Elasticity Imaging of Placental Tissue Demonstrates Potential for Disease State Discrimination

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Objective: To demonstrate the diagnostic potential of elasticity imaging as a novel method of discriminating the structural characteristics of placentae in health and disease. Our goal is to identify easily reproducible, direct, and non-invasive placental biomarkers based on elasticity imaging to detect and predict placenta-related disease.

Study Design: Prospective, descriptive cohort study of women presenting for care at a tertiary medical center with uncomplicated pregnancies or with ischemic placental disease or chronic hypertension (cHTN). Patients were enrolled antenatally for post-delivery placental collection. Sheer wave speeds (SWS) of the *ex vivo* placenta were measured with ultrasound elasticity techniques on a Siemens S3000 research platform. SWS data were acquired in triplicate with placenta in a water bath at physiologic temperature. SWS were compiled to describe the range of measurements within and between placentae. SWS discrimination between disease states quantified with ROC curves.

Results:14 term patients enrolled with 12 regions per placenta analyzed in triplicate for a total of 504 SWS measurements. Mean SWS varied across disease states with 1.60±0.47 m/s in uncomplicated pregnancies, 1.50±0.36 m/s in pregnancies complicated by cHTN, and 1.25 ±0.30 m/s in pregnancies complicated by ischemic placental disease. While SWS slowed in both pathologic states, differences in SWS were identified across regions of the placenta (Figure 1). Consequently, effective discrimination of disease state as demonstrated by area under a ROC curve relies on either knowledge of placental region quantified or utilizing a larger region of interest (Figure 2).

Conclusion: Contrary to limited prior reports, SWS decreases in placenta affected by ischemic placental disease and cHTN. However, variation across planes is significant, thus random SWS assessments are less effective at discriminating healthy from diseased tissue than location-informed assessment. Elasticity imaging