In-vivo Early-Gestation Placental Imaging Prospectively Predicts Adverse Pregnancy Outcomes in Ischemic Placental Disease

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Background
• Ischemic placental disease (IPD) is manifested as preeclampsia (PE), fetal growth restriction (FGR), and placental abruption
• IPD contributes to over 50% of cases of prematurity
• Uterine artery Doppler ultrasound studies have poor sensitivity and positive predictive values for IPD
• MRI evaluation of placental volume and blood flow has potential in improving accuracy of measurement and prediction of IPD

Hypothesis
• Placental MRI volume and blood flow assessments have enhanced reliability in the prediction of IPD, compared with Doppler ultrasound measurements of uterine artery pulsatility index.

Objectives
• To understand how placental MRIs in early pregnancy correlate to maternal and neonatal outcomes

Methods
• 200 women recruited and consented in early 1st trimester of pregnancy
• 2 Uterine artery ultrasound Doppler studies performed at 11-14 weeks, and 19-22 weeks gestational age
• 2 Placental MRI performed at 14-16 weeks, and 19-22 weeks of gestational age
• Neonatal outcomes recorded via chart review
• MRI Technique: Free-breathing T2-haste, and multi-delay, pseudo-continuous arterial spin labeling sequences
• Placental analysis: Placental regions of interest were manually generated in 3 different planes for analysis of volume and placental blood flow

Results

Figure 1. Results of uterine artery ultrasound Doppler evaluation, at 11-14 weeks gestational age (left graph) and 19-22 weeks gestational age (right graph). There was no significant difference in the pulsatility index (PI) at either gestational age between our control group and IPD group.

Figure 2. Results of placental volume at MRI visit 1 (14-16 weeks) and MRI visit 2 (19-22 weeks). Placental volumes significantly increased between visit 1 and visit 2, for all groups.

Figure 3. Results of parameters of placental blood flow at MRI visit 1.

Conclusions
• Placental volume increased between the first and second MRI visits
• Placental volume was reduced in subjects who developed IPD and delivered SGA babies
• Placental blood flow is reduced in subjects who clinically showed IPD characteristics
• MRI imaging is more reliable than ultrasound measurements of uterine artery pulsatility index

Significance and Future Direction
• We speculate that early gestation MRI placental blood flow and volume measurements can be predictive of the subsequent development of IPD
• Needs testing in a larger and more diverse cohort

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