

EP08.32 Fetal echocardiographic biomarkers for prenatal prediction of major congenital heart defects: data from the international multicentre CAIFE study

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Introduction

We investigated whether fetal cardiac biometry indices could serve as echocardiographic biomarkers for prenatal prediction of CHD using the data from the Clinical Artificial Intelligence Fetal Echocardiography (CAIFE) study.

Methods

We included 541 fetal echocardiograms obtained between 15 and 40 weeks of gestation (mean=25 weeks) comprising 323 normal and 218 major CHD cases. We evaluated 9 ratio-based echocardiographic biomarkers derived from standard echocardiographic views. Each biomarker was transformed into a normal-reference-adjusted z-score. The abnormality threshold was fixed at the 90th percentile of the normal distribution. The mean absolute z-score across biomarkers was used as a case-level anomaly score. Individual biomarkers were also assessed using their absolute z-score, and a supervised logistic regression model was used as a benchmark.

Results

The composite absolute z-score method demonstrated the best overall performance, achieving a mean AUC of 0.90, sensitivity of 77%, specificity of 89%, and F1 score of 0.80. This outperformed the supervised logistic regression model, which had a mean AUC of 0.77, sensitivity of 68%, specificity of 77%, and F1 score of 0.67. Among the individual biomarkers, the AscAo/PA and AV/PV dimension ratios exhibited the strongest discriminatory performance (Figure 1).

Conclusions

- A composite anomaly score outperformed both individual biomarkers and a supervised logistic regression benchmark.
- This percentile-threshold framework may offer a practical approach to biomarker-based screening throughout gestation and support the development of AI models for detecting echocardiographic biomarkers predictive of fetal CHD.

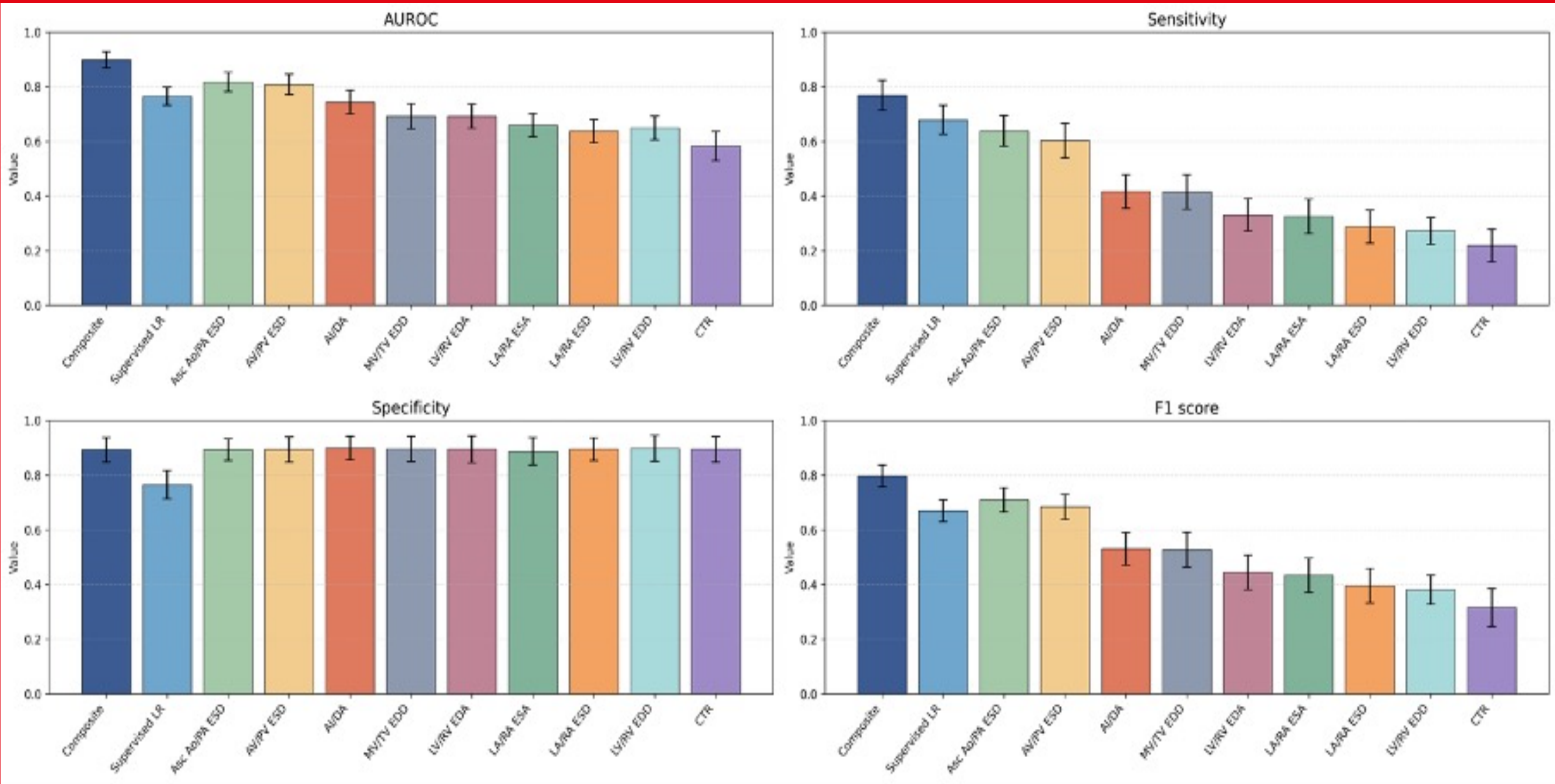


Figure 1. The bar-graph showing area under AUROC, sensitivity, specificity and F1 score for nine fetal cardiac biomarkers in prenatal prediction of CHD.

Biomarkers abbreviations: Asc Ao/PA ESD, ascending aorta/pulmonary artery end-systolic dimension ratio; AI/DA, aortic isthmus/ductal arch ratio; AV/PV ESD, aortic/pulmonary valve end-systolic dimension ratio; CTR, cardio-thoracic ratio; LV/RV EDA, left/right ventricular end-diastolic area ratio; LV/RV EDD, left/right ventricular end-diastolic dimension ratio; LA/RA ESA, left/right atrial end-systolic area ratio; LA/RA ESD, left/right atrial end-systolic dimension ratio; LS, logistic score; MV/TV EDD, mitral/tricuspid valve end-diastolic dimension ratio.

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