Public summary of PhD-thesis of Marion Vlemmix
PhD-defense date: 23 May 2018

Real-time electrohysterography: A novel technology used on the labour ward

Uterine activity monitoring is one of the crucial intrapartum measurements for labour surveillance. Unfortunately, conventional uterine monitoring methods (i.e., the intra-uterine pressure catheter (IUPC) and external tocodynamometry (TOCO)) have major drawbacks. Electrohysterography (EHG) is an innovative technology comprising electrodes on the maternal abdomen to measure the underlying uterine biopotentials and, from these, provide an EHG-based tocogram. EHG could enhance external uterine monitoring compared to TOCO due to the less position-sensitiveness by the adhesive contact electrodes, and the improved sensing despite of excessive subcutaneous tissue in obese patients. Additionally, instead of the global variations of intra-uterine pressure measured by IUPC on the one hand, or an average change of the abdominal wall curvature provided by external TOCO on the other hand, EHG provides more localised measurements by measuring the origin of uterine contractions. As recently several real-time EHG systems have been developed, this technology is therefore becoming available for daily practice on the labour ward.

In this PhD-thesis we validated a novel real-time EHG technology and studied the diagnostic value, advantages and limitations of EHG for uterine monitoring during term labour. In a prospective diagnostic accuracy study, we tested the performance of an EHG system in 52 women who were simultaneously exposed to IUPC, TOCO and EHG for two hours. The results revealed that EHG has a high sensitivity for uterine contraction detection with IUPC as reference, and the sensitivity of EHG was significantly higher than TOCO. EHG could also enhance external uterine monitoring in obese women as it was significantly less influenced by maternal obesity than TOCO. However, when using EHG in clinics, physicians do need to be aware that EHG detected a higher number of contractions compared to both IUPC and TOCO, possibly due to measuring the origin of contractions instead of its result.

Users’ and patients’ preferences were evaluated by customized questionnaires. The patients indicated to prefer EHG over IUPC and TOCO. The placement and presence of EHG electrodes were considered as the least cumbersome, while TOCO was preferred for sensor removal. Our participants reported increased physical discomfort due to the TOCO belt and its frequent need for repositioning. Healthcare professionals instead, reported ambiguous results regarding their preferences for either of the external methods. They advised several technical alterations for EHG such as a wireless and waterproof system with an integrated impedance meter.

In conclusion, this PhD-thesis shows that EHG is a sensitive method to improve external uterine monitoring throughout term labour for both non-obese and obese women. Moreover, it provides clinicians an extended overview of EHG characteristics for uterine monitoring during term labour that could be useful for optimal interpretation of EHG traces in clinics. In addition, it aids clinicians in better weighing the advantages and disadvantages of EHG versus IUPC and TOCO; i.e., the accuracy and invasiveness of IUPC, and the inaccuracy and safety of TOCO. Overall, this thesis supports obstetricians to start using real-time EHG on the labour ward.

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