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

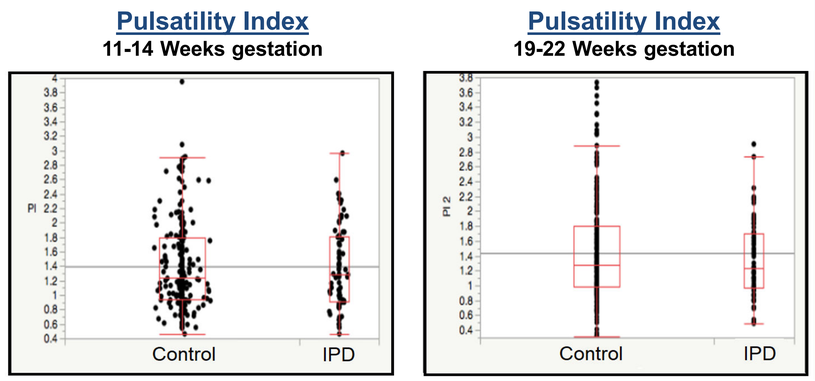

*Figure 1. Results of uterine artery ultrasound Doppler evaluation, at 11-14 weeks gestational age (left graph) and 19-22 weeks gestational age (right graph). There was **no significant difference in the pulsatility index (PI) at either gestational age between our control group and IPD group.***

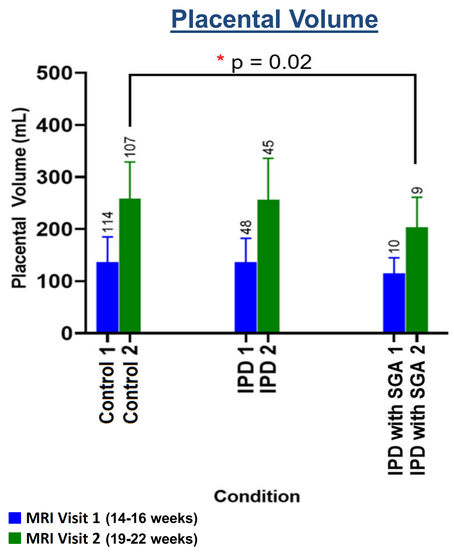

Figure 2. Results of placental volume at MRI visit 1 (14-16 weeks) and MRI visit 2 (19-22 weeks)

Placental volumes significantly increased between visit 1 and visit 2, for all groups.

** **Placental volume at visit 2 in mothers who developed both IPD and delivered SGA babies was significantly decreased, compared to placental volume at visit 2 in control group** (uncomplicated pregnancy)*

SGA, small for gestational age

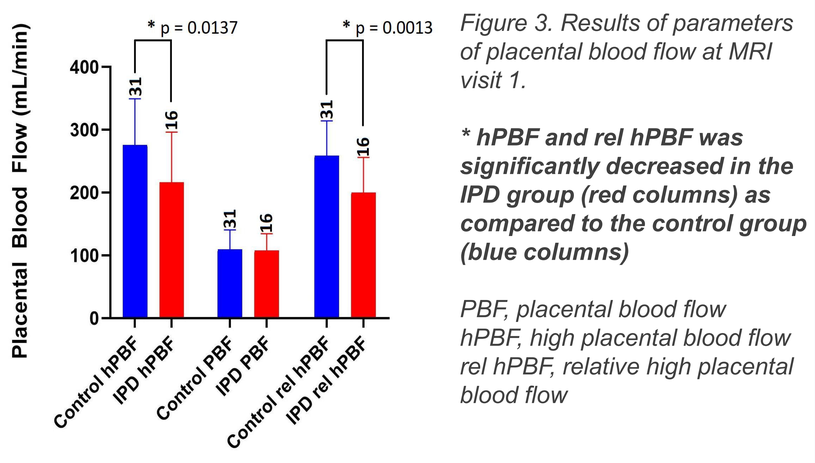

Figure 3. Results of parameters of placental blood flow at MRI visit 1.

** **hPBF and rel hPBF was significantly decreased in the IPD group (red columns) as compared to the control group (blue columns)***

PBF, placental blood flow
hPBF, high placental blood flow
rel hPBF, relative high placental blood flow

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

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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