalated cell subtypes in the kidney.

Methods: The animal model was induced in mice by ingesting HCl for 7 days. Kidney tissues were processed for immunohistochemistry.

Results: Dietary acid loading induces a reduction in urine pH. Anion exchanger (AE1)-positive type A cells exhibited distribution across the connecting tubule (CNT), cortical collecting duct (CCD), and outer medullary collecting duct (OMCD). Induction of metabolic acidosis significantly increased both the size and number of type A cells in the CCD and OMCD. In contrast, there was a reduction in the population of type B cells in CCD. A subpopulation of cells in the CNT, expressing apical H^+-ATPase and lacking AE1 expression, increased in cell size.

Conclusion: These results demonstrated that kidney intercalated cells may consist of diverse types of cells and are involved in acid secretion in metabolic acidosis.

Funding: This work was supported by the National Research Foundation of Korea (NRF-2020R1A2C1100184).

Keywords: Kidney, Immunohistochemistry, Acidosis, Collecting duct

A-0609

Cilk1 Modulates Hedgehog Pathway to Control Tooth Pattern

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Purpose: Primary cilium is a solitary organelle that transmits chemical and mechanical stimuli to the cell during development and tissue homeostasis. Cilk1 (Ciliogenesis associated kinase 1, also known as Ick), which is a highly conserved serine/threonine-protein kinase, localizes in primary cilia and regulates cilia formation. Human CILK1 mutations cause lethal endocrine-cerebro-osteodysplasia syndrome and short rib polydactyly syndromes. Additionally, it has been reported that the loss of Cilk1 function disrupts the regulation of ciliary transport and hedgehog signaling during development, and Cilk1-deficient mice shows severe ciliopathy phenotypes such as polydactyly, edema, cleft palate and abnormal tongue shape.

However, tooth phenotype in Cilk1-deficient mice has not been reported yet.

Methods: The expression pattern of Cilk1 was investigated with RNA in-situ hybridization. The morphological and molecular functions of Cilk1 in crown and root patterning was investigated using the Cilk1-deficient mice. The length and frequency of primary cilia were examined in the mandibular tooth germs. Additionally, to evaluate the relationship between tooth pattern and the activity of hedgehog pathway, we utilized the PCS1–MRS1$^{\triangle/\triangle}$ mice, which are Shh enhancer-deleted mice showing the supernumerary tooth formation.

Results: We found supernumerary teeth in both maxilla and mandible of Cilk1-deficient mice and a decreased expression level of hedgehog target genes in tooth germs of Cilk1-deficient mice with showing the longer and more primary cilia. Furthermore, in Cilk1$^{-/-}$; PCS1–MRCS1$^{\triangle/\triangle}$ mice, maxillary molars were fused and mandibular supernumerary molar became larger, indicating that the supernumerary tooth size and tooth fusion occur in proportion to the degree of hedgehog pathway activity.

Conclusion: These results suggest that Cilk1 controls hedgehog pathway activity in developing teeth by adjusting the length of primary cilia, thereby shaping tooth patterns ranging from the supernumerary tooth formation to the tooth fusion.

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Keywords: Cilk1, Primary cilia, Tooth development, Tooth patterning, Tooth morphorlogy

A-0611

Differentiation of Human Induced Pluripotent Stem Cells to Functional Taste Receptor Cells

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Purpose: Human-induced pluripotent stem cells (hiPSCs) are capable of differentiating into cells of all three germ layer and can be utilized as a source for regenerative medicine in clinical applications. Mammalian taste receptor cells are sensory cells that have properties of both epithelial and neuronal cells, and are thus developmentally intriguing. Taste buds are aggregates of taste receptor cells, which transduce chemical stimuli into neural signals to mediate the sense of taste. The purpose of this study is to differentiate hiPSC to a functional taste receptor cells capable of detecting different tastants.

Methods: hiPSC are differentiated in a stepwise manner to definitive endoderm which are further differentiated to lingual epithelium followed by differentiation to taste receptor cells. Molecular characterization of cells is performed at every stages of differentiation to confirm the presence of specific markers using immunofluorescence and RT-qPCR.

Results: Presence of definitive endoderm markers (FOXA2 and SOX17) and taste receptor cell markers (K8, SNAP25, TRPM5, EAAT1) were observed by immunofluorescene. Functional assessment of the taste receptor cells was done by calcium imaging by applying different taste stimulant to the cells followed by measuring the increase in intracellular calcium influx.

Conclusion: Successful differentiation of hiPSC to taste receptor cells were performed and confirmed by the presence of specific markers. Functional assessment of the taste receptor cells established its physiological activity.

Funding: This work was supported by the National Research Foundation of Korea (NRF) Grant funded by the Korea Government (MSIP).

Keywords: HiPSC, Definitive Endoderm, Lingual Epithelium, Taste Receptor Cells, Calcium Imaging

A-0614

Epithelial Plasticity Enables Taste Receptor Cell Regeneration following Lgr5+ Stem/Progenitor Cell Loss

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Purpose: Taste receptor cells are sensory cells embedded in the papilla of the oral cavity. These cells have a definite life span of 8-12 days and are renewed continuously by a pool of stem/progenitor cells present outside the taste bud. Genetic

lineage tracing has identified that Lgr5+ stem/progenitor cells present at the trench of the circumvallate papilla (CVP) give rise to all taste and non-taste epithelial cells during homeostasis, as well as during regeneration. It remains to be identified whether the CVP harbors another pool of stem cells that can regenerate the epithelium in the absence of Lgr5 expressing stem/progenitor cells.

Methods: Lgr5 expressing cells in the CVP of mice were specifically ablated using Lgr5 $^{DTR/+}$ mice that has diphtheria toxin receptor (DTR) gene knocked into the Lgr5 locus.

Results: Administration of diphtheria toxin led to the complete loss of Lgr5 expressing cells in the CVP. Ablation of Lgr5 expressing cells led to the degeneration of taste buds and taste receptor cells expressing K8 with degeneration of basal cells and basement membrane within 24 h after DT injection. Interestingly, after 72 h of injection, it was observed that the basal cells and basement membrane had completely regenerated in the CVP, but no taste buds were observed. By 2 weeks after the injection, the taste buds were also regenerated in the CVP. Lineage tracing using K8$^{CreERT2/+}$; R26R$^{Tom/+}$ showed that cells expressing K8 from Von Ebners gland duct participated in the regeneration of taste buds.

Conclusion: These data indicate that the differentiated cells from the Von Ebners gland duct participate in the regeneration of taste buds by undergoing dedifferentiation in the absence of a resident Lgr5 expressing stem cell pool.

Funding: This work was supported by the National Research Foundation of Korea (NRF) Grant funded by the Korea Government (MSIP) (2022R1A2B5B03001627 and NRF-2021R1A2C1005506).

Keywords: Lgr5 ablation, Stem cells, Taste receptor cells, Dedifferentiation, Regeneration

A-0617

Different Role of TRF1 and TRF2 Expression in Non-Small Cell Lung Cancers

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Purpose: TRF1, TRF2, and TERT (telomerase reverse transcriptase) are telomere-associated factors that regulate telomere length. Genetic changes in these genes may be associated with cancer pathogenesis; however, this relationship has not yet been comprehensively elucidated in lung cancer. Exploring the clinicopathologic and prognostic values of TRF1, TRF2, and TERT expression in non-small cell lung cancers (NSCLC).

Methods: The clinical significance of TRF1, TRF2, and TERT expression in 141 patients with NSCLC was investigated. Additionally, these findings were supported by the open big data from The Cancer Genome Atlas (TCGA).

Results: TRF1 and TRF2 expression levels tended to be associated with smoking, and TERT expression was positively correlated with age. The survival analysis showed that TRF1 expression predicted a better prognosis for squamous cell carcinoma (SCC), whereas TRF2 expression was associated with a shorter survival in adenocarcinoma. TCGA data also showed a better prognosis for SCC with TRF1 expression. However, the TRF2 results were not in agreement with our data.

Conclusion: We present the clinical and prognostic values of TRF1, TRF2, and TERT expression in NSCLC tissues and TCGA. Our findings suggest that TRF1 expression is a possible prognostic marker for NSCLC, particularly SCC.

Keywords: TRF1, Lung cancer, TRF2, TERT, Telomere

A-0623

Statin Prevents Cancer Development in Chronic Inflammation by Blocking Interleukin 33 Expression

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Purpose: Chronic inflammation is a major cause of cancer worldwide. Interleukin 33 (IL-33) is a crucial initiator of cancer-prone chronic inflammation; however, its induction mechanism by environmental causes of chronic inflammation in unknown. So, we demonstrated this mechanism in this study.

Methods: We used inflammed-tissue RNA-sequencing and cancer aniaml model to demonstrate our concepts and drug-screening with FDA-approved drug library to find inhibitor of this mechanism.

Results: We demonstrate that Toll-like receptor (TLR)3/4-TBK1-IRF3 pathway activation links environmental insults to IL-33 induction in the skin and pancreas. An FDA-approved drug library screen identified pitavastatin to effectively sup-

press IL-33 expression by blocking TBK1 membrane recruitment/activation through the mevalonate pathway inhibition. Accordingly, pitavastatin prevented chronic pancreatitis and its cancer sequela in an IL-33-dependent manner. The IRF3-IL-33 axis was highly active in chronic pancreatitis and its associated pancreatic cancer in humans. Interestingly, pitavastatin use correlated with a significantly reduced risk of chronic pancreatitis and pancreatic cancer in patients.

Conclusion: Our findings demonstrate that blocking the TBK1-IRF3 signaling pathway suppresses IL-33 expression and cancer-prone chronic inflammation. Statins present a safe and effective propylactic strategy to prevent chronic inflammation and its cancer sequela.

Keywords: Statin, Chronic inflammation, Cancer, TBK1-IRF3, IL-33

A-0624

Deficiency of FABP5 due to Activation of NOTCH Signaling Pathway Promotes Anti-Tumor Activity of Tumor Associated Macrophage in Colorectal Cancer

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Purpose: Tumor-associated macrophages (TAMs) play important roles in tumor progression. High TAM density in colorectal cancer (CRC) tissue was found to confer a good prognostic effect. Metabolic patterns have an important influence on macrophage functional polarization. Fatty-acid binding protein 5 (FABP5) is highly expressed in TAM and controls macrophage function by modulating lipid transport and metabolism. However, the effects whether FABP5 in TAM modulates CRC progression remains unclear. In this study, we examined the detailed distribution of FABP5+ TAMs in a CRC transplanted mouse model and explored the molecular mechanism affecting the expression of FABP5 in TAMs

Methods: Subcutaneous tumor model was established using MC38 cells and wild type or FABP5 knockout C57BL6 mouse in vivo. Bone-marrow derived macrophages (BMDMs) were co-cultured with MC38 in vitro. RO4929097 (γ secretase inhibitor) was used to inhibit NOTCH singling pathway. The FABP5 expression in TAMs and BMDMs were examined using qPCR, immunofluorescence, and immunohistochemistry.

Results: The tumor size in FABP5 knockout mice was significantly reduced compared with wild type group, Immunohistochemically, The cell density of TAMs in tumor was higher in KO mice compared with wt mice. FABP5 was strongly detected in TAMs located in the tumor margin but weaker in TAMs in the tumor core. Interestingly, intraperitoneal injection of RO upregulated the expression of FABP5 in TAMs in the tumor core. When BMDMs were contact co-cultured with MC38, FABP5 expression in BMDMs was significantly reduced, but restored after RO treatment.

Conclusion: FABP5 expression in TAMs may be suppressed by CRC via NOTCH signaling, thereby modulating the anti-tumor effects in macrophages.

Keywords: Colorectal cancer, Tumor associated macrophage, Fatty acid binding protein 5, NOTCH

A-0629

Generation of Human Cortical Organoids for Studying Microcephaly Phenotypes in Cohen Syndrome

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Purpose: Generation of human cortical organoids for studying microcephaly phenotypes in Cohen syndrome.

Methods: Generation of COH1 knockout human pluripotent stem cell (hPSCs) lines using CRISPR/Cas9, Generation of cortical organoids from COH1 KO hPSCs, Immunostaining, RNA-sequencing, MEA analysis.

Results: Neural organoids display three-dimensional structures resembling in vivo neural architectures. We previously developed a new protocol for culturing spinal cord organoids, enabling size control and synchronized neural tube morphogenesis. In this study, we assessed the application of this concept to induce anterior, human cortical organoids (hCO). Inducing neuroepithelial (NE) cells in 2D and re-aggregating them led to tube-forming morphogenesis similar to caudal

spinal cord induction. While dissociation and reaggregation of NE cells eliminated tube morphogenesis, it ensured uniform organoid sizes. The transcriptome profiles of these hCO resembled the frontal cortex of 20 weeks post-conception (PCW) human embryos. Using this hCO protocol, we investigated microcephaly phenotypes associated with Cohen syndrome (CS), caused by VPS13B gene mutations. Deleting VPS13B in human pluripotent stem cells resulted in Golgi dispersion and delayed growth retardation onset in mutant hCOs, akin to CS patients with secondary microcephaly. This delay is partly linked to reduced axonal growth. Additionally, mature CS organoids showed enhanced glutamate signaling and hyperexcitation.

Conclusion: In conclusion, this protocol is suitable for studying microcephaly phenotypes from human genetic mutations due to its simplicity and scalability.

Keywords: Cortical organoids, Microcephaly, Neurodevelopmental disorders, VPS13B

A-0631

Alterations of Tyrosine Phosphorylated Proteins Associated with Androgen Receptor Expression in Rat Prostate Development

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Purpose: Mammalian prostate gland plays a role in alkaline substance synthesis including proteins. These functions are depending on glandular maturation and testosterone-androgen receptor (AR) dependent actions. Since tyrosine phosphorylated (TyrPho) proteins, also important for secreting pathways, have been localized in the androgen dependent organs, association between AR and TyrPho protein expressions in prostate is still unknown. This study aimed to investigate the changes of such proteins in prostate gland of male castrated rats.

Methods: Nine prepubertal and adult twenty-two adult male rats were divided into the prepubertal (Pre, n=9), Sham (n=6), castrate for 3 (Cas-3, n=8) and for 7 (Cas-7, n=8) days groups, respectively. Serum testosterone level was determined. Histology and AR localization in each prostatic lobe were observed. TyrPho and AR protein expressions were also examined.

Results: The results showed undetectable testosterone level and low AR expression in Pre and Cas prostates with the decreased size. Few histopathologies were found in Cas groups. In ventral lobe, a Tyrpho protein was increased at the 49 kDa but the 54, 31, and 26 kDas were decreased in the Pre and Cas groups. For dorsolateral lobe, they were decreased at 33 and 30 kDas in Pre group and only 30 kDa was decreased in Cas-3 group. In the anterior lobe, the TyrPho proteins 56, 49, 39, 27, and 26 kDas were decreased in Pre group while 56, 27, and 26 kDas were decreased in Cas-3 group.

Conclusion: It concluded that the decrease of testosterone level is associate with AR expression leading to alterations TyrPho protein expressions during prostate development, indicating potential sub/infertility markers in prostate gland.

Keywords: Prostate gland, Androgen receptor, Tyrosine phosphorylated proteins, Castration

A-0632

Notum Plays a Regulatory Role in the Cusp and Root Patterning of the Mouse Molar

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Purpose: Notum has been recognized as a direct target of the Wnt/β-catenin signaling pathway and plays a vital role as a Wnt inhibitor within a negative feedback loop. In the tooth, Notum expression is evident in odontoblast progenitors and early odontoblasts during root formation. Moreover, Notum-deficient mice exhibit severe dentin defects and irregular roots in their teeth. However, the expression pattern of Notum during early tooth development and its role in crown and root patterns remains elusive. This study aimed to investigate the role of Notum in crown and root patterning to reveal the potential value of Notum in tooth morphogenesis.

Methods: The expression pattern of Notum and other tooth-specific genes was investigated with RNA in-situ hybridization and single-cell RNA sequencing analysis. The effect of Notum in crown and root patterning was investigated

using the Notum knockout mice by examining the phenotypic changes with microscopic and micro-CT techniques.

Results: Notum was expressed in the primary enamel knot (EK), secondary EKs, and dental papilla during tooth development. Notum-deficient mice showed enlarged secondary EKs, resulting in broader cusp tips, altered cusp patterns, and reduced concavity in crown outline. These changes in crown outline are directed to diminished cervical tongue length, thus inducing root fusion in Notum-deficient mice.

Conclusion: These findings support the previous concept that the tooth cusp and crown pattern considerably influence root pattern. The size of the secondary enamel knot, regulated by the Wnt/Notum negative feedback loop, impacts the patterns of the crown and root during tooth morphogenesis.

Funding: This work was supported by the National Research Foundation of Korea (NRF) grants funded by the Korea government (MSIT) (NRF-2020R1A2C2005790, NRF-2023R1A2C1007510, RS-2023-00269830).

Keywords: Notum protein, Tooth crown, Tooth root, Wnt signaling, Morphogenesis

A-0633

Momordica Charantia Fruit Extract with Antioxidant Capacity Improves the Expression of Tyrosine-Phosphorylated Proteins in Epididymal Fluid of Chronic Stress Rats

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Purpose: Although the protective effects of Momordica charantia L. (MC) extract on chemical-induced testicular damage have previously shown, the preventive effects of MC extract on functional proteins in the epididymis under chronic stress have never been reported. This study investigated the protective effects of MC fruit extract on epididymal protein secretion, especially tyrosine-phosphorylated (TyrPho) proteins, in rats exposed to chronic unpredictable stress (CUS).

Methods: Total phenolic compounds (TPC), total flavonoid compounds (TFC) and antioxidant capacities of MC extract were measured. Male rats were divided into the control, CUS, and 2 groups of CUS received different doses of MC extract (40 or 80 mg/kg). In treated groups, rats were given MC daily, followed by induction of CUS for 60 consecutive days. Plasma corticosterone and testosterone levels were analyzed after the end of experiment. Expressions of heat-shock protein 70 (HSP-70) and TyrPho proteins present in epididymal fluids were quantified using Western blot. The epididymal histology stained with H&E was also examined.

Results: MC extract possessed TPC, TFC, and had 2,2-diphenyl-1-picrylhydrazyl antioxidant capacity of (4.985 ± 0.086) mg trolox equivalents per gram, radical 50% inhibitory concentration of (2.011 ± 0.008) mg/mL and ferric reducing antioxidant power of (23.697 ± 0.819) lmol Fe(II) per gram. Testosterone level was significantly increased, while the corticosterone level was significantly improved in groups treated with MC extract, compared to the CUS animals. Particularly, high dose of MC extract prevented the impairments of HSP-70 and TyrPho protein expressions in the luminal fluid of the epididymis of CUS rats while there are no changes of epididymal histology between groups.

Conclusion: MC fruit extract had antioxidant activities and improved the functional proteins secreted from the head and tail of the epididymis. It is possible to develop the MC fruit extract as a male fertility supplement for enhancing functional sperm maturation in stressed men.

Funding: This research project was financially supported by the young researcher development project of Khon Kaen University.

Keywords: Epididymal fluid, Tyrosine phosphorylated proteins, Chronic unpredictable stress, Momordica charantia, Antioxidant capacity

A-0640

Comparison of Toxic Effects of Pyrethroid and Herbal Based Mosquito Vaporizers on Heart of Wistar Albino Rats: A Light Microscopic Study

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Purpose: To compare the histological changes due to pyrethroid and herbal based mosquito vaporizers on Heart and compare the effect of withdrawal of these vaporizers on histol-

ogy of Kidney of male wistar albino rats.

Methods: Total 26 well preserved male albino rats were dissected and Heart were separated and categorized in 3 groups: Control group (not exposed to any chemicals) Experimental group 1-Organs of 12 rats (divided in subgroup 1A and 1B, each subgroup contain 6 rats). Experimental Group 2–8 rats, divided in subgroup 2A and 2B, each subgroup contain 4 rats Ethical clearance was obtained from institutional ethics committee (Reference no.70/IAH/Pharma-15).

Results: The Heart were showing gross destruction in their histology and these changes were more marked in pyrethroid vaporizer exposed group than in herbal based mosquito vaporizer. Also some of the normal histological features were recovered after withdrawal of chemicals and reversal was better in herbal based mosquito vaporizer.

Conclusion: Histological findings of present study suggests that pyrethroid (Transfluthrin) based mosquito repellents are harmful to the vital organs Heart probably due to induction of oxidative stress. Herbal based mosquito repellent also showed damage though the severity was mild as compared to pyrethroid. Reversal changes were much better in herbal withdrawal group than the pyrethroid withdrawal group.

Keywords: Histological changes, pyrethroid, herbal, Heart, Mosquito vaporizer

A-0648

Aging in Place for Elderly after Allogeneic-HSCT (Allo-HSCT) with Dementia: Status How Informal Care Could Help Maintaining Higher Quality of Life?

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Purpose: The potential curative treatment is Allogeneic hematopoietic cell transplantation (Allo-HCT) although the long-term survival is quite poor. Indonesia is entering an aging society and the prevalence of Elderly with independence barriers reaches 3.7% (MoH, 2018). The elderly with post-Allo-HSCT are very dependent on the presence of a caregiver to maintain their QoL. However, certified informal caregivers are not available in Indonesia.

Methods: Using longitudinal and large-scale data (Indonesia Family Life Survey (IFLS) wave 5 of 2014), this study aims to explore how the availability of caregivers in maintaining the quality of life of Elderly post-Allo-HSCT with Dementia comorbidity.

Results: Indonesian seniors reach 10.8% of the total population and 48% have chronic diseases. 7.36% of patients with blood cancer recorded in Indonesia are Elderly. 34.7% of elderly with post-Allo-HSCT were identified as having dementia symptoms with moderate to severe (using mini-cognitive test scoring). The elderly needing long-term care due to these health conditions reached 9.7% and 88% of them did not have a caregiver. Less than 1% of seniors are cared for by paid caregivers and are concentrated in urban areas. Most of the elderly are cared for by their families (aging in the community). 36% of post-Allo-HSCT elderly with dementia are holders of social protection programs. Using the Geriatric Depression Scale (GDS) it was found that the percentage of post-Allo-HSCT elderly with dementia who had a caregiver with mental health problems was lower than respondents who did not have a caregiver.

Conclusion: As a country that will become the second-largest Silver Economy in the world after China, Indonesia is an aging market pushed to meet the availability of certified informal caregivers. Indonesia needs to expand health insurance, and standardize policies for certified caregivers, and senior living.

Keywords: Dementia, Elderly with hsct, Caregiver, Quality of life, Silver economy

A-0669

Improving Skin Elasticity and Basement Membrane Restoration in Aged Mice via Radiofrequency Treatment, Facilitated by Heat Shock Protein 47

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Purpose: This study investigates the efficacy of combined treatment involving monopolar and bipolar radiofrequency in

enhancing skin elasticity and restoring the basement membrane by upregulating heat shock protein 47 (HSP47) in aged animal skin. Skin elasticity and the integrity of the basement membrane are crucial for maintaining skin health and function, both of which decline with aging. The research explores the effects of the combined radiofrequency treatment on key markers including HSP47, CD206, interleukin-10 (IL-10), and collagen 17.

Methods: Through a series of experiments using in vitro and in vivo models, the combined radiofrequency treatment regimen was administered, followed by assessment using histological and immunohistochemical analyses.

Results: Results demonstrate a significant increase in skin elasticity and restoration of the basement membrane integrity following treatment. Immunohistochemical analysis reveals upregulation of HSP47, CD206, IL-10, and collagen 17 in response to the combined radiofrequency treatment, indicating their role in mediating the observed improvements. The findings suggest that the combined application of monopolar and bipolar radiofrequency effectively enhances skin elasticity and restores the basement membrane by modulating the expression of key proteins including HSP47, CD206, IL-10, and collagen 17.

Conclusion: These results offer valuable insights into potential therapeutic strategies for addressing age-related changes in skin integrity and function, with implications for dermatological interventions aimed at rejuvenating aged skin.

Keywords: Biopolar, Monopolar, Radiofrequency, Rejuvenation

A-0673

Ecklonia Cava Extracellular Vesicles Enhanced Dermal Collagen Synthesis through Modulation of Heat Shock Protein 70

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Purpose: This study investigates the potential of extracellular vesicles (EVs) derived from Ecklonia cava (EV-EC) and phlorotannins (PT) to promote collagen regeneration through the regulation of heat shock protein 70 (HSP70). Collagen, a fundamental component of the extracellular matrix, plays a critical role in tissue repair and regeneration. The research explores how EV-EC and PT influence collagen regeneration by modulating HSP70 expression, the transforming growth factor beta (TGF-β) signaling pathway, and mitogen-activated protein kinase (MAPK) signaling.

Methods: Through a series of in vitro keratinocyte senescence model and in vivo aged mice experiments, including cell culture assays and animal models, the study elucidates the complex interplay between EV-EC and PT involving HSP70, TGF-β, MAPK signaling, and collagen regeneration.

Results: Findings demonstrate that EV-EC, in conjunction with PT, significantly enhance collagen synthesis and deposition by regulating the TGF-β and MAPK signaling pathways. Furthermore, the upregulation of HSP70 emerges as a critical mediator in this process, underscoring its potential as a therapeutic target for tissue regeneration.

Conclusion: This research illuminates promising strategies for leveraging natural compounds from marine sources to develop innovative regenerative therapies aimed at enhancing rejuvenation.

Keywords: Extracellular vesicles derived from ecklonia cava, Phlorotannins, Rejuvenation, Heat shock protein 70

A-0692

Promotion of Glioblastoma Invasion in Temozolomide-Resistant Cells

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Purpose: Glioblastoma (GBM) is the most lethal and treatment-resistant tumor among brain cancers. Temozolomide (TMZ) is the standard chemotherapeutic agent for GBM, but the majority of patients experience recurrence and invasion of tumor cells. We previously reported that TMZ treatment in GBM cells regulates matrix metalloproteinases 9 (MMP9), which has the main function of promoting tumor cell invasion.

Methods: In this study, we described the process by which

we create acquired TMZ-resistant GBM cells through repeated culturing of cells with gradually doubling the TMZ concentration. A proteome profile experiment comparing the differences between these resistant cells and their parental cells was conducted.

Results: We demonstrated alterations in the expression of several proteases and protease inhibitors that contribute to the invasion and migration of tumor cells. TMZ-resistant cells were also promoted to increased invasion and migration showing by scratch and transwell assays. We also investigated the signaling pathways that are involved in promoting the alterations in cell behaviors caused by TMZ resistance.

Conclusion: This study provides valuable insights into the molecular mechanisms by which TMZ resistance leads to increased invasiveness and migration in GBM cells.

Keywords: Glioblastoma, Temozolomide, Resistance, Invasion

A-0696

CRISPR/Cas9 Engineering in Oral Epithelial Organoid for Understanding the Mechanistic Basis of Tumor-Induced Bone Resorption

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Purpose: To establish the CRISPR/Cas9 engineered ameloblastoma-like organoid for understanding the pathogenesis and underlying mechanisms of bone resorption durning tumor progression.

Methods: We knocked out the three most frequently mutated genes (BRAF, KRAS, SMO) in human normal oral epithelium with CRISPR/Cas9 system to generate ameloblastoma-like organoids. Furthermore, these CRISPR/Cas9 engineered organoids were co-cultured with osteoblasts and osteoclasts to recapitulate the ameloblastoma tumor microenvironment. To investigate the mechanistic bases of ameloblatoma-induced bone destruction, sing-cell RNA sequencing was performed.

Results: To gain insights into the morphology and structure of human normal oral epithelial organoids, we initially examined organoids derived from mouse oral epithelial cells. Our investigation identified three distinct types: solid, cystic, and keratinized. Notably, the solid type displayed a higher proliferation rate in the basal cell layer compared to the other types. Subsequently, we generated ameloblastoma-like organoids by CRISPR/Cas9-based gene knockout of BRAF, KRAS, and SMO in human normal oral epithelial cells, effectively recapitulated the neoplastic properties of ameloblastoma. Compared with human normal oral epithelial organoids, the ameloblastoma-like organoids generated by the triple knockout exhibited elevated levels of Ki-67 and K14 expression within the basal layer. Moreover, expression level of ameloblastin and amelogenin were increased in the triple knockout group compared to the other two groups. These findings suggest enhanced proliferation capacity and tumorigenic potential of the triple knockout organoids.

Conclusion: BRAF, KRAS, and SMO play crucial roles in the initiation of ameloblastoma, and CRISPR/Cas9 engineered organoids serve as valuable resources for investigating the mechanistic basis of tumor-induced bone resorption.

Funding: This work was supported by the National Research Foundation of Korea (NRF) Grant funded by the Korea Government (MSIP) (2022R1A2B5B03001627).

Keywords: Ameloblastoma, CRISPR/Cas9, Bone Resorption, Organoid

A-0741

Anti-Inflammatory Effects of Papenfusiella Kuromo Extracts through Suppression of NF-κB Activation in Porphyromonas Gingivalis LPS-Stimulated RAW 264.7 Macrophage

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Purpose: A brown alga, Papenfusiella kuromo (P. kuromo) is rarely found in the eastern and southern coast, Jeju island in Korea and in Japan. Though anti-oxidant and anti-inflammatory properties of P. kuromo are examined in previous research, its effect in the periodontal disease is not recorded yet.

Methods: In this study, we investigated the mechanisms underlying the anti-inflammatory effects of an extract from P. kuromo in Porphyromonas gingivalis (P. gingivalis) LPS-stimulated RAW 264.7 macrophage.

Results: We found that P. kuromo had no cytotoxic effect in cell viability compared to untreated RAW 264.7 macrophage. Treatment with P. kuromo in P. gingivalis LPS-stimulated RAW 264.7 macrophage reduced the levels of nitric oxide (NO) in dose-dependent manner via down-regulation of the inducible nitric oxide (iNOS) expression. RT-qPCR exhibited that P. kuromo dose-dependently inhibited interleukin (IL)-1β, IL-6 and tumor necrosis factor (TNF)-α, in P. gingivalis LPS-stimulated RAW 264.7 macrophage. Data of western blot analysis showed that P. gingivalis LPS-inuced phosphorylation of inhibitor kappa B alpha (IκBα) kinase (IKK) and IκBα degradation were dose-dependently suppressed by P. kuromo. In addition, treatment with P. kuromo in P. gingivalis LPS-stimulated RAW 264.7 macrophage also reduced the nuclear translocation of nuclear factor (NF)-κB p65, which suggests that anti-inflammatory effect of P. kuromo is associated with the suppression of the NF-κB signaling pathway.

Conclusion: Therefore, this study suggested that the extract of P. kuromo may possess an anti-inflammatory effect in the periodontal disease and could be used as a potential therapeutic agent for preventing periodontal diseases.

Keywords: Papenfusiella kuromo, Inflammation, Periodontitis, Nuclear factor κB, Macrophage

A-0743

Positional Information for Pattern Formation in Dental Mesenchyme during Embryonic Tooth Development

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Purpose: The concept of positional information is that cells acquire positional values to build the pattern formation in embryonic development and regeneration. During tooth development, various gene expression is different spatially along lingual and buccal direction, and successional dental teeth formation occurs only in lingual part of tooth germs. However, the positional information has not been studied yet until now. The purpose of this study is that the regional information of lingual and buccal part of dental mesenchyme was identified during tooth development.

Methods: Tooth germs at cap stage is dissected from mouse mandible, lingual and buccal part of tooth germs are divided, and analyzed with bulk RNA sequencing. Buccal part of dental mesenchyme from Wnt1-cre-tdTomato mice mandible, and lingual part from WT mice mandible were isolated, and dissociated into single cell. The dissociated cells from lingual or buccal part of dental mesenchyme were reaggregated, and recombined with dental epithelium.

Results: In RNA sequencing analysis, GO terms, such as odontogenesis, pattern specificataion, and proliferation were enriched in lingual part of dental mesenchym. GO terms, such as stem cell development, mesenchyme development, neural crest differentiation, and regeneration were enriched in buccal part of dental mesenchyme. Furthermore, when the lingual or buccal part of tooth germs were cultured in vitro for 2 days, and transplanted underneath the kidney capsule, the only lingual part of tooth germs has the odontogenic capacity. The reaggregation experiments provided that lingual part of dental mesenchyme contributes to tooth formation, buccal part of dental mesenchyme to surrounded tissue.

Conclusion: Based on these, we analyzed the spatial transcriptomic information of lingual and buccal part of tooth germs at cap stage. Furthermore, the odontogenic capacity was identified with regional specification of tooth germs. This study provides a novel model for pattern formation during embryonic tooth development.

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Keywords: Tooth development, Dental mesenchyme, Positional information, Lingual, Buccal

A-0779

Jagged1 Missense Mutation Unleashes Innate Immune Cell Dysregulation

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Purpose: Notch signaling pathway is vital for cell develop-

ment and immune system function. Mutations in the Jagged1 (JAG1) ligand of this pathway lead to Alagille syndrome (AGS), a pediatric genetic disorder causing bile duct reduction and organ abnormalities. However, whether JAG1-mediated Notch signaling regulates inflammatory responses in innate immune cells remains unknown. In this study, to elucidate the correlation between impaired Notch signaling mediated by the mutated JAG1 and inflammatory responses in innate immune cells.

Methods: We investigated the functional effect of JAG1 missense mutations on innate immune cells, specifically neutrophils and macrophages.

Results: We confirmed increased recruitment of neutrophils and macrophages in the liver of JAG1 deficiency mice. Furthermore, JAG1 deficiency stimulates pro-inflammatory cytokine secretion and M1 macrophage polarization, inducing excessive macrophage extracellular traps. Furthermore, we observed heightened neutrophil infiltration and changes in migration patterns in the liver of JAG1-deficient mice using two-photon intravital imaging. These findings suggest that JAG1 deficiency worsens liver damage and may lead to the development of biliary sepsis.

Conclusion: Understanding how JAG1/Notch signaling abnormalities affect innate immune cells provides a basis for developing therapeutic strategies for Notch signaling-related diseases and innate immune response abnormalities caused by JAG1-mediated Notch signaling.

Funding: This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (NRF-2022R1I1A1A01070969).

Keywords: Alagille syndrome, Notch signaling, Jagged1, Liver, Macrophage

A-0793

Single-Cell RNA Sequencing Reveals Transitional Cellular Changes during Progression of Abdominal Aortic Aneurysm

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Purpose: To identify changes in cellular composition and associated changes in genes expression during progression of abdominal aortic aneurysm (AAA).

Methods: Normal and AAA tissues were collected from 5 patients. Tissue was dissociated by enzymatic and mechanical methods and live cells were collected by FACS. And we performed 3' mRNA library preparation kit (10X Genomics) and sequenced on an Illumina NovaSeq 6000. Raw fastq data were processed by Cell Ranger 7.0 with GRCh38 as a reference. The single-cell sequencing data were analyzed by using R package Seurat.

Results: We identified 11 major cell types including Smooth muscle cell (SMC), T, B, and other immune cells. As a subpopulations of SMC, we observed the number of contractile SMC and fibroblast were decreased in AAA tissue, and the gene enrichment analysis revealed the expression of pathways such as apoptosis and SMC migration. We also identified increased immune infiltration in AAA tissue. Through cell-cell interaction analysis, we identified inflammatory signaling specific to AAA tissue between the cells consisting the aortic wall and immune cells. These findings suggest that the progression of AAA occurs through increased infiltration of immune cells and induction of apoptosis in non-immune cells that maintain the function and integrity of the aortic wall.

Conclusion: Here we showed that the major changes during AAA progression, including a decrease in the cells comprising the aortic wall and an increased infiltration of immune cells. These transcriptional changes could also potentially be used as biomarkers.

Keywords: Abdominal aortic aneurysm, AAA, Single cell RNA, Transcriptome

A-0799

The Role of Cdc42 in Skin Epidermal Development and Epidermal Barrier Formation

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Purpose: Cdc42 is a Rho GTPase that regulates diverse cellular functions. Here, we used genetic techniques to investigate the role of Cdc42 in epidermal development and epidermal barrier formation.

Methods: Keratinocyte-restricted Cdc42 knockout mice were generated with the Cre-LoxP system under the keratin 14 (K14) promoter. The skin and other tissues were collected from mutant and wild-type mice, and their cellular, molecular, morphological, and physiological features were analyzed.

Results: Loss of Cdc42 in the epidermis in vivo resulted in neonatal lethality and impairment of epidermal barrier formation. Cdc42 deficiency led to the loss of epidermal stem cells. The absence of Cdc42 led to increased thickening of the epidermis, which was associated with increased proliferation and reduced apoptosis of keratinocytes. In addition, Cdc42 deficiency damaged tight junctions, adherens junctions and desmosomes. RNA sequencing results showed that the most significantly altered genes were enriched by the terms of "keratinization" and "cornified envelope" (CE). Among the differentially expressed genes in the CE term, several members of the small proline-rich protein (SPRR) family were upregulated. Further study revealed that there may be a Cdc42-SPRR pathway, which may correlate with epidermal barrier function.

Conclusion: In conclusion, our study indicates that Cdc42 is essential for epidermal development and epidermal barrier formation. Defects in Cdc42-SPRR signaling may be associated with skin barrier dysfunction and a variety of skin diseases.

Funding: Our study indicates that Cdc42 is essential for epidermal development and epidermal barrier formation. Defects in Cdc42-SPRR signaling may be associated with skin barrier dysfunction and a variety of skin diseases.

Keywords: Epidermal development, Epidermal barrier, Skin development, Cdc42, Cornified envelope

A-0820

Comparative Analysis of iPSC and iPSC-Derived RPE Cells in Treating Sodium Iodate-Induced Dry-Type AMD

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Purpose: Age-related macular degeneration (AMD) is a leading cause of vision loss, with dry AMD being the most common type, accounting for 85-90% of all AMD cases, according to data from the World Health Organization (WHO). In 2020, the estimated prevalence of dry AMD globally was 0.37%, equivalent to 270 million people. Currently, there is no specific treatment for dry AMD, only therapies to slow its progression. Induced pluripotent stem cells (iPSCs) and their derived iPSC-retinal pigment epithelium (RPE) cells are believed to have therapeutic potential for dry AMD. Therefore, our experiment aims to compare the therapeutic effects of iPSCs and iPSC-RPE cells, with the goal of developing a safer treatment modality.

Methods: We identified the stem cell specificity of iPSCs. Subsequently, we conducted differentiation experiments of iPSC-RPE and assessed whether the cells expressed specific genes related to retinal pigment epithelium. We established a dry AMD cell model with the purpose of utilizing it as the target for iPSC and iPSC-RPE therapy. Therefore, we designed co-culture experiments and measured markers of cell necrosis to observe the therapeutic effect.

Results: We established a disease model of AMD using sodium iodate, wherein cell necrosis was observed in our established dry AMD cell model. Following treatment co-culture, significant differences in the expression of necrosis genes were confirmed by Western blot analysis, effectively attenuating cell necrosis and modulating the regulation of cell death signals. We further discovered that both types of stem cells not only restored the functionality of the upstream protein FADD but also prompted cells to initiate self-renewal. Based on these findings, we hypothesized that the cells may secrete cytokines

or exosomes, resulting in therapeutic effects on the dry AMD cell model.

Conclusion: Therefore, we conclude that iPSCs and iPSC-RPE are capable of utilizing substances secreted by stem cells to achieve therapeutic effects on damaged cells.

Keywords: IPSC, IPSC-RPE, Dry-AMD, Therapy, Molecules

A-0824

Effect of Aptamin C on Enhancement of NK Cell Activity: From in Vitro Experiments to Clinical Descriptions

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Purpose: Natural killer (NK) cells are crucial in the innate immune system. NK cells immediately eliminate abnormal cells via ligand-receptor signaling mechanisms. Vitamin C has been indicated as an NK cell bioenhancer by protecting NK cells from reactive oxygen species and resulting in its activation. However, vitamin C is susceptible to oxidation, which limits NK cell activation. In this study, we utilize Aptamin C, which is a conjugate of vitamin C with its specific aptamer, to maintain the antioxidant properties of vitamin C.

Methods: A clinical trial was conducted involving 120 volunteers who were administered either aptamin C (36.057 mg/day) or a placebo for 4 weeks. NK cell cytotoxicity and the cytokine level were evaluated 2 weeks and 4 weeks after administration. For in vitro study, NK-92 cells were treated with aptamin C for 48 hours, and the cytotoxicity against a leukemia cell line was evaluated by flow cytometry analysis. Additionally, the effect of aptamin C on NK cell proliferation was assessed using the Alamar Blue assay. The signaling pathway engaged in Aptamin C-induced NK cell activation was investigated by western blot analysis.

Results: The cytotoxicity of NK cells isolated from the Aptamin C intake group significantly increased after 2 weeks. Cytokines associated with NK cell activity exhibited the highest levels in serum 4 weeks after Aptamin C intake. In vitro experiments revealed increased cytotoxicity and cytotoxic granule production in Aptamin C-treated NK cells. NK cell proliferation was promoted and phosphorylation of STAT-3 was increased by Aptamin C-treatment, suggesting its potential role in NK cell activation.

Conclusion: Overall, the findings indicate that Aptamin C promotes the NK cell activation, highlighting its prospective role in augmenting immunomodulatory agents within NK cell therapy.

Keywords: NK cell, Aptamin C, Cytotoxicity, Proliferation

A-0825

Alloferon Inhibits IL-22-Dependent Expression of Chemokine Receptors and Metastasis-Related Factors in Pancreatic Cancer

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Purpose: Pancreatic cancer frequently metastasizes into organs and tissues near the pancreas. Metastasis contributes to making the curative approach unachievable and leads to poor prognosis. IL-22 is a member of the IL-10 family of cytokines and increases the factors involved in the progression and metastasis of pancreatic cancer. Therefore, this study aims to develop a strategy to suppress pancreatic cancer metastasis by regulating IL-22Rα expression.

Methods: To explore the correlation between IL-22Rα and chemokine receptor expression, AsPC-1 and Panc-1 cells were transduced through lentivirus-mediated shIL-22Rα delivery. The downregulation of IL-22Rα and its associated expression of chemokine receptors were assessed through western blot analysis. To evaluate the role of alloferon as a regulator of IL-22Rα expression, we measured the level of IL-22Rα expression using immunofluorescence, western blot, and flow cytometry analysis after treatment with alloferon. The effect of alloferon in the migration ability toward chemokine ligands, IP-10 or SDF-1, was investigated using the transwell migration assay. Finally, the effects of downregulating IL-22Rα expression on tumor growth and metastasis-related factors were investigated using an in vivo xenotransplantation model.

Results: This study reveals, for the first time, that IL-22 induces CXCR3 and CXCR4 expression. In addition, alloferon, an immune modulator, decreases IL-22Rα expression, thereby downregulating IL-22-induced CXCR3 and CXCR4 expression. The ability to migrate toward the ligands of CXCR3 and CXCR4 was significantly decreased in cells treated with alloferon. It was also confirmed that migration was inhibited in cells transduced with IL-22Rα shRNA. Furthermore, this study showed that IL-22Ra downregulation suppressed tumor progression in immunocompromised mice.

Conclusion: We identified the novel role of IL-22 as a regulator of CXCR3 and CXCR4 expression leading to metastasis and tumor development. It was suggested that the regulation of IL-22Rα expression might be considered as a therapeutic target and that alloferon could be a potential therapeutic agent in pancreatic cancer.

Keywords: Pancreatic cancer, Alloferon, IL-22Rα, Cancer progression

A-0826

Alloferon Regulates the Growth and Movement of Trichomonas Vaginalis by Altering Hydrogenosomes

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Purpose: Trichomoniasis infected with Trichomonas vaginalis (T. vaginalis), can cause mild symptoms like itching and burning but can also lead to more serious adverse outcomes. While typically treated with metronidazole, this medication can face resistance from T. vaginalis and some individuals may experience side effects. Hence, the research on effective therapeutic methods is essential to improve traditional therapy for trichomoniasis.

Methods: To investigate the potential of alloferon as a therapeutic agent for parasitic infection, we measured the activity of hydrogenosomes in T. vaginalis using flow cytometric analysis and observed the morphology of hydrogenosomes through a transmission electron microscopy. In addition, the cell cycle of T. vaginalis was assessed using cell cycle analysis. To the synergetic effect of alloferon and metronidazole, the movement of T. vaginalis was observed through a microscopy and video recording.

Results: T. vaginalis treated with alloferon reduced the activity of its energy-producing organelles, hydrogenosomes and changed structure of hydrogenosome. In addition, alloferon induced cell cycle arrest in the S phase of T. vaginalis, thereby leading to decreased proliferation. While metronidazole alone at its minimum lethal concentration was ineffective, combining it with alloferon, significantly suppressed motility and proliferation in T. vaginalis.

Conclusion: Alloferon induces decreased growth and movement of T. vaginalis by altering the morphology and size of hydrogenosomes. Our findings suggest that alloferon could be a synergistic agent in combination therapy with metronidazole for trichomoniasis.

Keywords: Trichomonas vaginalis, Alloferon, Hydrogenosome, Metronidazole

A-0856

Elucidation of Pathogenesis of Neurodegenerative Diseases through Studying Novel Ferritinophagy Receptor

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Purpose: Iron is an essential nutrient for various cell biological functions, including energy production and oxygen transportation. Given the critical role of iron homeostasis in cellular health and function, its disruption can lead to various diseases. Elevated iron levels in the brain can intensify oxidative stress and inflammatory responses, ultimately leading to neuronal damage. Neurodegenerative diseases, such as Alzheimer's disease and Parkinson's disease, are associated with dysfunction in iron homeostasis and excessive ROS. However, the precise involvement of iron homeostasis in neurodegenerative diseases remains poorly understood. Ferritin, the major iron storage protein, is crucial for maintaining intracellular iron levels. Recently, it has been revealed that ferritin undergoes degradation through ferritinophagy, a type of selective autophagy. Autophagy is a lysosome-dependent degradative

pathway to remove harmful intracellular molecules. Importantly, selective autophagy requires selective autophagy receptors (SARs) that act specifically on their targets. Nuclear receptor coactivator 4 (NCOA4) is known to bind ferritin and mediate autophagic degradation of ferritin. NCOA4 is the only SAR identified for ferritin so far, and their interaction is insufficient to elucidate the relationship between iron homeostasis and neurodegenerative diseases. Therefore, we aimed to discover a novel SAR for ferritin.

Methods: We carried out siRNA-mediated knockdown of various autophagy receptors.

Results: We found that knockdown of some SAR genes resulted in accumulation of ferritin protein.

Conclusion: We anticipate that our findings will provide valuable insights into potential therapeutic targets aimed at mitigating the impact of iron dysregulation on neurodegenerative diseases.

Keywords: Neurodegenerative diseases, Autophagy, Ferritinophagy

A-0861

Ibuprofen-Induced Multiorgan Malformation during Embryogenesis in Xenopus Laevis

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Purpose: Ibuprofen, one of the most commonly prescribed nonsteroidal anti-inflammatory drugs, has not been fully assessed for embryonic toxicity in vertebrates. Here, we systematically assessed the embryotoxicity of ibuprofen in Xenopus laevis at various concentrations during embryogenesis.

Methods: Embryos were treated with different con- centrations of ibuprofen, ranging from 8 to 64 mg/L, at 23 C for 96 h, and examined daily and evaluated at 72 hpf. Lethal or teratogenic effects were documented. For histological analysis, paraffin embedded embryos were transversely sectioned at a thickness of 10-μm and stained with hematoxylin and eosin. Total RNA was isolated from embryos at stages 6, 12, 22 and 36, and real-time quantitative PCR was performed.

Results: Ibuprofen-treated embryos showed delayed or failed dorsal lip formation and its closure at the beginning of gastrulation. This resulted in herniation of the endodermal mass after gastrulation under high concentrations of ibuprofen-treated embryos. Underdeveloped intestines with stage and/or intestinal malrotation, distorted microcephaly, and hy- poplastic heart, lungs, and pronephric tubules were observed in ibuprofen-treated embryos. Cephalic, cardiac, and truncal edema were also observed in them. The severity of the deformities was observed in a concentration- dependent manner. The teratogenic index was 2.28. These gross and histological disruptions correlated well with the altered expression of each organ marker gene.

Conclusion: In conclusion, ibuprofen induced delayed and disrupted gastrulation in the early developmental stage and multiorgan malformation later in the organogenesis stage of Xenopus laevis embryos.

Keywords: Embryotoxicity, Fetax, Ibuprofen, Multiorgan malformation, Xenopus laevis

A-0864

High-Sugar Diet Affects the Immune Mechanism of Pregnancy Outcome through the Balance of Th17/Treg

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Purpose: To investigate the immunological mechanism of how high-sugar diet affects pregnancy outcomes through the Th17/Treg balance.

Methods: Female SD rats were randomly divided into a normal diet group and a high-sugar diet group. The high-sugar diet group was further divided into a control group, an AMPK inhibitor Compound C group, and an AMPK agonist AICAR group. After mating with male rats and detecting vaginal plugs, fasting blood glucose, body weight, miscarriage, and preterm delivery were monitored in the four groups of pregnant rats. On day 14 of pregnancy, the pregnant rats were sacrificed to collect the placenta and calculate the embryonic resorption rate. Western blot was used to detect the expression of p-AMPKα and AMPKα proteins in the placenta, chemiluminescence for ROS levels, flow cytometry for Th17 and Treg cells, qPCR for IL-17 and IL-10 mRNA expression, and immunohistochemistry for ROR-γt and FoxP3 protein expression.

Results: The body weight and fasting blood glucose in the high-sugar group significantly increased, with significantly

higher rates of premature delivery, abortion, and embryonic resorption compared to the regular diet group. The absolute count of Th17 (IL-17+CD4+) cells increased, while that of Treg (CD25+FoxP3+) cells decreased in placental lymphocytes, leading to an elevated Th17/Treg ratio. The expression of p-AMPKα decreased, while ROS levels increased. IL-17 and ROR-γt levels were elevated, while IL-10 and FoxP3 levels decreased. Compared to the high-sugar diet control group, the AMPK activator AICAR reversed the inhibition of AMPKα phosphorylation caused by high sugar, resulting in improvements in the aforementioned indicators in pregnant rats.

Conclusion: The hyperglycemic state of the body inactivates AMPKα through ROS-dependent inhibition of its phosphorylation, indirectly regulating the differentiation and function of Th17 and Treg cells, leading to an imbalance in Th17/Treg and significantly increasing adverse pregnancy outcomes in pregnant rats.

Keywords: High-Sugar Diet, Th17/Treg, Pregnancy Outcomes, Immune Mechanisms, ROS

A-o868

The Impact of Secretome Derived from Umbilical Cord on the Safety and Efficacy of Organic Severe Non-Responder Erectile Dysfunction following One-Day Injection, Measured by NPT, SPL, and Corpus Cavernosum Diameter

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Purpose: The objective of this study was to examine the effects of secretome derived from the umbilical cord on the safety and efficacy as a treatment for organic severe non-responder erectile dysfunction. specifically the Nocturnal Penile Tumescence (NPT), Stretched Penile Length (SPL), and Corpus Cavernosum Diameter in individuals who had received a one-day injection.

Methods: This study recruited seven participants who receiving standard care for diabetes mellitus. The participants received one-day Injection of secretome. Pre- and post-intervention measurements of NPT, SPL, and corpus cavernosum diameter were conducted to assess any alterations. The safety evaluation involved the observation of hematoma formation, pain intensity, bleeding, and indications of infection after the administration of secretome. The parameters were assessed immediately after the injection and during subsequent examination.

Results: The findings of this study show notable variations in NPT after the injection of secretome. The NPT showed enhancement following the intervention, indicating beneficial impact on erectile function. Nevertheless, there were no statistically significant disparities observed in SPL or corpus cavernosum diameter. The absence of substantial modifications in SPL and corpus cavernosum width indicates that the intervention predominantly impacted physiological mechanisms associated with erectile function, rather than inducing alterations in penile morphology or tissue structure. Subsequent investigations are required to clarify the precise processes that underlie the reported effects. The safety evaluations indicated that no occurrences of hematoma formation, pain exceeding thresholds, bleeding, or indications of infection subsequent to the administration of secretome. The results of this study indicate that the intervention was well-tolerated by the participants and did not result in any adverse responses or complications.

Conclusion: The results indicate that secretome exhibits efficacy and tolerability, hence indicating its potential as a secure treatment alternative for erectile dysfunction. Nevertheless, additional investigation is necessary to clarify the safety characteristics and enhance treatment protocols for wider clinical use.

Funding: The Hibah PUTI 2022 grant provided financial support for this project.

Keywords: Erectile dysfunction, Umbilical cord-derived secretome, Nocturnal Penile Tumescence (NPT), Stretched Penile Length (SPL), Corpus cavernosum diameter

A-0881

Molecular Characterization of the Masseter Muscle in a Murine Model of Autosomal Dominant Centronuclear Myopathy

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Purpose: Autosomal dominant centronuclear myopathy (AD-CNM) is an inherited muscle disease that manifests with progressive loss of skeletal muscle mass and strength. One of the most prevalent causes of AD-CNM are mutations in the DNM2 gene that encodes the dynamin-2 GTP-ase. Mutations in dynamin-2 are associated with defects in the actin cytoskeleton organization and fiber-type disproportion in distal skeletal muscles. However, it is unknown if similar mechanisms operate in the masticatory muscles. The objective of this work was to evaluate the organization of the actin cytoskeleton and the type of muscle fibers in the masseter muscle of knock-in (KI) mice harboring the p.R465W dynamin-2 mutations, the most common causing AD-CNM.

Methods: Actin organization was assessed by measuring the relative amounts of filamentous (F-) and monomeric (G-) actin and by quantifying the actin polymerization capacity in fibers isolated from masseter muscles of KI-mice and their wild-type (WT) littermates. The relative expression of the isoforms I and II of the myosin-ATP-ase was also analyzed as indicative of the muscle fiber-type.

Results: A significant increase in the F/G-actin ratio, a limited capacity of new actin network polymerization and a relative decrease in the expression of the type-I myosin-ATP-ase over the type II was evident in the masseters of KI mice, compared to age-matched WT mice.

Conclusion: These data suggest an imbalance in the actin organization and a decrease in the oxidative muscle fibers with predominance of glycolytic muscle fibers, susceptible to fatigue in the masseter muscle of KI mice. This work allows to characterize at the molecular level the impact of the mutations in dynamin-2 that cause AD-CNM on the masticatory muscles, an aspect that is still unknown.

Keywords: Centronuclear myopathy, Orofacial musculature, Masseter muscle, Dynamin-2, Actin cytoskeleton

A-0882

Fasciology Accomplish the Biological Theory about the Differences Structure between the Life Spans of Different Species: That Is to Make Up for the Biological Research Axis on Time (Life Span)

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Purpose: One of the great contributions of the Chinese nation to the world is traditional Chinese medicine. For thousands of years, traditional Chinese medicine had underpinned the health care systems of east Asian nations, while in the last 300 years, the role has waned, giving way to biomedical system originated in the West. It is our inescapable responsibility to revive TCM. Fasciology created by our team is the golden key to open the treasure house of TCM, and it is a tool to uncover the mystery of TCM.

Methods: Fasciology is an original new discipline system proposed by us after more than 20 years of research. It includes: fascial anatomy, fascial histology, fascial physiology, fascial pathology, fascial immunology and fascial diagnosis and treatment. Fasciology is the theoretical support to the wide concept of health.

Results: In the past, the study of human morphology was carried out in two ways: systematic anatomy and topographic anatomy. Fascial Anatomy presents a two-system theory, which regards the human body as a support and reserve system of non-specific connective tissue throughout the body and the functional cells differentiated from the support and reserve system. The research on the mutual influence, mutual transformation and interact of the two systems is called Fasciology.

Conclusion: Acupoints: Points on the fascia framework that

can produce strong biological information (nerve information, trauma information, thermal effect, acousto-optic electromagnetic, etc.) Ren Meridian: visceral fascia evolved from limb shoots to the fascia on the palmar side of limbs in the course of biological evolution. Heart Meridian (the visceral fascia that runs along the large blood vessels of the upper limb to the palm); Pulmonary meridian (runs along the large blood vessels of the upper limb to the palm); Pericardial meridian (superficial running, heart meridian on ulnar side, lung meridian on radial side).

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Keywords: Fascia Anatomy, Fasciology, Acupoint, Meridian, Meridian

A-0885

Fascia Network Could Be the Anatomical Basis for Acupoints and Meridians in the Human Body

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Purpose: The anatomical basis for the concept of meridians in traditional Chinese medicine (TCM) has not been resolved. This paper reviews the evidence supporting a relationship between acupuncture points/meridians and fascia. The reviewed evidence supports the view that the human body's fascia network may be the physical substrate represented by the meridians of TCM. Specifically, this hypothesis is supported by anatomical observations of body scan data demonstrating that the fascia network resembles the theoretical meridian system in salient ways, as well as physiological, histological, and clinical observations. This view represents a theoretical basis and means for applying modern biomedical research to examining TCM principles and therapies, and it favors a holistic approach to diagnosis and treatment.

Methods: Comparison between acupuncture points (from the anatomical guidelines provided in and fascia imaging data. The fascia connective tissue gathering areas were constructed using MIMICS11.02 software based on the digital datasets of VCH bodies.

Results: Firstly, it is noteworthy that reconstructions of the fascial connective tissues in the body trunk and limbs show line-like structures which are similar to those of acupoints and meridians/collaterals. Secondly, these fascial strings form a network of lines that are close to the virtual meridians in anatomical location. Furthermore, as shown in Figure 2, subsequent 3D fascial reconstructive studies involving computed tomography and magnetic resonance imaging (MRI) of living human bodies revealed a pattern of line-like structures that appear similar in form and distribution to the traditional Chinese meridians. The VCH and living body imaging studies together indicate that the anatomy of the fascial network in the human body is consistent with the traditionalview of the meridian network pattern.

Conclusion: Acupoints: Points on the fascia framework that can produce strong biological information. Meridians: framework of nonspecific connective tissue throughout the body.

Funding: The paper was supported by Grants from the National Basic Research 973 Program (no. 2007CB512705) and the National Natural Science Foundation of China (no. 30801464).

Keywords: Fascia Anatomy, Fascial connective tissues, Acupoint, Meridian, Fasciology

A-0887

Application of Human Induced Pluripotent Stem Cells for Vascular Disease Modeling

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Purpose: Vascular diseases remain a significant health concern due to delayed diagnosis and treatment. The transition of vascular smooth muscle cells (VSMCs) from contractile to synthetic state is crucial in disease progression. Nonetheless, replicating these pathophysiological features in human models is still a considerable challenge. Utilizing induced pluripotent stem cell (iPSC) technology offers a promising approach to studying VSMC phenotypic changes in human diseases. This investigation aims to differentiate iPSCs into VSMCs to establish an in vitro model for studying vascular diseases and potential therapies.

Methods: Human peripheral blood mononuclear cells

(PBMCs) were isolated and reprogrammed into feeder-free iPSCs, characterized using karyotyping, reverse transcription polymerase chain reaction, immunofluorescent staining, and in vivo teratoma formation assays. These iPSCs were subsequently differentiated into VSMCs, confirmed by specific markers. To mimic the pathological response after vascular injury, VSMCs were cultured in 2D or 3D conditions and treated with platelet-derived growth factor (PDGF) to induce dedifferentiation, evidenced by increased proliferation and altered marker expressions.

Results: The iPSCs from PBMCs had normal karyotypes, expressed pluripotent markers OCT4, SOX2, NANOG, SSEA-4, TRA1-60, as well as TRA1-80, and possessed three-germ layer differentiation ability. After VSMC differentiation, VSMC-specific markers SM α-actin and SM22α showed positive expression in differentiated cells, while flow cytometry analysis revealed high differentiation efficiency. Furthermore, compared to the traditional 2D methods, the 3D approach is more responsive to the difference in phenotype switching performance, demonstrated by the augmentation of cell proliferation and reduction of VSMC markers SM α-actin, SM22α, SM-MHC, and calponin after PDGF treatment.

Conclusion: Overall, our study effectively simulated the phenotypic transition of VSMCs derived from human iPSCs within a 3D environment. This in vitro system not only enhances our understanding of the underlying mechanisms of vascular diseases in humans but also offers a substitute for minimizing animal experimentation and advancing therapeutic approaches.

Keywords: Induced pluripotent stem cells, Vascular smooth muscle cells, Disease Modeling

A-0896

Unlocking the Potential: Developing Cognitive Skills in Histology Medical Education

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Purpose: Anatomical sciences, including histology, have been pivotal in medical education throughout history. The mastery of this discipline is essential to bridge the gap between preclinical and clinical years. To facilitate metacognitive and active learning in a self-paced and self-directed manner, AI chatbots can be employed to enhance nacient abilities for lifelong learning. This project aims to promote active learning and metacognitive skills through the use of an iterative AI chatbot for students.

Methods: Iterative cases were developed, enabling knowledge-based exploration in contexts mimicking real-life clinical scenarios, where not all information is readily available. Specifically, three clinical cases focusing on the endocrine system were designed for second-year medical students at Oakland University William Beaumont School of Medicine. These cases integrated anatomy, histology, radiology, and histopathology.

Results: A pilot study is currently underway involving 25 second-year preclinical medical students using an AI chatbot tool developed with DialogFlow and hosted on a Google-based web application ("Line.") to allow for interaction from computers or a smartphone.

Conclusion: It is anticipated that modern pedagogical techniques combining AI chatbots with concurrent metacognitive frameworks will develop a deeper understanding of anatomical sciences and their application to clinical cases. The use of these AI-driven programs is expected to aid in course design and assessment, catering specifically to the educational needs of Generation Z learners in the current era of technological advancement.

Keywords: Histology, Medical Education, A.I. Chatbot

A-0912

Functional Evaluation Developmental Signaling Molecules in Alveolar Bone Process Formation using Microinjection Technique

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Purpose: The alveolar bone process, bearing the teeth, is known to have dynamic functional interactions with surrounding tissues including periodontal ligament, cementum and blood vessels. However, the detailed mechanisms underlying its development is not understood yet. In this study, we employed the previously established animal experimental model system to evaluate the precise molecular and cellular mechanisms on alveolar bone formation.

Methods: At least fifteen PN5 (postnatal day 5) mice were prepared for micro-injections of candidate molecules which were selected from the previous reports, Glepp1 and Decursin. After 5 days from the micro-injection into the lower first molar forming mesial tooth root, we examined the detailed morphological changes of the alveolar bone process during mouse development using HE, MTC staining. Additionally, we evaluated the precise localization pattern of various signaling molecules involved in blood vessel formation including CD31, VEGF, PERIOSTIN, RUNX2, and Osteocalcin Innervation of the alveolar bone process was examined following micro injection of candidate molecules including Glepp1-AAV and Decursin. In addition, the mineralized pattern of alveolar bone process was examined with micro-CT evaluation.

Results: After 5 days, microinjection led to a significant increase in newly synthesized collagen along the alveolar bone-forming region, as demonstrated by MTC. Additionally, we examined the immunolocalizations of bon-forming and blood-vessel-forming markers, including RUNX2, Osteocalcin, CD31, VEGF, and PERIOSTIN. Our results revealed increased localizations of these markers along the alveolar bone and periodontal ligaments of microinjected compared to control.

Conclusion: Based on our results, we confirmed the gain of function of Glepp1, known to involved in dental hard tissue formation during developmental stage, using AAV system in ectopic alveolar formation. Meanwhile, Decursin, reported as inhibitory functional molecule for blood vessel formation would prohibit the alveolar bone formation. This evaluation method with micro-injection model system would be the plausible answer for evaluation of molecules for alveolar bone maintenence and regeneration.

Keywords: Periodontium, Alveolar bone, Regeneration, Signaling regulation, Model system

A-0927

Highly Aligned Ternary Nanofiber Matrices Loaded with MXene Expedite Regeneration of Volumetric Muscle Loss

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Purpose: Current therapeutic approaches for volumetric muscle loss (VML) face challenges due to limited graft availability and insufficient bioactivities. To overcome these limitations, tissue-engineered scaffolds have emerged as a promising alternative.

Methods: A three-component nanofiber matrix composed of collagen, polyethylene oxide, and polyvinyl alcohol was fabricated using an electrospinning technique. MXene nanoparticles were then incorporated into the three-component nanofiber matrix. After harvesting C2C12 myoblasts, mRNA was extracted and sequenced. Differential gene expression analysis, protein-protein interaction network, and pathway enrichment were performed to identify key genes and pathways regulated by MXene.

Results: We developed aligned ternary nanofibrous matrices comprised of poly(lactide-co-ε-caprolactone) integrated with collagen and Ti3C2Tx MXene nanoparticles (NPs) (PCM

matrices), and explored their myogenic potential for skeletal muscle tissue regeneration. The PCM matrices demonstrated favorable physicochemical properties, including structural uniformity, alignment, microporosity, and hydrophilicity. In vitro assays revealed that the PCM matrices promoted cellular behaviors and myogenic differentiation of C2C12 myoblasts. Moreover, in vivo experiments demonstrated enhanced muscle remodeling and recovery in mice treated with PCM matrices following VML injury. Mechanistic insights from next-generation sequencing revealed that MXene NPs facilitated protein and ion availability within PCM matrices, leading to elevated intracellular Ca^{2+} levels in myoblasts through the activation of inducible nitric oxide synthase (iNOS) and serum/glucocorticoid regulated kinase 1 (SGK1), ultimately promoting myogenic differentiation via the mTOR-AKT pathway. Additionally, upregulated iNOS and increased NO^- contributed to myoblast proliferation and fiber fusion, thereby facilitating overall myoblast maturation.

Conclusion: This study propose a model that the MXene NPs promote calcium deposition around the cells, leading to elevated levels of intracellular Ca^{2+}, which triggers the upregulation of iNOS and SGK1. Enhanced SGK1 activity influences cell proliferation, survival, and myogenesis by activating the mTOR-AKT pathway. Additionally, upregulated iNOS and increased production of NO^- contribute to myoblast proliferation and fiber fusion, ultimately promoting overall myotube maturation.

Keywords: Ternary nanofibrous matrices, Myogenesis, Regeneration of volumetric muscle loss, Next generation sequencing

A-0931

Deciphering the Toxic Effects of Polystyrene Nanoparticle on Erythropoiesis at Single Cell Resolution

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Purpose: Recent studies have raised concerns about the potential harmful effects of nanoplastics, suggesting that these tiny plastic particles could induce stress reactions in organisms and impede their growth and development. Our study aims to identify the cells most affected by nanoparticles and uncover the molecular mechanisms driving these changes.

Methods: Zebrafish embryos were exposed to polystyrene nanoparticles (PS20nm) and subjected to single-cell RNA sequencing at 120 hpf. Subsequent data analysis utilized bioinformatic methods to identify differential gene expression, conduct gene ontology analysis, and infer cell fate trajectories. To validate the sequencing findings, additional experiments were performed, including gene expression verification and metabolic change assessment, supported by LC/MS analysis. Throughout the study, statistical evaluations were conducted to ensure the reliability of our conclusions.

Results: We observed significant alterations in red blood cell (RBC) clusters following PS20nm exposure. Gene ontology analysis revealed a widespread reduction in translation-related processes within RBCs. Knockdown experiments of related genes confirmed a decreased RBC count, validating the scRNA-seq findings. Moreover, trajectory analysis unveiled impaired erythropoiesis, with PS20nm exposure hindering differentiation. Reduced heme synthesis and expression of key erythropoiesis genes were also noted, supported by decreased heme levels observed through LC/MS analysis.

Conclusion: Our study provides insights into the adverse effects of PS20nm exposure on zebrafish embryonic development, particularly highlighting disruptions in erythropoiesis and heme synthesis pathways.

Keywords: Polystyrene nanoplastics, Zebrafish embryos, Single-cell RNA sequencing, Erythropoiesis, Heme synthesis

A-0947

The Effect of Mesenchymal Stem Cell on the Resolution of Liver Fibrosis: Analysis of Collagen Content, α-SMA, and TIMP-1 Expression in the Rat Liver

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Purpose: Our previous study has revealed that intravenous injection of a single dose, 1×106 human umbilical cord-derived MSC (hUC-MSC) reduced fibrosis in the liver of 2-Acetylaminofluorene (2AAF) and Carbon tetrachloride (CCl4)-induced chronic liver injury rat model. Continuing the research, to elucidate the mechanism of the fibrosis resolution, recent study observed and analyzed the changes of collagen content, α-Smooth Muscle Actin (α-SMA), and Tissue Inhibitor of Metalloproteinases-1 (TIMP-1) expression in those rats liver.

Methods: Microscopic examination used to observe the collagen content (by Van Gieson staining) and α-SMA expression (immunostaining); whereas, TIMP-1 expression was quantitatively tested by ELISA.

Results: Analysis showed that in the hUC-MSC rat, the collagen %, α-SMA density, and TIMP-1 concentration in the liver were reduced compared to the non-hUC-MSC rat ($p<0.05$). Pearson correlation showed a significant association between collagen % and α-SMA ($p<0.05$; $r=0686$), collagen % and TIMP-1 (p,0.05; $r=0.698$), and between α-SMA and TIMP-1 ($p=0.001$; $r=0.638$).

Conclusion: These results implied that hUC-MSC reduced liver fibrosis by reducing the extracellular matrix concentration via decreasing the activity of hepatic stellate cells (reduced expression of α-SMA), which followed by the reduction of TIMP-1 and collagen degradation.

Funding: This research was supported by postgraduate research grant (PUTI pascasarjana) year 2022.

Keywords: Liver fibrosis, Mesenchymal Stem Cells, Apha-SMA, TIMP-1, Collagen content

A-0959

The Regenerative and Protective Potential of Combretum Molle Methanolic Leaf Extract Against D-Galactose Induced Aging on Hepato-Renal and Intestinal Histomorphology of Adult Male Sprague Dawley Rats

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Purpose: The purpose of this study was to investigate the regenerative capacity and protective ability of combretum molle leaf extract on the liver, kidney, spleen, and intestines, including plasma and serum of D-galactose-induced aging model of male Sprague Dawley rats. C.molle has been reported to be rich in a variety of free radical scavenging molecules, such as phenolic compounds and other endogenous metabolites, which are rich in antioxidant activity hence, its ability to balance free radical scavenging activity, antioxidant properties, and antiinflammatory activities including its regenerative capacity or ability to preserve the structure were investigated.

Methods: Thirty adult male Sprague Dawley rats were exposed to daily subcutaneous injections of Dgalactose (150 mg/ml/kg) and oral administration of Combretum molle (500 mg/ml/kg) for 90 days. The rats were assigned to five treatment groups, namely Control (normal saline), Prophylactic group (C. molle only) Accelerated aging group (D-galactose only) Combination group (C.molle and D-galactose simultaneously), and Induction group (received D-gal then C.molle).

Results: The administration of Combretum molle improved the histomorphometric parameters of the small intestine, such as the villi height, width, crypt depth and muscle layer thickness compared to the blunted and irregular crypts with no surface epithelium, reduced goblet cell density, and increased Intercellular space observed in the accelerated aging group. In the liver, kidney, and spleen a significant tissue injury was observed with diffuse periportal hepatic vacuolation, increased necrosis of hepatic cells with marked accumulation of fat cells, irregular-shaped kidney tubules, and glomerulus and disarrangement of spleen parenchyma respectively in an accelerated aging group.There were significantly decreased levels of Thiobarbituric acid-reactive substances (TBARS), and significantly

increased activity of antioxidant enzymes and GSH in tissue homogenate and serum in C.molle administered groups.

Conclusion: C. molle leaf extracts exhibited therapeutic potential to suppress the onset of D-galactose aging and effects of reactive oxygen species.

Keywords: Aging, Antioxidants, Medicinal plnats, ROS (reactive oxygen species)

A-0969

Differential Expression and Localization of Cd300a and Tryptase in Salivary Glands and Oral Mucosa: An Immunohistochemical Study

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Purpose: Cd300a and tryptase are two molecules of interest in immunological and pathological studies. Cd300a is an inhibitory receptor found primarily on myeloid cells, including mast cells, macrophages, and dendritic cells, where it plays a role in modulating immune responses. Tryptase, on the other hand, is a serine protease predominantly stored in mast cell granules and is involved in processes such as inflammation, tissue remodeling, and host defense mechanisms. In our study, we are investigating the expression of Cd300a and tryptase in various cases involving major and minor salivary glands as well as oral mucosa.

Methods: Utilizing immunohistochemistry and double immunofluorescence techniques with antibodies sourced from Abcam, we assessed the presence of these molecules in different tissue pathological and normal structures.

Results: Our findings indicated that tryptase exhibited positivity in various epithelial structures, notably within the salivary gland ducts, particularly the striated ducts, while acini (adenomers) were negative. Additionally, endothelial cells were tryptase positive but Cd300a negative. Tissue infiltrates displayed cells that were positive for both tryptase and Cd300a. The results of our study suggest a distinct localization and functional implication of tryptase within the epithelial and endothelial compartments of salivary glands, whereas. Cd300a appears to be more involved in immune cell regulation within infiltrates.

Conclusion: These findings contribute to a better understanding of the differential roles of tryptase and Cd300a in salivary gland and oral mucosal biology, potentially informing future therapeutic strategies targeting these molecules in related pathologies.

Keywords: CD300a, Tryptase, Salivary Glands, Oral Mucosa

A-0975

Recycling Machinery of Integrin Coupled with Focal Adhesion Turnover via RAB11-UNC13D-FAK Axis for Migration of Pancreatic Cancer Cells

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Purpose: Recycling of endosomal vesicles is critical for the migration of cancer cells, which leads to the metastasis of pancreatic cancer and devastating cancer-related death. So, new diagnostic and therapeutic molecules which target the recycling of endosomal vesicles need to be developed.

Methods: Public databases including TCGA, ICGC, GSE21501, GSE28735, and GENT are analyzed to derive diagnostic and therapeutic targets. To reveal biological roles and underlying mechanisms of molecular targets, various molecular biological experiments were conducted.

Results: First, we identified UNC13D's overexpression in patients with pancreatic cancer (n=824) and its prognostic significance and high hazard ratio (HR) in four independent pancreatic cancer cohorts (TCGA, n=178, p=0.014, HR=3.629; ICGC, n=91, p=0.000, HR=4.362; GSE21501, n=102, p=0.003, HR=2.257; GSE28735, n=45, p=0.022, HR=2.681). Additionally, its expression is associated with the clinicopathological progression of pancreatic cancer. Further biological studies

have shown that UNC13D regulates the migration of pancreatic cancer cells by coupling the exocytosis of recycling endosomes with focal adhesion turnover via the regulation of FAK phosphorylation. Immunoprecipitation and immunocytochemistry showed the formation of the RAB11-UNC13D-FAK axis in endosomes during integrin recycling. We observed that UNC13D directly interacted with the FERM domain of FAK and regulated FAK phosphorylation in a calcium-dependent manner.

Conclusion: We highlight that UNC13D, a novel prognostic factor, promotes pancreatic cancer progression by coupling integrin recycling with focal adhesion turnover via the RAB11-UNC13D-FAK axis for the migration of pancreatic cancer cells.

Keywords: UNC13D, RAB11, FAK, Integrin, Focal adhesion

A-0976

Role of Peroxiredoxin 1 Induced by Epstein-Barr Virus Infection in Nasopharyngeal Carcinoma

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Purpose: Nasopharyngeal carcinoma (NPC), a common cancer in Southern China, is associated with Epstein-Barr Virus (EBV) infection. Although many therapies for NPC have been established, the definite role of EBV in NPC remains unclear. Therefore, this work focuses on LMP2A, a latent EBV gene, and investigates whether LMP2A is related to peroxiredoxin 1 (PRDX1) in EBV-positive NPC.

Methods: The mRNA and protein expression levels of LMP2A, PRDX1, and beta-catenin were compared in patient samples. To identify molecular mechanisms, EBV-negative NP69 and EBV-positive C666-1 NPC cell lines were used. After making an agar cell block for cell slides, the intensity of LMP2A expression was observed visually. To measure the level of reactive oxygen species, both fluorescence microscope and flow cytometry were used. To investigate the intracellular signaling molecular mechanisms with and without the LMP2A gene, reverse transcription polymerase chain reaction and western blotting were used.

Results: Both patient samples and cells of nasopharyngeal carcinoma infected with EBV had increased expression of LMP2A compared with controls, and high ROS levels were identified. Cell viability assay showed that LMP2A promoted cell growth by regulating gene expression. Furthermore, LMP2A induced the expression of PRDX1 and beta-catenin. LMP2A also increased the expression of both cyclin B1 and cyclin D1.

Conclusion: In NPC cells, PRDX1 and beta-catenin were regulated through LMP2A expression, which reduced cell growth through cell cycle–related gene expression. This study suggests that LMP2A could be a target molecule for inhibiting cancer progression in NPC cells infected with EBV.

Funding: This study was supported by The National Research Foundation of Korea grant funded by the Korea government (MSIT) (grant no. RS-2024-00354069).

Keywords: Nasopharyngeal carcinoma, Latent membrane protein 2A, Peroxiredoxin 1, Beta-catenin, Cell cycle

A-0977

CD150-Dependent Activation of EBV-Transformed B Cells Induces the Differentiation of Peripheral Blood Monocytes via the Secretion of Multiple Cytokines

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Purpose: CD150, also termed signaling lymphocyte activation molecule family member 1, is a cell surface receptor expressed on T cells, B cells, dendritic cells (DCs) and some tumors. Stimulation of CD150 on immune cells induces cell proliferation and cytokine production. However, the function of CD150 in Epstein-Barr virus (EBV)-infected B cells is still not fully understood.

Methods: CD150 expression on B cells increased rapidly following EBV infection, and various CD150 antibodies, measles viral proteins and recombinant CD150 proteins induced the secretion of multiple cytokines in both $CD150^+$ EBV-transformed B cells and EBV^+ lymphoma cells.

Results: The IL-1α protein level showed the greatest increase among all cytokines measured. The culture supernatant containing these cytokines induced the rapid differentiation

of monocytes to DCs after only 2 days in vitro, which was faster than the established DC maturation time. Furthermore, knockdown of CD150 expression led to a reduction in the secretion of multiple cytokines, and monocyte differentiation was partially inhibited by anti-IL-1α and anti-granulocyte-macrophage colony-stimulating factor neutralizing antibodies.

Conclusion: The results of the present study suggest that CD150 activation triggers cytokine production in EBV-transformed B cells, and that measles virus coinfection might affect immune responses through the production of various cytokines in EBV$^+$ lymphoma cells.

Funding: This study was supported by The National Research Foundation of Korea grant funded by the Korea government (MSIT) (grant no. RS-2024-00354069).

Keywords: CD150, Epstein-Barr virus, B cells, Cytokines, Dendritic cells

[D. Biological Anthropology]

A-0122

Validation of Dental Feature-Based Age Estimation Models using Orthopantomogram for Koreans

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Purpose: This study aimed to validate the accuracy of a previously published method for age estimation by analyzing dental features in Korean orthopantomograms (OPGs).

Methods: We examined a total of 118 OPGs, aged 20 to 89 years (64 males and 54 females, mean age 53.89±19.83 years). The sample was stratified by sex and age decade group, with random selection from each stratum. We counted the number of missing teeth, prosthetic teeth, filled teeth, and implants, and applied two age estimation models: Model A, which used the entire dentition, and Model B, which relied solely on posterior teeth on both sides of the jaws.

Results: The accuracy of each model was evaluated using the root mean square error (RMSE) between chronological and estimated ages. Model B demonstrated superior estimation performance with an RMSE of 10.589 years, compared to Model A's RMSE of 10.743 years. Furthermore, both models showed comparable accuracy to existing age estimation methods in Korean forensic practice. Notably, Model B exhibited more consistent performance across different age groups, with a narrower RMSE range (5.09 years) compared to Model A (8.54 years).

Conclusion: These findings suggest that age estimation using dental features is suitable for Korean forensic applications. Given its overall accuracy and consistent performance, Model B is preferred over Model A. However, the applicability of these models may vary internationally. Therefore, country-specific studies are recommended to ensure their accuracy and reliability in diverse clinical settings. This study underscores the importance of context-specific validation in forensic age estimation methods.

Funding: This study was supported by a National Research Foundation of Korea (NRF) grant (No. 2022R1F1A1063719).

Keywords: Forensic Odontology, Age estimation, Orthopantomogram, Dental features

A-0294

Correlation of Arm and Leg Length with Height of Adult Women in the Dayak Bukit, Dayak Ngaju, and Banjar Hulu Tribes in the Island of Kalimantan-Indonesia

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Purpose: Body height is a crucial parameter in anthropometry, and estimating height plays a significant role in the forensic identification of measured body parts. Measurements of forearm and lower leg lengths can serve as alternatives for estimating body height. This research aims to determine the correlation between forearm and lower leg lengths with the body height of adult women from the Dayak Bukit, Dayak

Ngaju, and Banjar Hulu ethnic groups in Kalimantan Island.

Methods: The study employs an observational analytical cross-sectional design, utilizing purposive sampling techniques with 38 subjects for each ethnic group, aged 20-40 years and meeting inclusion and exclusion criteria.

Results: Pearson's correlation test results for right and left forearms are as follows: Dayak Bukit r=0.786 and r=0.791, Dayak Ngaju r=0.797 and r=0.797, and Banjar Hulu r=0.825 and r=0.837. For right and left lower legs: Dayak Bukit r=0.850 and r=0.839, Dayak Ngaju r=0.854 and r=0.833, and Banjar Hulu r=0.699 and r=0.718.

Conclusion: Strong correlations are found between forearm length and body height in adult women of the Dayak Bukit and Dayak Ngaju ethnic groups, with a very strong correlation observed in adult women of the Banjar Hulu ethnic group. A strong correlation is identified between lower leg length and body height in adult women of the Banjar Hulu ethnic group, while a very strong correlation is observed in the Dayak Bukit and Dayak Ngaju ethnic groups.

Keywords: Forearm Length, Lower Leg Length, Body Height

A-0295

Differences in Head Shape Characteristics using Cephalic Index among Tribes in the Island of Kalimantan-Indonesia

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Purpose: The island of Kalimantan is inhabited by various ethnic groups, including the Dayak Ngaju, Dayak Bukit, and Banjar Hulu. Research by Radam suggests that the Dayak Bukit and Banjar Hulu have the closest kinship. Tjilik Riwut's study, however, claims that the Dayak Bukit is part of the Dayak Ngaju. The debated differences in their ancestral relationships necessitate identification for verification. The identification of these three ethnic groups utilizes the cephalic index. This research aims to identify and verify the kinship relationships among three ethnic groups in Kalimantan (Dayak Ngaju, Dayak Bukit, and Banjar Hulu) through the analysis of head shape characteristics using the cephalic index, with the hope of contributing to a deeper understanding of the ethnic kinship history on the island of Kalimantan.

Methods: The study involves 180 male and female subjects from the mentioned ethnic groups, with a cross-sectional observational analytical design and 60 subjects per ethnic group. The head shape characteristics are assessed using the cephalic index.

Results: The results of the Kruskall Wallis test reveal significant differences in the mean head width, head length, and cephalic index among the three ethnic groups in Kalimantan ($p<0.05$). However, there is no significant difference in the mean cephalic index between males and females in these ethnic groups ($p>0.05$).

Conclusion: Discrepancies in the mean cephalic index, head width, and head length are found between the Dayak Ngaju-Banjar Hulu and Dayak Bukit-Dayak Ngaju ethnic groups ($p<0.05$), while no significant difference is observed between the Dayak Bukit and Banjar Hulu ($p>0.05$). Based on the comparison of these head shape characteristics, there is a possibility of a kinship relationship between the Dayak Bukit and Banjar Hulu ethnic groups.

Keywords: Banjar Hulu tribe, Dayak Bukit tribe, Dayak Ngaju tribe, Cephalic index

A-0298

Gender Differences in Maximum Oxygen Consumption among Individuals with Similar Body Composition

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Purpose: This study aimed to investigate the gender differences in maximum oxygen consumption (VO2max) among individuals in their 20s with similar body composition. The specific focus was on comparing men and women, distinguishing them based on comparable body composition parameters.

Methods: Participants in their 20s were categorized into male and female groups with similar body composition. The study utilized body fat analysis (%BF) and treadmill maximal exercise tests to measure VO2max. The objective was to assess

aerobic exercise capacity and examine the potential differences in VO2max between genders, considering participants with similar body fat.

Results: The study revealed a statistically significant difference in VO2max between the two groups with similar body fat percentages. Notably, a correlation was observed, indicating that lower body fat percentages were associated with higher VO2max. This suggests a close relationship between body fat percentage and maximum oxygen consumption.

Conclusion: In conclusion, regardless of gender, the study suggests a strong association between body fat percentage and VO2max. The results imply that even with different genders, individuals with lower body fat percentages tend to exhibit higher aerobic exercise capacity. The limited sample size in this study emphasizes the need for further research to comprehensively explore gender differences, especially considering the common tendency for men to have more muscle mass and larger lung capacities.

Keywords: Gender differences, Maximum oxygen consumption (VO2max), Body composition, Aerobic exercise capacity, Body fat percentage

A-0310

2D-2D Craniofacial Superimposition using Artificial Intelligence

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Purpose: Craniofacial superimposition has evolved from the old method of comparing images of faces and skulls and relying on human decision-making. Modern applications now use artificial intelligence for positive identification. One popular method involves applying equations to accurately overlap facial and skull images.

Methods: Transformation matrix was created by integrating knowledge of anatomical landmarks using Euclidean distance equation. This research was conducted on a sample of 30 males and 40 females, with facial photos imported from the database of the Osteology Research and Training Center (ORTC), Chiang Mai University, and skulls photographed with a DSLR camera. Identification performance was compared between 9 and 16 anatomical landmarks using MANOVA analysis to determine the differences between each testing group using Hotelling's Trace test (p-value < 0.05).

Results: The experiment using 9 and 16 anatomical landmarks found differences in each male testing group with statistical significance, while in the female testing group differences were only found in the 9 anatomical landmark testing group. The Prosthion- Labial superius and Infradental- Labial inferius showed statistically significant differences in the male testing group using 9 and 16 anatomical landmarks including Gnathion-Gnathion', while in females no differences were found. Results showed that 9 anatomical landmarks were sufficient for craniofacial superimposition using a genetic algorithm, especially in males.

Conclusion: Artificial intelligence can be applied for 2D-2D craniofacial superimposition to make decisions based on anatomical landmark relationships, and the method is also user-friendly, therefore promoting further development.

Funding: This Faculty of Medicine, Chiang Mai University with funding no. 091/2565.

Keywords: Craniofacial superimposition, Human identification, Skull, Artificial Intelligence, Forensic Anthropology

A-0323

A Metric Sex Estimation Method for Five Traits of the Skull in 3D Images

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Purpose: The skull, as a three-dimensional structure with irregular shapes and surfaces, presents difficulties in devising measurements for sexually dimorphic shape variations, even though the sexually dimorphic traits are easily observable. This study aimed to propose new metric method for sex estimation using quantitative analysis of five traits of Walker's

non-metric method, which are mastoid process, glabella, supraorbital ridge, mental eminence and nuchal crest, on the three-dimensional reconstructed skull images.

Methods: A total of 661 adult skull images were used and with 561 images selected randomly after excluding 100 images, five traits for sex estimation on skulls were measured individually and each logistic regression analysis was performed. With 100 images, the non-metric and metric method were performed in each traits and compared the accuracy of sex estimation for verification. Out of five traits, mastoid process, glabella and supraorbital ridge were quantified by the volume, and mental eminence and nuchal crest by surface area.

Results: As a result, in the non-metric method, the sex accuracy was 50% for mastoid process, 76% for glabella, 54% for supraorbital ridge, 41% for mental eminence, and 45% for nuchal crest. In the metric method, the accuracy was 73% for mastoid process, 81% for glabella, 70% for supraorbital ridge, 71% for mental eminence, and 92% for nuchal crest. In the final sex estimation, if three or more traits are male, the individual was classified as male; if three or more traits are female, the individual was classified as female. The metric method demonstrated sex accuracy of 95%, while non-metric method showed 88%.

Conclusion: In conclusion, this study proposes a new metric method for sex estimation compared to Walker's non-metric method, specifically on five traits. It is believed that this metric method can enhance the accuracy of sex estimation using skulls not only for Koreans but also for other populations.

Keywords: Metric method, Sex estimation, Skull, Five traits, 3D

A-0350

Applying Micro-Computed Tomography of Talus and Calcaneus to Identify a Biological Profile Based on Machine Learning

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Purpose: The biological profile is a vital instrument in forensic science. It enables examining biological details derived from bones discovered at crime scenes. This approach encompasses the analysis of sex, age, stature, and ancestry for comprehensive forensic assessment. Given its influence on subsequent evaluations, the initial phase in biological profiles involves sex assessment. Historically, prior research has relied on radiographs, including X-rays, MRI, and CT, to assess biological profiles. However, a recent advancement in medical imaging technology, micro-CT, offers high-resolution and high-quality images. This technology presents an intriguing opportunity to integrate image processing and machine learning techniques and to evaluate biological profiles. Micro-CT aims to enhance the accuracy and reliability of forensic analysis tools by applying this innovative technology.

Methods: This research utilized micro-CT scans of the calcaneus and talus obtained from recently deceased cadavers to guide the implementation of machine learning models. The study focused on extracting features from micro-CT images to facilitate biological profile assessment. In pre-processing, the grayscale image undergoes conversion into a binary image. Following pre-processing, the segmentation process defines the feature extraction area. The features utilized pixel differentiation, bone fraction, trabecular thickness, and spacing. The assessment of biological profiles through machine learning involves classifying various features extracted from micro-CT images using a machine learning model.

Results: The study highlights that high-quality micro-CT images enhance the accuracy and reliability of various feature extractions during image processing.

Conclusion: Consequently, the application of machine learning that evaluates biological profiles becomes an area worthy of exploration with potential implications for future forensic analysis tools.

Keywords: Micro-CT images, Talus, Calcaneus, High-quality, Machine learning

A-0406

When Diagnosing Long Bone Fractures in Infants

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Purpose: The role of forensic anthropologist is to analyze the fractures including estimation of biological profile. Child abuse are often caused by family members, so the cause of

the fracture tends to remain unrevealed. Radiologist focus on major injuries, which can lead to overlooking other body part injuries. The purpose of this presentation is to review a child abuse case of humeral fracture that was combined with several overlooked rib fractures.

Methods: This case concerns a male neonate who died five months after birth. According to the case summary, when the boy was four months old, his right humerus underwent a crushed fracture because his four-year-old sister grabbed his hand and hung down below while his mother was holding him. The diagnosis was made by taking X-ray images of the right and left humerus. After 17 days of injury, a follow-up X-ray was taken. However, he was found dead at home 25 days after taking a follow-up X-ray. The autopsy report revealed that the child had skull fractures and subdural hemorrhage, which enabled the police to re-examine the child's previous hospital records.

Results: A forensic anthropologist suggested possible fracture sites and calluses in the X-ray images. He noted that serial fractures and serial calluses were observed on left ribs. These findings were confirmed by a radiologist. The forensic anthropologist also noted that the outline of the humerus was unclear. The radiologist diagnosed that the unclear outline of bone was a positive finding that occurs when a minor fracture is repeated.

Conclusion: Combined long bone fractures and rib fractures are often reported in cases of "shaken baby syndrome" and "abusive head trauma." When you diagnose the long bone fractures in infants, it is necessary to check in other body part injuries to exclude the possibility of child abuse. Child abuse can be preventable.

Keywords: Child abuse, Forensic anthropologist, Fracture, Long bone, X-ray diagnosis

A-0459

Comparative Bone Analysis between Spheniscus sp and Pelecanoides Garnotii by Histomorphometry and Radiological Analysis

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Purpose: Sea birds have developed bone adaptations to dive and deal with the buoyancy of the aquatic environment. An example of this is the penguins of the genus Spheniscus sp., which have modified their long bones to be havier, allowing them to dive efficiently. However, the question arises as to how birds that must both dive and fly adapt, such as in the case of Pelecanoides garnotii, a bird very similar to penguins except for its ability to fly.

Methods: Histomorphometric and radiological comparative analysis between the midshaft diaphysis of the humerus and femur of a penguin from the genus Spheniscus sp. and a Pelecanoides garnotii was conducted using the K index and the cortical diaphyseal index (CDI) measuring the thickness of the bone cortex, and a functional index evaluating bone shape (circular sector).

Results: Results revealed that Spheniscus sp. exhibits greater cortical thickness than Pelecanoides garnotii, both in the humerus and femur, and the shape of the long bones of Spheniscus sp. is similar to a line compared to P. garnotii, which is similar to a disc. The values obtained from Pelecanoides garnotii, with low cortical thickness and a disc-like shape in long bones, specifically the humerus and femur, compared to Spheniscus sp. penguins, relate to its flight capacity, as it requires lighter and more aerodynamic bone structures to maintain its ability to fly.

Conclusion: It is concluded that there are differences in

cortical thickness between a penguin from the genus Spheniscus sp. and a Pelecanoides garnotii, but not in shape. This study provides unprecedented histological images of the bone tissue of Pelecanoides garnotii, which is a valuable contribution to scientific literature.

Keywords: Seabirds, Bone modifications, Spheniscus sp. penguins, Pelecanoides garnotii, Histological analysis

A-0615

The Identification of Remains of the Korean Protomartyr, Paul Yun Ji-Chung

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Purpose: Yun Ji-chung (1759-1791) was Roman Catholics in the late Joseon Dynasty. He confessed his faith while being interrogated in Jeolla Gamyeong and was martyred by beheading in outside the South Gate of Jeonju, on December 8, 1791. The remains were found 230 years later, on March 11, 2021, in a Catholic cemetery managed by the Chonami Shrine in Wanju, South Korea, along with a ceramic bowl inscription. The purpose of this study is to identify the remains through anthropological research.

Methods: The types, the numbers, and the external findings of bones were investigated. The age, the sex, the height, and the traumatic and pathological findings of the victim at the time of death estimated. And the lengths and sizes of various parts of the bones were measured, and then photographs were taken. In order to confirm the same paternal blood relationship with Haenam Yun family, Y-Chromosome DNA test (Y-STR, Y-short tandem repeat) of remains was performed.

Results: At the time of death, precisely truncated damage was found in the body of fifth cervical vertebrae. The victim was 27-37 years old and male. Y-STR had same paternal lineage as Haenam Yun's relatives. The ceramic bowl inscription, the location and timing of the cemetery, and the historical evidence of the historical records were combined. The remains were identified as Yun Ji-chung, who was martyred by beheading in 1791.

Conclusion: These results are exemplary examples of the identification of human remains through a combination of excavated inscription, historical evidence, gender, age, height, specific trauma findings, and genetic test results, and can be used as a standard method for future human remains excavation studies. And these results can be used as basic data for related forensic medicine, physical anthropology and historical research.

Keywords: Yun Ji-chung, Korean protomartyr, Human remains, Y-STR, Beheading

A-0618

The Identification of Remains of the Korean Protomartyr, James Kwon Sang-Yeon

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Purpose: Kwon Sang-yeon (1751-1791) was Roman Catholics in the late Joseon Dynasty. He confessed his faith while being interrogated in Jeolla Gamyeong and was martyred by beheading in outside the South Gate of Jeonju, on December 8, 1791. The remains were found 230 years later, on March 11, 2021, in a Catholic cemetery managed by the Chonami Shrine in Wanju, South Korea., along with a ceramic bowl inscription. The purpose of this study is to identify the remains through anthropological research.

Methods: The types, the numbers, and the external findings of bones were investigated. The age, the sex, the height, and the traumatic and pathological findings of the victims at the time of death estimated. And the lengths and sizes of various parts of the bones were measured, and then photographs were taken. In order to confirm the same paternal blood relationship with Andong Kwon family, Y-Chromosome DNA test (Y-STR, Y-short tandem repeat) of remains was performed.

Results: The victim was 31-41 years old and male. Y-STR

had same paternal lineage as Andong Kwon's relatives. The ceramic bowl inscription, the location and timing of the cemetery, and the historical evidence of the historical records were combined. The remains were identified as Kwon Sang-yeon who was martyred by beheading in 1791.

Conclusion: These results are exemplary examples of the identification of human remains through a combination of excavated inscription, historical evidence, gender, age, height, and genetic test results, and can be used as a standard method for future human remains excavation studies. And these results can be used as basic data for related forensic medicine, physical anthropology and historical research.

Keywords: Kwon Sang-yeon, Korean protomartyr, Human remains, Y-STR

A-0620

The Identification of Remains of Francis Yun Ji-Heon, Korean Martyr of the Sinyu Persecution

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Purpose: Yun Ji-heon (1764-1801) was Roman Catholics in the late Joseon Dynasty. He was martyred by beheading outside of the South Gate of Jeonju and his body was cut several parts on September 17, 1801, during the reign of King Sunjo of the Joseon Dynasty due to the Sinyu Persecution. This remains were found 220 years later, on March 11, 2021, in a Catholic cemetery managed by the Chonami Shrine in Wanju, South Korea. The purpose of this study is to identify the remains through anthropological research.

Methods: The type, the number, and the external findings of bones were investigated. The age, sex, height, and traumatic and pathological findings of the victim at the time of death estimated. And the lengths and sizes of various parts of the bones were measured, and then photographs were taken. Y-Chromosome DNA test (Y-STR, Y-short tandem repeat) of the remains was performed.

Results: At the time of death, fractures or precisely amputated injuries were found in the body of second cervical vertebrae, in the lower parts of both humerus, and in the lower part of left femur. The victim was 27-37 years old and male. Y-STR had same paternal lineage as Haenam Yun's family. The location and timing of the cemetery, and the historical evidence of the historical records were combined. The remains were identified as Yun Ji-heon, who was martyred by beheading in 1801 and his body was hacked into six parts.

Conclusion: These results are exemplary examples of the identification of human remains through a combination of historical evidence, gender, age, height, specific trauma findings, and genetic test results, and can be used as a standard method for future human remains excavation studies. And these results can be used as basic data for related forensic medicine, physical anthropology and historical research.

Keywords: Yun Ji-heon, Korean martyr, Human remains, Y-STR, Beheading

A-0634

Exploring Nasal Foramina: An Anatomical Investigation using Dried Bone Specimens

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Purpose: The nasal foramen is located in the nasal bone and provides a passage for vessels to supply the nasal area. It is the passage for a vascular supply to the nose. This project aimed to establish reliable references for the nasal foramina for future clinical applications.

Methods: Dried skulls, 46 from the Division of Anatomy, University of Phayao, Thailand, and 26 from the Tulane University School of Medicine, New Orleans, LA, USA, were collected and examined. The location, number, and sizes of nasal foramina were noted. The distances from each nasal foramen to the internasal suture, frontonasal suture, nasomaxillary suture, nasion, and rhinion were also recorded and used in the statistical analytical programs for these samples.

Results: In this study, the most common type of nasal foramen in all skulls was type II (one external opening) at 65.97%,

followed by type I (no foramen opening) at 20.83%, type III (two external openings) at 11.11% and type IV at 2.08% (three external openings). Nasal foramen subtypes in many of the Thai and American skulls were type IIb and type IIa. The diameter of a connecting nasal foramen was significantly larger than that of a non-connecting nasal foramen. Examples from embalmed cadavers also confirmed the passage of the external nasal artery through the nasal cavity.

Conclusion: The present study shows no significant difference in nasal foramen morphometry between Thai and American skulls. It illustrates recent data on type and subtype classifications and confirms the location of a vascular passage through the nasal foramen. This is the first study of NF variations of the nasal bone and their respective classifications.

Keywords: Nasal foramen, Nasal bone, Vascular passage, Anatomy, Face

A-0809

Forensic Study of Height Prediction using Sternum Body Length in Chest X-ray Images

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Purpose: Estimating height is a crucial clue for identifying individuals. This correlation study on between sternum body length and height estimation can be utilized as a tool for identifying victims using the length of the sternal body found at forensic scenes.

Methods: We investigated the correlation between estimated height and sternal body length obtained enrolled from Chest chest radiographs (CXRs) of 600 patients from a tertiary hospital. Skilled radiologists performed delineated segmentation detection boundaries of the sternal bodyies's outline on CXRs. The actual length of the sternal body was measured using thethese predicted boxes circumscribing the sternal body and pixel spacing method, sternal body pixel num × xy pixel space. Pearson correlation analysis was conducted between height of CXR and sternal body length. Height was considered the dependent variable, while sternal body length, sex, and age were treated as explanatory independent variables in multiple linear regression analysis. Compounding was assessed based on the change in β Value in each regression analysis.

Results: The regression formula for predicting height using sternal body length is y = 129.62 + (3.33 × length of sternal body). The Pearson correlation coefficient for sternal body length and height was +0.64 (p=0.416), indicating a positive linear relationship between height (y) and sternal body length (x). The simple regression formula for predicting height using sternal body length is y = 129.62 + (3.33 × length of sternal bodyx (Adj R^2 = 0.415)).

Conclusion: Previous studies on height estimation using bones have primarily relied on postmortem methods, posing challenges in sample acquisition and large-scale usage. However, our study leveraged CXRs of living individuals, facilitating relatively easy access to large samples. With the utilization of AI-driven automatic segmentation and length measurement techniques, height estimation equations can be derived from all bones in medical imaging data, indicating high applicability potential.

Keywords: Forensic anthropology,, Sternum, Height estimation, Regression analysis, Artificial intelligence

A-0850

Sex Estimation of Modern Koreans using a Non-Metric Traits-Based Program

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Purpose: Using non-metric traits for sex estimation may be simple to use, but it lacks objectivity due to potential errors among researchers, making it difficult to ensure reliability. Several attempts have been made to overcome these challenges using statistical models, but research on this topic has been limited in Korea. This study aims to evaluate the accuracy of MorphoPASSE, a sex estimation program based on non-metric traits, for contemporary Korean populations. Developed by Klales(2018), MorphoPASSE evaluates the features of the cranial and coxal bones to provide the posterior probability of sex.

Methods: For this study, post-mortem computed tomography (PMCT) data from 100 individuals (50 males, 50 females) collected by the National Forensic Service were randomly se-

lected. After obtaining 3D images of cranial and coxal bones, trait scoring for the morphology was conducted twice on a scale of 1 to 5. Posterior probability was calculated by MorphoPASSE program and predicted sex were compared with actual sex.

Results: The result of the Kappa test conducted for intra-observer errors showed moderate agreement. Without a threshold (pp=50%), the prediction model using coxal bone demonstrated a 92% accuracy, while the prediction model based on cranial morphology showed a 78% accuracy. Applying a minimum threshold of 75% decreased model accuracy to 80% (os coxae) and 60% (cranial). Mann-Whitney U tests revealed significantly lower posterior probability distributions in the female group for both prediction models ($p < .001$).

Conclusion: This research focused on validating the accuracy of MorphoPASSE program using data from modern Koreans. The results show that when using the morphology of the os coxae, a reliable accuracy is achieved. However, since applying a higher threshold resulted in a decrease in the model's accuracy, an analysis of the factors influencing this and the reasons for lower accuracy in females compared to males will need to be conducted in further research.

Keywords: Non-metric sex estimation, Forensic anthropology, Posterior probability, MorphoPASSE, Korean

A-0921

Correlation Analysis between Sternum Measurement and Height in Chest X-ray Images

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Purpose: Estimating height from a body is a crucial clue for identifying individuals. This correlation study on height estimation can be utilized as a tool for identifying victims using the length of the sternal body found at forensic scenes.

Methods: We investigated the correlation between estimated height and sternal body length obtained from Chest radiographs (CXRs) of 500 patients aged 20 and above. Skilled radiologists performed segmentation of the sternal body's outline on CXRs. The actual length of the sternal body was measured using the pixel spacing method, sternal body pixel num × xy pixel space. Pearson correlation analysis was conducted between height and sternal body length. Height was considered the dependent variable, while sternal body length, gender, and age were treated as explanatory variables in multiple linear regression analysis. Compounding was assessed based on the change in β Value in each regression analysis.

Results: The regression formula for predicting height using sternal body length is $y = 129.62 + (3.33 \times \text{length of sternal body})$. The Pearson correlation coefficient for sternal body length and height was +0.64, indicating a positive linear relationship between height and sternal body length. The variables affecting height, including sternal body length, gender, and age, were examined, with no significant mutual influence among the variables.

Conclusion: Previous studies on height estimation using bones have primarily relied on postmortem methods, posing challenges in sample acquisition and large-scale usage. However, our study leveraged CXRs of living individuals, facilitating relatively easy access to large samples. With the utilization of AI-driven automatic segmentation and length measurement techniques, height estimation equations can be derived from all bones in medical imaging data, indicating high applicability potential. The study's significance lies in deriving regression equations using the Korean population, facilitating their application in height estimation practices in Korea.

Keywords: Forensic anthropology, Sternum, Height estimation, Regression analysis, Artificial intelligence

A-0973

Morphological Types and Position of the Pterion in Adult Sri Lankan Skulls: Comparisons with Other World Populations

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Purpose: The present study was conducted to investigate the morphology of the pterion, and its position in adult Sri Lankan skulls and compare with those of other world populations.

Methods: Fifty eight pteria of twenty nine adult skulls of known gender were analyzed to determine the sutural mor-

phology of the pterion, and its precise location in relation to the posterolateral aspect of the frontozygomatic suture, midpoint of the zygomatic arch, anterior and superior most point of the external auditory meatus, and the inferior most point of the mastoid process.

Results: The predominant pterion type observed was sphenoparietal (82.5%), followed by stellate (8.7%), frontotemporal (5.3%), and epipteric (3.5%). The predominance of the sphenoparietal type has been observed in Nigerians, Indians, Australian Aborigines, Turks, Thai, and Japanese. The incidence of stellate type is reported to be higher in the Japanese. The frontotemporal type in Sri Lankans is lower when compared to Turks, Kenyans, and Nigerians, but high when compared to West Anatolians and Thai populations. The mean distances from the center of the pterion to the frontozygomatic suture were measured as 31.11 ± 5.02 mm and 26.98 ± 3.45 mm; to the zygomatic arch, 38.92 ± 3.55 mm and 36.16 ± 3.83 mm; to the mastoid process, 81.54 ± 4.62 mm and 77.79 ± 3.88 mm; and to the external acoustic meatus, 53.62 ± 2.58 mm and 51.91 ± 2.98 mm, in males and females, respectively.

Conclusion: The pterion in the males is positioned at a higher point from the zygomatic arch than in females while sphenoparietal type of pterion predominates in Sri Lankan skulls. A detailed knowledge of different bony articulations of the pterion and its position in different world populations would be of immense benefit in forensic identification of human remains and to surgeons while performing the pterional approach.

Keywords: Morphology, Morphometry, Pterion, Variations

[E. Anatomical Education]

A-0030

OSPE in Integrated Anatomy Practical Paper: Assessment of Professional Competency among Medical Undergraduates in Nepal

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Purpose: To calculate disparity in setting of OSPE questions to assess according to the Difficult index, discriminating index and identify the construct of each cohort is reliable, and internally consistent for the clinical anatomy competency mapped for learning outcome(blue printing) in core curriculum.

Methods: An Observational, cross sectional, quantitative study was conducted among the 100 medical students of BP Koirala Institute of Health Sciences, Nepal, attending the OSPE examination, non probability, purposive sampling technique was applied for obtaining data. The ethical clearance was obtained from institutional review committee(IRC-2144/021). Final assessment and marks obtained in OSPE assessment (dependent variables) was noted, Difficulty index, Discrimination, PBC (Point Biserial Correlation), Internal consistency for reliability of the total examination (Cronbach α) was calculated.

Results: The difficulty index of GIT OSPE was found (0.788±0.18, SEE=0.158), endocrine (0.93±0.17, SEE=0.19) and CNS (0.93±0.3,SEE=0.187). The discrimination index for GIT was (0.071-0.66), Endocrine (0.090-1.00) CNS (0.12-1.00). The point biserial correlation (PBC) ranged from 0.355-0.818 (0.63±0.16) in GIT, 0.631-0.798 (0.69±0.0.067) for Endocrine and 0.575-0.835 (0.714±0.08) for CNS. The internal consistency was observed to be α=0.84

Conclusion: PBC ranging from 0 to 1 is supposed to be positive discrimination whereas from 0 to -1 is negative discrimination. Low difficult index is supposed to have a high PBC value indicating good performance. PBC value more than 0.3 in most station of OSPE make the construct a reliable one for assessing clinical antomy competency as per competency based medical curriculum.

Keywords: Difficulty index, Discrimination index, PBC (Point Biserial Correlation), Assessment, Competency

A-0037

The Critical Analysis of Perception & Effectiveness of Online Anatomy Lab Exercise (LABEX) on Undergraduate Students of BPKIHS during COVID-19 Pandemic

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Purpose: The present study was done to evaluate the stu-

dents' perception and its effectiveness regarding the impact of pandemic in anatomy lab exercise (LABEX).

Methods: Non-interventional descriptive study was performed using semi-structured questionnaire to first year medical and dental undergraduate students of BPKIHS after IRC clearance. Basic questions regarding the students' means of study, their perception on Anatomy education during pandemic and reflective writing were collected. The effectiveness of LABEX was verified by MCQs (pre-test and post-test). Student's paired test for analysis of effectiveness of LABEX and Thematic analysis for reflective writing were performed. The categorical variables were tested for association using pearson's chi-square test and they were presented as frequencies and percentages. A $p<0.05$ was considered as statistically signifcant.

Results: The mean age was calculated as 20.84. The result of our study showed that there was no difference in perception of online anatomy LABEX by gender, stream or nationality. Except for question regarding "inadequate interaction with teachers" had difference in perception gender wise. We found that, use of content video uploading prior to LABEX increases the effectiveness of online LABEX ($p<0.001$). The thematic analysis showed "accessibility of recorded class" as major strength and "less efficient of online LABEX" as major weakness of online LABEX.

Conclusion: The physical form of anatomy education is best way of learning but online LABEX can be used as alternative during pandemic despite of its numerous weaknesses.

Keywords: COVID, Anatomy Education, Perception, Lab exercise (LABEX)

A-0044

Anatomical Model for Didactic Use of the 21st Century Based on a 19st Century Model of Mache Paper

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Purpose: Preserve the heritage value of the anatomical original model of dr. Louis. T. Auzoux of 1871 and maintain the pedagogical value through the use of replicas with the use of new materials of 21 st century.

Methods: A silicone rubber mold is made without damaging the original model and then creating a fiberglass model with 4 copies. Imperfections are eliminated, their various pieces are adjusted that now bind with magnets with each other. They are painted by emulating the initial colors using existing photographs in Latin American and European museums and anatomy laboratories.

Results: The finished models are presented by comparing them with the original.

Conclusion: It is possible to use new specimens obtained from old models to be used in the teaching/learning process of the new generations of students from the health careers of the University of Chile, mixing the old and the modern respecting the heritage, the story and the teaching of anatomy.

Keywords: Anatomical models, Dr. Luis Auzoux, Heritage, History of anatomy, Mache paper

A-0080

Blurred Lines and Binary Bias: Reporting on Sex and Gender in Recent Anatomy Education Research

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Purpose: Recent shifts in societal recognition of sex and gender identity underscores the significance of acknowledging and reporting diversity in pedagogical research. Given the importance of understanding sex and gender as variables that affect generalizability and applicability of research findings, accurate reporting of this diversity in anatomy education research is imperative if it is to remain relevant and applicable for developing pedagogical practices. The aim of this study was to review the reporting of sex or gender in anatomy education research.

Methods: An automated search within Scopus and Web of Science databases identified 181 primary research articles in the field of anatomy education published international in 2022. A manual review found 98 of these publications reported the sex or gender of the participants featured in the respective studies.

Results: The sex of participants (male/female) was recorded in 92.86% of studies, while gender (man/woman) was recorded in 7.17% of studies. No studies recorded both sex and gender of participants. Of the 58 publications where survey questions

were available to review, 38.18% of those that recorded participants' sex, labelled this as a question relating to a participant's gender. Participants were offered only binary categories for sex or gender in 91.84% of studies, while a non-binary option was offered in 7.14%, and a "prefer not to answer" option offered in 5.10% of studies. Finally, 69 studies utilized the data on sex or gender in their analysis or discussion, with 60% conflating their categorization or using associated terminology interchangeably.

Conclusion: Gender identity is underreported in anatomy education research, and non-binary individuals remain significantly underrepresented. A high degree of conflation between sex and gender highlights the need for improved standardization and reporting guidelines, a challenge that is notably confounded by international cultural and linguistic differences.

Keywords: Education, Gender, Sex, Non-binary

A-0090

Effectiveness of the Zipgrade App in Marking and Data Analysis in the Human Anatomy Department at the University of Rwanda

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Purpose: To assess the Effectiveness of the Zipgrade app in marking and data analysis in the Human Anatomy Department at the University of Rwanda.

Methods: The study used the Assessment of Gross Anatomy III module where a test of 80 multiple choice questions was prepared for 71 students from Level 2 of Pharmacy Department. The Zipgrade App was used to prepare and mark the answer sheets at the end of the assessment. Within 15 minutes, 69 out of the 71 answer sheets were scanned and marked electronically on the mobile Zipgrade app using a smartphone. Two copies were not scanned due to poor shading. The Zipgrade mobile app analyzes the performance of every student but also on each question.

Results: The Zipgrade App provided results in the form of percentages, tables, and graphs. The minimum score was 38/80 (47.5%), while the maximum score was 71/80 (88.8%). The average score was 58.4/80 (73.1%). The median is 60 (75%), while the standard deviation was found to be 0.09. Six students scored 85-90%, ten students scored 80-85%, nineteen scored 75-80%, and seventeen students obtained 70-75%. Seven students got 65-70%, and three students scored 60-65%. Five students scored between 50 and 60%, and two students failed the assessment by scoring 45-49%. Item analysis of questions showed that question 63 was the easiest, where 100% of students passed, and the most difficult was question 10, where only 10.1% of students passed the question.

Conclusion: Zipgrade App is an important technology in marking and grading, and it is a more efficient tool for a data-driven education system in today's world. ZipGrade is a free online app, and that helps to grade student assessments in multiple choice formats. It is an effective tool to analyze the student's performance within a short time.

Keywords: Zipgrade, Marking, Assessment, Analysis, Multiple choice questions

A-0178

A Preliminary Study on using Drawing as a Learning Tool in the Gross Anatomy Laboratory

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Purpose: This pilot study aimed to investigate the effectiveness of the experience of learning anatomy by drawing anatomical structures on the learning of gross anatomy by medical students.

Methods: The study was carried out on 15 second-year medical students enrolled in the elective course 'Artistic Anatomy' who volunteered to take part in the study. The students were first given a 10-question pre-test on forearm muscles and then randomly divided into 3 groups. Group I studied on a cadaver, Group II studied by drawing and Group III studied both on a cadaver and by drawing. A post-test of 10 questions and a feedback questionnaire were then administered to the students. SPSS (IBM Corp. Published 2012. IBM SPSS Statistics, Version 21.0, Armonk, NY: IBM Corp.) was used for the statistical analysis and $p<0.05$ was considered to be statistically significant.

Results: For all three groups, post-test scores were significantly higher ($p<0.001$). Group comparisons revealed that

post-test scores of Group III students were significantly higher than Group I students (p=0.041). In addition, it was observed in the feedback questionnaire that the post-test scores of the students who reported drawing while studying anatomy before the study were higher than the other students (p<0.05).

Conclusion: This study showed that drawing was an effective method of learning for the gross anatomy laboratories and would be most effective when used alongside cadaveric educational methods. Accordingly, we believe that drawing courses in anatomy education can be included in the curriculum and this situation can guide anatomists and medical students. This is a preliminary study and further studies are planned to cover different regions and systems.

Keywords: Anatomy and drawing, Drawing in anatomy education, Medical education, Anatomy education

A-0182

Do the Differences in Exposure in Training Instances of Anatomy during Undergraduate Merit to be Considered by Medical Specialty Programs?

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Purpose: To know the exposure to anatomy training courses with which first-year orthopedist residents enter the medical specialty.

Methods: Cross-sectional study. First-year residents of orthopedist were included. During the first month of residency, a survey on exposure to anatomy training instances was administered. A descriptive analysis was performed, reporting averages (standard deviation), relative (%) and absolute (n) frequencies. Study approved by the ethical scientific committee (221123001).

Results: 19 residents were included. The average time since passing anatomy in undergraduate was 7 years (± 1.5). 38.89% (n=7) passed the course 9 or more years ago. 50% (n=9) indicated having studied mainly with cadaveric preparations and partially with anatomical replicas and 27.78% (n=5) used only cadaveric preparations. 77.78% did not practice dissection during undergraduate. 11.11% (n=2) were undergraduate anatomy assistants and none have been anatomy professors. During the professional stage, 5.56% took an anatomy course. 55.56% (n=10) indicated that their specialty did not have anatomy courses, 38.89% (n=7) that anatomy is an optional subject and only one resident indicated that it is mandatory. 77.8% (n=14) considered it essential to have anatomy courses in training and 22.22% (n=4) considered it necessary. 88.9% (n=16) strongly agree that anatomy is fundamental knowledge for the performance of the orthopedist.

Conclusion: Exposure to anatomy training courses in undergraduate, as well as during medical specialty training, is insufficient. This contrasts with the perception that, in orthopedist, anatomy is fundamental knowledge. These results suggest the need to incorporate anatomy courses into orthopedist training plans.

Funding: National Research and Development Agency (ANID), Chile. Fondecyt Initiation Project 2023 N°11230300.

Keywords: Anatomical knowledge, Medical education, Formation, Study plans, Orthopedics and Traumatology

A-0183

Anatomical Knowledge in First-Year Residents of Traumatology: Determination of the Impact of a Theoretical-Practical Educational Intervention

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Purpose: Compare anatomical knowledge of the upper limb (UL) and lower limb (LL), acquired by orthopedic residents when carrying out an anatomical training program.

Methods: Experimental study. An educational intervention was carried out in a group of 18 first-year orthopedic resident doctors, assessing anatomical knowledge of UL and LL during the first three months of specialist training (previous anatomical training is unknown). The residents took an anatomical training course, being randomly divided into a control group (they took a theoretical anatomy course) and an experimental group (they took a theoretical and practical anatomy course),

both groups receiving the same theoretical course. At the end of the training, both groups performed the same evaluations with short answer questions, evaluating the anatomical knowledge of UL and LL, both evaluations with a maximum score of 56. Knowledge was compared before and after the intervention, and performance between the control and experimental groups. The statistical analysis evaluated normality with Shapiro Wilk, the inferential analysis used Student's T test for independent and paired samples, values $p<0.05$ being considered statistically significant. Study approved by the ethical scientific committee (221123001).

Results: At the beginning of the course, no differences were observed in the scores obtained between the control group [UL 19.77+2.34); LL 25.33+2.63)] and experimental group [UL 22.2+2.74); LL 25.8+2.67)] ($p>0.05$). At the end of the course, higher scores were observed in the experimental group [UL 39.7+3.05), LL 42.44+2.26)] versus the control group [UL 30.44+2.77); LL 36.56+5.64)] ($p=0.02$; $p=0.03$ respectively). Both groups significantly increased the score obtained ($p<0.001$).

Conclusion: Both groups significantly improved their knowledge at the end of the anatomical training course, however, the experimental group obtained better results. This evidence justifies the need to incorporate theoretical and practical anatomical training courses in the study plans of medical specialties.

Funding: National Research and Development Agency (ANID), Chile. Fondecyt Initiation Project 2023 N°11230300.

Keywords: Anatomical knowledge, Medical education, Formation, Orthopedics and traumatology, Study plans

A-0232

Boosting Anatomical Knowledge with Echocardiography and Videos, Focusing on Cognitive Load, Self-Efficacy, and Motivation

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Purpose: In light of the increasing acknowledgement of integrating ultrasound into undergraduate medical curricula, this study aimed to empirically evaluate its impact on anatomy learning and related cognitive factors. The research compared the effectiveness of echocardiography-based instruction with narrated anatomy videos in enhancing students' understanding of anatomical relationships, autonomous motivation, self-efficacy beliefs, mental load, and attitudes.

Methods: Conducted as a randomized controlled trial with a cross-over design, the study involved second-year medical students participating in a supplementary booster course focused on cardiac anatomy. Participants underwent both echocardiography-based teaching and narrated anatomy video conditions in a random order. Spatial anatomical knowledge tests, autonomous motivation and self-efficacy scales, and mental load assessments were conducted before and after each intervention phase, with a perception-based survey administered at the study's conclusion.

Results: Results from the 206 participating students revealed no significant differences in knowledge test and autonomous motivation scale scores between the echocardiography and video cohorts immediately after the interventions (T1). However, students in the echocardiography group reported higher self-efficacy beliefs ($p = 0.043$) and increased levels of perceived mental load ($p < 0.001$). At the study's end (T2), the results showed that neither sequence of interventions resulted in significant differences in anatomy scores, autonomous motivation, or self-efficacy. However, a significant difference in mental load was found again, with students in cohort B (echocardiography intervention) reporting a higher level of mental load ($p < 0.001$). Finally, students reported favorably on the echocardiography experience.

Conclusion: In conclusion, hands-on echocardiography sessions were well-received by medical students and correlated with high levels of self-efficacy beliefs. However, the study's findings suggest that the reported mental load in the ultrasound condition may have mitigated any potential benefits in anatomy learning. The study emphasizes the complex interplay of instructional methods, cognitive factors, and learner experiences in the context of anatomy education.

Keywords: Echocardiography, Aantomy, Education, Video

A-0249

Sources of Human Bodies for Anatomy Education and Research in Malawi

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Purpose: The use of human body dissection forms an essential part of teaching anatomy to health professions students in Malawi. Despite worldwide struggles in sourcing sufficient human bodies for anatomy education, the current recommendations on the best anatomy practices require the use of bodies exclusively from body donation programs. The current study aims to describe the sources of human bodies used for anatomy education in the Malawian context and reflect on the feasibility of using human bodies from the body donation program only.

Methods: A retrospective audit of the cadaveric records for the 2006-2022 academic years was done. The perceived challenges when sourcing the bodies were identified and described.

Results: Most (97.3%) of the bodies used between 2006 and 2022 were unclaimed, with few donated (2.7%). The bodies were predominantly males (95.2%) with very few females (4.8%). All the unclaimed bodies were sourced from hospitals. The skeletal remains from all the unclaimed bodies were retained indefinitely in the skeletal repository for teaching and potential research purposes. The body donation program in Malawi was patronised by populations of European descent only. Strongly held sociocultural, religious and economic reasons were perceived as significant barriers to sourcing bodies of the indigenous Malawians through the body donation program.

Conclusion: Bodies for anatomy education in Malawi are mainly from unclaimed individuals, similar to other African countries. Given the Malawian context, transitioning from using "mostly unclaimed bodies (and, less often, body donation)" to using "mostly body donation (and, less often, unclaimed bodies)" is recommended.

Keywords: Anatomy education, Indigenous Malawian, Body donation program, Body sourcing, Unclaimed body

A-0258

Supporting Minority Cultures during the Dissecting Room Experience: A Pilot Study Exploring the Requirements of Pasifika Medical Students

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Purpose: The first experience of medical students in the dissecting room (DR) is a challenging event. Few data exist to guide the implementation of culturally appropriate support in the DR for students from ethnic minorities. This pilot study explored Pasifika students' first experience of the DR and exposure to body donors to assist the development of cultural support strategies for this event.

Methods: Participants were 2nd year Pasifika medical students who had no prior DR exposure. Following the first exposure to the DR and body donors, face-to-face interviews were conducted. Questions included 'How would you make the DR and body donor experience more comfortable to you, taking into account your cultural needs and values?' Interviews were recorded, then transcribed and analysed thematically.

Results: Eight Pasifika students were interviewed (age range 18-32 years, mean age 21.3 years, 5 females); interview duration ranged from 18-33 minutes (mean 22.5 minutes). Three core themes were identified: student experiences, behaviours, and DR environment. Students broadly felt their cultural needs were not completely being met. Suggestions for making the DR a more culturally supportive environment included being spoken to by community leaders (e.g. Pasifika pastors, Pasifika doctors), having more Pasifika anatomy staff, and allowing a separate time for Pasifika students to pay respects to donors before dissection. Further elements included the incorporation of Christian-based religious support, access to a prayer room, and guided prayers before entering the DR.

Conclusion: Findings indicate Pasifika medical students believe enhanced cultural support is required to increase their comfort and improve student engagement with the DR experience. Students suggested that simple changes in staffing and engagement practices could provide increased cultural support and comfort during this event. Such changes would also facilitate increased cultural knowledge and promote cultural diversity in the medical student cohort.

Keywords: Dissection room, Cultural safety, Culture, Anatomy education, Dissection

A-0271

The Relationship between COVID-19 Pandemic and Graduation Criteria Focusing on Research Competence in a Medical School

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Purpose: The Medical School stipulates graduation criteria on learning, research, and volunteer activities. Among these criteria, research activities are specifying on publication in journals or presentation in conferences or awards in in-school presentation. COVID-19 pandemic limited in-person activities in various research activities of students. Therefore, we analyzed the effects of COVID-19 pandemic and research competence in a Medical School.

Methods: We divided years into pre-, intra-, and post-COVID-19 pandemic periods as 2018-2019, 2020-2021, and 2022-2023, and analyzed each research competence based on achievement year, type of research competence, and major of supervisors.

Results: Results were as follows: Half (50.2%) of students completed their duties in 4th year (senior). About 2/3 (66.67%) of students have completed publication of an article while 1/3 showed presentation. Publications could be further subdivided into journals listed in science citation index (SCI), Korea citation index (KCI), and other journals, which consist of 38.2, 36.5, and 25.3%. Major of supervisors were divided into basic (49.4%: Anatomy; Pharmacology; Physiology; and Microbiology in order of frequency) and clinical (50.6%: Internal Medicine; Ear, Nose & Throat; Psychiatry; Pediatrics; and Radiation Oncology) medical science. The proportion of presentation in conferences slightly increased in intra-COVID-19 period (37.9%) as compared to pre- and post-COVID-19 period (31.3 and 30.6%, respectively). There was no further significant difference on research competence among COVID-19 pandemic period.

Conclusion: These results could be interpreted that research activities on publications did not affected by COVID-19 pandemic, and that on-line presentation in conferences could replace the off-line conference to achieve graduation criteria of students.

Keywords: COVID-19 pandemic, Research competence, Graduation criteria

A-0309

Enhancing Anatomy Spotter Assessments: Leveraging iPads for Immediate Feedback and Interactive Learning Experiences

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Purpose: This study investigates the use of iPads to enhance question-answering and feedback provision in anatomy spotter assessments at Brighton and Sussex Medical School (BSMS). The traditional pen and paper short answer questions in formative spotter assessments were replaced with single best answer questions on iPads, allowing for immediate feedback during the assessment and better alignment with the summative exam. Results and detailed feedback were sent to the students digitally post-assessment.

Methods: After completing the formative spotter assessment, student evaluation data was gathered on the iPad-based format and its perceived impact on learning. Qualtrics Survey Software was utilized to distribute assessment questions, results, feedback, and evaluation forms.

Results: Evaluation data from 63 out of 165 first-year medical students who completed the spotter assessment revealed positive responses. A majority (n=57, 90.5%) stated that they felt the anatomy spotter assessment was a useful way to test their knowledge of anatomy. Sixty-two students (98.4) stated they preferred completing the assessment using the iPad rather than with pen and paper. Students appreciated the provision of immediate feedback, with 56 students (88.9%) stating they would prefer to receive their results between answering each question, rather than only receiving their marks and feedback at the end of the assessment.

Conclusion: Student evaluations highlight iPads as effective tools for transforming anatomy spotter assessments into dynamic, interactive learning experiences. This approach eased the marking process for teachers and reduced the time

required to complete each question. The use of iPads also enabled quick identification of challenging areas for the student cohort, aiding in refining teaching strategies. The provision of immediate feedback enabled students to better understand gaps in their own learning and aided correct identification of structures on the prosection. These findings contribute insights to the ongoing discussion on integrating technology in medical education, offering innovative approaches to enhance anatomy assessment methodologies.

Keywords: Spotter, Technology Enhanced Learning, Feedback

A-0313

A Case of International Collaboration: First Cadaver Dissection Experiences of Medical School Students and Faculty Members

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Purpose: Cadaveric dissection is an important component of medical education, providing students with unique learning experiences about human anatomy and gaining important knowledge and skills for their future careers. Various studies have found that students prefer cadaver dissection to learn human anatomy and think that it is more effective and valuable. Since the use of cadavers for educational purposes is prohibited by law in medical schools in Italy, medical students graduate without training on cadavers. In fact, some of the faculty members in the anatomy departments of medical schools have not received cadaver training and have never performed a dissection.

Methods: In July 2023, the anatomy departments of the School of Medicine of Acibadem University, Turkey and University of Turin, Italy, organized a faculty development program on cadaver dissection methods and its use in medical education. In this training program, in which the faculty members of anatomy departments and medical students participated together, it was planned to experience the training processes carried out with cadavers, and based on this experience, it was aimed to provide short-term development in the training program and practices.

Results: In this study, it was aimed to ensure that faculty members obtain gains that they can transfer to their own educational programs and to evaluate the effectiveness of the developmental program and its results with the RE-AIM methodology. The RE-AIM framework (reach, effectiveness, adoption, implementation, and maintenance) has been widely used for evaluating the effectiveness of developmental education programs.

Conclusion: This collaborative study had a positive impact on the faculty members of both medical schools in terms of the departments' development of their own programs and teaching methods. Participating in the program with their students also ensured a high level of effectiveness.

Keywords: Cadaver dissection, International collaboration, Educational progress

A-0341

Core Musculoskeletal Syllabi for Undergraduate Medicine and Physiotherapy Student Education

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Purpose: Determining what anatomy knowledge is required for health professional students, before they enter the workplace, is essential. Given the reduction in teaching hours dedicated to anatomy and the proliferation of different teaching approaches, detailed anatomical syllabi form useful resources for educators. The purpose of this presentation is to compare musculoskeletal anatomy syllabi for two specific cohorts of undergraduate students – medicine and physiotherapy.

Methods: A hybrid Delphi process was utilised to develop specific musculoskeletal syllabi for students studying medicine or physiotherapy, for the IFAA. Two separate international panels comprising a mix of clinicians and anatomists (medicine, n = 20; physiotherapy, n = 53) rated a list of topic items. The items were considered based on their relevance for competent undergraduate students, and using specific criteria were categorised as either core, recommended, not recommended or not core.

Results: Approximately 2200 musculoskeletal items were rated in each study, with considerably more items in the physiotherapy syllabus (77.5%) being deemed core/recommended compared to medicine (49.0%). The proportion of items regarded as core/recommended in the musculoskeletal concepts category was similar (physiotherapy = 70.0%; medicine = 64.8%). However, across all other categories, a higher proportion of items were deemed core/recommended for physiotherapy compared to medical students: vertebral column (76.1% vs 50.2%), upper limb (78.1% vs 48.6%) and lower limb (78.4% vs 41.3%). Notable differences in content include extensive lists of bones, joints, ligaments and muscles in the physiotherapy syllabus, while the medical syllabus contains more information relating to the pathological application of anatomy and vascular structures.

Conclusion: While some overlap in anatomical content is evident between medicine and physiotherapy, these two musculoskeletal syllabi reflect the unique nature of each profession. These syllabi can be used by educators as a guide to delivering the minimum level of anatomical knowledge required of newly graduated students.

Keywords: Anatomy syllabi, Education, Undergraduate, Medicine, Physiotherapy

A-0348

Assessing Anatomical Knowledge Retention and Learning Styles among Omani Nursing Students: A Cross-Sectional Study

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Purpose: Anatomy and physiology, a foundational bioscience course for nursing students, is critical for clinical practice. However, literature indicates that nursing students often possess inadequate anatomical knowledge, with insufficient retention further hindering effective application in clinical situations. This study aims to evaluate anatomical knowledge retention across four cohorts of nursing students (2018 to 2021). Additionally, given the wide variation in learning styles among students, we also explored the relationship between different learning styles and the retention of anatomical knowledge among nursing students.

Methods: A cross-sectional study was conducted at the College of Nursing, Sultan Qaboos University in Muscat, Oman. Participating students completed a validated and reliable 42-item multiple-choice test that covered the 11 systems of the human body. In addition to this, they filled out a demographic questionnaire and the VARK (Visual, Auditory, Reading/Write, and Kinesthetic) learning style questionnaire. Ethical approval was obtained from the College of Nursing ethical committee and data collection was conducted during the Spring 2023 semester.

Results: We recruited 209 students from four cohorts spanning 2018 to 2021, with 74% being female and an average age of 21±1.08 years. Our analysis revealed a significant decrease in the overall mean score from 24.21±4.64 in cohort 2021 to 17.03±4.68 in cohort 2018 ($F(3, 205)=12.488$, $p<.001$), indicating that students' retention of anatomical knowledge decreased over time. The majority of students (45.5%) preferred multimodal learning approaches, followed by kinesthetic (27.8%), while read/write was the least preferred method (7.2%). Although the differences were not statistically significant, kinesthetic learners exhibited marginally better retention of anatomical knowledge compared to other learning styles ($F(4, 204)=2.1$, $p=0.082$).

Conclusion: This decline of anatomical knowledge underscores the necessity of integrating anatomy more effectively within the nursing curriculum, potentially embedding it later in the program to enhance retention and application in clinical settings.

Keywords: Anatomy, Nursing. Knowledge retention, Education, Oman

A-0376

Down to the Bone: The Impact of 3D versus 2D Learning in Anatomy Education

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Purpose: Increasing student numbers and curriculum reforms reduce the available time in the dissection room, enforcing development of alternative teaching methods maximizing efficiency of anatomy education. In addition to conventional atlases, students embrace commercially computer-generated 3D models for remote anatomical studies. However, costs and limited realism of these 3D models underscore the necessity for accurate, morphable and manipulable 3D high fidelity models (3D-HFMs). 3D-HFMs are produced by scanning cadaveric specimens. Development of 3D-HFMs is a cost- and time-consuming task and the effect of 3D learning needs evaluation before integration in the curriculum.

Methods: A study was set up to investigate the learning effect of 3D-HFMs. It focused on the impact of static 2D key views (2D-KVs) versus manipulable 3D-HFMs on learning processes and outcomes when preparing for hands-on skull osteology in first-year physical therapy students. 58 students were randomly assigned into two groups (n=29). Following an assessment of prior anatomical knowledge and spatial ability, they were exposed to an instructional knowledge clip elucidating fundamental aspects of the temporal bone. Next, depending on experimental conditions, they used 2D-KVs or 3D-HFMs to study the same bone. Following this phase, a post-test was carried out, evaluating perceived cognitive load and both factual (definitions, straightforward recall) and conceptual (spatial organization, understanding of pathways) anatomical knowledge.

Results: Results showed a higher perceived cognitive load in the 2D condition. Results regarding post-knowledge were mixed: students in the 2D condition excel in factual knowledge, while those in the 3D condition demonstrate superior performance in conceptual knowledge.

Conclusion: Aligned with Bloom's taxonomy, integration of 2D and 3D models should be contingent upon the cognitive domain needed for learning specific anatomical matters. Both visualizations have their own unique educational value. Utilization of 2D representations is recommended for dissemination of factual knowledge, while incorporation of 3D representations is advocated for instruction of conceptual knowledge.

Keywords: Anatomy Education, Anatomy Digitalization, Three Dimensional Models

A-0390

Integrating Cross-Sectional Anatomy into the Medical School Curriculum using Visible Human Project Based Applications and Ultrasound

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Purpose: Cross-sectional anatomy is known to be one of the challenging skills and a vital foundation to clinical practice. Medical students at the Second Faculty of Medicine of Charles University in Prague, Czech Republic, joined optional courses, tutoring and appended sessions during the academic years of 2018/2019 to 2023/2024 specifically to learn cross-sectional anatomy to better correlate what have been observed in the basic and systemic anatomy on imaging methods (X-ray, CT, MRI, ultrasound).

Methods: Three consecutive courses were implemented. First: cross-sectional anatomy utilizing the virtual dissection table (Anatomage) interactively beside MRI and ultrasound. Second: ultrasound anatomy of the internal organs and of the musculoskeletal system. The performance of 70 participants was evaluated in the form of a written test composed of labeling ten cross-sections (Anatomage, MRI, and ultrasound images), and to draw two cross-section schemes. The results of the written tests were compared to their results in the obligatory anatomy subject. Their attitude toward the training lessons was assessed through a survey. The questionnaire asked the participants to scale 1-5 their satisfaction level, their gained hand skills of handling the ultrasound probe, the ability to

recognize structures on MRI and ultrasound, as well as their confidence level in evaluating the anatomy of radiological images.

Results: Students participating in cross-sectional anatomy training showed higher test scores. Students reported high level of practical engagement in the implemented courses.

Conclusion: Recognizing anatomical structures and topographical spaces on cross-sectional images via CT/MRI DICOM viewer and real-time ultrasound is an essential practical skill that is better equipped when trained from an early stage of the medical curriculum. Inevitably, cadaveric dissection and prosection remain the cornerstone of gross anatomy education. Integrating both modalities of teaching would extend students' practical skills in applied clinical anatomy.

Funding: Grant Sponsor – The 4EU+ European University Alliance; Grant number: 4EU+ 2021_F1_06.

Keywords: Anatomage, Cross-sectional anatomy, Visible Human Project, Ultrasound anatomy, Anatomy education

A-0420

Development of 3D Human Models Based on Korean Fetal Body Data by Gestational Age

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Purpose: Observing actual fetuses for learning is beneficial in evaluating various fetal growth stages according to gestational age. However, the utilization of fetal samples is constrained by ethical issues and considerations for privacy and personal information protection, along with a decrease in practical opportunities due to a low birthrate society. Therefore, there was a demand for a complementary solution, a 3D fetal human model.

Methods: Autodesk Maya, Maxon Zbrush, and Adobe Substance 3D Painter were utilized as tools for creating the 3D models. The created 3D models were imported into Unreal Engine, where interactive features were added to develop the final application.

Results: We developed gestational age-specific 3D human models covering weeks 4 to 40 based on the existing data set of Korean fetal body.

Conclusion: This allows for the observation of fetal growth level at each gestational age and enables direct manipulation of 3D models, providing various perspectives for observation. Implementing Korean fetal standards in three dimensions addresses the shortage of practical learning opportunities, providing an effective learning experience.

Funding: This research was conducted with funding from the Ministry of Health and Welfare in 2023 and support from the Korea Health Industry Development Institute (HI23C0170).

Keywords: Korean, Fetus, 3D, Human model

A-0421

Creation of 3D Animation on Fetal-Neonatal Normal Transition and Neonatal Resuscitation

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Purpose: Neonatal resuscitation is essential for newborns struggling to adapt to the transition from the womb to the outside world. About 10% of newborns require immediate intervention, such as chest compression, to ensure proper breathing, and it is essential for medical personnel to understand changes in circulatory organs and neonatal resuscitation techniques.

Methods: It produced 3D animation using programs such as Autodesk Maya, ZBrush, and Adobe Substance 3D Painter.

Results: In this study, a 3D animation illustrated positive pressure ventilation during the fetal-neonatal transition and newborn resuscitation. Emphasizing fetal lung circulation in three dimensions highlighted hemodynamic characteristics and the organic circulatory link between the fetus and newborn.

Conclusion: By comparing prenatal and postnatal circulation, this study facilitates a clear understanding of procedures

in newborn resuscitation and subsequent stabilization. The animation created is expected to be a fundamental resource for comprehending the normal transitional process and increasing awareness of resuscitation through visualizations.

Funding: This research was conducted with funding from the Ministry of Health and Welfare in 2023 and support from the Korea Health Industry Development Institute (HI23C0170).

Keywords: Fetus, Neonate, Normal Transition, Neonatal Resuscitation, 3D Animation

A-0435

What Makes an Anatomy Objectively Structured Practical Examination Test Item Hard?

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Purpose: Moving our Objectively Structured Practical Assessments (OSPEs) in Anatomy to an online platform (ExamWrite®) allowed us to analyse facility (F) of test items (TIs) and compare these with the Modified Angoff Standard set Cut scores (MASC) assigned by a panel of 5-8 experienced judges. Bloom's taxonomy level of each TI was also compared. We aimed to determine what constitutes a "hard" OSPE TI. Knowing this will help us create an assessment with an appropriate number of "hard" "moderately hard" and "easy" questions.

Methods: We analysed TIs used in four recent summative OSPE assessments conducted in 2022 and 2023 (118 TIs) for the University of Aberdeen, UK, Year 2 MBChB programme. We studied all TIs that had a low MASC (0.1-0.49) (judged by the standard-setting panel as "hard"). All TIs with a low Facility (<0.3) which were hard questions based on student performance were also studied. TIs were assigned Bloom's taxonomy levels: Level 1/2 ("identify" type questions); Level 3/4 (e.g. action of specific parts/fibres of muscles); Level 5/6 (e.g. applied anatomy). The nature of the TI (i.e. wet specimen, histology, radiology or clinical image) was noted.

Results: We did not find any correlation between low MASC (judged as hard by the standard setting panel), and low facility. There was also no correlation between facility and the Bloom's taxonomy level. Radiology and Histology TIs were more likely to have a low facility (i.e. hard).

Conclusion: Factors such as what is considered core knowledge influence Facility. How learning outcomes are covered influences MASC. Issues such as specimen clarity are also considered during standard setting though they do not influence Bloom's levels nor do they seem to be predictive of Facility. Further detailed analysis of these prilimary results may help us understand the complex interplay of these elements.

Keywords: Test Item Facility, Modified Angoff Standard set Cut Scote, Bloom's taxonomy level, Objectively Structured Practical Examination

A-0496

Knowledge, Attitude and Perception of Anatomy Students to Modern Advanced Teaching Methods and Technology in Anatomy Education among African Universities

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Purpose: The landscape of anatomy education has undergone a profound shift, moving beyond traditional approaches like didactic lectures and cadaveric dissection to embrace cutting-edge methods including virtual dissection, anatomical stimulators, and radiological imaging amongst others. This study aims to examine the knowledge, attitudes and perceptions of anatomy students regarding recent modern advanced methods in anatomy education.

Methods: A Google Form questionnaire was circulated among 237 students in Nigeria, Uganda, and Kenya, enrolled in medical and paramedical courses featuring Human Anatomy. The questionnaire, comprising three subsections, focused on assessing students' knowledge of modern advanced methods, their attitudes and perceptions toward these methods. The inclusion of three countries aimed to capture diverse perspectives, providing a comprehensive foundation for efficient learning environments.

Results: Majority of the participants 112 (47.3%) were Nige-

rian students, Ugandans 96 (40.5%) and Kenyans 29 (12.4%). A good number of students 132 (55.7%) lack familiarity and demonstrate an astonishing unawareness in the modern advanced teaching methods in anatomy education. Majority of the students 197, 133 and 143 (83.1%, 56.1% and 60.3%) have good knowledge of teaching methods and technologies in teaching Anatomy as it relates to virtual dissection, Anatomical simulators and Imaging technologies respectively, as one of the recent teaching technologies. Notably, 70% of the students' perceived the use of modern advanced teaching methods in anatomy education as advantageous since it would increase effectiveness and reduce time wasting.

Conclusion: This study advocated for a balanced approach to anatomy education in Nigeria, Uganda, and Kenya. It underscored the critical unawareness on the part of the students of the necessary modern Anatomy teaching technologies, underscores the critical need for well-equipped anatomy labs, and advocates for the seamless integration of modern technologies. The findings underscored a paradigm shift toward student-centric approaches.

Keywords: Anatomy Education, Modern advanced Anatomy methods, Knowledge, Attitude, Perception

A-0511

Effectiveness of Ultrasound as a Teaching Tool in Human Anatomy: A Systematic Review

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Purpose: This study aimed to determine the effectiveness of ultrasound as a teaching tool to improve understanding and retention of human anatomy in health sciences students.

Methods: To answer the research question, "What is the effectiveness of ultrasound as a teaching tool to enhance understanding and retention of human anatomy in health science students?", an search of articles was conducted, considering the following inclusion criteria: 1) primary studies, 2) conducted in humans, 3) conducted between 2019 and 2024, 4) published in any language. Secondary studies, animal studies, and studies evaluating ultrasound for purposes other than teaching anatomy were excluded. The search was performed in the PubMed and WOS databases. The keywords used were the MeSH terms "anatomy", "medical education", "education", "ultrasound", "ultrasonography", "sonography", and "learning", using boolean operators AND/OR. The procedure involved selecting by title and abstract, and reading the full text of the articles, eliminating those not related to the study objective, following the PRISMA methodology.

Results: The search identified 1,387 references (625 in PubMed and 762 in WOS). After reading the titles and removing duplicate studies, 1,359 were excluded. 27 studies were identified as potentially relevant; therefore, their abstracts were analyzed. 11 articles were excluded, and after a thorough review of the text, 16 studies were included. The studies linked the use of ultrasound with the grades obtained by undergraduate students and their perception through surveys. All studies positively assessed the use of ultrasound as a complement to traditional undergraduate anatomy teaching, with an impact on student learning, anatomical understanding, and interest.

Conclusion: Based on this advancement, we propose that ultrasound constitutes a legitimate pedagogical instrument, with potential application in the university setting, to enhance students' understanding of anatomy and provide them practical exposure to contemporary technology.

Keywords: Ultrasound, Ultrasonography, Sonography, Anatomy, Medical education

A-0532

Development Process of a Silicone Facial Model using Korean Average Soft Tissue Data for Clinical Simulation

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Purpose: This study aims to develop an educational face phantom that closely replicates the actual procedural sensation, using the latest concepts of facial anatomy, and establish a comprehensive guideline manual.

Methods: We utilized a surface statistical 3D model of Koreans along with the average thickness of facial soft tissue

to derive the 3D shapes of bone, muscle, and skin layers. In Blender 3.5, we combined data from these layers and meticulously sculpted detailed muscle and fat shapes. Following 3D printing, we cast the models using urethane with different hardness levels. To monitor the syringe movement, we employed motion capture technology. A warning sound was generated whenever the needle approached the phantom's critical area, signaling potential danger.

Results: We created a comprehensive silicone facial model using 3D data from each layer, incorporating 14 key muscles crucial for invasive procedures. Additionally, structures such as the parotid gland, parotid duct, buccal fat pad, and submuscular fat pad (SOOF, ROOF) were included. The distribution of arteries and nerves was meticulously designed and attached based on the average shape of Koreans.

Conclusion: The results from this study are anticipated to offer clinicians comprehensive training and high levels of satisfaction. However, this is a result of focusing only on Korean face data. Our next step involves applying this methodology to craft more intricate facial models representing Westerners and different age groups. These models will be distributed experimentally to clinicians for subjective evaluations. Moreover, ongoing research is dedicated to advancing cannulae development through the utilization of motion capture technology.

Keywords: Face phantom, Silicone face, Motion capture cannular, Clinical anatomy

A-0553

Clay Modeling as an Educational Tool for Understanding Relationship of Mediastinal Structures

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Purpose: Understanding the relationships between anatomical structures represents the greatest challenge for students during the study of anatomy, especially understanding the complex relationships of mediastinal structures. In the cases where active dissection is not feasible, clay modeling can serve as a helpful educational tool.

Methods: We describe the experiences of the Department of Anatomy, Faculty of Medicine Novi Sad, Serbia in the application of clay modeling in learning the anatomy of mediastinum.

Results: During the period 2017-2023 Department of Anatomy of Faculty of Medicine Novi Sad has organized over 50 workshops "The position of mediastinal structures" attended by more than 1000 students of the first year of Medicine. Workshops were organized as extracurricular activities. Students were invited to attend workshop voluntarily after regular academic activities. Workshops were moderated by teaching staff. Each workshop lasted for 90 minutes and it was attended by 20 students. Students were suggested to work in pairs. Each par was given a A4-sized drawing of empty mediastinum. Their task was to model organs, blood vessels, nerves and lymphatics and put them in the right position going from posterior to anterior. Organs, blood vessels, lymphatic ducts were modeled out of clay, while rubber bands were used to display nerves. Each step was performed following the instructions given on the Power Point Presentation. Students were encouraged to consult the textbooks and anatomy atlases and to discuss about the relationship of mediastinal structures while modeling. During the workshops students showed high creativity and inventiveness which was supported by positive learning environment. They highly rated this learning experience.

Conclusion: Clay modeling is a helpful haptic experience in anatomical education. In the cases where cadaver dissection is unavailable or limited, it offers active learning approach which engages students and helps better visual perception, developing spatial ability and better retention of knowledge.

Keywords: Anatomy education, Clay modeling, Mediastinum

A-0556

Making It Fun: Design and Implementation of Innovative Educational Videos for Introductory Anatomy

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Purpose: The introductory anatomy course presents the fundamental concepts of the human body to students enrolled in science and health programs. However, the large volume

and complexity of the learning content display challenges for students. To enhance student engagement and learning, innovative educational videos for nine different topics were created. This research discusses the design, implementation, and evaluation of studio-quality introductory videos for improving student engagement and comprehension of the inter-dependence of various systems in the human body.

Methods: The nine major topics and its subsequent videos were created, in which scripts and storyboards were drawn using Microsoft PowerPoint. The footage was filmed in 4K and edited with the relevant graphics and keying effects using Adobe Premiere Pro. The final products were uploaded to the university's media storage platform and embedded to the course learning management system. The videos were released prior to online lecture and in-person practical sessions.

Results: A total of 195 students enrolled in the introductory anatomy course over the period of 10 weeks. Contents covered included the skeletal, muscular, nervous, special senses, cardiovascular, respiratory, digestive, urinary, and reproductive systems. Assessment performance data was compared to that of the cohort from previous years. Student satisfaction survey was also evaluated.

Conclusion: The implementation of the introductory videos helped to engage and encourage students in learning about the anatomy of the major human body systems. Comparison of student performance and satisfaction between different courses and cohorts may show better analysis of the effectiveness and sustainability of these newly developed resources.

Keywords: Anatomy, Engagement, Design, Innovation, Videos

A-0581

Innovation in Anatomy Education: A Cost-Effective Approach using 3D Pen for Personalised 3D Modelling

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Purpose: This study aimed to introduce a cost-effective and easily accessible approach to anatomy education through the utilization of 3D pens.

Methods: The materials for personalized 3D modeling included a (Robobloq brand) 3D pen, 1.75 mm diameter colored PLA filaments (melting at 200°C), 2-finger protection silicone, and a heat-resistant drawing surface. The 3D pen used in the study weighed 65g and was priced at $10, with 1 meter of PLA filament costing $0.35.

Results: Trainers designed the 3D model using the 3D pen, but due to the rapid and straightforward nature of the proposed modeling, students could be encouraged to design complex structures, fostering increased student-trainer ethical interaction. As a demonstration, the intricate larynx structure, known for its complexity, was constructed using the 3D pen. Initially, laryngeal cartilages were 2D drawn on pre-prepared templates, and these drawings were then transformed into 3D models. Different filament colors were used to represent various laryngeal membranes and intrinsic muscles were added to complete the laryngeal skeleton. Subsequently, the thyroid gland and hyoid bone were drawn and incorporated into the model. The entire model required 4 meters of filament and weighed 11g. In our study, 1 hour was spent on the construction of cartilages and 1 hour on the construction of other structures, totaling 2 hours.

Conclusion: This study introduces an effective, cost-friendly, student-centric alternative for anatomy education, holding the potential to enhance student-instructor interaction. The developed 3D model, or similar creations, could be widely applied in medical or health sciences education, offering a valuable addition to traditional teaching methods.

Keywords: 3D pen, 3D modelling, Anatomy education, Larynx, Training

A-0601

Exploring Virtual Anatomy Learning: An Irish Students' Perception

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Purpose: Anatomy is an essential discipline for healthcare professionals; however, a through understating of its complexity is often challenging. Visualization is a key element to learn and comprehend intricate anatomical structures. Virtual Real-

ity (VR) is a three-dimensional cutting-edge technology that can supplement traditional anatomical teaching and provides an accessible learning environment by allowing the students to visualise, immerse and interact with anatomical structures. Furthermore, VR can provide an inclusive learning environment in accordance with the principles of the Universal Design for Learning. This study focuses on the students' perception of using VR in understanding eye and ear anatomy.

Methods: 8 MSc in Human Anatomy and 9 undergraduate Neuroscience students participated in the study. To fully comprehend and immerse in the learning process, a VR practice session was offered. The data collection was gathered a week later and was based on two questionnaires. The pre-questionnaire, collected before the VR ear and eye anatomy session, gathered demographic information and initial anatomy understanding.The post-questionnaire evaluated the students' perception of using VR as well as their self-reported changes in understating the complexity of these anatomical structures following the practical session. Ethical approval was obtained from the Social Research Ethics Committee at University College Cork (Log 2023-076).

Results: The results of this study found a high acceptance rate of using VR among both cohorts of students. Furthermore, the MSc students' data suggests an improvement in their self-perceived anatomy awareness. These results suggest that VR has the potential to enhance student engagement, motivation, and understanding of anatomical structures.

Conclusion: Overall, the authors of this study conclude that using VR can effectively enrich anatomy education by increasing students' motivation, engagement and promotes active learning.

Keywords: VR, Visualisation, Anatomy learning, Students' perception

A-0604

Investigating the Public's Understanding of Genital Anatomy to Design Tailored Outreach Events

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Purpose: Numerous studies have demonstrated a concerning lack of comprehension of genital anatomy among the general populace. Moreover, the limited diversity of genital imagery in medical literature may exacerbate discomfort during intimate clinical examinations and, in extreme cases, lead to genital dissatisfaction prompting individuals to consider aesthetic surgery. Consequently, this study aimed to explore the public's understanding of genital anatomy and leverage these findings to design customized educational outreach programs aimed at destigmatizing the topic and enhancing health literacy of genital anatomy.

Methods: 191 participants were asked to complete a 10-question multiple choice test to identify external genital structures from two schematic images of biological male and female genitals. The average scores were collated, and one-way ANOVA statistical tests were performed to compare data across demographic groups.

Results: The average test score was 89.6% (SD 15.9%), with participants achieving average scores of 92.2% (SD 18.2%) and 88% (SD 22.9%) for questions pertaining to biological male and female genitals, respectively. Notably, among those responding to questions about biological female genitals, individuals aged 21–30 (95.6%; SD 11.9%) significantly outperformed ($p = 0.0491$) those aged 51–60 (77.3%; SD 23.3%). Conversely, while there was no significant difference in scores for questions concerning biological male genitals, individuals aged 61–70 (100%; SD 0.0%) outperformed those aged 18–20 (86.1%; SD 27.4%).

Conclusion: Despite the public surpassing initial expectations, these results highlight the need for targeted outreach events. Events aimed at educating the public about biological female genital anatomy should focus on individuals aged 50 and above, whereas initiatives concerning biological male genital anatomy should target those under 20, given their lower performance in the study. Prior to designing the outreach programme, the study should be replicated utilizing photographic images and qualitative research should elucidate pertinent themes to enhance public health literacy regarding external genitalia.

Keywords: Public understanding, Genital anatomy, Outreach, Inclusivity, Anatomical education

A-0605

What Do Doctors Want? Investigating Design Parameters for Procedural Simulations

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Purpose: The purpose of this work is to explore the preferred esign parameters of procedural skills trainers among physicians.

Methods: A survey was disseminated to physicians participating in various procedural workshops at the University of Queensland. The questionnaire sought insights into the significance of face and construct validity, particularly focusing on aspects related to both physical and psychological fidelity.

Results: Initial findings suggest that physicians prioritize tactile fidelity as the most crucial aspect in a simulation intended for teaching procedural skills. Additionally, anatomical fidelity was also consistently regarded as highly important by the participants. This study is currently ongoing and results are pending analysis. Results will be available at the time of presentation.

Conclusion: The significance of end-user perspectives in shaping educational tools is crucial, yet it is sometimes undervalued. This study addresses this gap by surveying physicians, the end-users, to gain insights into critical aspects of simulation design for procedural skills training. The findings underscore that among these aspects, physical fidelity emerges as the foremost design priority.

Keywords: Simulations, Medical education, Physical Fidelity

A-0625

Exploring Colonial Influences within an Applied Anatomy Curriculum

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Purpose: Decolonising the curriculum allows us to acknowledge and challenge areas in the syllabus influenced by colonialism. An inclusive curriculum can address the attainment gap between Black, Asian and Minority Ethnic (BAME) students and their white peers, increase student engagement, and potentially transform students' attitudes and impact their professional formation. This provides a necessary move to make the student experience more diverse and inclusive. This study aimed to explore the learning material, topics covered, and recommended reading for issues related to representation, diversity and highlight opportunities to disrupt colonial influence.

Methods: Following ethical approval from the University of Bristol Ethics of Research Committee, an audit was carried out of all seminar-based units delivered to third-year Applied Anatomy students at the University of Bristol. The unit's learning materials were examined, and data was captured about the topic, style of teaching, who teaches it and the representation within the learning resources. The recommended reading list was also examined.

Results: The analysis of the recommended articles' authorship demonstrated that 84% originated from the Global North, and 72% had a male principal author. Also, 63% of authors were categorised as ethnically white. Although the learning materials covered diverse topics and provided multiple opportunities to discuss race, variations, sex and gender, the historical origin and different cultural perspectives were not always highlighted.

Conclusion: A wider challenge within the discipline of anatomy is the lack of diversity of imagery content, which was often reflected in the images used in the learning material. To support decolonisation efforts, academics should seek resources from alternative journal banks. Honest and transparent discussions between academics, librarians and students can help better understand the challenges facing decolonisation efforts and build wider strategies affecting anatomy education.

Funding: This project received an Education Development Project grant from Bristol Institute for Learning and Teaching.

Keywords: Decolonisation, Diversification, Equality, Curriculum, Education

A-0627

Decolonising the Applied Anatomy Curriculum: Students' and Staff Perspectives

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Purpose: There has been an increased interest and work towards decolonising the curriculum in higher education institutes in recent years. Recognising methods and strategies to drive anti-colonial efforts, as well as identifying examples, can be challenging in the discipline of anatomy. This study aimed to investigate students' and staff perceptions and experiences regarding the decolonisation of the Applied Anatomy Programme curriculum at the University of Bristol.

Methods: Ethical approval from the University of Bristol Ethics of Research Committee was obtained for this study. Subsequently, students enrolled in the Applied Anatomy Programme were invited to answer a student survey designed to measure their perception of decolonising the curriculum and their experience in the programme. Staff from the School of Anatomy were invited to answer a staff survey designed to explore your perception of decolonisation.

Results: Most participants had limited knowledge of the impacts of colonialism on anatomy yet were able to recognise the importance of anti-colonial efforts. Although staff were able to explain the steps they undertook to decolonise their teaching practices, these steps were not consistently recognised by students. Staff identified the lack of diversity in anatomical images and limited guidance and advice as two main challenges to decolonisation efforts in the dicipline of anatomy.

Conclusion: This study showed useful insights into the experience and perception of students and staff regarding the decolonisation efforts in an Applied Anatomy curriculum. Decolonisation is a complex concept that requires critical deconstruction, rethinking and creative reconstruction of all elements related to the formal and hidden curricula. As a result of this project a toolkit was designed where questions to prompt reflection and examples of best practice is collected.

Funding: This project received an Education Development Project grant from Bristol Institute for Learning and Teaching, University of Bristol.

Keywords: Decolonisation, Diversification, Education, Curriculum

A-0670

Maximizing Student Engagement in Anatomy with Holo Anatomy and Game-Based Learning Techniques

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Purpose: The primary aim of this study was to enhance students' understanding of the three-dimensional structures and functional relationships within the gastrointestinal (GI) system. This objective was pursued with the intention of overcoming traditional challenges in teaching complex anatomical concepts, by leveraging advanced visualization tools to facilitate a deeper comprehension of spatial relationships and organ functions.

Methods: Our approach utilized the HoloAnatomy software, augmented with a series of multiple-choice questions focused on clinical anatomy. These questions were designed to encourage progressive disclosure of related anatomical structures through detailed holograms. Students were organized into small groups of 5-6 and engaged in a competitive learning environment, with each group striving to outperform the others. To foster motivation and participation, nominal prizes were awarded to the winning groups at the session's conclusion.

Results: The feedback received from students was overwhelmingly positive, with many highlighting the engaging nature of the learning experience. The use of competitive elements, combined with the interactive holographic displays provided by the HoloAnatomy software, significantly increased student engagement throughout the teaching sessions. This was evidenced by enthusiastic participation and the detailed, favorable evaluations submitted by students, indicating a heightened interest and involvement in learning about the GI system's anatomy.

Conclusion: The integration of HoloAnatomy software with interactive, competitive learning techniques proved to be an effective educational strategy, markedly enhancing student engagement and understanding of GI anatomy. Based on the success of this approach, as demonstrated by student feedback and observed engagement levels, we plan to incorporate this

method into future anatomy teaching sessions. This study underscores the potential of combining advanced visualization technologies with game-based learning to enrich medical education.

Keywords: Virtual Reality, HoloAnatomy, Game Based Learning, Engagement, Active learning

A-0675

Strategic Essential Anatomy Learning: Maximizing Proficiency with the Level of COSTA Framework

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Purpose: In medical education, mastering complex anatomical structures within limited study time is challenging. Prioritizing anatomical terms strategically is crucial for optimal learning. The Level of COSTA (Competency of Organ, Structure, and Terminology Anatomy) framework strategically identifies learning priorities, enhances engagement, promotes metacognitive awareness, and documents learning systematically. This study explores the framework's development, integration into Problem-Based Learning (PBL), and student perceptions, aiming to demonstrate its strategic impact on anatomy education.

Methods: An exploratory descriptive study was conducted, involving criteria formulation, analysis of anatomical terms from the standard curriculum prescribed by the Indonesian Association of Anatomists (PAAI) and the Federative International Programme for Anatomical Terminology (FIPAT), framework application in PBL, and student perception assessment using the Revised Study Process Questionnaire 2 Factors (R-SPQ-2F). A sample of 108 students was selected via probability sampling.

Results: The Level of COSTA categorizes anatomical terms into four hierarchical levels based on relevance to clinical knowledge, compliance with competency standards for Indonesian doctors (SKDI), and integration into learning aids. Out of 7,113 terms, only 44.4% were classified under the Level of COSTA. Essential terminology (Level 3 and Level 4) accounted for 45% of the Level of COSTA or 20% of 7,113 terms. Student feedback highlighted increased effectiveness (88.1%) and engagement (71.4%) in anatomy learning, with 89% finding the framework user-friendly and 92.6% endorsing its continued use.

Conclusion: The Level of COSTA framework offers learning advantages by directing students' focus toward essential knowledge acquisition, fostering deeper understanding, and engagement with anatomical concepts. Positive student perceptions further underscore the framework's result in enhancing anatomy education.

Keywords: Anatomy learning, Level of COSTA, Medical education, Prioritization

A-0687

Revolutionizing Anatomy Education: Unveiling Trends, Technologies, and Insights in Learning Media

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Purpose: Anatomy learning has seen significant progress in recent years. Many learning media with technological approaches have emerged, refining the anatomy learning process. Research on the effectiveness of each learning medium has also been extensively conducted. This study aims to provide an overview of research trends related to anatomy teaching media.

Methods: This is a bibliometric research utilizing the Scopus database. The keywords used in this research are 'learning,' 'media,' and 'anatomy'. Visualization of results was done using the VOSviewer application, and image analysis on the Scopus web.

Results: The search yielded 704 documents and a total of 7463 keywords. In VOSviewer, with a minimum keyword occurrence of 10, 241 items, 4 clusters, and 13816 links were obtained. Research on this topic has been present since 1968 and peaked in 2022. The most frequently used keyword is 'human.' The country with the highest publication count is the United States, with over 200 articles. Some of the recent research topics include computer-assisted diagnosis, machine learning, and artificial neural networks. These topics are developing in line with the increasing use of technology in education due to

the Covid-19 pandemic.

Conclusion: Anatomy education needs to continue paying attention to the use of technology-based anatomy learning media, which has been widely developed recently. The use of technology provides benefits for students in enhancing their understanding of anatomy.

Keywords: Anatomy, Learning media, Technology, Medical education

A-0699

Implementation of the Anatomical Ethics and Law Module at University of KwaZulu Natal

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Purpose: An integral component in a broad medical and scientific curriculum is anatomical education utilising cadavers. A major moral and ethical concern on the continent as well in our own country, is the use of unclaimed cadavers for anatomical teaching and research. In addition, there has been a drastic decline in the availability of cadaveric material for teaching and research in South Africa. Due to ethical ambiguities worldwide, cadaver procurement for teaching and research require regulations. In South Africa this is guided by the National Health Act 2003 and is regulated by statutory appointment of the provincial Inspectors of Anatomy.

Methods: A review of the module (including its design), student viewpoints, and outcomes are presented in this paper.

Results: To address the restructuring of the undergraduate medical science (anatomy) program, the Department of Anatomy at UKZN implemented a module directed at the appreciation of ethics related to the use of cadavers for teaching and research. The implementation of the anatomical ethics and law course has been critical for Medical Science students.

Conclusion: This course is a step in the right direction in educating the scholars at an undergraduate level of the value of the cadaver in education, fundamental debates and discussion on current trends in procurement practice; allows for discourses in establishing common ethical and legal frameworks at Universities in South Africa by addressing several cultural, religious and socio-economic concerns of all population groups.

Keywords: Anatomical education, Ethics and law

A-0710

Demonstrating the Reach of Anatomical Education and Community Engagement: A Case Study of the Anatomy Department at Brighton and Sussex Medical School

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Purpose: Brighton and Sussex Medical School (BSMS) plays a central role in advancing anatomical education within the healthcare sector and broader community.

Methods: The pedagogical approaches employed at BSMS significantly contribute to the expansion of anatomical knowledge for the 425 undergraduate and 48 postgraduate students taught each year. BSMS ensures a comprehensive educational experience for its students by using a combination of didactic teaching and innovative learning methodologies, including digital resources such as the Anatomy Laboratory Interface (ALI) app, Complete Anatomy app, VR headsets and butterfly ultrasounds. The department annually trains over 1200 surgical and healthcare professionals, hosting flagship courses such as 'Definitive Skills in Trauma Surgery' and 'Damage Control and Orthopaedic Trauma Surgery' in collaboration with the Royal College of Surgeons. This allows for the highly specialised training of surgeons and consultants who often work in international zones of conflict. We also host a number of medical technology companies who teach their innovative techniques to surgeons to allow them experience before these are implemented in a surgical environment.

Results: Anatomy at BSMS extends its outreach to 640 students from other disciplines within the university, including Medical Neuroscience and Biomedical Science, offering them opportunities to engage in hands-on learning experiences within the anatomy lab. The department organises widening participation initiatives, including a Summer School and public events like the 'Matters of the Heart' event, where attendees dissect animal hearts to deepen their understanding of cardiac anatomy. These initiatives enhance the reputation of Anatomy at BSMS but also allow meaningful engagement with the public – teaching over 80 participants at the most recent event.

Conclusion: Anatomy at BSMS is innovative in its use of

teaching methods, contributions to surgical education and active involvement in community outreach. We believe it is important to disseminate experiences to enrich discussions on best practice and the future of anatomy.

Keywords: Anatomy, Innovative teaching, Surgical Skills, Digital resources, Royal College of Surgeons

A-0713

In Situ Production of Ammonium Nitrate: A New Approach to Thiel Embalming

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Purpose: One of the chemicals used in the Thiel embalming process is ammonium nitrate. However, it is highly combustible and needs special requirements in terms of handling and storage, and could lead to catastrophic explosion if improperly stored. The research objective was to develop a safer alternative method to reduce the potential hazards associated with ammonium nitrate storage and handling in the embalming process.

Methods: Ammonium nitrate was produced in situ by mixing ammonia solution and nitric acid. The resulting aquous ammonium nitrate was used in Thiel embalming at our department in place of the conventional ammonium nitrate powder. Safety aspects of this propotol was thoroughly outline.

Results: Thiel cadavers embalmed with aqueous ammonium nitrate by mixing ammonia solution and nitric acid showed no difference in comparison with conventional Thiel cadavers. The tissue retained its lifelike appearance and flexibility, suitable for medical education and surgical skills training. However, there was a slight ammonia smell to the cadavers.

Conclusion: This alternative method, involving the in situ production of ammonium nitrate by mixing ammonia solution and nitric acid, eliminates the need for storing ammonium nitrate powder. Therefore, it reduces the hazards associated with the storage and handling of ammonium nitrate in the embalming process.

Keywords: Thiel embalming, Ammonium nitrate, laboratory safety

A-0714

Evaluating the Effectiveness of Learning Resources Pre and Post Curriculum Revision in Medical Education at Universidad de Los Andes

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Purpose: The medical curriculum is a dynamic entity, requiring periodic evaluations and revisions to ensure it meets the evolving needs of healthcare education and practice. This study aimed to assess the effectiveness of learning resources employed in the medical program at Universidad de Los Andes before and after a significant curricular revision.

Methods: A mixed-methods research design was implemented, involving quantitative analysis of academic performance indicators and qualitative feedback from students and faculty through surveys and interviews. The curriculum revision focused on integrating more practical, patient-centered learning experiences and modern digital resources to enhance student engagement and knowledge application. The study compared data from two cohorts: one educated under the old curriculum and another under the revised curriculum, across various parameters including knowledge retention, student satisfaction, and faculty perceptions.

Results: Preliminary findings suggest that the revised curriculum, with its enhanced learning resources and methodologies, has led to improved student performance and satisfaction.

Conclusion: The study underscores the importance of continuous curriculum evaluation and the potential impact of tailored learning resources on medical education outcomes. This research contributes to the broader discourse on medical curriculum development, offering insights that could guide future educational reforms in medical schools globally.

Keywords: Healthcare, Curriculum, Learning resources

A-0722

Development of 3D-Printed Brain Mannequin for Anatomical Learning Devices: Progression from Database Imaging to Validation and Usability Test

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Purpose: Traditional anatomical learning process is challenged by digitalization and technology development, especially in 3D-printing. Database of imaging can be used for the source of 3D-printing or digitalization products. Here, we elucidated validation and usability of the 3D-printed brain mannequin for first grade of medical student.

Methods: Database imaging of brain was made based on CT-Scan results, then 3D-printed brain mannequin was made based on those databases using Fused Deposition Modelling (FDM) technique. Validation test was carried out by 5 experts in anatomists, neurologists, and neurosurgeons. Meanwhile, usability test was done in medical students, with 31 subjects who were randomly divided into 2 groups. Group I was first exposed to the cadaveric cerebrum then gor 3D-printed brain mannequin. Group II was exposed vice versa. Pretest, posttest I, and posttest II values were taken in limited use sessions. Comparison of the scores of the two groups was tested using the Mann- Whitney test and the Independent – t test. Comparison of the difference in scores in the paired groups using the Wilcoxon test. The p value <0.05 was considered significant.

Results: 3D-printed brain mannequin was successfully made based on CT-Scan imaging with got 94.38% score in general validation of the experts. Furthermore, 3D-printed mannequin was in the very feasible category on the facies superolateral (93.68%), facies inferior (89.5%), and facies medial (90.17%). The limited use test showed that there was no significant difference in the posttest scores for group I (7.68) and group II (6.26). Delta posttest II - pretest group I (8.38) was significantly higher than delta posttest I - pretest group I (6.00) which showed beneficial effects of 3D-printed mannequin. 80.6% of subjects passed the limited use test.

Conclusion: 3D-printed brain mannequin gets a very decent score and is effectively used as an anatomy teaching medium.

Funding: This study was funded by Indonesia Goverment with Penelitian Terapan scheme.

Keywords: 3D printing, Learning devices, Data base of imaging, Validation, Usability test

A-0740

The Anatomy Structured Critical Examination (ASCE) - A Validity Examination

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Purpose: The Anatomy Structured Critical Examination (ASCE) is a practical and verbal in-person exam used to examine the anatomical knowledge, understanding, and problem solving, in the final year of an undergraduate (UG) intercalated Bachelor of Science (iBSc). The ASCE deviates from the traditional Objective Structured Clinical Examination in that it consists solely of anatomy stations. Hence, the validity of this exam merits examination. This was achieved firstly, through a careful review of the validity and how has been applied in the context of similar assessments; secondly, through an retrospective psychometric analysis of student performance data; and thirdly, a review of examiner perceptions of ASCE validity.

Methods: In order to quantitatively examine ASCE performance, psychometric analyses were conducted on 7 cohorts' (n=130) ASCE scores. These analyses included: assessment of predictive and concurrent validity, and assessment of reliability and consistency of performance data. Furthermore, to examine perceptions of validity, examiners were surveyed for their opinions on ASCE practice, examiner consistency and perceptions on threats to validity, including construct underrepresentation and construct irrelevant variance.

Results: Data suggest that the ASCE provides a consistent and fair assessment of student anatomy understanding and problem solving and that internal processes protect well

against construct underrepresentation and construct underrepresentation and construct irrelevant variance. In addition to good performance data, examiners largely perceived positive ASCE validity.

Conclusion: Examiner perceptions and psychometric/cohort analyses provide initial construct validity evidence for the ASCE. Findings indicate the ASCE produces reliable candidate scores aligned with requisite anatomy knowledge and problem solving, appropriate to the level. Thus the ASCE shows promise for making accurate inferences about candidates' competence and performance. Ongoing gathering of validity evidence, including student performance, is necessary to further evaluate score interpretations and uses.

Keywords: Examination, Assessment, Validity

A-0745

An Open Loop Suture: A Reliable Alternative in Microvascular Anastomosis

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Purpose: A microvascular technique that ensures vessel patency and minimises the ischaemic time is very valuable for free tissue transfers. The simple interrupted suture (IS) technique is the gold standard for end-to-end microsurgical anastomosis. Lee introduced the open loop technique for the anastomosis of very small vessels to avoid catching the posterior wall of the vessel. To evaluate the success of the open loop suture (OLS) technique in very small vessels and compare it with the simple IS technique.

Methods: The study was performed in 30 Wistar rats, using the carotid arteries. The IS technique was performed on one side and the OLS on the other. The endpoints evaluated were the operating time, leakage through the anastomosis, and patency rates immediately and 1 and 72 h after the anastomosis. The Student's t-test was used.

Results: The mean anastomosis time was 29.97 s for IS and 26.27 s for OLS (p=0.039). The anastomosis leakage was measured using the need for additional stitches; the IS technique required 13 extra stitches and the OLS 10 (p=0.18). The patency rates were 100% with both techniques. Discussion: We have incorporated the open loop suture technique by using a continuous suture forming a spiral in which the loops are interrupted gradually once every stitch is tied. The operating time was significantly shorter, without decreasing the success rate. The technique should be useful in very small vessels by avoiding through stitches and reducing the ischemia time in complex free tissue transfers.

Conclusion: The open loop suture is a safe, reliable technique for obtaining a patent anastomosis with proper placement, spacing, and coaptation of the stitches more quickly.

Keywords: Microsurgical anastomosis, Open loop suture technique, Simple interrupted suture, Free tissue transfers

A-0786

Low-Cost Innovative Adjuncts to Gross Anatomy Teaching

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Purpose: With the decrease in hours dedicated to dissection in many anatomy practicals, there is an opportunity to introduce adjunctive learning approaches. Here, we report three low-cost interventions implemented in three programmes at Queen's University Belfast.

Methods: For the first intervention, a selection of airway devices (£55) was coupled with hemisected cadaveric specimens. The second-year medical student cohort (n = 262) could manipulate the devices to gain contextual and clinical information relating to airway anatomy. The second intervention was a curated collection of 59 pathology specimens that were exhibited alongside 36 accompanying information sheets and prosections in 7 first-year medicine anatomy practicals (n = 268). The third intervention was a template-guided drawing exercise focussing on the cranial nerves (available on request). Templates were printed in A3 size, coloured markers were provided (£40), and students in the second-year BSc Human Biology class drew in concert with the example projected from the lecturer's document camera.

Results: All students in each cohort participated in an intervention, surveys were distributed following each intervention. Institutional ethical approval was granted for all three studies

(MHLS 24_53, MHLS 24_31, MHLS 24_50). For the airway device, pathology, and drawing interventions the number of survey respondents was 38, 35, and 27 respectively. Respondents agreed the interventions aided understanding (94, 94, 100%) and were enjoyable (100, 97, 93%). Regarding the airway intervention, 97% agreed it helped them to appreciate the clinical context of the anatomy in their practical. In the pathology intervention, one participant noted it "highlighted unique and interesting conditions which wouldn't be seen in many cadaveric bodies". In the drawing intervention, even among students who considered themselves poor drawers (n=19), 95% enjoyed the activity and 100% felt it aided their understanding.

Conclusion: These novel, cost-effective teaching interventions were positively received by students, affirming their value as adjunctive approaches to supplement anatomy practicals.

Keywords: Medical Education, Airway Anatomy, Screencast, Pathology, Gross Anatomy

A-0788

Harmonizing Diversity: Introducing a Universal Classification System for Anatomical Variations

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Purpose: Inherent variations of gross anatomy exist within human body with potential to complicate procedures and lead to misdiagnoses, if not adequately understood. Current literature shows an inconsistency in the evidence of variations and how they are reported: different terminology and classification systems. Most of these studies focuses on specific variations they encounter, rather than actively observing for the others. Since anatomical variations tend to vary among populations, even the absence of certain variations is worthwhile documenting. Most of these challenges can be overcome by approaching with a universal classification system and a database. Though few studies have put forward classification systems they are highly specified for a single anatomical region. In this study, we propose a simple and feasible universal classification approach and the concept of a database that would target completeness without limiting the ability to conduct a thorough evaluation.

Methods: Literature search was done to look for recordings of variations in anatomy and a common classification appraoch was designed.

Results: Solid organ variations are classified as variations in; measurements (size, weight, length); shape; consistency (presence, absence, multiplication); variation in associated structures or ducts (origin, termination, branching, variation in supply and consistency); and variations in blood, lymphatics and nervous supply. For nerves, lymphatics or vessels, variations can be classified as variation in origin (level and way of origin); variation in termination (level and method of termination as bifurcation, trifurcation etc.); consistency; and site of supply. Additional category of 'other' includes extra variations (hypoplasia, fenestration etc.)

Conclusion: Adhering to a universal classification system and a data base when doing research could potentially tackle many of the challenges encountered in adressing gaps in knowledge on anatomical variations.

Keywords: Variation in anatomy, Universal Classification, Database

A-0828

How Much Do They Remember? Anatomical Knowledge Retention in Nursing Education- A Four Year Longitudinal Study

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Purpose: The mounting evidence shows that medicine, allied health, and nursing students struggle to transfer the crucial anatomical knowledge they gain in the first year to the subsequent years of their program of study (Narnaware and Neumeier, 2020). However, most knowledge retention studies have been evaluated in medical and allied health students and rarely assessed in nursing students. The present study, therefore, evaluated anatomical knowledge retention over four years of nursing and identified knowledge gaps to suggest targeted interventions to mitigate knowledge gaps.

Methods: Using the online game-based quizzing platform-Kahoot, approx. 70-80 nursing students were quizzed on nine to eleven multiple-choice questions on eleven anatomical organ systems. These scores were compared to first-year quiz

scores on the exact content of the organ systems to evaluate overall knowledge retention over the four years.

Results: The results show that nursing students lost 33.5%, 31.8% and 29.6% in the second, third and fourth years of nursing, respectively, and knowledge loss varied greatly by the system, with the highest retention for the gastrointestinal system with a 10.3% knowledge loss and the lowest retention for the head and neck lymphatic system with a 57.4% loss. Most systems maintained similar trends of retention over time. The special senses showed a significant loss of 20.6% in the second year, improved its retention by 17.3% loss in the third year, and then significantly decreased to a 37% loss in the fourth year. The muscular system, on the other hand, showed a 30.7% loss in the second, 40.3% in the third year and 26.6% in the fourth year. Other organ systems exhibited significant improvement in knowledge retention over four years.

Conclusion: This study suggests that identifying potential knowledge retention gaps in nursing cohorts will allow anatomy educators to develop robust interventional strategies to mitigate knowledge gaps in their program of study.

Funding: The principal author (Raj Narnaware) has applied for a research meeting outreach grant.

Keywords: Nursing education, Anatomy, Knowledge retention, Undergraduate nursing, Interventions

A-0832

Undergraduate Students' Engagement using Social Media as a Learning Resource in Anatomy Education: A Systematic Review and Meta-Analysis

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Purpose: Anatomy education is a cornerstone of health sciences curricula. However, educators face challenges such as declining contact hours and the emergence of integrated courses. The incorporation of new learning methodologies and digital tools, including social media, has been proposed as a strategy to address these challenges. Researchers have reported that using social media in anatomy education could positively impact student learning, making it a suitable approach for digital native students. This systematic review aimed to investigate student engagement with social media in learning anatomy and the potential impact of the COVID-19 pandemic on this engagement.

Methods: A systematic review and meta-analysis were conducted following PRISMA guidelines. The search strategy on PubMed included terms related to 'social media', 'anatomy', and 'engagement'. A meta-analysis of the proportion of students' engagement was performed using the maximum-likelihood model (metafor, R package).

Results: The initial PubMed search identified 565 studies, of which 11 were selected and included in the full analysis. Most studies (10/11) involved medical students and utilized various social media platforms: YouTube (6), Facebook (2), Instagram (2), and Twitter (1). The overall students' engagement with social media in learning anatomy was 0.87 (95% CI: 0.83 – 0.91). Before and after COVID-19, students' engagement was 0.85 (95% CI: 0.76 – 0.94) and 0.87 (95% CI: 0.84 – 0.93), respectively.

Conclusion: The studies indicated a high level of students' engagement with the use of social media as a resource in anatomy education. They also showed a variety of social media platforms, reflecting the emergence of new platforms and trends in digital resource usage. Despite the COVID-19 pandemic, high students' engagement with social media remained consistent across platforms, suggesting its continued usefulness in anatomy education.

Keywords: Anatomy education, Social media, Engagement, Digital learning, Meta-analysis

A-0836

Artificial Intelligence for Digital Pathology Image Analysis

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Purpose: Histopathological image analysis is the golden standard for most cancer diagnosis and it is a difficult and time-consuming task for pathologists. Computer aided diagnosis (CAD) based on deep learning algorithms has been well studied and but this kind of methods often have poor interpretability. In this talk, we will introduce our works on im-

proving CAD performance and its interpretability at the same time.

Methods: Most studies in this field focus on slide level classification of Whole Slide Image (WSI), which makes it difficult to interpret how a classification decision is made. On the contrary, we proposed patch-level classification method that can give a reliable positive/negative prediction for each patch, so key patches leading to the slide level prediction results can be found. To this end, we developed a weakly supervised learning method and a few shot learning method.

Results: Experiments on public datasets show that our method can achieve high patch-level AUC when it is trained with weakly labeled (slide-level labels). When the training slides is very limited, a fairly good classification performance can also be achieved.

Conclusion: Our method show patch-level capability when it is only trained with weak slide-level labels or even with very few data. It can help improve the interpretability of WSI CAD and can be potentially used in education of histopathological image analysis when the data or label is scare.

Keywords: Histopathological image analysis, Computer aided diagnosis, Deep learning, Artificial intelligence

A-0853

Leveraging Innovative Teaching Methods in Anatomy Medical Education to Attract Generation Z Educators

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Purpose: The scarcity of anatomy faculty in medical education is anticipated to worsen as senior faculty retire, coinciding with fewer students entering the field. Adaptations in curricular structure, including time reduction for content and a shift toward active learning, have necessitated increased integration of technology in anatomy teaching. These changes are partly motivated by Generation Z students' comfort with technology and their preference for educational methods that optimize efficiency. Can these modifications in teaching approaches be harnessed to appeal to prospective anatomy teaching assistants and faculty?

Methods: In our anatomy elective, medical students are tasked with developing and presenting teaching activities centered on their chosen anatomical areas. They have the freedom to utilize various presentation formats, from traditional dissections to technology-driven tools like HoloAnatomy®. The most recent cohort opted to showcase HoloAnatomy®activities, including presentations on ophthalmology and obstetrics and gynecology.

Results: Despite receiving minimal training on the software, students demonstrated remarkable proficiency in developing and facilitating activities. Their presentations, which incorporated features like removing tissue layers stepwise and utilizing magnification tools, were well-received by their audience.

Conclusion: Our findings suggest that capitalizing on student creativity in constructing educational activities holds significant promise. Furthermore, the preference for HoloAnatomy® among students highlights its potential as a recruitment tool for future Generation Z faculty members. In essence, as medical education adapts to meet the needs of technologically adept learners, embracing innovative technologies may serve as a means to attract and retain the anatomists of tomorrow.

Keywords: Innovations, Teaching, Faculty, Recruitment, Educators

A-0876

Health Colleges Students' Perceptions and Attitude of Effective Anatomy Teaching Methods in King Khalid University, Saudi Arabia

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Purpose: Different methods and strategies have been utilized in teaching anatomy in classroom and laboratory. Due to the increase in students' number, costs and lack of resources, the need to find the most effective teaching modalities is critical. The aim of this study was to determine the most perceived and effective anatomy teaching modalities.

Methods: During the academic year 2022/2023/2024, students at different levels at Medical, Dental and Nursing colleges at King Khalid University, Saudi Arabia were invited to participate in online-based questionnaire. The survey composed of 8 questions and each question contains nine different

teaching methods to be answered using five-point Likert-scale.

Results: 307 responses were collected, of which 71% were medical students, 27% were dental students and 6% were nursing students. Plastic models and 3D software were found to be the most effective methods in providing a good background for other basic sciences subjects. Online videos and 3D software were shown to be effective in providing a good background for clinical disciplines and encourage self-directed learning. Moreover, understanding clinical anatomy was better achieved through cadavers' dissection.

Conclusion: Students' perceptions can help academic staff to select the most effective anatomy teaching methods.

Keywords: Anatomy, Students' perceptions, Teaching methods, Medical education

A-0901

Anatomy Assistantship Program (AAP) at Universidad del Desarrollo

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Purpose: To describe the history and organization of the Anatomy Assistantship Program for undergraduate students at the Faculty of Medicine of the Universidad del Desarrollo, Chile.

Methods: Observational descriptive.

Results: The assistantship program of the Department of Anatomy of the Faculty of Medicine of the Universidad del Desarrollo was born in 2003 with the mission of supporting ad honorem the teaching of the Anatomy chair of the Medicine careers and medical collaboration and is formed by part of a group of faculty students guided by a teaching team. To become assistants, applicants must have successfully passed the Anatomy subject of their original careers, then complete an annual training course in which they deepen their anatomical knowledge and develop relevant teaching skills for this work. The assistantship program is mainly based on the active learning strategy: Near Peer-Teaching (NPT), developed by students from their second year of university. The assistants can additionally participate in the preparation of material (cadaveric dissections) and support in research within the department. In addition, organize monthly assistant seminars, an open instance, in which different topics of interest are addressed through presentations and/or visit of expert guests.

Conclusion: The AAP is a fundamental pillar in the teaching-learning process of new students and is mainly based on the near peer-teaching (NPT) strategy. Each year, the team of assistants contributes to the anatomical teaching of more than 800 new students, while their participation in this activity allows them to develop teaching and leadership skills for the benefit of their future professional work.

Keywords: Anatomy, Near Peer-teaching, Medical Education

A-0916

Flexing Your Knowledge: Surface Electromyography in Surgical Training

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Purpose: Current demands to streamline medical education and training are being driven by the pressures of economic and health demands. Such demands pose new challenges for surgical trainees, particularly in the procedural skills component of training. Historically, the feedback to trainees regarding procedural skills is subjective and often provided by different experts, which makes it difficult for the trainee to see a clear progression in their skills. In order to standardise surgical training, resulting in competent surgeons has led to the call for objective measures of skill competency. We propose the use of surface electromyography (sEMG), which may assist with instructing trainees on proper muscle activation and manoeuvres.

Methods: In this study, surface electrodes will be placed on the upper limbs of participants from two different cohorts as they place secondary trocars into synthetic abdomens (mimic) and cadaveric abdomens. The two different cohorts will consist of experts (surgeons routinely performing laparoscopic surgery) and novices (medical students who have never performed trocar insertion). Kinematic (e.g., acceleration, applied force) and sEMG (e.g., muscle activation, number and type of muscles) parameters will be compared. The novice cohort will be asked to place a baseline trocar into a mimic, and then will be provided with verbal, video, and demonstrated instruction. Following instruction (intervention), students will be asked to place trocars

into a mimic and cadaveric abdomen. Novices will be provided with feedback based on the data collected from experts, and performance following the intervention will be assessed.

Results: Data collection in progress.

Conclusion: This study will show the potential application of sEMG as an objective measure of performance during training, resulting in more efficient surgical training. Such improvements may enhance the quality of surgical education, which can create safer, more competent surgeons, which will ultimately result in improved patient care and safety.

Funding: WELLCOME Leap SAVE.

Keywords: Electromyography, Surgical education, Laparoscopy, Muscles, Medical

A-0917

Implementing a Virtual Reality Based Metaverse for Enhanced Anatomy Education: A 8 Year Development Insight

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Purpose: To address the limitations of traditional anatomy classes, we developed an anatomical metaverse. This program is designed to enhance teaching and learning efficiency by incorporating advanced and diverse content.

Methods: Over the past 8 years, we have created and refined anatomical models using 3D modeling techniques. The latest version (2024) of these models has been specifically designed for ease of use and to emphasize their utility as educational tools in actual anatomy lectures and laboratories.

Results: While maintaining the existing systematic hierarchies, the program introduces a refined hierarchical system divided into sections such as the back, head and neck, thorax, abdomen, pelvis, and upper and lower extremities. This structure aligns closely with the chapters of traditional anatomy textbooks and lab manuals. The program enables users to explore 3D anatomy and view real dissection images and dissection guides simultaneously, enhancing its utility in anatomy lectures and labs. The actual application of anatomy classes at Seoul National University College of Medicine in 2023 showed that, compared to the exclusive use of cadavers, observation-based learning utilizing VR showed statistical significance (students N = 30, P<.05). Additionally, the program includes maternal-fetal anatomical models and detailed topographical anatomy of the head and neck. We also developed a mobile application featuring screen sharing and multiplayer functionalities to further enhance accessibility and collaborative learning.

Conclusion: The virtual reality anatomy program significantly enhances traditional anatomical education by providing an interactive, detailed exploration of human anatomy in a structured and user-friendly environment. By facilitating the simultaneous exploration of 3D anatomy alongside real dissection images and guides, the program effectively addresses the constraints of real anatomy classes and enhances the practical experience of anatomy laboratories. We anticipate that such digital innovations will provide unique opportunities to experience anatomy labs in a virtual space, thereby making advanced anatomical education more accessible and collaborative.

Keywords: Anatomy, Education, Virtual reality, Metaverse

A-0919

The Declining Popularity of Wikipedia and Its Implications for Healthcare Professionals and Anatomists

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Purpose: The evolution of medical education reflects a shift toward favoring digital resources over traditional lectures and promoting self-directed learning. Despite debates on its accuracy, Wikipedia's extensive use by medical professionals and students underscores its significant role in healthcare information dissemination. However, with the emergence of other online platforms, Wikipedia's usage over the last 10 years should be documented. This study aims to analyze the page views of systematically selected Wikipedia articles over the last decade.

Methods: A total of 1,192 medicine-related articles (top importance and high importance articles) and 408 anatomy-related articles from the English Wikipedia were systematically selected. Monthly page views of these articles from 2015 to present were analyzed to examine the interaction between public health interests and digital information consumption. The Augmented Dickey-Fuller test was used to test stationarity in time series.

Results: Between 2015 and 2019, the collective page views of top importance articles and high importance medicine-related articles averaged over 8,000,000 and 30,000,000 views, respectively. Both categories reached their record highs during the COVID-19 pandemic in early 2020, reaching over 11,000,000 views and 50,000,000 views for top importance and high importance articles, respectively. In 2021, however, the page views for top importance articles dropped below 5,000,000 views, and high importance articles had only 20,000,000 views. Similarly, anatomy-related articles showed a drastic decline in page views over time, from 12,000,000 views in 2016 and 2017 to 7,000,000 views in 2023 and 2024. The Augmented Dickey-Fuller test indicated that the time series was non-stationary for both medicine-related and anatomy-related articles (p=0.883 and p=0.807, respectively), suggesting a continuous decline in page views.

Conclusion: Our data indicate that there is a continuous decline in Wikipedia page views over the last decade for both medicine-related and anatomy-related articles, suggesting that users might be turning to other sources of information.

Keywords: Wikipedia, Online resources, Medical students

A-0970

Evaluating the Effectiveness of Drawing as a Pedagogical Tool in Teaching Histology and Human Anatomy to Dental and Allied Health Sciences: A Three-Year Observational Study

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Purpose: Anatomical sciences are visual sciences that deal with the structure at gross and microscopic levels. Throughout history, drawing has served as a prominent tool for learning and teaching anatomical sciences, tracing back to notable figures such as Claudius Galen, Andreas Vesalius, Leonardo Da Vinci, and Henry Vandyke Carter's illustrations in Gray's Anatomy among others.

Methods: In this observational pilot study spanning over three years, we investigated the efficacy of utilizing drawing as a pedagogical tool for learning histology and human anatomy. This study involved 201 participants comprising dental, and allied health sciences. Pre- and post-activity surveys were administered to asses students' perceptions and attitudes towards incorporating drawing as an adjunctive method for teaching and learning structural sciences, particularly histology and anatomy.

Results: Analysis of the survey data revealed a significant level of appreciation and interest in the drawing approach, with 80% of participants expressing a positive inclination towards its future integration into educational practices.

Conclusion: The significance of drawing as a pedagogical approach for anatomical sciences, drawing upon insights from previous research and observations gleaned from our surveys. In conclusion, on this basis we recommend further development and implementation of drawing-based teaching methodologies in future educational contexts.

Keywords: Teaching, Anatomy, Histology, Drawing

[F. Ethics in Anatomy]

A-0187

The Anatomist: The 1936 Performance of James Bridie's Play in the University of the Witwatersrand's Dissection Hall

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Purpose: A unique event in the history of anatomy took place in May 1936 when performance of James Bridie's play The Anatomist, was staged in the University of the Witwatersrand's dissection hall. The Anatomist was based on the 1828 incident when William Burk and Wiliam Hare murdered sixteen people to sell their bodies for dissection to the famous Edinburgh Anatomist Robert Knox. The aim of this study is to present this theatrical/anatomical production and its educational and ethical implications.

Methods: The archival materials from the University of the Witwatersrand Central Records and Archives were analysed.

Results: The production was prepared for charitable purposes and was carried out by the Department of Anatomy staff and students. The spiritus movens of the production was Raymond Arthur Dart (1893-1988), the Head of recently established Department of Anatomy. The production was

highly successful, well received by the public and academics. The uniqueness and appropriateness of a dissection hall as the venue was emphasised by all reviewers as was the engaging performance of the students and staff, particularly Raymond Dart. The correspondence with Dart shows that students understood the value of the play and its implications for their educational and professional careers. This is not surprising as the play raises several ethical issues related to tissue sourcing and education/research carried out on it.

Conclusion: Robert Knox, 'the anatomist' in the centre of the Burke and Hare affaire, was not portraited negatively, as he was seen at the time when the crimes were committed, but as a victim of unfortunate circumstances in the noble pursuit of science. However, the ethics of using unclaimed bodies for dissection, a common practice in the 1930s, was not seen as an ethical challenge, an issue which will be raised only by the next generation of South African anatomists.

Keywords: History of anatomy, Medical humanities, Raymond Dart, University of the Witwatersrand

A-0292

Is Beauchamp and Childress's 'Four Pillars' of Biomedical Ethics Universally Appropriate as an Ethical Model for Body Donation Practices?

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Purpose: The 'Four pillars' of biomedical ethics, a normative ethical framework proposed by Beauchamp and Childress, consist of autonomy, beneficence, non-maleficence, and justice as guides for decision-making around biomedical research on the living. It is often used as a moral-principled guide for the ethical practice of body donation, however, there has been little scrutiny on whether it is appropriate for a global anatomy community.

Methods: Using a socioethical perspective, study of Beauchamp and Childress's framework was undertaken by a systematic analysis of factors commonly used to assess normative ethical frameworks in practice. This included a focus on universalizability, implementation, and applicability, specifically focusing on body donation.

Results: Upholding autonomy is challenging both from a cultural perspective where some societies prioritise the wishes of families over those of the individual, and a logistical perspective where acquiring informed consent is implausible with persons who are dead. Further, dead persons are nonautonomous and cannot have autonomy violated. While beneficence is often a genuine consequence of body donation, commercial activities including military applications involving donors raise questions around who benefits, and what 'benefit' means. For non-maleficence, while harm to the 'memory' of the dead is possible, many philosophical and legal frameworks suggest harming the dead is not possible, and the concept is therefore difficult to apply. Determining what constitutes 'justice' for body donors is challenging as minimal specific legal frameworks govern contemporary use of body donors, including commercial or digital activity, where ethical norms may be compromised.

Conclusion: Use of the 'Four pillars' as an ethical framework for body donation is inherently problematic. Each principle appears inadequate or paradoxical in practice, when considering the cultural, legal, and societal differences between regions. Other normative ethical frameworks should be considered to guide practice, given the shared operations of body donation programs as well as our shared humanity across the globe.

Keywords: Body donation, Ethics, Normative ethics, Law, Anatomy education

A-0527

Publish or Perish! A Bibliometric Analysis 271 Turkish Faculty in the Field of Anatomy

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Purpose: In the anatomy academic community, metrics indicating research output are frequently considered for faculty promotions. The h index, an author's h paper with at least h citations, is commonly used to measure academic success. However, the index discredits junior researchers, crediting publication quantity and discounts highly cited works. Considering the importance of bibliometrics in the academic community, additional indexes and time-independent indexes are needed to measure work efficiency. This study will measure the h in-

dex independently of time (m quotient). In addition to the h index, the g index will be compared among Turkish anatomists as professors, associate professors, and assistant professors.

Methods: Information about universities with medical faculties was taken from "yök atlas" an official Turkish website. Professors, associate professors, and assistant professors in anatomy in these state universities were noted. Each academician's h index, g index, and m quotient were determined using Google Scholar through the Publish or Perish program.

Results: Index information of 128 professors, 69 associate professors, and 74 assistant professors in anatomy was determined. Average h indexes were determined as 13,56, 7,21, and 3,93 for professors, associate professors, and assistant professors, respectively. When we examined the time-independent h-index, that is, m-quantities, the averages for professors, associate professors, and assistant professors were determined to be 0,58, 0.59, and 0.36, respectively. When we examined the g indexes, the averages for the professor, associate professor, and assistant professor were determined as 23,88, 12,28, and 6,54, respectively.

Conclusion: Similar figures are obtained when the H index is corrected independently of time. Academicians who have longer careers have much more chances of getting cited. Therefore, correction of the time factor should be necessary in academic rank.

Keywords: H index, G index

A-0772

The Effects of a Two-Hour Lecture on Ethics in Anatomy on Perceptions of Medical Students towards Human Cadavers

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Purpose: Dissection practice is regarded as an effective tool for medical students to develop nontraditional discipline-independent skills. Structured approaches where body donors are presented as first patients or silent teachers/mentors based on previous studies that investigated student perceptions. To our knowledge, no study has investigated the perceptions of Turkish medical students towards body donors and possible effects of lectures in ethics in anatomy on their perceptions.

Methods: A study with before-after design without a control group was planned to evaluate student perception before and after a two-hour module, and after cadaver exposure. Following ethical committee approval (date: 05.09.2017; number: 939), surveys one week prior and one week past the module, and a final survey after cadaver exposure at the end of spring term were utilized. The surveys included 11 scale Likert items. Temporal changes were evaluated with ANOVA, while pairwise comparisons were done with t-test.

Results: Out of 310 first year students, the number of students who responded to the first, second, and third surveys were 196 (63,2%), 119 (38,4%), and 82 (26,5%), respectively. A statistically significant decrease was observed for the statement on cadaver being just a dead body for the first and third surveys (p=0,008). Other statements on cadaver being a first patient, biological material, teacher, educational tool, gift, or entrusted to them did not change following ethics module or cadaver exposure.

Conclusion: Turkish medical students did not have a dominant preference regarding their perception of the cadaver. Development and implementation of an educational policy for cadavers' role for Turkish medical students is needed. A qualitative evaluation might help us to gain a deeper understanding of student perceptions and provide an opportunity for students to respect the body donor and gain a better appreciation of human dignity.

Keywords: Anatomy education, Body donation, Cadaver, First patient, Teacher

[G. Anatomical Terminology]

A-0358

The Life and Contributions of the Famous Anatomist Friedrich Gustav Jacob Henle (1809-1885) to Anatomy

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Purpose: German anatomist and histologist Friedrich Gus-

tav Jacob Henle made significant contributions to the field of medical science in the 19th century.

Methods: Having the opportunity to work with notable figures such as Johannes Peter Müller at an early age, Henle's career was shaped by the influence of these figures. Henle began studying medicine at the University of Bonn in 1827. After completing his education, he conducted research in anatomy, histology, and pathology.

Results: As a distinguished anatomist, Henle had several anatomical structures named after him, with the loop of Henle being the most well-known a renal duct he discovered in the mid-19th century.

Conclusion: This study emphasizes Henle's life and his lasting impact on anatomy.

Keywords: Friedrich henle, Henle's ligament, Anatomy

A-0380

Johannes Peter Muller (1801-1858): An Esteemed Figure in Shaping Scientific Inquiry and Advancing Medical Knowledge

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Purpose: The purpose of this text is to generally introduce the life of Johannes Peter Müller and his contributions to the world of science. It also emphasizes Müller's scientific contributions by focusing on his important work in the fields of the nervous system, visual sciences and embryology.

Methods: This text is written in a narrative format, describing Müller's biographical information, important theories and scientific experiments. As a method, the important periods in Müller's life are emphasized and the content is created by explaining his scientific studies and theories.

Results: This text, which describes Müller's life and scientific work, reveals that he was an important figure and how his contributions to the fields of the nervous system, visual sciences and embryology affected the world of science.

Conclusion: Johannes Peter Müller's influence on the scientific world is still felt not only during his time, but also today. Müller's nervous system and anatomical studies broke new ground in the scientific world and made significant contributions to medical education. His multidisciplinary approach has left a legacy in science and education, inspiring students and providing strong foundations for the world of science.

Keywords: Johannes Peter Muller, Mullerian duct, Muller's frog experiment, Anatomist, Physiologist

A-0476

Student's Perceptions of Anatomical Terminology

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Purpose: Terminology is an important communication tool both within and outside certain scientific fields, so it deserves attention. When used correctly, terminology is a basic and indispensable system of terms that can help understand the intricacies of a scientific discipline, including medicine. Anatomy is a fundamental discipline in medical education, providing a fundamental understanding of the structure of the human body. Most students consider that anatomy is a difficult subject because they have to memorize body structure and organ positions using terms they were barely familiar with before. Anatomical terminology derived from Greek and Latin. The ability to understand and remember anatomical terminology is believed to be very helpful in learning anatomy and medical science. This study aims to present students's perception and describe how medical students remember and understand anatomical terms.

Methods: This study is an observational study involving respondents, namely 225 students at the end of first- semester, Faculty of Medicine, Universitas Sebelas Maret Surakarta, Indonesia. The subjects were asked to fill out a questionnaire distributed in g-form. The questionnaire contains 10 questions consisting of 8 closed and 2 opened questions. The collected data is tabulated and presented in the form of a description.

Results: Two hundred students were responded, and it was found that 100% of respondents admitted that anatomical terminology was very necessary and really helped them in studying medicine. The majority (92%) of respondents only became acquainted with anatomical terms when studying at medical faculty, because they used the national language Indonesian

when studying anatomy before. Most respondents thought that anatomical terms were difficult (90%) but they felt happy to learn it (75%). The respondents learned by rote learning (55%), 40% learned using a certain method of collecting bridges, and 5% used mixed methods.

Conclusion: Having a good understanding and memory of anatomical terminology is very helpful for students in studying medicine.

Keywords: Anatomical terminology, Medical students, Perception, Indonesia

A-0489

Bridging the Gap: Precise English Translations of the Terminologia Anatomica 2 - Helping a World That Doesn't Read Latin

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Purpose: Our project and poster focusses on the lack of proper English translations to accompany the Latin phrases of the TA2. The TA2 itself offers what it terms "English equivalent names", which can easily be mistaken for translations; but these are actually the original English names for the same body parts. The fact that these are so easily mistaken for translations often leaves those who use the TA2 unsure as to exactly how the Latin terms connect to the more vernacular versions. More broadly, this can mislead all those who use the TA2 – students, health professionals, and researchers – since the disconnect between the Latin phrases and their vernacular versions causes them to see the phrases as mere barcodes to be memorized, rather than as complex names having their own consistently used meaningful parts and logic.

Methods: We are currently building precise English translations (what we are tentatively calling our "McMaster translations") for the more than 7,000 terms of the TA2.

Results: We are proposing to the anatomical/medical community that they include our very literal English translations for each Latin phrase of the TA2 (whenever they use the English version of the TA2), consistent with the original grammar.

Conclusion: Although the TA2 is meant to be universal, its current lack of universal acceptance is partly due to the hurdles created by eschewing literal translations.

Keywords: Terminology, TA, Translations, Latin

A-0649

'Wordotomy' ? Removing Barriers to Healthcare Education through Gamified Etymology

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Purpose: Throughout their anatomy training, students are inundated with new terms forming their professional language. Recognising this obstacle, we created a learning resource for our students, combining gameplay and visual cues to highlight how etymology facilitates learning new technical terms. After successful integration into the curriculum, this resource has been shared more widely and is now utilised by healthcare educators around the world (www.wordotomy.com).

Methods: Wordotomy are specially designed cards resembling standard playing cards. Each card has the word 'root' printed on one side, e.g. 'pathy'. On the reverse the root is repeated with its meaning, alongside a visual representation of the definition and an example of the root used in a biomedical context, e.g. 'neuropathy'. Different gameplay approaches tailor the student experience. Global, semi-quantitative feedback was obtained from surveys completed by students after using the game in timetabled teaching sessions. Detailed qualitative feedback was gained from focus groups of medical undergraduates.

Results: Before playing Wordotomy, 27% of first year medical students had never previously considered that understanding word roots helps understand definitions. A further 24% were aware that terms could be broken down into roots but did not realise these had meaning. Over 50% of students were unaware of how to use etymology to decipher technical language.

Conclusion: Wordotomy is integrated into a range of different anatomy programmes and we are working with other educators to create 'expansion packs' that explore specific topics or learning stages. A strength of Wordotomy is emphasising – visually and textually – the meaning of morphemes rather than their linguistic derivation or using homonyms. This reduces reliance on memorisation, aids retention of knowledge and equips learners with the skills and confidence to understand and apply new vocabulary. Here we present our findings on

how a gamified approach to etymology can reduce barriers to further learning.

Keywords: Etymology, Terminology, Gamification, Wordotomy

A-0928

Overview of the Uterine Natural Killer Cell's Discovery - One of the Human Cells with the Highest Number of Synonymous Names

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Purpose: Morphologically, uterine NK cells correspond to large granular lymphocytes and belong to innate immunity. They represent 70% of maternal leukocytes during pregnancy.

Methods: Review including the study of archival sources as well as a comprehensive review of current world textbooks of histology and uterine pathology.

Results: The discovery of uterine NK cells is generally attributed to Herwig Hamperl, one of the most prominent representatives of German pathology. Hamperl (1950), in his first comprehensive work, refers to the newly discovered cells in the endometrium as fluorescent granular cells o "fluorocytes". In his subsequent manuscript in 1954, Hamperl named these cells "endometrial granulocytes". Later, Hamperl and his co-worker Gisela Hellweg (1958) described these cells as "granular endometrial stromal cells" (Körnchenzellen or K cells). In the 1980s and early 1990s, after the routine introduction of immunohistochemistry into practice, these cells began to be referred to as "large granular lymphocytes". Around 1990, they were finally identified as a type of natural killer cell. In that time, the first scientific publications that named this cell population as the currently known "uterine/decidual NK cells" were published. There are probably few cells in the human body with as many different names as uterine NK cells. Eponymously, they are called Hamperl cells after their discoverer. Hamperl himself named them "K cells". Surprisingly, this name also appears in contemporary textbooks focused on uterine pathology. Another historical term, but at the same time an utterly misleading term, is "endometrial stromal granulocyte", which nevertheless appears in some contemporary histology textbooks. Terminologia Histologica refers to these cells as endometrial granular cells or endometrial natural killer cells (unlike the commonly known term uterine NK cells).

Conclusion: We are surprised that even after more than 70 years since their detailed description, there is no mention of uterine NK cells in most of the latest textbooks on histology.

Funding: This research was funded by a grant from The Slovak Ministry of Education (No. VEGA 1/0625/23), entitled "Immunologically active endometrial cells in the context of embryo implantation and their targeting in the treatment of infertility".

Keywords: Uterine NK cells, Endometrial granular cells, Terminologia Histologica, Histology Education, History of Histology

[H. Inno-Anatomy]

A-0027

Macroscopic Staining of Brain Sections: An Effective Innovative Tool to Interpret Cross Sectional Neuroanatomy - Students Perspective

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Purpose: Neuroanatomy is considered one of the most challenging parts of anatomy curriculum and the complexity in understanding neuroanatomy generates from the lack of a 3-dimensional view of the structures. Since everything appears grey and white and is difficult to differentiate the various structures in a cross section of brain, staining aids in the visual interpretation and retention. There are various staining methods employed such as Mulligan's method, Alston's method, Prussian blue reaction method, however the results obtained by Alston's method was the best as gathered from previous literature.

Methods: The study was conducted in the department of Anatomy, formalin fixed brain slices measuring 10 mm thickness were stained using Alston's method. 250 medical students of the first professional year were demonstrated features such as the internal capsule, caudate nucleus, lentiform and thalamus in the stained and unstained horizontal sections of cerebrum during their neuroanatomy practical sessions. Following

which a feedback was collected regarding both the specimens using Microsoft Forms.

Results: There was a positive feedback from the students with 85% of them preferring the stained over the unstained section. Excerpts from the open ended question where all in favour of the stained sections -"much easier to see and identify the parts in the stained section because of the clear distinction between white and grey matter".

Conclusion: Macroscopic staining of sections of the brain using Alston's method could be implemented as an innovative method for effective teaching of neuroanatomy since students appreciated the structures better in the stained sections which enhanced their retention of neuroanatomy. Since Alston stain produces the least shrinkage, these stained sections could be utilized for research studies and such specimens could also be platinated.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not for-profit sectors.

Keywords: Alston stain, Grey and white matter, Neuroanatomy, Cross section, Cerebrum

A-0176

Polyethylene Glycol Reduces Hangover Symptoms with Protection of Liver and Intestine against Alcohol Consumption

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Purpose: Present study revealed the effectiveness of polyethylene glycol (PEG) for hangover symptoms with mouse model of binge drinking.

Methods: 8-week-old male C57BL6J wild type (WT) mice with vehicle, binge drinking (4 g/kg body weight), or binge drinking plus PEG (2 g/kg body weight) were analyzed by behavioral test and blood concentration test using gas chromatography. H&E, immunohistochemistry, and immunofluorescence staining were conducted with the slides of liver and intestine. Quantitative real-time polymerase chain reaction (qRT-PCR) and flow cytometry were utilized with tissue and mononuclear cells of liver and tissue of intestine.

Results: Serum aspartate aminotransferase (AST) and alanine aminotransferase (ALT) levels and mRNA levels of Cyp2e1 and Tnf were upregulated in binge drinking group of mice, compared to controls. Elevated neutrophil infiltration and increased damage of hepatocytes were observed by flow cytometry and histologic finding in binge drinking group. Also, collapsed intestinal barrier and activated cytochrome P450 2E1 (CYP2E1) and alcohol dehydrogenase (ADH) were shown in slides of intestine in acute alcohol consumption group, compared to the vehicle. Concentrations of ethanol and acetaldehyde in blood were increased and behavioral test showed impaired motor function of mice in the binge group. Interestingly, PEG administration after alcohol consumption significantly downregulated serum AST and ALT levels and decreased mRNA level of Tnf of liver tissue. Liver injury was recovered and neutrophil infiltration was decreased with liver of additional PEG-treated mice. Moreover, gut injury was reduced and expression of ADH and CYP2E1 in the gut barrier were downregulated in histologic findings of intestine of PEG group. Increased blood concentration of ethanol and acetaldehyde and motor impairment due to acute ethanol consumption drastically recovered with PEG administration.

Conclusion: PEG administration after acute binge drinking would be a novel therapeutic option for protection of liver and gut, and reducing hangover symptoms.

Keywords: Polyethylene glycol, Alcoholic liver disease, Intestine, Hangover

A-0179

Enhancing Diversity, Equality, and Inclusivity in the 6th Edition of an International Anatomy and Physiology Textbook: Challenging Our Own Assumptions, a Paradigm Shift in Medical Education

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Purpose: As teachers it is often difficult to know how to

move away from the notion of a 'textbook' example. As authors there is an opportunity to champion change, to assist teachers and students in taking forward evolving understanding into practice.

Methods: In creating the 6th edition of an established international anatomy and physiology textbook, this talk charts the decisions undertaken to enable a transformative evolution to align with the evolving needs of modern medical education and patient care. The changes were conceived with a resolute focus on fostering inclusivity, embracing diversity, and ensuring gender equality in medical illustration and content. The driving force behind this initiative stemmed from a critical assessment of inherent biases in medical illustration and a lack of comprehensive information regarding diverse anatomies. A multifaceted approach was adopted, aimed at addressing these disparities comprehensively. Championing inclusivity by ensuring representation of diverse skin tones across illustrations and prioritized gender equality by incorporating relevant physiological data for both sexes.

Results: The new edition brought forth progressive content additions, including transgender anatomy, women's health, and pivotal physiological aspects such as menopause, pregnancy, and labor. It was crucial to rectify outdated anatomical terminology, removing eponyms where possible, and thereby reflecting contemporary medical knowledge.

Conclusion: Our aspiration is for this edition to resonate with students, serving as a cornerstone in their education, and, ultimately, as a catalyst for more equitable and patient-centered medical practices in the forthcoming decades.

Funding: Funding to attend IFAA was co funded by Brighton and Sussex Medical School and Elsevier.

Keywords: Textbook, Inclusivity, Anatomy and Physiology, Transgender Anatomy

A-0239

3-Dimensional Analysis of Physiological Sclerotic Dentin via MicroCT

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Purpose: Physiological dentin sclerosis is a natural physiological process of the tooth. In sclerotic dentin, mineral deposits accumulate within the dentinal tubules starting from the external end of the tubules near the cementum and progresses towards the pulp chamber, beginning at the apical root expanding coronally. Physiological dentin sclerosis has a unique characteristic in which it occurs at the mesiodistal ends of the tooth as opposed to the buccolingual ends, displaying a distinctive butterfly-shaped pattern when the tooth is cut horizontally through the midline. In terms of practical significance, physiological dentin sclerosis has been documented to hold importance and influence endodontic treatments and forensic odontology research. Despite the advancements of current imaging techniques, physiological sclerotic dentin has yet to be visualized independently without the surrounding normal dentin. As of today, the measurement of physiological sclerotic dentin has only been limited to 2-dimensional measurements, focusing on its length and area. There is no known practical method for measuring volumetric physiological sclerotic dentin. In this study, we propose a novel innovative method to quantify the volume of physiological sclerotic dentin utilising micro-computed tomography (microCT)-generated gray-scale value.

Methods: 30 single-rooted non-gender specific premolars of known chronological age from the Malay population were scanned using a microCT scanner (XSlicer SMX-6000, Shimadzu, Japan). The X-ray source was operated at a voltage of 160 kV and a current of 100 μA. 3-dimensional volume datasets for every tooth were reconstructed and densitometry analysis were performed on the root dentin region.

Results: Results show that the microCT-generated grey-

scale profile of the sclerotic dentin region is capable of visualising the distinctive mesiodistal butterfly-shaped pattern seen in physiological sclerotic dentin sections.

Conclusion: This method though in its infancy opens the avenue for future accurate 3-dimensional analysis of sclerotic dentin for both clinical and dental forensic purposes in both whole and fragmented teeth.

Keywords: Sclerotic Dentin, MicroCT, Dental Anatomy, Forensic Odontology, Endodontics

A-0276

Meniscal Motion: The Relation between Meniscal Dynamics and Tibiofemoral Kinematics

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Purpose: The mechanical stress on the knee joint accumulates with the repetitive impact of over 1 million steps taken every year. Recognizing the pivotal role of the menisci in distributing pressure over the tibial plateau, researchers have been intrigued by meniscal dynamics for over 30 years. However, progress in understanding meniscal dynamics has been impeded by limitations in imaging resolution and discrete positional assessment. Hence, the primary objective of this study is to develop a computational knee model to continuously assess meniscal dynamics. This model will hypothesize the conformity of meniscal dynamics to the underlying tibiofemoral kinematics.

Methods: A high-resolution MRI dataset of healthy subjects (n = 11, mean age 25.4 years ± 2.58) was employed, capturing knees in 4 configurations of flexion. In each configuration, the menisci were modeled as elastic, volume preserving structures extending from the anterior to the posterior horn and adapting to the underlying tibiofemoral anatomy. Continuous meniscal modeling between 0° and 90° of knee flexion was achieved through the application of Principal Polynomial Shape Analysis (PPSA). Subsequently, meniscal displacement was measured point-dependently in the presence of anatomical correspondence.

Results: Initial knee flexion revealed a 4.47 mm displacement at the anterior horn of the medial meniscus, reaching a maximum of 6.24 mm at 60° of flexion. At 90° of flexion, the largest displacement occurred at the posterior horn of the lateral meniscus, measuring 6.51 mm.

Conclusion: The results affirmed a strong correlation between meniscal dynamics and tibiofemoral kinematics. Moreover, the introduction of point-dependent distance calculations based on anatomical correspondence enabled automatic and standardized distance calculations, surpassing manual measurements. Advancing beyond static meniscal modeling, utilizing Principal Polynomial Shape Analysis (PPSA), an innovative computational model was developed and validated. The dynamic knee model demonstrated potential as an educational instrument for advancing comprehension of meniscal movement.

Funding: This work was supported by an Aspirant Grant from the Research Foundation – Flanders (#1122821N, FWO) (AVO).

Keywords: Computational Modeling, Meniscal Dynamics, PPSA

A-0307

The Development and Application of Web-Based 3D-Scanned Anatomical Specimens for the Instruction of Pelvic Gross Anatomy as a Preparation for Dissection for 3rd Year Medical Students

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Purpose: For the instruction of pelvic anatomy for 3rd year medical students at faculty of medicine, we observed that the instructors and learners encountered obstacles including the variability of 1) cadaveric organs, 2) the experience of instructors, 3) the preparedness of the students and 4) tight learning schedule. In this study, we explored the efficacy in addressing these obstacles through the use of web-based 3D model for the student to review prior to dissection.

Methods: The generation of pelvic web-based 3D model involved the use of illumination 3D scanning device, 3D photo-

grammetry and photogrammetric software. Then models were refined using 3D sculpting software and uploading onto the Sketchfab 3D visualization. Clinical guidelines and quizzes are also added in 3 languages Thai, English and Chinese. For the efficacy assessment, a total of 150 medical students were included. After the lecture session, the students were then introduced to the annotated web-based 3D models before doing the cadaveric dissection. The learning outcomes were measured using worksheets and spot tests. The scores were compared to the last academic year and the comments given by the students were analyses.

Results: The spot test average scores of the student using the web-based 3D-model were higher than the previous year by 14.8% (from 7.98 to 9.46 out of 10). The worksheet scores also increased from 7.25 to 8.56 out of 10 (13.10%). Comments from students were, 72% positive feedback while 26% left no comments and the negative feedback was 2%. The student satisfaction score also increased from 4.25 to 4.49 out of 5.

Conclusion: Using web-based 3D model of pelvic real specimens was helpful. The top three advantages were 1) showing the complete major organs which many are missing from the cadavers, 2) to be able to study anywhere at any time 3) gain some experience before dissecting cadavers.

Funding: Srinakharinwirot University.

Keywords: Web-based 3D model, Gross anatomy real specimen, Pelvis anatomy, 3D cadaveric dissection, Pelvis 3D

A-0359

Optimising Group Work Strategies in Virtual Anatomy Education

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Purpose: The purpose of this research was to capture students' overall perceptions of the virtual anatomy platform Anatomage, and address the challenges and benefits associated with its use. This facet of the research focuses on small group learning and aims to contribute practical guidance to enhancing small group work skills during virtual anatomy use which is crucial for healthcare professionals. Currently, there is little guidance supported by pedagogic principles on how to successfully incorporate this into virtual anatomy curricula.

Methods: Anatomy educators at the University of Plymouth conducted action research, utilising a mixed-methods approach. Initial focus groups were held to identify students' perceptions, benefits, and challenges while interacting with the Anatomage platform. Thematic analysis produced a plethora of themes, one of which was group work. Evidence-based interventions were then implemented based on the identified challenges, including decreasing group size and instructing students to rotate roles within their groups. Subsequently, a questionnaire and second series of focus groups were employed to evaluate the effectiveness of these interventions.

Results: Analysis of initial focus group data revealed that group size and dynamics significantly impacted students' experiences with the Anatomage platform. The implemented interventions successfully addressed these issues, as evidenced by the positive outcomes observed in the follow-up questionnaire and focus groups. Additional subthemes emerged from the post-intervention data collection, providing insights into how facilitation, social pressure, peer learning, and working with friends affected group work. Further interventions will be created and assessed to address these subthemes.

Conclusion: This research contributes to the optimisation of small-group learning when integrating virtual anatomy into curricula. The authors provide practical advice informed by pedagogical principles, as well as insights from management and psychology, offering a multidisciplinary perspective for educators seeking to enhance anatomy education through virtual platforms.

Keywords: Virtual anatomy, Digital anatomy, Anatomy innovation, Groupwork, Anatomy education

A-0371

Vegetable as Learning Tool to Study Anatomy: Tomato vs Kidneys

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Purpose: Since time immemorial, cadavers has been used for the teaching of human anatomy in medical schools. However, due to proliferations of medical schools and some acts, getting access to human tissues is becoming difficult, which resulted to development of platinates and digital methods for anatomy teachings.This study aims to highlights new teach-

ing tool for studying anatomy; by comparing the anatomy of tomato to that of goat's kidneys for demonstrations in medical education.

Methods: The tomato was sliced transversely, while the kidneys longitudinally to show their inner structures. Using same-coloured pins, the anatomical structures of the kidneys were labelled, while structures in the tomato that resembles the identified kidneys structures were also labelled and compared.

Results: The following parts of the tomato were successfully compared with the anatomy of the kidney; the exocarp is renal capsule, the mesocarp is the cortex, endocarp is the medulla, locular cavity resembles the pyramids, placenta of tomato resembles the major calyx and minor calyx, and finally the columella represent as the hilum. Additionally, students gave positive feedbacks after the learning sessions.

Conclusion: This innovation showed that, anatomy can be learned even using vegetables such as tomatoes.

Keywords: Tomato, Goat kidney, Anatomy, Cadavers, Education

A-0375

Assessment of Skeletal Age in Children using Artificial Intelligence - A Mini Review

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Purpose: Paediatric skeletal age assessment plays a role in medical as well as non medical fields. The most widely used methods of skeletal age assessment are Greulich Pyle (GP) and Tanner Whitehouse (TW) methods using hand x-rays. The advancements in artificial intelligence (AI) have paved the way for automated and objective approaches to bone age assessment. This review provides an overview of the current state of research on the application of AI in bone age assessment in children.

Methods: A mini-review was conducted to search the role of AI in bone age assessment in children. The AI models used to assess the skeletal age and the accuracy of the models used were reviewed.

Results: Current available automated bone age assessment softwares include Bone Xpert, VUNO Med-BoneAge, MediAI-BA solution and OpenBoneAge. Machine learning techniques include Artificial Neural Networks (ANN) and conventional (non deep) Machine Learning (ML) models. The RSNA paediatric Bone Age Challenge showed the applicability of ML and AI in medical imaging as an emerging tool and methods of improving diagnostic care. AI model based on GP and TW methods showed clinical efficacy by reducing reading time and improving the inter-observer reliability. Those models have used Convolutional Neural Network (CNN). A Korean model based on CNN showed a better performance in bone age assessment than GP-based model.

Conclusion: AI offers an automated way to offload time-consuming manual processes and improve practitioner performance. Convolutional neural network based deep learning models improve the accuracy and consistency and helps to reduce the burden on clinical personnel. Heterogeneity among studies in terms of age ranges, dataset sizes, and performance metrics make the comparison challenging. Research should explore socioeconomic, ethnic, and other factors that affect the bone age.

Keywords: Skeletal age, Artificial intelligence, Medical imaging, Convelutional Neural Networks

A-0388

Anatomical Structures in an Improved Realistic Mathematical Eye Model for the Simulation of Blunt Eye Injuries

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Purpose: Mathematical modelling and biomechanical analysis is already a routine part of medical practice for the description of the mechanisms of physical forces on biological systems. The key to performing biomechanical computational analyses is to define the individual structures of a given system, including their material properties. The aim of the study

was to improve the model of the eye described in the literature by the addition of other anatomical structures whose injuries have been described in the clinical literature - the ciliary muscle and the iris. This updated model of the eye was then subjected to dynamic effects simulating a blow, and the risk of overloading, which could lead to disability of individual structures and impairment of the functionality of the optical system was identified.

Methods: Analyses were performed as numerical simulations using the finite element method (FEM) of Abaqus. The model simulated a blunt rigid body impact at 50 m/s, which is the speed of a baseball ball during a swing.

Results: The biomechanical FE simulations clearly showed which anatomical structures were at the highest risk of being damaged, not only in absolute terms, but also as a function of time. The simulations showed the load distribution from the cornea through the iris, the ciliary body, the lens including its suspension apparatus, the vitreous and the bulbar wall. The deformation of the eyeball was also shown as a function of the magnitude and direction of the applied forces.

Conclusion: The results will lead to a better understanding of the mechanism of injury of individual anatomical structures. The biomechanical analyses also showed that the developed model can be applied in other areas, such as the stability analysis of the dynamic system of the eye after artificial lens implantation or the healing risks of transcorneal approaches in ocular surgery.

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Keywords: Eye Anatomy, Injury, Biomechanical Simulation, FEM

A-0401

Medical Illustrations and the Role of the Anatomist

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Purpose: Medical illustrations are essential to the story telling element of medicine and science by conveying complex and accurate information. Medical illustrations play a crucial role in medical education, research, and communication. While medical illustrators contribute anatomical, technical, and artistic expertise to translate dense medical literature visually, current attribution standards often fall short in acknowledging the collaborative nature of medical illustration and is specifically of concern in anatomical illustration. This potentially leaves the specific contributions of anatomists underrepresented, thus impacting the genuine recognition or acknowledgment of work. The aim of this study is to highlight the existing gap in attribution guidelines for medical illustrators, emphasising the pivotal role and vast range of skills the anatomist in this dynamic.

Methods: A structured review of the historical evolution of medical illustration, the symbiotic relationship between anatomists, clinicians and illustrators will be conducted. Additionally, showcasing select examples of medical illustrations created for surgical education and social media will illustrate the intricate process involved and emphasise the considerable technical and anatomical expertise contributed during their creation.

Results: The history and contemporary practices of anatomists, clinicians and illustrators are closely entwined. Considerable evidence has been presented to demonstrate the unique and individually valuable contributions made by each, although attribution has been a consistent weakness throughout all eras investigated. Ethical considerations are necessitated in this discussion, particularly around issues surrounding accurate attribution, informed consent, and the need for comprehensive guidelines that reflect the shared contributions of both parties, and that can be recognised by institutions as another branch of the traditional "impact factor".

Conclusion: By recognising the unique expertise each professional brings to the process, this study advocates for enhanced attribution practices that bridge the gap between artistic technical, creative, and anatomical precision in medical illustrations.

Keywords: Medical illustration, Surgical illustration, Anatomy art, Author attribution, Social media

A-0436

Tumor Restriction Hyperthermia in Cancer Treatment using MPI (Magnetic Particle Imaging)

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Purpose: Hyperthermia (HT) for cancer treatment has been utilized in clinical trials as a monotherapy and is proven to be highly effective when combined with other treatment modalities such as radiation and chemotherapy. Clinical hyperthermia is characterized by a local increase in temperature (38-42°C) in malignancies. According to reports, cancer cells have a comparatively greater sensitivity to cell apoptosis/necrosis compared to normal cells, as well as an immune response to heat. In this study, a high-frequency hyperthermia that induces the formation of alternating current magnetic fields (AMF) was developed based on MPI. In addition, compared with similar SPIONs available, it aims to achieve heat by injecting synomag-D, a SPION that has an efficient heating capacity for the equipment, into the tumor.

Methods: Subcutaneous injections of 2 × 106 CT26 cells per head Balb/C mice. tumor volumes reached approximately 100 mm3, intratumoral injection of SPIONs (2 mg of Fe/cm3 tumor) Mice were exposed to 30 min of AMF with a frequency of 20 kHz, 100 mT for 30 min.

Results: We successfully identified and validated commercially available SPIONs that were most suitable for hyperthermia equipment Dextran-based magnetic nanoparticles, Synomag-D were employed as they exhibit excellent properties as a tracer for MPI-hyperthermia. mouse received intratumoral injection of Synomag- D SPIONs (Fe 6 mg/head). The temperature curve of the MHT has been extrapolated using the thermal camera data. The skin surface temperature was measured up to 40°C in tumors that received SPION injections.

Conclusion: As the hyperthermia continued, the immune response promoted cancer cell phagocytosis, and the effect of preventing metastatic spread and tumor growth was confirmed by screening the expressed factors. the direction of nano-based medical treatment technology can be shown, and conditions may be established for the development of MPI equipment technology for human.

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Keywords: Magnetic particle Imaging (MPI), SPION, Hyperthermia, Nanomedicine, Caner therapy

A-0444

Fine Tuning-Based Super-Resolution Method for Developing Precise Human Digital Twins

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Purpose: Developing precise digital twins of humans requires high-resolution medical images, which are typically costly and time-consuming to obtain. While AI-based super-resolution models offer a solution, the majority of them are not tailored for medical images, thereby limiting their ability to provide precise and finely detailed results. Therefore, this study proposes an AI-based precision medical image-specific super-resolution model by fine-tuning the pre-existing general domain super-resolution model on the medical images.

Methods: This study introduces an AI-based precision medical image-specific super-resolution model, fine-tuning the state-of-the-art general domain models such as BSRGAN, DPSR, HAT, RealESRGAN, and SwinIR. We fine-tuned those models on 1.9 million high-quality medical images of the Digital Korean dataset, owned by the Korea Institute of Science and Technology Information (KISTI). To validate the effectiveness of the proposed model, we compared and analyzed the existing model with the fine-tuned model with Peak Signal-to-Noise Ratio (PSNR) as a performance evaluation metric. Furthermore, generated high-resolution medical images were evaluated by anatomy and medical imaging experts

from Ewha Womans University to confirm their suitability.

Results: All proposed models outperformed the existing models, with 2.12dB higher PSNR on average. It is believed that the proposed models were not only well-adapted to medical domain, but also effectively incorporated the general knowledge from existing models. Moreover, the expert's evaluation indicated that the proposed models demonstrated superior super-resolution performance compared to existing models.

Conclusion: This study presents super-resolution models specifically designed for medical images, demonstrating significant improvement in the quality of low-resolution medical images. These advancements are poised to enhance 3D human body modeling and enable precise digital human twins. Furthermore, the development of high-quality medical image datasets is expected to improve medical diagnosis, surgical planning, and spur future advancements in medical imaging.

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Keywords: Human Digital Twin, Super-resolution, Digital Korean, Transfer Learning, Mean Opinion Score

A-0501

Calculating Curvature through Gradient Descent and Nonlinear Regression: A Novel Mathematical Approach to Digital Anatomical Morphometry

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Purpose: Measurement of angular projection of structures has long been an established approach in anatomical morphometry, particularly in regards to bones. However, many of the described projection angles are in reference to inherently curved structures, often oversimplifying their topologies. Measuring the curvature of a projecting structure allows for a more accurate description of the structure's behavior in regards to its proximal–distal course in a given plane. The objective of this study is to develop a quick, quantitative method for determining structural curvature from digital images.

Methods: Projection angulation and curvature was modeled on and assessed by the acromion of 50 dry scapulae. Digital images were taken at a known scale, perpendicular to the acromion, and then processed with ImageJ software. Angles were measured by the angle tool and for curvature, seven markers were placed along the external and internal margins of the acromion. Utilizing Excel's Solver function, the coordinate points were passed through a rotation matrix and optimized for second order regression. Solver was instructed to minimize the sum of squared estimated error between our measured and calculated coordinate values by manipulating the angle of point rotation and regression equation coefficients.

Results: Significant differences were found between external, internal, and midline acromion measurements in both angles and curvatures. External angle = 80.8 (14.2) °; internal angle = 130.3 (13.6) °; midline angle = 105.6 (10.5) °; [reported as mean (SD)]. External curvature = 0.055 (0.015) mm^{-1}; internal curvature = 0.035 (0.025) mm^{-1}; midline curvature = 0.046 (0.017) mm^{-1}; [reported as median (IQR)].

Conclusion: Solver allows for researchers and clinicians to quickly characterize morphometric courses and properties of a given structure. Paired with other scalar measurements, curvature can complete the picture of an anatomical structure's pattern.

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Keywords: Curvature, Angle, Gradient Descent, Morphometry, Acromion

A-0552

Ethical Dimensions of AI Integration in Anatomical Research: Balancing Innovation with Societal Values

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Purpose: The integration of Artificial Intelligence (AI) into anatomical research has heralded a new era in medical diagnostics and therapies. AI-driven algorithms exhibit unprecedented accuracy and efficiency in analyzing complex anatomical data, offering transformative potential for healthcare delivery. However, as AI technologies become increasingly ubiquitous in clinical practice, ethical considerations surrounding their implementation demand careful examination. This study seeks to elucidate the ethical dimensions inherent in integrating AI within anatomical research and clinical settings. By analyzing current ethical frameworks and synthesizing empirical evidence, we aim to delineate the challenges and opportunities AI presents in the context of medical diagnostics and therapies.

Methods: A systematic review of literature about AI applications in anatomical research and healthcare ethics was conducted. Additionally, qualitative interviews with healthcare professionals and AI experts were undertaken to gather insights into real-world ethical dilemmas and stakeholder perspectives.

Results: Our analysis reveals a spectrum of ethical considerations stemming from the integration of AI in anatomical research, including issues related to data privacy, algorithmic transparency, patient autonomy, and equity in healthcare access. Furthermore, we identify potential strategies for navigating these ethical challenges, such as developing standardized protocols for AI algorithm validation, enhancing patient education on AI-enabled healthcare interventions, and fostering interdisciplinary collaboration among stakeholders.

Conclusion: The integration of AI in anatomical research holds immense promise for revolutionizing medical diagnostics and therapies. However, realizing this potential must be accompanied by a steadfast commitment to ethical principles and societal values. By engaging in transparent dialogue and collaborative decision-making, stakeholders can collectively navigate the ethical complexities of AI integration, ensuring that technological innovation aligns with the broader goals of improving patient care, promoting equity, and upholding ethical integrity in healthcare delivery.

Keywords: Artificial Intelligence, Anatomical research, Healthcare ethics

A-0586

AR-Based Interactive Rehabilitation Exercise System Focused on Hand and Wrist Joint Movement

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Purpose: To propose an augmented reality (AR)-based interactive rehabilitation exercise system focused on hand and wrist joint movements using hand-tracking techniques with patient-specific 3D anatomical structures. Patients underwent a coordinated range of motion (ROM) test to determine whether they have movement disorders. Furthermore, patients who have experienced physical therapy to improve their prognosis can be tested to determine the effectiveness of the therapy or physical disability. For these tests, we have developed a simple, intuitive measurement method using AR cameras to measure using a protractor, a traditional method of visual measurement.

Methods: The AR camera tracks the position and angle of 21 joints with the ROM of the carpometacarpal joint in real-time and generates a 3D skeletal muscle model of the hand to identify muscles in motion. The third metacarpal bone and the center of the wrist joint are used as the axis and axial center for measuring the wrist joint's angle of motion as follows: The back of the hand flexion is measured by placing the protractor between the third and fourth fingers and bending the wrist back as far as possible. Flexion is measured by placing the protractor on the back of your hand and flexing your wrist as far as possible. For the yaw and scales exercise, with placement of

the protractor's center on your wrist of your hand in pronation and the protractor rod along your third finger, then measure.

Results: Through the user's exercises, we measured whether they were within the normal ROM for each movement. In addition, joint movements were measured overlaid relevant 3D anatomical structures in real-time to engage aid learning.

Conclusion: We developed a AR-based rehabilitation exercise system considering the movement of hand and wrist joints, which can quantify the movement of the wrist joint and deliver accurate information, to help improve prognosis.

Keywords: Augmented reality, Rehabilitation exercise system, Hand tracking, Range of motion, Hand and wrist joint movement

A-0590

3D Visualization Model of the Thigh Muscles and the Knee Joint Movement for Developing Human Digital Twin

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Purpose: Human Digital Twin technology, replaces the human body in virtual space and is gaining prominence in clinical applications for medical diagnosis, prediction, and practical implementation. There is no 3D full-body human model developed that includes movement. The previous our study, Digital Korean, focused only on 3D models of human bones. The aim of this study is to construct a model of human bones and muscles that includes movement. We prioritized the knee joint for initial development.

Methods: We achieved meticulous segmentation of bones and muscles by leveraging computed tomography (CT) and magnetic resonance imaging (MRI), leading to a precise digitization of the structure of the human body. Subsequently, the collected data was utilized to create a 3D visualization model with a focus on knee joint movement. Utilizing the 3D Slicer open-source software platform, we generated a total of 416 models representing various anatomical structures extracted from 24 anonymized CT and MRI datasets. The models were specifically focused on five key bones (hip bone, femur, patella, tibia, fibula) and eight major muscles (long head of biceps femoris, short head of biceps femoris, rectus femoris, vastus lateralis, vastus medialis, vastus intermedius, semimembranosus, semitendinosus). Additional imaging was performed at 150° and 120° to investigate knee joint mobility.

Results: We have compiled diverse CT, MRI, and digital imaging and communications in medicine (DICOM) research data, including anatomical information, to establish a foundational dataset. Using this data, we developed visualization software for simulation of 3D reconstruction models of the knee region and joint dynamics.

Conclusion: This software contributes to the advancement of personalized medicine and enhances our understanding of knee joint functionality. In addition to the knee joint, 3D visualization for other joints should be implemented. Our research provides a foundation for advancing medical diagnostics and human digital twin technology.

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Keywords: Human digital twin, Artificial intelligence, Thigh muscle, Knee joint, Segmentation

A-0596

The Future of Anatomical Education: Integrating Virtual Anatomy in Existing Curricula

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Purpose: With the dynamic landscape of education, the integration of virtual anatomy is likely to be a pivotal element in future medical education. In response to this, higher education institutions are expected to adopt blended teaching and learning approaches, catering to the needs of diverse learners and enhance accessibility to anatomical education. Nevertheless, navigating the sheer number of new virtual anatomy platforms and resources poses a challenge, requiring educators to navigate this abundance and effectively integrate them into exist-

ing curricula. This presentation seeks to offer practical guidance, firmly grounded in pedagogical principles, to anatomy educators equipping them with insights on integrating virtual anatomy into their curriculum.

Methods: Educational literature was explored to find a suitable framework to support the meaningful integration of virtual anatomy into curricula. Kern's 6-step process provided a robust tool for delineating the process of identifying curriculum necessities, understanding learners needs and barriers to learning, and establishing measurable learning objectives. The authors have applied these principles to current virtual anatomy learning approaches using practical examples from their own technology-focused curriculum.

Results: The authors present insights into this educational strategy aimed at effectively navigating the multitude of virtual anatomy options supported by practical examples. They provide a flexible framework that educators can tailor to their own curricula to ensure cohesive alignment with the needs of teaching sessions.

Conclusion: The approaches presented will equip educators with strategies for incorporating virtual anatomy technologies into their teaching methodologies. By doing so, educators can not only address the evolving landscape of medical education but also enhance the inclusivity and effectiveness of anatomical learning experiences for a broad spectrum of students in preparation for the demands of the future.

Keywords: Virtual anatomy, Kern's 6 step, Curriculum design, Technology-supported curriculum

A-0651

The Effect of Hand Pressure on the Suboccipital Triangle on Headaches and Neck Range of Motion

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Purpose: This study is to reduce the intensity and frequency of headaches by applying intentional stimulation to the suboccipital triangle area and to construct data by measuring and comparing the range of motion of the neck.

Methods: The subjects of the study were 10 adult men and women aged 20 to 50 who had experienced headaches more than once a week for the past 3 months. The study lasted eight weeks, with Intentional stimulation performed twice a week for 20 minutes each time. Participants were asked to measure the intensity and frequency of their headaches, the impact on their quality of life, and the range of motion of their neck using the headache patient questionnaire, visual analogue scale, Headache Impact Test-6 and a goniometer.

Results: While this subject of this study showed a significant effect in reducing the intensity and frequency of headaches, no significant effect was observed in improving the range of motion of the neck.

Conclusion: The results of this study suggest that intentional stimulation of suboccipital triangle has a significant effect on headaches. This study was believed that the data accumulated by applying the intentional stimulation used in this study to other subjects will be good effect to support this study.

Keywords: Suboccipital triangle, Headache, Intentional stimulation, Pain relief

A-0665

A Conversion Model from MRI/CT Images to Anatomical Body Slice for Developing Precise Human Digital Twin

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Purpose: Human digital twins, digitally reproducing human anatomical and physiological characteristics, have gained prominence in the medical field. To build a precise human digital twin, high-quality medical images and advanced vision-AI technology are required to extract comprehensive information of the human body. Despite the widespread use of MRI and CT, preserving color and structural information in these images poses a challenge. Therefore, this study proposes a vision AI-based conversion model, which takes MRI or CT as input and reconstruct anatomical body slice.

Methods: As the vision-AI-based conversion model, we

propose three models which reconstruct body slice from different inputs: CT, MRI or CT+MRI. To build the proposed models, we employed a state-of-the-art reconstruction model based on SwinTransformer, and the Visible Korean dataset consisting of MRI, CT, and Body Slice of the human body is used for training and testing of the models.

Results: To validate the superiority of the proposed models, quantitative evaluation was conducted on the 10% of the Visible Korean, and qualitative evaluation was performed on 8 additional images, with PSNR and SSIM. The results showed that all models successfully reconstructed body slice, capturing color and detailed structural information effectively. Especially, the CT to Body Slice model outperformed the other models, while the CT+MRI to Body Slice model demonstrated the lowest performances.

Conclusion: In summary, this study introduces a vision AI-based body slice conversion model for precise human digital twins, addressing challenges in preserving detailed information in MRI and CT. Based on the SwinTransformer, we proposed three reconstruction models which take different input sources. Despite the difficulties in preserving information in MRI and CT images, the reconstructed body slices of all proposed models effectively captured color and detailed structural information. We believe that the results can contribute to advancing vision AI in medical applications, especially in the precise human digital twin developments.

Funding: This research was supported by Korea Institute of Science and Technology Information (KISTI) (No. (KISTI) K-24-L01-C03-S01, (NTIS) 1711198423).

Keywords: Human Digital Twin, Visible Korean, Swin Transformer, Anatomical Image, Medical AI

A-0680

Development of Virtual Environment Maternal-Fetal Medical Information Service

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Purpose: Korea has been facing social problems such as a low birthrate, declining rural population, shortage of healthcare workers, and lack of infrastructure. To address these issues, we have developed a virtual environment maternal-fetal medical information service based on anatomy, allowing for various educational contents related to childbirth. Currently, we have completed the first phase of development out of five.

Methods: Using software programmes such as Autodesk Maya (Autodesk, Inc.), Blender (Blender Foundation), Zbrush (Pixologic), and Substance 3D Painter (Adobe Inc.), this study creates virtual 3D models of the maternal uterus, placenta, and fetus. Based on clinical data collected from Seoul St. Mary's Hospital, we developed a maternal-fetal model for each week of gestation that represented both normal and abnormal conditions. Our dataset was used to design a virtual childbirth simulation training system. Furthermore, we designed the AI system architecture and developed a chatbot utilizing AI trained on the model. To facilitate the delivery of knowledge to users, we created healthcare content centered on obstetrics and gynecology using a comprehensive anatomy. Finally, all the results were integrated into a single platform using Unity 3D (Unity Technologies).

Results: Development of virtual environment maternal-fetal medical information service : AI chatbot, Medical contents, virtual childbirth simulation training system

Conclusion: The virtual environment maternal-fetal healthcare information service platform helps healthcare workers learn and practice in environments and procedures similar to real-life vaginal deliveries. The platform also allows them to proactively respond to unexpected events, such as birth defects. Most notably, it provides guidelines and virtual experiences for unusual situations, thereby enabling learners to actively respond to the unexpected. AI chatbots and health-

care content are also expected to be of considerable help to users. The service will be able to provide solutions for expanding the national healthcare information infrastructure and solving various problems related to childbirth in Korea.

Funding: This research was supported by a grant of the Korea Health Technology R&D Project through the Korea Health Industry Development Institute (KHIDI), funded by the Ministry of Health &Welfare, Republic of Korea (grant number: HI23C0170).

Keywords: Medical schools, Digital medical service, Digital twin human model, Maternal-Fetal, Virtual surgical simulation

A-0684

A Case Report about the Recovering Methods According to Back Pain Region in Canoeists

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Purpose: The purpose of this study is to find the recovering point of each reason of back pain in university canoeists and help improve performance through quick recovery.

Methods: Pain region, degree, and athlete experience were investigated for 18 university canoeists, and compression was performed on a few of regions where pain occurred.

Results: Pain region, degree, and athlete experience were investigated for 18 university canoeists, and compression was performed on a few of regions where pain occurred.

Conclusion: Lower back pain is thought to be significantly increased in canoeists who have to twist their upper body from a seated position and exert forward force to row. The condition of the iliopsoas, tensor fascia latae, erector spinae, and gluteus medius affects where lower back pain occurs.

Keywords: Canoeists, Sacroiliac junction, Compression, Lower back pain

A-0685

Effects of Bowling Athlete's Pain Recovery Methods on Pain and Performance

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Purpose: The purpose of this study was to investigate the effect of physical stimulation on the pain and performance of bowling athletes at the common origin site of the anterior compartment muscles of the forearm, including the medial epicondyle.

Methods: Over the course of 7 days, university bowlers performed pressure techniques on the common flexor origin site with medial epicondyle, applying pressure for 10-15 seconds three times both before and after daily training sessions. Daily pain scores were meticulously documented.

Results: Out of the 18 bowlers reporting wrist and forearm fatigue and pain, a significant 40-50% reduction in both was observed. Notably, the 5 bowlers with finger inflammation documented a corresponding 40-50% decrease in pain.

Conclusion: For bowlers who make repetitive swings using balls weighing up to 16 pounds, physical stimulation of the common flexor origin site with medial epicondyle where flexor muscles attach is thought to be effective in reducing pain. Therefore it would be a good method to do it every day during recovery training.

Keywords: Ten-pin bowling, Pain, Medial epicondyle, Common flexor origin site of forearm

A-0686

The Investigation about Physical Ability According to Injury Region in Fencing Athletes

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Purpose: This study conducted physical ability test of side step, standing long jump, sit-up and push-up to identify the physical ability required for fencing among athletes in University.

Methods: The age of participants were aged 19 to 23. The

procedure and purpose of the prior study were fully explained to the subjects, and voluntary consents were obtained. Agility, muscular endurance, and upper body endurance were measured using standardized methods.

Results: The average number of male and female athletes in the side step test was 28.00±2.67 and 25.54±2.19, respectively, which was lower than the average standard deviation for subjects with past ankle injuries. The results of the standing long jump conducted on male athletes and female athletes were 263.75±14.56 cm and 208.13±15.80 cm, respectively which was lower than the average result for subjects with past knee injuries. The number of the push-up conducted on male and female athletes were 46.68±18.12 and 41.27±13.16. The result of the sit-up test conducted on male and female athletes was 51.00±11.12 and 46.27±7.27.

Conclusion: These data suggest that injuries can have a negative impact on physical ability tests. The impact of each injury on the physical ability test is negative. Therefore, the test results for each injury are being investigated.

Keywords: Fencing, Ankle joint, Sport injury, Injury prevention, Physical ability test

A-0703

Using Soft Embalmed Cadaver for Visualization of Inguinal Lymphatic Structures

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Purpose: The lymphatic system is essential for maintaining homeostasis and plays a crucial role in immune and digestive functions within the human body. Additionally, it has also been implicated in the dissemination of cancer. The delicate nature of the lymphatic vessels, however, makes dissection highly challenging particularly in the embalmed cadavers. Existing successful lymphatic mapping studies predominantly utilize fresh cadavers and specialized equipment, which are not readily available nor suitable for undergraduate laboratory teaching. Consequently, undergraduate anatomy students often struggle to visualize and understand the vast network of the lymphatic system in vivo.

Methods: The creation of a lymphatic specimen for anatomy laboratory teaching could enhance students' understanding of the intricate lymphatic networks and their anatomical relationship with surrounding structures. This study utilized a soft-embalmed cadaver to develop an inguinal lymphatic specimen, employing the Spalteholz clearing technique and subcutaneous injection of a hydrogen peroxide and dye mixture.

Results: The dissected specimen and tissue effectively display variable-sized inguinal lymph nodes along with the associated afferent and efferent lymphatic vessels. Magnified images of the lympahtic vessels also show the specific bamboo-trunk or bead like appearance. These results highlight the feasibility of preserving and studying lymphatics in soft-embalmed cadavers.

Conclusion: The resulting specimen serves as a valuable teaching resource for visualizing the lymphatic system in the anatomy laboratory. The reproducibility and the affordability of materials suggest there is potential to create similar lymphatic specimens for various body regions, serving as effective educational tools for anatomy instruction. The positive outcomes of this process encourages further investigation into lymphatic structures in embalmed cadavers, fostering opportunities for both educational and research purposes.

Funding: The authors acknowledge the funding and support provided by King Saud bin Abdulaziz University for Health Sciences and College of Medicine and Health Teaching and Learning bursary, UCC 2022.

Keywords: Soft-embalming, Hydrogen peroxide, Lymphatic system, Subcutaneous injection, Anatomy teaching

A-0897

Examining the Effect of Change in Pelvis Load Transfer on the Biomechanical Properties of Leg Muscles

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Purpose: Entire mechanical chain in the columna vertebralis interacts and a change in position of spine can also cause

rotation of pelvis. Normal gait depends on proper position and balanced functioning of bones, joints and myofascial structures acting on joints. Since pelvic position changes in individuals with scoliosis, weight transfer won't be equal, thus bones, joints and all soft tissue structures in lower extremities will be affected. This study aims to investigate biomechanical effects of changes in weight transfer due to scoliosis on myofascial structures such as gastrocnemius, soleus, tibialis anterior muscles, calcaneal tendon, and plantar fascia. Effect of this change on patient gait patterns can be evaluated and a treatment plan can be shaped.

Methods: Ethical approval was obtained from Gaziantep University Clinical Research Ethics Committee(2023/295). Thirty-five individuals (mean age:13.52±1.9, 11males, 23females) who applied to Gaziantep University Orthopedics and Traumatology Department and were diagnosed with adolescent idiopathic scoliosis were included. Direction of pelvic axial rotation was determined on pelvis radiographs of individuals. Stiffness, tonus and elasticity values were measured with MyotonePRO device for properties of myofascial structures.

Results: It was found that there was a strong positive correlation in tonus, a moderate positive correlation in calcaneal tendon and a strong positive correlation in other parameters in stiffness. In elasticity value, it was determined that there was a strong correlation only in calcaneal tendon, while there was a positive moderate correlation in two heads of gastrocnemius and tibialis anterior.

Conclusion: Although it's thought that weight transfer may cause changes in myofascial structures due to altered pelvic position in individuals with scoliosis, no significant difference was found between pelvic asymmetry and same and opposite sides. There were significant correlations between biomechanical properties of muscles. It's thought that making these changes measurable will contribute to clinic.

Keywords: Myofascial structures, Biomechanics, MyotonePro, Adolescent idiopathic scoliosis, Pelvic rotation

A-0899

Biomechanical Investigation of Trapezius Muscle According to the Convex-Concave Side of Scoliotic Curvature

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Purpose: Approximately 70% of scoliosis deformities are caused by idiopathic scoliosis. The occurrence of this condition in individuals aged 10 and above is referred to as adolescent idiopathic scoliosis(AIS). Scoliosis can lead to biomechanical changes in musculoskeletal system. Additionally, prolonged, repetitive static positions can lead to pathological changes such as muscle fatigue, accumulation of muscle metabolites and stiffness. Therefore, conducting detailed musculoskeletal examination in individuals with scoliosis is highly important. This study aims to investigate changes in biomechanical properties of trapezius muscle(TM) before and after exercise session based on convex-concave side of scoliosis curvature in AIS patients.

Methods: Thirty-four individuals (mean age:13.88±2.33 years, male:11, female:13) between the ages of 10-18, diagnosed with AIS by relevant physician and referred to the Department of Orthopedics and Traumatology at Gaziantep University Faculty of Medicine, were included in study. These individuals had no additional spinal pathologies apart from scoliosis. Tone, stiffness and elasticity of TM were measured using MyotonePRO device before and after 40-minute exercise session. Statistical analyses of obtained data were conducted using SPSS25.0 software. If $p<0.05$, it was determined that there was statistically significant difference. Approval was obtained from Gaziantep University Clinical Research Ethics Committee with approval number 2023/294.

Results: In the evaluated individuals, a weak negative correlation was found between tone value before exercise session and stiffness value after exercise session on the convex-concave sides. After exercise session, a moderate positive correlation was found in tone value, while before and after exercise session, a moderate positive correlation was found in elasticity value between convex-concave sides.

Conclusion: In this study, it was found that there was no significant difference in the muscle tone, stiffness, and elasticity of the trapezius muscle in individuals with AIS before and after a single session of exercise. We believe that the data obtained could serve as a resource for future studies.

Keywords: MyotonePRO, Trapezius muscle, Scoliosis, Biomechanics, Muscle tone

A-0963

Occipital Joint Formed from Occipital Bone and Occipital Vertebrae Renames 1st Cervical Vertebrae

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Purpose: The inferior external occipital bone(IEOB) has unique morphology which articulates with another interestingly shaped bone from the apex of vertebral column inaccurately termed 1st-cervical vertebrae(1stCV). 1stCV shares no features with typical cervical vertebrae(CV), and should not be considered a CV. Structurely, 1stCV resembles the IEOB, which is demonstrated in axial scans. Functionally, it operates with the skull, not the cervical spine. In structure and function it could be termed the occipital vertebrae which is the inferior articulation with the IEOB region which is the superior articulation of the occipital joint(OJ). Craniovertebral joint(CVJ) is a broad term versus OJ with superior and inferior articulations of occipital named bones(IEOB and occiptal-vertebrae). Study objective is to analyze IEOB morphology and 1stCV challenging inaccurately termed current beliefs.

Methods: Literature search of IEOB and 1st-cervical vertebrae recognized as OJ was conducted.

Results: Literature search of IEOB and 1stCV revealed they are structurally and functionally similar, not uniquely different as currently taught and perceived. Synovial joints represent direct connections between the skull and 1stCV allowing range of flexion-extension, but joint shape prevents axial rotation. As the head rotates via the transverse plane, 1stCV is obliged to move with it. Toltech bilaminar imaging revealed anatomy supporting an OJ or CVJ consisting of IEOB and occipital vertebrae. Understanding the anatomy of the OJ is important for all healthcare providers who interact with the head and neck to acquire airways, conduct surgery, manipulate the upper spine, those who stablilize the head and neck, and medical technology companies designing safer head and neck equipment.

Conclusion: This study revealed 1stCV is an inaccurate term for this bone which clinically and morphologically integrates with the IEOB region deserving the term occipital vertebrae forming a new named joint-OJ, or at least be termed the occipital vertebrae as inferior articulation of the CVJ.

Keywords: Novel terminology, Innovative Clinical Anatomy

A-0972

Soft Polymer-Based 3D Printed Neuroanatomy Models: Revolutionizing Kinaesthetic Learning in Anatomy Practical

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Purpose: Practical sessions are fundamental in anatomy teaching and learning. They allow students to visualize and manipulate anatomical structures, which are crucial for understanding spatial relationships. Moreover, hands-on learning during practical is essential for kinaesthetic learning. The most utilized teaching tools are plastic models. However, these models have several limitations, such as hard, inaccurate, expensive, and susceptibility to damage. Therefore, this study aims to develop three-dimensional (3D) printed neuroanatomy models using soft polymers to mimic the real consistency of human anatomical structures.

Methods: This study comprises of two phases. Phase one involves the development of 3D-printed models using soft polymers. Thermoplastic urethane (TPU), ethylene propylene diene monomer (EPDM), and styrene butadiene rubber (SBR) were processed into customized blended compounds. The tensile properties of TPU 85A, TPU95A, TPU: EPDM, and TPU:SBR blends were characterized. A human brain MRI image was segmented using 3D Slicer software to obtain regions

of interest, then converted to STL format, and printed using an Ender 3 3D printer. Phase two involves the validation of 3D-printed models, using response process validity (RPV) questionnaires among anatomy lecturers. The RPV questionnaire includes 18 items under three domains: (i) Structural fidelity and consistency, (ii) Practicability and usability, and (iii) Accessibility and cost-effectiveness.

Results: The cerebrum, ventricles, Circle of Willis, and dural venous sinuses models were printed using TPU 85A, which had the best tensile strength and elasticity. Validation results showed that the Circle of Willis model scored highest (0.73) for structural fidelity and consistency. The ventricles and venous sinuses models scored highest (0.77) for practicability and usability. Lastly, the ventricles model also scored highest (0.90) for accessibility and cost-effectiveness.

Conclusion: This study developed and validated soft polymer-based 3D printed neuroanatomy models. They demonstrate a significant improvement over traditional plastic models, suggesting their potential to enhance kinaesthetic learning in anatomy practical.

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Keywords: 3D-printed models, Kinaesthetic learning, Anatomy practical, Neuroanatomy, Soft polymer

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