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

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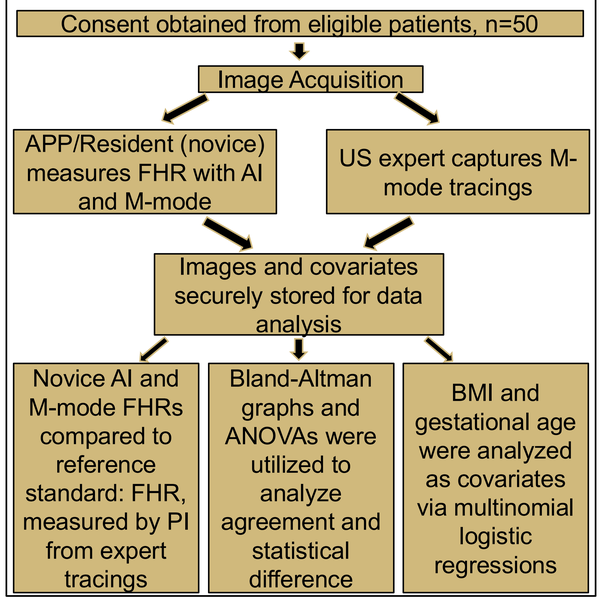
Background

- First trimester pregnancy complications are frequent in the emergency department (ED), with over 1/3 of patients presenting at least once during pregnancy
- Ultrasound (US) evaluation of the first trimester fetus is a core skill for ED physicians
- Fetal bradycardia (heart rate <100 BPM), is a predictor of early pregnancy loss
- The American College of Obstetricians and Gynecologists (ACOG) recommend measurement of fetal heart rate (FHR) to identify pregnancies at high risk for early pregnancy loss
- Measuring FHR can be difficult for novice sonographers

Objectives

- To validate the use of an Artificial Intelligence (AI) instrument to accurately measure FHR in first trimester pregnancies when compared to the gold standard of M-mode analysis

Methods



Results

Bland-Altman Plot of Differences: Reference Standard-AI FHR

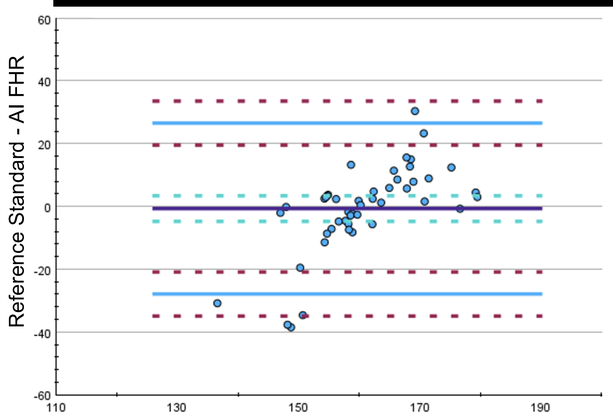


Figure 1. Plot of Differences: Reference Standard-AI FHR. The differences are clustered close to zero; the AI tool produces measurements close to the reference standard.

Bland-Altman Plot of Differences: Reference Standard-Novice M-mode

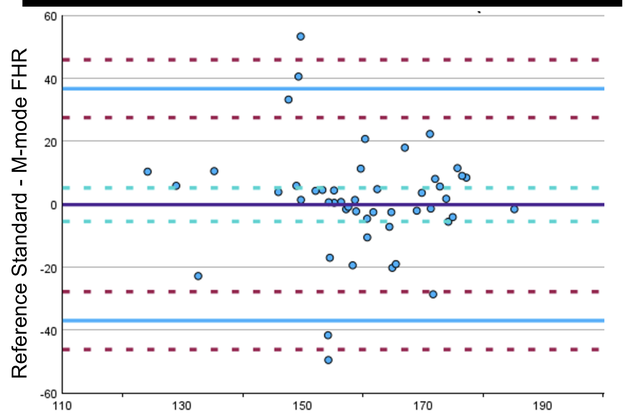


Figure 2. Plot of Differences: Reference Standard-M mode. There is more scatter and less agreement between the novice M-mode and reference standard.

Absolute Mean Level of Agreement Between Reference Standard and AI FHR vs. Novice M-mode

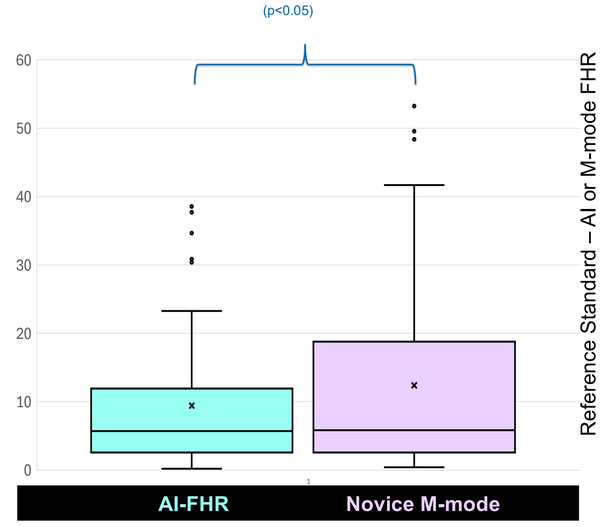


Figure 3. Absolute Mean Difference Between Reference Standard and FHR Methods. The AI tool has a smaller mean difference and less variability compared to Novice M-mode.

AI FHR and M-mode: Level of Agreement (Absolute Value) vs. Gestational Age

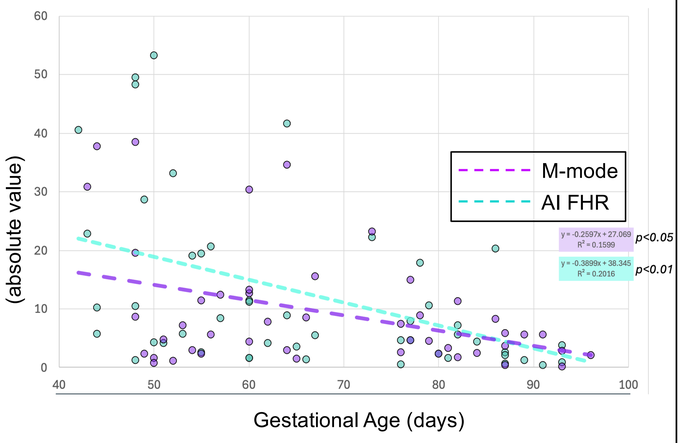


Figure 4. Level of Agreement vs. Gestational Age. As gestational age increases, both methods have higher levels of agreement when compared to the reference standard.

Conclusions

- AI FHR tool has a strong agreement with expert calculated rates, suggesting good preliminary accuracy of the AI tool
- Novice M-mode measurements had wider limits of agreement with the expert reference standard, indicating greater variability and technical difficulty
- Both the AI tool and M-mode measurements were more accurate with increasing gestational age
- These early findings may suggest that the AI FHR tool could improve consistency and efficiency, particularly for less experienced users
- Improving FHR measurement in the emergency setting may facilitate earlier recognition of high-risk pregnancies, helping to optimize emergency care for patients presenting with first trimester complications

Future Directions

- Data collection and analysis are ongoing to confirm these preliminary trends and further evaluate performance
- Future studies should evaluate the clinical workflow impact and potential time savings of AI integration in Emergency Ultrasound

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