Electrical inhibition (EI) of preterm uterine electrical activity, uterine mechanical activity and preterm birth

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Background: Uterine smooth muscle electrical activity precedes and controls the preterm uterine mechanical contractions. This is monitored with electromyogram (EMG), electrohysterogram (EHG) and tocodynamometry (TOCO). EHG is a more objective measure of contraction force than the TOCO.

Objective: EI of preterm uterine EMG and subsequent inhibition of mechanical activity (frequency and force).

Study Design: Women in preterm labor at 24-34 weeks gestation had standard monitoring of TOCO and fetal heart rate (FHR) with simultaneous external monitoring (OBMedical, Gainsville, FL) of EHG and fetal electrocardiogram (fECG). An electrical pacemaker gave EI to an electrode catheter placed into the vaginal posterior fornix next to the cervix. EI was a bipolar constant current square wave pulse: 0-10mA, 0-28ms/pulse, 0-30 Hz. There were 3 groups of EI: 20, 40 or 80 minutes. EI was a 10-second burst only during a monitored contraction. Each group had 20 minutes of pre-EI sham control (C1) and post-EI sham control (C2). Outcome measures were TOCO and EHG contraction frequency or peak-to-peak (P-P) interval and EMG power spectral density (PSD). Differences in the estimated means of P-P and PSD for the C1, EI, and C2 periods used a mixed-model analysis of variance and a paired t-test with a 0.05 two-sided significance level.

Results: Electrical PSD and mechanical TOCO and EHG P-P all decreased during EI compared to C1 and C2. FHR and fECG were unchanged. Also, EI decreased uterine resting tone.

Conclusions: This is the first EI study of human preterm uterine electrical and mechanical activity i.e. contraction frequency and force. EI is an electroceutical tocolytic with no systemic side-effects on mother or baby. The EI mechanism is unknown, but may produce membrane hyperpolarization. EI decreased preterm uterine resting tone that may increase placental blood flow. EI may decrease the resting tone of other smooth muscles in certain neonatal pathologies e.g. persistent pulmonary hypertension of the newborn.

Recent Publications

Biography
Jeffrey Karsdon completed his medical education at the Free University of Brussels, Belgium. After completing his pediatric residency in New York and neonatology fellowship in San Francisco he worked at the University of Leiden, the Netherlands for 7 years before returning to the United States. He is a Clinical Neonatologist and Scientist with a passion for preventing preterm birth. His innovative approach to inhibiting the uterine contractions of a preterm birth with an electrical pacemaker is a paradigm shift in preventing preterm birth. It allows for a very localized and rapid inhibitory effect with no systemic side-effects. He is pioneering the way to an electroceutical tocolytic and into a new era of interventional uterine electrophysiology. His unique method of inhibiting smooth muscle contractions and tone paves the way for treating other pathologies caused by increased smooth muscle tone.

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