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Fetal Sympathetic Nervous Activity during the Second Trimester of Pregnancy: Preliminary Results

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Introduction

Spectral analysis of fetal heart rate variability may offer valuable additional information that can be used to assess fetal wellbeing. However, more insight in spectral estimates of heart rate variability is required. In literature, spectral analysis of fetal heart rate has been reported only for pregnancies >20 weeks of gestation. The development of a non-invasive fetal ECG device has enabled the recording of the beat-to-beat fetal heart rate in pregnancies of 18 weeks of gestational age (GA) and higher. To investigate fetal sympathetic nervous activity in the second trimester of pregnancy, the beat-to-beat fetal heart rate was recorded in pregnancies of 18-27 weeks of gestation and spectrally analysed.

Methods

Recordings were performed in 5 healthy pregnancies and a total of 14 recordings of 45 minutes were acquired. Measurements were performed with a prototype non-invasive fetal ECG device (NEMO, developed in cooperation with Maastricht Instruments BV) that records electrical activity on the maternal abdomen. From these recordings, fetal ECG traces were extracted, from which R-R interval series were obtained. 5-minute segments of sufficient signal quality were analysed by fast Fourier transform with appropriate pre and post processing. Spectral powers were calculated in the very low frequency (VLF) band (<0.04 Hz), the low frequency (LF) band (0.04-0.15 Hz), and the high frequency (HF) band (0.4-1.5 Hz). In addition, normalised low (LFn) and high (HF_n) frequency powers were calculated, as these may reflect autonomic nervous activity more objectively.

Results

77 segments of 5 minutes were analysed. Figure 1 shows the LFn powers that were calculated. In the period before 20 weeks of gestation, LFn is found to be significantly lower than in the period after 20 weeks of gestation (<20 weeks GA: LFn = 0.39 0.20, >20 weeks GA: LFn = 0.74 0.15, p<0.001).

Discussion and Conclusion

The significantly lower normalised LF power for gestational ages <20 weeks might indicate that functional development of the fetal sympathetic nervous system does not take place earlier than 20 weeks of gestation. However, additional measurements are necessary to further investigate this hypothesis. In particular, results at 20 weeks of gestation are very interesting, as the preliminary results suggest that at this gestational age a transition might occur.