Non-Invasive Uterine Electromyography in High BMI Laboring Patients

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Research Question

Is non-invasive uterine electromyography, specifically for high BMI labor patients' contractions, accurate against existing sensors (TOCO and IUPC)?

Background

Non-invasive uterine electromyography is an alternate way to record contractions in laboring patients, using electrical activity in the uterine muscle. Most notably, it is non-invasive and does not need to be readjusted once placed.[2] Contraction output from the tocodynamometer significantly deteriorates as the patients' BMI becomes higher. Intrauterine pressure catheter, while the gold standard, requires rupture of membranes and therefore, is a higher risk of infection. Even in cases of high BMI, the contraction accuracy from uterine electromyography remains high.

Methods

156 laboring, term patients from SSH's BU and MSC units were monitored with MindChild's Meridian M110 device and either the tocodynamometer or intrauterine pressure catheter (TOCO or IUPC) simultaneously. True positive, false positive, and false negative contractions were recorded against the contraction method used by the labor management team (TOCO or IUPC). Sensitivity and positive predictive value of contractions were calculated using statistical formulas.

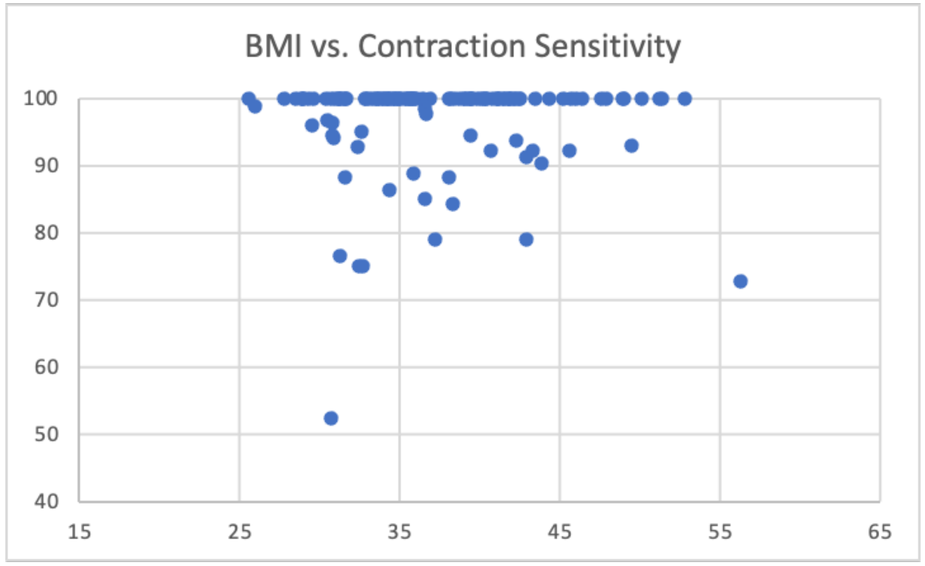
$$\text{Sensitivity: } \frac{TP}{TP+FN}$$

$$\text{Positive Predictive Value: } \frac{TP}{TP+FP}$$

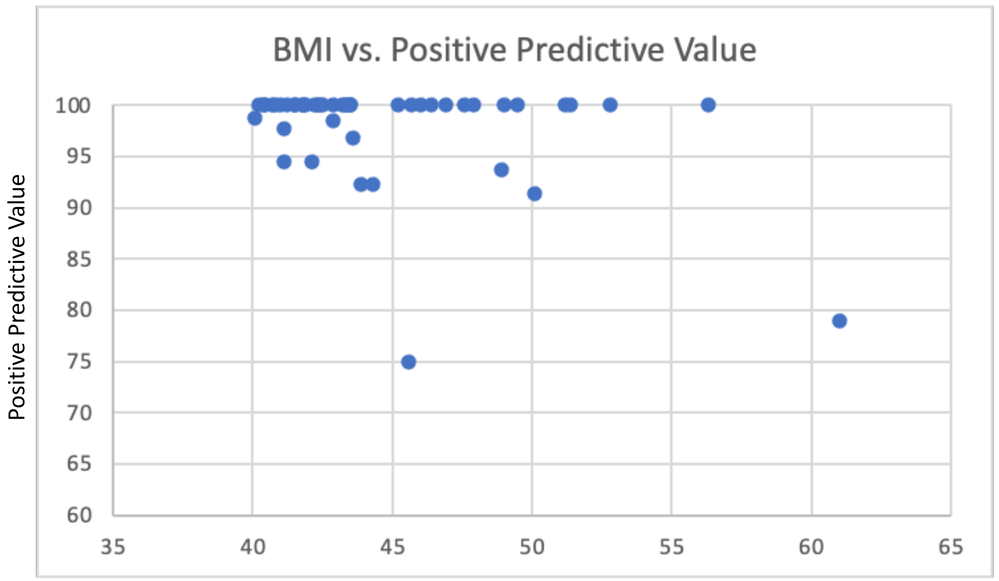
True Positive=TP
False Negative=FN
False Positive=FP

Results

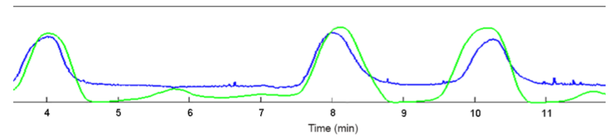
- The sensitivity of the uterine EMG in the study participants from the Meridian M110 was calculated to be 96.4129 overall.
- The positive predictive value was 93.3972.



- As BMI increases, the contraction sensitivity and positive predictive value remains relatively constant, with few outliers throughout the BMI spectrum.
- 48 patients with a BMI of 40 or higher had a contraction sensitivity rate of 96.084%, while the positive predictive value was 90.716.



Results cont.



Visual example of simultaneous contraction monitoring with existing sensors vs. Meridian M110[3]

- Meridian M110 in green
- IUPC in blue

Discussion/Recommendations

The use of non-invasive uterine EMG is a useful and accurate tool to use for laboring patients, especially those of higher BMI, where the TOCO or IUPC is not feasible. Members of the labor management team must constantly readjust the TOCO, taking time away from other nursing and patient care activities. In addition, the placement of the IUPC requires rupture of membranes and increases risk of infection.[4] It also requires advanced first stage of labor. Uterine EMG performs well against the existing hardware, as shown by the high sensitivity rate and positive predictive value, especially in patients with a BMI of 40 and above. This tool can be used by the labor management team for increased patient comfort and reduced adjustment time for high BMI labor patients. This can potentially decrease the number of birth complications and unnecessary cesarean sections, improving birth outcomes for mother and baby.

References

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Conflict of Interest Declaration

COI Declaration: Adam Wolfberg, Jay Ward, and Jim Robertson own equity in and are officers in MindChild Medical, Inc,: the sponsor of the study