

Title:

Evaluating an AI Tool for Fetal Heart Rate Measurement in First-Trimester Emergency Ultrasound: Interim Results

Background:

Presentation for first trimester pregnancy complications are common in the emergency department (ED), with over one-third of patients presenting at least once throughout their pregnancy. Evaluation of early pregnancies with ultrasound (US) is a core skill for ED physicians. Accurate measurement of fetal heart rate (FHR) is essential to identify high-risk pregnancies, as fetal bradycardia (<100 BPM) predicts early pregnancy loss. However, obtaining reliable FHR measurements can be challenging for novice sonographers. Artificial Intelligence (AI) may improve accuracy and consistency in FHR assessment.

Objectives:

To validate an AI instrument for measuring FHR in first trimester pregnancies compared to the gold standard of M-mode analysis.

Methods:

An interim analysis of the prospective study was conducted with 50 eligible patients. Emergency medicine residents and advanced practice providers measured FHR using both AI and M-mode techniques. Expert sonographers captured reference M-mode tracings which were used retrospectively to generate the reference standard FHR for each US encounter. Bland-Altman plots and ANOVAs were used to assess agreement and statistical differences between AI, novice M-mode, and reference standard measurements. Gestational age and BMI were analyzed as covariates.

Results:

AI-derived FHR measurements demonstrated strong agreement with expert-calculated reference standards, with narrower limits of agreement compared to novice M-mode measurements. Novice M-mode measurements exhibited greater variability and wider limits of agreement. Both AI and M-mode accuracy improved with increasing gestational age ($p < 0.05$). The mean absolute difference between AI and reference FHR was significantly smaller than between novice M-mode and reference FHR ($p < 0.05$).

Conclusions:

The AI FHR tool showed high agreement with expert measurements, suggesting strong preliminary accuracy and potential for clinical utility. AI use may reduce variability among novice sonographers, improving efficiency and reliability in early pregnancy FHR assessment. These findings support further validation and evaluation of AI integration into emergency ultrasound workflows to enhance recognition of high-risk pregnancies.