Fetal heart rate variability analysis for detection of asphyxia can be improved by including uterine activity information

Citation for published version (APA):

Document status and date:
Gepubliceerd: 01/01/2015

Document Version:
Uitgevers PDF, ook bekend als Version of Record

Please check the document version of this publication:
• A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
• The final author version and the galley proof are versions of the publication after peer review.
• The final published version features the final layout of the paper including the volume, issue and page numbers.

Link to publication

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:
www.tue.nl/taverne

Take down policy
If you believe that this document breaches copyright please contact us at:
openaccess@tue.nl
providing details and we will investigate your claim.

Download date: 25. Apr. 2020
Fetal heart rate variability (HRV) provides information on fetal distress. However, interpretation of fetal HRV during labor is difficult due to the influence of uterine contractions on fetal HRV. The aim of this study is to investigate whether separating contractions and rest periods in HRV analysis can improve the detection of fetal asphyxia.

Keyword(s): biosignals

1. INTRODUCTION

During labor, uterine contractions can cause temporal oxygen deficiency for the fetus. When oxygen deficiency is severe and prolonged, this can result in asphyxia which is associated with neonatal morbidity and mortality. It is therefore important that clinicians can timely intervene before asphyxia develops.

Recent studies have shown that valuable information for detection of asphyxia can be obtained by analysis of fetal heart rate variability (HRV) [1]. However, most HRV features have been developed for adults. Unlike for adults, changes in the fetal cardiovascular system during labor cannot be controlled, which makes interpretation of HRV features difficult. The aim of this study is to examine whether separating contractions and rest periods can improve HRV analysis for the detection of asphyxia during labor.

2. METHODS

A case-control study was performed using 14 fetuses with asphyxia (umbilical artery pH<7.05), matched with 14 healthy fetuses (umbilical artery pH>7.20). In this study, the standard deviation (SD), high frequency power (HF), and sample entropy (SampEn) were used. For each patient, HRV features were calculated using the final 15 minutes of good quality signal before birth (with less than twenty percent loss of fetal heart rate and no loss of uterine activity trace). A comparison was made between HRV features of fetuses with and without asphyxia, when calculated over the entire 15 minutes, and separately during contractions and rest periods.

3. RESULTS

No statistically significant difference was found between the two groups for HRV features calculated from the entire 15 minutes, separately during contractions, or separately during rest periods. However, when considering the ratio between HRV features calculated during contractions and rest periods, SD and SampEn were significantly lower for the group with asphyxia, as shown in Table 1.

Table 1. HRV features: ratio between contractions and rest periods. Results are shown as median [inter-quartile range].

<table>
<thead>
<tr>
<th>HRV feature</th>
<th>without asphyxia</th>
<th>with asphyxia</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD</td>
<td>1.5 [1.1-2.0]</td>
<td>1.1 [1.0-1.3]</td>
</tr>
<tr>
<td>HF</td>
<td>3.1 [1.5-4.5]</td>
<td>2.0 [1.1-4.1]</td>
</tr>
<tr>
<td>SampEn</td>
<td>1.9 [1.6-3.2]</td>
<td>1.4 [1.0-1.8]</td>
</tr>
</tbody>
</table>

4. CONCLUSIONS

Results in our study suggest that separating contractions and rest periods improves HRV analysis for the detection of asphyxia during labor. A larger dataset is required to validate our results for clinical practice.

References