

valuable prognostic factor for the patients requiring therapeutic management as soon as possible.

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CO 10 Non-invasive fetal electrocardiography for the detection of fetal arrhythmias: Toward a fetal Holter

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Background Non-invasive fetal ECG is a promising low-cost and non-invasive continuous fetal monitoring technique.

Objective In this work, we explore the potential of non-invasive fetal electrocardiography as a novel technique for fetal arrhythmias diagnoses.

Study design The population of this prospective study comprised 12 arrhythmic fetus and 14 normal ones, according to a routine fetal echocardiography. We diagnosed the fetal cardiac rhythm of the 26 fetuses using the non-invasive fetal ECG and compared it to the echocardiographic reference diagnosis. For this purpose, extraction of the non-invasive fetal ECG and detection of abnormal rhythm events were performed automatically. Two perinatal cardiologists, blinded to the echocardiographic diagnosis, analyzed these events.

Results Diagnosis based on the non-invasive fetal ECG recognized the following rhythm disorders: 6 cases with extrasystoles, 2 tachyarrhythmia, 1 bradyarrhythmia, 1 irregular atrial rhythm and 1 case with blocked P-waves (Fig. 1). Non-invasive fetal ECG and fetal echocardiography agreed on all cases (26/26) on whether the fetus had normal rhythm or an arrhythmia. However, in one arrhythmic case the ECG miss-diagnosed the fetus with sinus pauses although it had been diagnosed with atrial tachycardia with variable conduction by echocardiography.

Conclusion The non-invasive fetal ECG allowed to diagnose for fetal arrhythmias and in most cases provided refinement on the arrhythmias when compared to fetal echocardiography. This is mainly due to the longer recording time and the possibility to automate the detection of abnormal rhythm events. However, in some cases the low resolution of the P-wave in the ECG traces (Fig. 2) made it difficult to resolve the mechanism behind the arrhythmia and in one case the low P-wave resolution led to an inaccurate diagnosis. The low-resolution of the extracted P-wave represents the main challenge for improving the diagnostic performance of fetal ECG. This paper is a proof of concept and a first step toward the creation of a fetal Holter ECG device. Such a device will offer new opportunities for fetal diagnosis and monitoring because it is low-cost, non-invasive, requires a minimal set-up, and can enable the detection of both persistent and intermittent fetal cardiac rhythm disorders.

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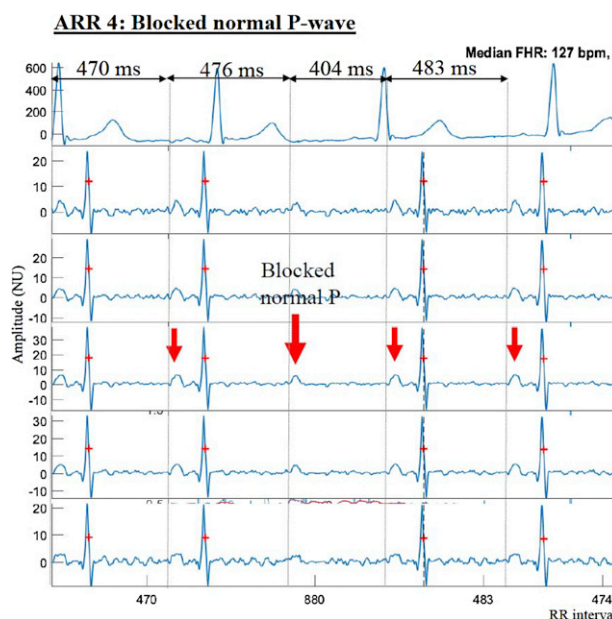


Fig. 1 Example of fetal ECG (5 lower lines) with the mother ECG (1st line). The red arrows point on the P waves. The longer arrow points on one blocked P-Wave.

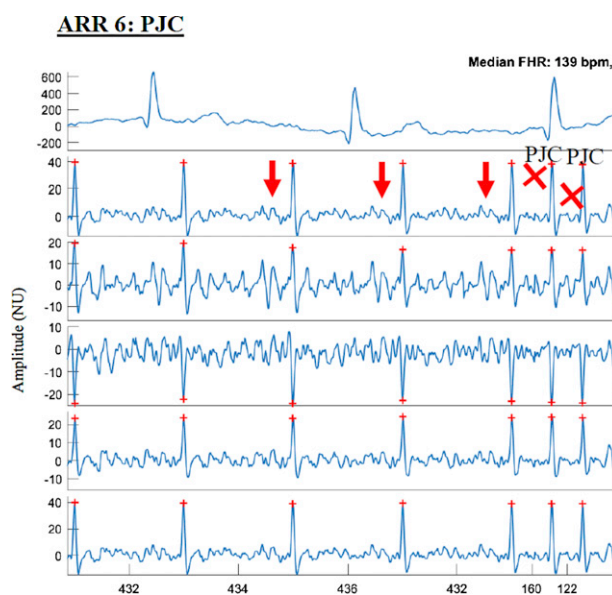


Fig. 2 Example of premature junctional contraction (PJC). The P waves (red arrows) are more difficult to detect in this example.

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