

Use of fetal ECG in the assessment of fetal cardiac rhythm

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Objective

In fetal life, non-invasive electrocardiography (ECG) can be obtained using magnetocardiography or abdominal fetal ECG (fECG) but echocardiography remains the dominant modality. Some ECG parameters e. g. QT interval cannot be measured directly by echocardiography. Long-QT syndrome is a genetic channelopathy which predisposes to malignant arrhythmias. There is a paucity of data on important prognostic features during fetal life.

Methods

Systematic review of cases of long-QT syndrome presenting in fetal life to investigate important diagnostic and prognostic ECG features. We further describe our initial experience in obtaining and extracting fECG using the MonicaAN24 monitor. This includes 188 fECG traces analysed to assess the cardiac time intervals (CTI) and ten fetuses with known/suspected arrhythmia.

Results

83 studies including 265 fetuses with long-QT syndrome were identified. A longer fetal QTc measured using magnetocardiography was the single most predictive factor for death (ROC area under curve (AUC), 0.85 (95% confidence interval (CI) 0.66-1.0)); risk of death increased with QTc interval greater than 600ms. Neither FHR nor FHR z-score predicted death (ROC AUC 0.51 (95% CI 0.31-0.71) and 0.59 (95% CI 0.37-0.80), respectively). Overall, 188 fECG traces were analysed with measurement of the CTI. PR was 107.60ms/12.07ms (mean/SD) in 173/188(92%), QRS 54.72/6.35 in 170/188(90%) and QTc 407.48/32.71 in 123/188(65%) cases. There was good agreement with previously published literature using fECG and magnetocardiography. Ten cases were recruited with known or suspected arrhythmia. fECG for up to 15 hours using a portable device at home gave information on FHR, intermittent arrhythmias, CTI and response to treatment.

Conclusion

The QT interval is prognostically important in fetal long-QT syndrome. This underscores the importance of fetal ECG findings that could be significant in other patient groups including unexplained intrauterine death. fECG has the potential to improve arrhythmia detection, diagnosis, and risk stratification as well as the response to prenatal therapy.