Non-invasive fetal electrocardiography

Possibilities of detecting heart disease

R. Vullings PhD MSc
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Fetal monitoring

Two major problems in obstetrics: *preterm delivery* and *asphyxia*

- >10k cases per year in NL
- Main cause of neonatal mortality
- >2k cases per year in NL
- Children often depend on care for the rest of their life.
- Follow-up costs > 900 k€

If diagnosed early, asphyxia and preterm delivery might be prevented
Fetal monitoring

External methods:
Unreliable and inaccurate.

Internal methods:
Risks and often too late.

Early diagnosis not possible with current technology
Heart disease

- Standard prenatal screening (20 weeks)
Heart disease
Heart disease

- Standard prenatal screening (20 weeks)
- About half of heart disease cases missed\(^1\)
  - More specialized screening? (expensive)
  - Extra information?

\(^1\) Randall et al. BJOG 112(1), 24-30, 2005
Non-invasive fetal electrocardiography

- Applicable throughout pregnancy
- Less discomfort to mother and free of risks to fetus
- Even more information than internal fetal monitoring

Potential of screening for fetal heart disease?
Non-invasive fetal electrocardiography

Fetal heart rate

RR-interval → heart rate
Non-invasive fetal electrocardiography
Non-invasive fetal electrocardiography
Non-invasive fetal electrocardiography

- Goal: diagnostic ECG
  - Required: fetal vectorcardiogram + fetal orientation
    - Palpation
    - Ultrasound

How to deal with movement?
Non-invasive fetal electrocardiography
Non-invasive fetal electrocardiography

- Goal: diagnostic ECG
  - Required: fetal vectorcardiogram + fetal orientation
Diagnostic fetal ECG

Non-invasive fetal ECG

Invasive fetal ECG
Diagnostic fetal ECG
Conclusions

- Non-invasive electrophysiological recordings can provide same quality of information as current invasive methods

- Because of multiple electrodes, even more information available
  - Detection and classification of arrhythmias
  - Diagnostic (e.g. Einthoven) ECG leads

- Diagnostic ECG information might lead to early detection of congenital heart disease and/or asphyxia.
Thank you

Contact: r.vullings@tue.nl