

Fetal left ventricular strain – Impact of angle of insonation and frame rate

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Introduction: Speckle tracking echocardiography (STE) is used increasingly as a method to assess fetal myocardial deformation and velocity in health and disease. However, comparison of results among different studies is challenging as temporal resolution and position of fetal heart relative to the angle of insonation differs. The primary aim of this study was to explore whether temporal resolution (frames per second, FPS) and angle of insonation (apex position) can influence left ventricular endocardial global longitudinal strain (GLS), and the secondary aim was to report the reproducibility of the analysis of fetal STE.

Methods: Ultrasound clips of the fetal four-chamber view were obtained during routine clinical scanning in 75 healthy fetuses from 19-38 weeks gestation, using Canon Aplio i800 machines. The analysis was performed by two trained operators (JS, TD) using Vitrea software (Canon) to calculate left ventricular GLS. For every fetus, three different orientations of the fetal heart (apex up/down, apex perpendicular, apex oblique) were obtained, at low and high acoustic FPS. Analysis was performed using linear mixed model analysis. The intra and inter-analysers reproducibility was evaluated in 40 clips which were analysed by both operators blinded to the other's findings

Results: Analysis was performed on 312 clips (144 in 2nd trimester; 168 in 3rd trimester). FPS and angle of insonation were important determinants of GLS. Higher FPS (mean 118.4 ± 34.4), compared to lower FPS (62.6 ± 13.5), for the same scanning site resulted in lower GLS ($-19.6\% \pm 2.8$ vs. $-21.3\% \pm 4.0$, $p < 0.001$). Apex perpendicular views were associated with higher GLS in comparison with apex up/down ($-23.6\% \pm 4.1$ vs. $-21.3\% \pm 4.0$, $p < 0.001$). The composite influence of FPS and position of fetal heart on GLS is illustrated below (figure). There was good intra and inter-analysers reliability of GLS (intraclass correlation coefficient 0.88 and 0.84 respectively).

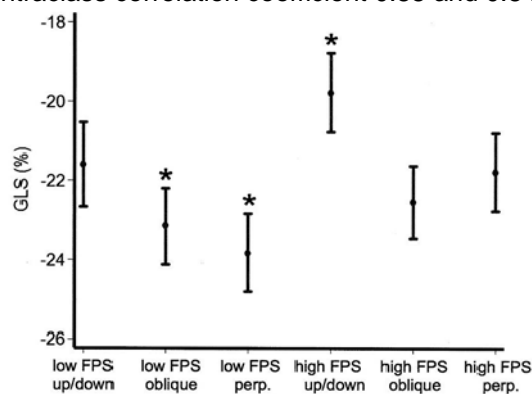


Figure: perp., perpendicular, * $p < 0.05$

Conclusions: Our results indicate that the angle of insonation and acquisition frame rate are important determinants of GLS. These factors should be taken into account when comparing studies using different protocols of acquisition. Speckle tracking cannot be regarded as an "angle independent" modality during fetal life.