

ELECTRICAL INHIBITION (EI) OF PRETERM UTERINE ELECTRICAL AND MECHANICAL ACTIVITY

Jeffrey Karsdon¹, Kathryn E Patrick¹, Frederick Naftolin², Neil Euliano³ and Anthony Gregg¹

¹University of Florida, USA

²New York University Medical Center, USA

³O B Medical, Gainesville, USA

Introduction: Uterine smooth muscle electrical activity precedes mechanical contractions and can be monitored with uterine electromyogram (EMG). A novel localized electrical method is proposed, electrical inhibition (EI), that uses a weak electrical current as a theorized uterine pacemaker to alter preterm activity of the uterus. The effect of EI on uterine activity can be objectively monitored using uterine tocodynamometry (TOCO) and EMG. The investigators hypothesis, preterm uterine electrical and mechanical activity can be inhibited by EI.

Methods: Patients in preterm labor between 24-34 weeks gestation were identified and consented as per an IRB-approved protocol. An FDA-approved EI catheter was placed into the vagina adjacent to the posterior cervix under ultrasound guidance. Each patient underwent a 20-minute pre-EI (C1) period, a 20-minute EI intervention (EI) period, and a 20-minute post-EI control (C2) period. EI was administered by the FDA-approved EI device. During the EI intervention, a constant bipolar current (0-20 mA at 0-50 Hz) was manually administered for 10 s with a pulse duration of 0-20 ms at the time of a contraction based on EMG recording. Uterine EMG was recorded with abdominal surface electrodes. The uterine EMG was computerized to produce the electro-hysterogram (EHG) and EMG power spectral density (PSD). TOCO and EHG contraction frequency or peak-to-peak (P-P) interval and EMG peak frequency (Pf) were calculated from the PSD. A paired student t-test was used to analyze differences in P-P and Pf between each C1, EI, and C2 periods at the 0.05 significance level.

Results: The average Pf was significantly decreased between C1 and EI intervention periods (0.306 vs. 0.221 Hz, $p=0.045$) as well as between C1 and C2 periods (0.306 vs. 0.202 Hz, $p=0.022$). The average P-P interval was significantly increased between C1 and EI periods (7.1 vs. 11 min, $p=0.047$). Finally, uterine contraction frequency on TOCO was decreased between C2 and C1 periods (5.5 vs. 8.3 min). There were no adverse events in either mother-neonate dyad related to EI intervention.

Conclusion: Preterm human uterine electrical and mechanical activity were decreased with EI. Knowledge from this study could advance the field of preterm birth prevention by supporting the development of an electroceutical tocolytic that obviates the systemic maternofetal side effects of traditional tocolytics.