Renal Interlobar Vein Impedance Index as a First-Trimester Marker Does Not Predict Hypertensive Disorders of Pregnancy

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Objectives—The purpose of this study was to examine whether the maternal renal interlobar vein impedance index as assessed by first-trimester sonography is able to predict the later development of hypertensive disorders of pregnancy.

Methods—Venous Doppler parameters of both maternal kidneys were studied in 214 pregnant women at gestational ages of 11 weeks to 13 weeks 6 days. Patients were classified according to outcomes related to hypertensive disorders. Detection rates and areas under receiver operating characteristic curves were determined for the maternal renal interlobar vein impedance index as a first-trimester predictor of preeclampsia and gestational hypertension.

Results—Among the 214 patients, 22 (10.3%) developed preeclampsia; 10 (4.7%) developed gestational hypertension; and 182 were unaffected by hypertensive disorders (controls; 85.0%). In the overall study population, there was no difference in the impedance index between the right (0.44; 95% confidence interval, 0.35–0.50) and left (0.43; 95% confidence interval, 0.35–0.53) sides (P = .86). The average impedance index did not differ among women destined to develop preeclampsia (0.46; 95% confidence interval, 0.38–0.57), gestational hypertension (0.39; 95% confidence interval, 0.33–0.46), or pregnancies uncomplicated by hypertensive disease (0.42; 95% confidence interval, 0.37–0.50; P = .15). Low detection rates and the area under the curve analysis demonstrated that the impedance index was not predictive of hypertensive disorders of pregnancy.

Conclusions—The maternal renal interlobar vein impedance index should not be considered a first-trimester marker of hypertensive disorders of pregnancy.

Key Words—Doppler sonography; hypertension; obstetric ultrasound; preeclampsia; renal venous circulation

Preeclampsia is recognized as the most important of the hypertensive disorders of pregnancy, affecting 2% to 3% of all gestations, although its prevalence may be much higher in less-developed countries. Preeclampsia remains a leading cause of morbidity and mortality for both mothers and their infants. The pathophysiologic mechanism of this condition comprises impaired trophoblastic invasion of the maternal spiral arteries, placental hypoxia, and the subsequent release of inflammatory factors, which activate and damage the maternal vascular endothelium.
Subclinical endothelial dysfunction is a risk factor for impaired placental, placental dysfunction, and thus hypertensive disorders of pregnancy. Evidence of this endothelial dysfunction may be present in early pregnancy, before the development of clinical disease, thereby facilitating first-trimester predictive tests for hypertensive disorders of pregnancy. The most effective of these tests are multiparametric, incorporating the maternal history, uterine artery Doppler parameters, maternal mean arterial pressure, and serum markers. The predictive value of other vascular tests, such as Doppler analysis of the maternal ophthalmic artery, middle cerebral artery, and brachial artery, has also been investigated previously.

Recent studies performed in the second and third trimesters of pregnancy have assessed the venous compartment of healthy pregnant women using Doppler interrogation of maternal hepatic and renal interlobar veins and have demonstrated a gradual decline in the impedance index in both vessels with advancing gestation. In contrast, in women with preeclampsia, these indices increase significantly in the third trimester. The renal interlobar vein impedance index has shown a good intraobserver correlation coefficient on the order of 0.88 and a moderate interobserver correlation of 0.66.

To date, there have been no published prospective studies evaluating differences in the venous compartments of women in early pregnancy who will and will not develop hypertensive disorders of pregnancy. Moreover, the renal interlobar vein impedance index has not been studied as a first-trimester predictor of preeclampsia but may contribute to an integrated assessment of arterial and venous compartments in models of preeclampsia prediction. The purpose of this study was to evaluate the utility of the maternal renal interlobar vein impedance index in the first trimester of pregnancy for early prediction of preeclampsia.

**Materials and Methods**

**Study Design and Setting**

This prospective observational study was conducted on pregnant women at gestational ages of 11 weeks to 13 weeks 6 days. Participants were recruited from and examined at public health units at the Maternal-Fetal Medicine Service of either the Hospital Geral de Fortaleza or the Hospital Distrital Gonzaga Mota Messejana, both located at Fortaleza, in the Northeast region of Brazil.

**Participants**

Pregnant women with singleton pregnancies at gestational ages of 11 weeks to 13 weeks 6 days were eligible to participate. Exclusion criteria included pregnancy loss before 24 weeks’ gestation, major fetal malformations, birth of a small-for-gestational-age neonate not related to hypertensive disorders of pregnancy, and loss to follow-up. Participants were recruited between February 2011 and January 2013. The study was approved by the local Human Research Ethics Committee, and all participants provided signed informed consent.

**Data Acquisition**

Demographic and medical history data were obtained from participants using a form previously approved by the local Ethics Committee and included the participant’s birth date, number of previous pregnancies, and personal and family histories of disease, including preeclampsia and chronic hypertension. Weight (kilograms) and height (centimeters) measurements were obtained with a stadiometer and a platform scale (Filizola, São Paulo, Brazil). Gestational age was determined by the last menstrual period and adjusted when necessary by the first-trimester ultrasound scan.

Participants were positioned supine, and both kidneys were scanned in the transverse plane just above the renal hilum. The renal interlobar arteries and veins were identified with a color Doppler mapping. Participants were instructed to hold their breath after deep inspiration and remain apneic during the brief period of Doppler interrogation. Simultaneous pulsed wave Doppler assessment of the renal interlobar arteries and veins was performed to avoid misidentification of the vessels. The pulsed wave spectral waveform was frozen when at least 2 or 3 similar Doppler waves during apnea were obtained. Since the direction of Doppler interrogation is generally parallel to the vessels examined, the angle of insonation was generally maintained at less than 30° and as near to 0° as possible (Figure 1), with angle correction rarely being required. We used a 3.5–5.0-MHz convex probe and a Voluson 730 Pro ultrasound machine (GE Healthcare, Zipf, Austria). All renal vein Doppler studies were performed by a single operator (S.B.M.H.M.). The following Doppler indices were obtained in both renal interlobar veins: maximum velocity for right and left kidneys (centimeters per second), minimum velocity for right and left kidneys (centimeters per second), and the difference between the maximum and minimum velocities (Δ velocity) for right and left kidneys (centimeters per second). The renal interlobar vein impedance index was calculated by the formula Δ velocity/maximum velocity for each side, the mean of which provided the overall impedance index.
Outcome Measurements
Preeclampsia and gestational hypertension were defined according to the then-current criteria established by the International Society for the Study of Hypertension in Pregnancy. Gestational hypertension was characterized as diastolic blood pressure of 90 mm Hg or higher, measured on 2 different occasions 4 hours apart, after 20 weeks’ gestation, without substantial proteinuria, in a previously normotensive woman. Preeclampsia was defined as gestational hypertension with proteinuria of 300 mg or greater in a 24-hour urine collection or 2 readings of ++ or more on a dipstick analysis. Preeclampsia superimposed on chronic hypertension was classified as preeclampsia, and the diagnosis was established if new substantial proteinuria was observed after 20 weeks’ gestation in women with known chronic hypertension. Pregnancy outcome data were obtained directly from patients or from hospital discharge and state maternity registry sources.

Statistical Analysis
Statistical analysis was performed by a single author (W.P.M.) using SPSS version 18.0 software for Windows (IBM Corporation, Armonk, NY) and Prism software (GraphPad Software, Inc, San Diego, CA). Comparisons between preeclampsia and control groups and between gestational hypertension and control groups were performed by the Mann-Whitney test for continuous parameters and the Fisher exact test for binary/categorical parameters. Doppler parameters were compared between the right and left kidneys by the Wilcoxon matched-pairs signed rank test. Detection rates for hypertensive disorders at 5%, 10%, and 20% false-positive rates were obtained for the impedance index, and screening performance was determined by analysis of receiver operating characteristic curves.

Results
Participants
The study cohort initially consisted of 250 consecutive singleton pregnancies with a live fetus between 11 and 14 weeks’ gestation. The pregnancy outcomes of 12 (4.8%) cases could not be ascertained; thus, these cases were excluded. Also excluded were 21 (8.4%) normotensive women who delivered neonates with birth weights below the 10th percentile, and 3 (1.2%) whose pregnancies resulted in fetal death or miscarriage before 24 weeks’ gestation. In the remaining 214 women, 22 (10.3%) developed preeclampsia; 10 developed gestational hypertension (4.7%); and 182 (85.0%) were unaffected by hypertensive disorders of pregnancy.

Main Results
Participant characteristics are summarized in Table 1. Body mass index, age, and mean arterial pressure were statistically significantly greater, and a family history of preeclampsia was more common, in women who went on to develop preeclampsia compared with controls. Gestational age and newborn weight at delivery were significantly lower in the group affected by preeclampsia compared with controls. There was no significant difference in the maternal characteristics of the gestational hypertension group compared with controls. There were also no significant differences in other characteristics, such as ethnicity, parity, and history of preeclampsia between both groups and controls. Similarly, there was no difference in the prevalence of smoking, chronic hypertension, ethnicity, and alcohol consumption among patients with preeclampsia or gestational hypertension and controls.

There were significant differences in all study groups between the right and left maternal renal interlobar vein Doppler velocimetric parameters, such as maximum velocity, minimum velocity, and Δ velocity, with higher velocities being recorded on the right. There was, however, no difference between the right and left impedance indices (Table 2). The impedance index (average between right and left sides) did not differ among preeclampsia, gestational hypertension, and control groups either (Table 3).

The detection rates for the renal interlobar vein impedance index as a predictive test for preeclampsia and gestational hypertension at false-positive rates of 5%, 10%, and 20% are presented in Table 4. In the receiver operating characteristic curve analysis, the areas under the curves...


(AUCs) demonstrated that the renal interlobar vein impedance index was not able to predict pregnancies that would develop hypertensive disorders of pregnancy, as shown in Table 4 and Figure 2.

Discussion

Over the last 3 decades, many trials have evaluated a range of predictors for preeclampsia in the first trimester of pregnancy, leading to the development of algorithms that combine maternal characteristics with biochemical and biophysical markers.40–43 Doppler parameters of several arterial vessels have been evaluated in this context,44–47 although the study of the maternal venous compartment has generally been neglected in obstetrics.48 To date, there have been just a few small trials evaluating the renal interlobar veins in normal and preeclamptic pregnancies, all of which have been performed in the third trimester. Our study aimed to evaluate the utility of the renal interlobar vein impedance index in the first trimester for prediction of later hypertensive disorders of pregnancy.

Our results did not show differences between the impedance indices for the right and left kidneys in the first trimester of normal pregnancy, in contrast to studies performed in the third trimester, which showed higher values in the left kidney in uncomplicated pregnancies.49 Similarly, there were no significant differences in the right and left impedance indices and the average thereof among the preeclampsia, gestational hypertension, and control groups. In the third trimester, other studies have shown a significantly higher renal interlobar vein impedance index in preeclampsia than in unaffected controls,50 with a greater difference on the left side and in preeclampsia of early onset.51 This finding suggests that changes in the maternal venous compartment may not predate the development of clinical disease, in contrast to the early changes observed in some arterial beds.

The participants in this study originated from a population at mixed risk for preeclampsia and were heterogeneous in terms of age, body mass index, ethnicity, parity, and also the presence of other risk factors such as previous hypertension, diabetes mellitus, and either a family or personal history of preeclampsia. As such, they represent a “real-world” population in which predictive tests for preeclampsia may be assessed. The incidence of preeclampsia was 10.3%, in keeping with published rates for the developing world, wherein the incidence may be greater than 10%.52 Our outcomes were similar to those of a previous study conducted in the same city, in which the incidence of preeclampsia was 7.0%.4 In contrast, the incidence described in medical literature for developed countries is in the order of 2% to 5%,53,54 with rates in the United Kingdom being

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Preeclampsia (n = 22)</th>
<th>Hypertension (n = 10)</th>
<th>Control (n = 182)</th>
<th>p&lt;sub&gt;a&lt;/sub&gt;</th>
<th>p&lt;sub&gt;b&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>29 (24.5–34.0)</td>
<td>27 (23.3–31.0)</td>
<td>25 (21.0–30.0)</td>
<td>.02</td>
<td>.46</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>28.5 (25.5–31.7)</td>
<td>27.5 (24.7–32.1)</td>
<td>25.5 (22.5–28.3)</td>
<td>.002</td>
<td>.15</td>
</tr>
<tr>
<td>GA at scan, wk</td>
<td>12.0 (11.0–13.0)</td>
<td>12.0 (11.8–12.0)</td>
<td>12.0 (12.0–13.0)</td>
<td>.70</td>
<td>.15</td>
</tr>
<tr>
<td>CRL at scan, mm</td>
<td>65 (50.0–773)</td>
<td>62 (52.3–64.0)</td>
<td>64.5 (54.0–75.3)</td>
<td>.90</td>
<td>.15</td>
</tr>
<tr>
<td>MAP, mm Hg</td>
<td>89.5 (83.9–100.7)</td>
<td>86.8 (76.6–93.5)</td>
<td>81.3 (72.2–88.6)</td>
<td>&lt;.001</td>
<td>.39</td>
</tr>
<tr>
<td>Ethnicity, n (%)</td>
<td>2 (9)</td>
<td>2 (20)</td>
<td>14 (8)</td>
<td>.85</td>
<td>.43</td>
</tr>
<tr>
<td>White</td>
<td>2 (9)</td>
<td>2 (20)</td>
<td>14 (8)</td>
<td>.85</td>
<td>.43</td>
</tr>
<tr>
<td>Native Brazilian</td>
<td>20 (91)</td>
<td>8 (80)</td>
<td>162 (89)</td>
<td>.06</td>
<td>.35</td>
</tr>
<tr>
<td>Black</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>6 (3)</td>
<td>.03</td>
<td>&gt;.99</td>
</tr>
<tr>
<td>Previous delivery, n (%)</td>
<td>12 (55)</td>
<td>7 (70)</td>
<td>97 (53)</td>
<td>&gt;.99</td>
<td>.35</td>
</tr>
<tr>
<td>Previous preeclampsia, n (%)</td>
<td>4 (18)</td>
<td>2 (20)</td>
<td>11 (6)</td>
<td>.06</td>
<td>.34</td>
</tr>
<tr>
<td>Familial preeclampsia, n (%)</td>
<td>6 (27)</td>
<td>0 (0)</td>
<td>10 (6)</td>
<td>.03</td>
<td>&gt;.99</td>
</tr>
<tr>
<td>Smoking, n (%)</td>
<td>1 (5)</td>
<td>0 (0)</td>
<td>11 (6)</td>
<td>&gt;.99</td>
<td>&gt;.99</td>
</tr>
<tr>
<td>Chronic hypertension, n (%)</td>
<td>3 (14)</td>
<td>0 (0)</td>
<td>9 (6)</td>
<td>.13</td>
<td>&gt;.99</td>
</tr>
<tr>
<td>Diabetes, n (%)</td>
<td>1 (5)</td>
<td>1 (10)</td>
<td>1 (1)</td>
<td>.21</td>
<td>.10</td>
</tr>
<tr>
<td>GA at birth, wk</td>
<td>375 (35.5–38.3)</td>
<td>390 (38.0–39.3)</td>
<td>39.0 (38.0–40.0)</td>
<td>&lt;.001</td>
<td>.19</td>
</tr>
<tr>
<td>Birth weight, g</td>
<td>2945 (2500–3508)</td>
<td>3275 (3154–3495)</td>
<td>3455 (3200–3785)</td>
<td>.002</td>
<td>.26</td>
</tr>
</tbody>
</table>

For data presented as median (interquartile range), P values were determined by the Mann-Whitney test for continuous parameters; for data presented as number (percent), P values were determined by the Fisher exact test for the binary/categorical parameters. BMI indicates body mass index; CRL, crown-rump length; GA, gestational age; and MAP, mean arterial pressure.

*Comparison between preeclampsia and control.

**Comparison between gestational hypertension and control.
even lower, at 1% to 2%. The catchment areas of the hospitals in which this study was conducted mostly comprise very low-income populations, who have limited access to pre- and early-pregnancy care. This factor may partially explain our high incidence of preeclampsia and our 4.7% rate of gestational hypertension, which was higher than the rates reported in other studies (1.2%–2.2%).

Cesarean delivery rates were high overall in the study population, at 60.8%, and among patients with preeclampsia, they reached 95.5%. Among the controls, the incidence of cesarean delivery was 57.8%. These rates are high for low-risk patients by global standards but are comparable to the average in Brazil: a country widely criticized for having one of the highest cesarean delivery rates in the world.

Maternal characteristics that were significantly different among groups included body mass index, mean arterial pressure, history of preeclampsia (mother or sister) and history of diabetes. These parameters are established clinical predictors of preeclampsia. Gestational age and birth weight at delivery were significantly lower for those with hypertensive disorders of pregnancy than for unaffected patients, partially as a consequence of iatrogenic earlier delivery of women with hypertensive disorders of pregnancy.

Normal pregnancy is characterized by venous and arterial vasodilatation and increased vascular volume, as a result of higher distensibility, compliance, and venous capacity. Changes in the venous compartment induced by pregnancy facilitate increased cardiac output, which is especially important in the third trimester, and may take up to 3 months postpartum to return to prepregnancy levels. In contrast, women with preeclampsia have a dysfunctional cardiovascular adaptation to pregnancy, with vasoconstriction, a further increase in cardiac output, and diastolic cardiac dysfunction. Some weeks before the clinical onset of the disease, the plasma volume decreases, and the usual adaptive changes in the venous vascular bed do not occur.

This subnormal plasma volume persists postpartum in a substantial proportion of formerly preeclamptic women, who later have an abnormal cardiovascular response to exercise and a tripled risk of recurrent preeclampsia and cardiovascular disease.

The higher renal interlobar vein impedance index values observed in the third trimester of preeclamptic pregnancies are related to the Doppler wave venous preceleration nadir, which is caused by the retrograde intra-venous reflux that occurs after right atrial contraction.

### Table 2. Comparison Between Right and Left Maternal Renal Interlobar Vein Doppler Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Right Kidney</th>
<th>Left Kidney</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vmax, cm/s</td>
<td>13.3 (10.1–16.9)</td>
<td>11.8 (9.9–15.1)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Vmin, cm/s</td>
<td>7.2 (5.8–9.7)</td>
<td>6.8 (5.0–8.7)</td>
<td>.002</td>
</tr>
<tr>
<td>ΔVel, cm/s</td>
<td>5.5 (3.8–8.0)</td>
<td>5.1 (3.9–7.2)</td>
<td>.03</td>
</tr>
<tr>
<td>Impedance index</td>
<td>0.44 (0.35–0.50)</td>
<td>0.43 (0.35–0.53)</td>
<td>.86</td>
</tr>
</tbody>
</table>

Data are presented as median (interquartile range), and P values were determined by the Wilcoxon matched-pairs signed rank test. ΔVel indicates maximum velocity (Vmax) – minimum velocity (Vmin).

### Table 3. Maternal Renal Interlobar Vein Doppler Parameters

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Preeclampsia (n = 22)</th>
<th>Hypertension (n = 10)</th>
<th>Control (n = 182)</th>
<th>P*</th>
<th>Pb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vmax (right), cm/s</td>
<td>14.5 (9.6–22.7)</td>
<td>10.6 (8.0–13.2)</td>
<td>3.3 (10.6–16.9)</td>
<td>.55</td>
<td>.01</td>
</tr>
<tr>
<td>Vmax (left), cm/s</td>
<td>12.2 (8.4–16.3)</td>
<td>11.8 (9.8–15.7)</td>
<td>11.7 (10.1–15.1)</td>
<td>.95</td>
<td>.90</td>
</tr>
<tr>
<td>Vmax (average), cm/s</td>
<td>14.1 (9.3–20.7)</td>
<td>11.5 (10.4–12.8)</td>
<td>12.7 (10.4–15.6)</td>
<td>.67</td>
<td>.27</td>
</tr>
<tr>
<td>Vmax (right), cm/s</td>
<td>7.7 (5.6–10.7)</td>
<td>6.7 (4.8–8.2)</td>
<td>7.2 (5.8–9.6)</td>
<td>.48</td>
<td>.21</td>
</tr>
<tr>
<td>Vmin (average), cm/s</td>
<td>70.5 (5.5–10.6)</td>
<td>6.8 (5.4–7.8)</td>
<td>7.2 (5.8–8.8)</td>
<td>.99</td>
<td>.42</td>
</tr>
<tr>
<td>ΔVel (right), cm/s</td>
<td>5.3 (4.5–10.8)</td>
<td>3.6 (2.9–4.6)</td>
<td>5.8 (4.0–8.0)</td>
<td>.61</td>
<td>.006</td>
</tr>
<tr>
<td>ΔVel (average), cm/s</td>
<td>6.1 (4.2–8.6)</td>
<td>4.6 (3.0–5.9)</td>
<td>5.1 (3.9–7.1)</td>
<td>.21</td>
<td>.55</td>
</tr>
<tr>
<td>Impedance index (right)</td>
<td>5.7 (3.6–9.9)</td>
<td>4.3 (3.0–5.6)</td>
<td>5.4 (4.1–7.2)</td>
<td>.51</td>
<td>.08</td>
</tr>
<tr>
<td>Impedance index (left)</td>
<td>0.43 (0.34–0.58)</td>
<td>0.39 (0.32–0.46)</td>
<td>0.44 (0.35–0.50)</td>
<td>.76</td>
<td>.17</td>
</tr>
<tr>
<td>Impedance index (average)</td>
<td>0.51 (0.43–0.56)</td>
<td>0.40 (0.35–0.47)</td>
<td>0.42 (0.35–0.50)</td>
<td>.02</td>
<td>.61</td>
</tr>
</tbody>
</table>

Data are presented as median (interquartile range), and P values were determined by the Mann-Whitney test. ΔVel indicates maximum velocity (Vmax) – minimum velocity (Vmin).

Comparison between preeclampsia and control.

Comparison between gestational hypertension and control.
which in preeclampsia can extend to the level of the kidneys, leading to a sharp deceleration of blood flow and higher renal interlobar vein impedance index values. It is unclear whether the elevated impedance index values in preeclampsia are related to increased cardiac diastolic dysfunction or to reduced venous distensibility.60,65 A recent retrospective study concluded that there is a progressive worsening of arterial and venous hemodynamic adaptation from gestational hypertension to late preeclampsia and then to early preeclampsia, with higher renal interlobar vein impedance index values in early and late preeclampsia than in uncomplicated pregnancies but no significant differences in patients with gestational hypertension.66

We achieved low detection rates for preeclampsia and gestational hypertension using the renal interlobar vein impedance index in the first trimester of pregnancy, as the AUCs in this study showed no difference in first-trimester impedance index values among women who later developed hypertensive disorders of pregnancy and those who did not. It is therefore reasonable to assume that alterations in maternal venous hemodynamics do not substantially predate the development of the clinical features of preeclampsia and may only become apparent once the disease is established.

We acknowledge the relatively small sample size and the lack of a priori sample size estimation as limitations of this study. We believe that in future studies with larger populations, it would be possible to perform analyses stratified by various maternal characteristics.

In conclusion, the Doppler impedance of the maternal renal interlobar veins in the first trimester of pregnancy was not different between patients who went on to develop hypertensive disorders of pregnancy and those who did not. Thus, it is not an early predictive marker for these later pregnancy complications.

Table 4. Diagnostic Accuracy of the Renal Interlobar Venous Impedance Index Assessed During the Late First Trimester to Predict Hypertensive Disorders of Pregnancy

<table>
<thead>
<tr>
<th>Disorder</th>
<th>AUC</th>
<th>95% CI</th>
<th>False-Positive Rate:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>20%  10%  5%</td>
</tr>
<tr>
<td>Preeclampsia</td>
<td>0.59</td>
<td>0.46–0.73</td>
<td>46  27  5</td>
</tr>
<tr>
<td>Gestational hypertension</td>
<td>0.62</td>
<td>0.44–0.80</td>
<td>30  20  10</td>
</tr>
</tbody>
</table>

Figure 2. Receiver operating characteristic curves of the renal interlobar vein impedance (RIVI) for prediction of preeclampsia (A) and gestational hypertension (B). In A, the AUC is 0.59. In B, the AUC is 0.62.
References


