Motor trajectories from birth to 5 years of children born at less than 30 weeks’ gestation: early predictors and functional implications. Protocol for a prospective cohort study


Abstract

Introduction: Motor impairments are one of the most frequently reported adverse neurodevelopmental consequences in children born < 30 weeks’ gestation. Up to 15% of children born at < 30 weeks have cerebral palsy and an additional 50% have mild to severe motor impairment at school age. The first 5 years of life are critical for the development of fundamental motor skills. These skills form the basis for more complex skills that are required to competently and confidently participate in schooling, sporting and recreational activities. In children born at < 30 weeks’ gestation, the trajectory of motor development from birth to 5 years is not fully understood. The neural alterations that underpin motor impairments in these children are also unclear. It is essential to determine if early clinical evaluations and neuroimaging biomarkers can predict later motor impairment and associated functional problems at 5 years of age. This will help to identify children who will benefit the most from early intervention and improve functional outcomes at school age. Research aims: The primary aim of this study is to compare the prevalence of motor impairment from birth to 5 years of age between children born at < 30 weeks and term-born controls, and to determine whether persistent abnormal motor assessments in the newborn period is those born at < 30 weeks predict abnormal motor functioning at 5 years of age. Secondary aims for children born at < 30 weeks and term-born children are: 1) to determine whether novel early magnetic resonance imaging-based structural or functional biomarkers that can predict motor impairments at 5 years are detectable in the neonatal period; 2) to investigate the association between motor impairments and concurrent deficits in body structure and function at 5 years of age; and 3) to explore how motor impairments at 5 years (including abnormalities of gait, postural control and strength) are associated with concurrent functional outcomes, including physical activity, cognitive ability, learning ability, and behavioural and emotional problems. Design: Prospective longitudinal cohort study. Participants and setting: 150 preterm children (born at < 30 weeks’ gestation) and 151 term-born children (born at ≥ 36 completed weeks’ gestation and weighing ≥ 2499 g) admitted to the Royal Women’s Hospital, Melbourne, were recruited at birth and will be invited to participate in a 5-year follow-up study. Procedure: This study will examine previously collected data (from birth to 2 years) that comprise detailed motor assessments, and structural and functional brain MRI images. At 5 years, preterm and term, children will be examined using comprehensive motor assessments, including: the Movement Assessment Battery for Children (2nd edition) and measures of gait function through spatiotemporal (assessed with the GAITRite® Walkway) and dynamic postural control (assessed with Microsoft Kinect) variables; and hand grip strength (assessed with a dynamometer); and measures of physical activity (assessed using accelerometry), cognitive development (assessed with Wechsler Preschool and Primary Scale of Intelligence), and emotional and behavioural status (assessed with the Strengths and Difficulties Questionnaire and the Developmental and Wellbeing Assessment). At the 5-year assessment, parents/caregivers will be asked to complete questionnaires on demographics, physical activity, activities of daily living, behaviour, additional therapy (eg, physiotherapy and occupational therapy), and motor function (assessed with Pediatric Evaluation of Disability Inventory, Pediatric Quality of Life Questionnaire, the Little Developmental Co-ordination Questionnaire and an activity diary). Analysis: For the primary aim, the prevalence of motor impairment from birth to 5 years will be compared between children born at < 30 weeks and at term, using the proportion of children classified as abnormal at each of the time points (term age, 1, 2 and 5 years). Persistent motor impairments during the neonatal period will be assessed as a predictor of severity of motor impairment at 5 years of age in children born < 30 weeks using linear regression. Models will be fitted using generalised estimating equations to allow for the clustering of multiple births. Analysis will be repeated with adjustment for predictors of motor outcome, including additional therapy, sex, brain injury and chronic lung disease. Discussion/significance: Understanding the developmental precursors of motor impairment in children born before 30 weeks is essential for limiting disruption to skill development, and potential secondary impacts on physical activity, participation, academic achievement, self-esteem and associated outcomes (such as obesity, poor physical fitness and social isolation). An improved understanding of motor skill development will enable targeting of interventions and streamlining of services to children at highest risk of motor impairments.

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