383 INCREASES IN HUMAN FETAL HEMOGLOBIN OXYGEN SATURATION DURING LATE FETAL HEART RATE DECELERATIONS AS A RESPONSE TO INTRAUTERINE STRESS. J. Van Hook, C. Harvey, G. Anderson, T. Shailer, L. Troyer. Dept. OB/GYN, The University of Texas Medical Branch, Galveston, TX.

OBJECTIVE: The goal of this study was to measure capillary oxygen saturation during late fetal heart rate decelerations in the term human fetus to support or refute evidence that suggests the well-oxygenated fetus may exhibit periods of late decelerative heart rate events.

STUDY DESIGN: The study group was composed of term human fetuses enrolled in one intrapartum fetal pulse oximetry study who subsequently developed late decelerations during labor. A Nellcor N-400 reflectance fetal oximeter applied to the fetal presenting part was used to measure fetal hemoglobin saturation (SpO2). The fetal heart rate was measured with a direct spiral electrocardiogram and fetal ICG pigments were used to validate fetal photoplethysmographic data. Toccodynamometry, maternal uterine activity and intrapartum pressure catheters were placed when clinically indicated. Clinicians were blinded to fetal SpO2 results, and analysis was performed retrospectively at the conclusion of each case.

RESULTS: 167 patients were initially included in the study. All were term cephalic presentation at active labor. Mean gestational age (±SD) was 39.4 weeks (±3.3). Late decelerations were identified in 40 patients. The corresponding fetal hemoglobin saturation responses were divided into two groups: increased and decreased fetal SpO2. Increased saturation was measured in 30 fetuses during late decelerations; baseline and maximal saturations were 57.1% ± 12.5 and 71.3% ± 10.6 respectively. Nineteen fetuses decreased saturation during late decelerations; baseline and maximal saturations for this group were 66.4% ± 10.3 and 50.5% ± 10.8 respectively. There was no difference in neonatal outcome between the groups. No relationship between sequence, severity or frequency of late decelerations and the change of fetal SpO2 was observed.

CONCLUSIONS: Late deceleration heart rate patterns occur in healthy fetuses with normal baseline predicted oxygen saturation values. The two patterns of fetal SpO2 change (increased and decreased SpO2) suggest a biphasic response that may occur with late decelerations. This may represent a physiologic protective mechanism whereby oxygenated fetal blood is selectively shunted to the fetal upper body during intrapartum stress.


OBJECTIVE: Previous studies evaluating the effect of maternally-administered oxygen on the human fetus during labor have conflicting conclusions and have failed to evaluate the fetal SpO2 after oxygen was discontinued. The objective of this study was to confirm or disprove previously reported conclusions and to additionally evaluate the fetus after oxygen therapy had been discontinued.

STUDY DESIGN: Maternal-fetal cohorts who were term, in active labor, and who had continuous electronic fetal pulse oximetry were enrolled. Entry criteria required a baseline fetal SpO2 of > 35% for a minimum of one hour as measured by a Nellcor N-400 fetal pulse oximeter and 2 fetals in the cohort were selected to measure fetal hemoglobin saturation (SpO2) at baseline and during therapy. Oxygen therapy was administered to the mother via non-rebreathing face mask at 1 LPM for 10 consecutive minutes. Oxygen therapy produced individualized responses in the fetal subjects with 2 increasing SpO2 values; 2 with no change in saturation; and 1 exhibiting a decrease in SpO2. The post therapy measurements demonstrated a significant decrease from original baseline values in an average of 14.2 percentage points for a mean decrease of 22.3% (p<0.005).

CONCLUSIONS: This data suggests that individual fetal response to maternal oxygen therapy during the intrapartum period may be variable and dependent upon multiple variables. The physiologic mechanism(s) that produced significantly lower fetal SpO2 values remain unclear. Hypothesized explanations include hypoxemia secondary to the mother and/or direct alterations in uteroplacental blood flow. Additional studies are needed to confirm these findings and to further analyze the effect of duration of oxygen therapy on the human fetus.


OBJECTIVE: The null hypothesis is that there is a correlation between fetal O2-saturation during labor and the fetal outcome.

STUDY DESIGN: 232 deliveries were monitored by fetal pulse oximetry with a probe developed by Rall and Knitza. The deliveries were classified by the umbilical-cord-pH at delivery and the Apgar score. SpO2-values during the last 60, 30 and 10 minutes and the last minute of labor were correlated to the fetal outcome. Cases with bad fetal outcome were checked on periods of low O2-saturations.

RESULTS: A correlation was found between the O2-saturation during the last 60 minutes of labor and the fetal outcome in low pH-groups but not in the group of children with low Apgar score but normal umbilical-cord-pH.

CONCLUSIONS: Not only the average O2-saturation in the last 60 minutes of labor is of mean influence on the fetal outcome but also point of time, duration and degree of low SpO2-values as expression of a possible hypoxia.

ACKNOWLEDGMENT: This presentation is part of the dissertation of Irina Schaffner at the LMU, Munich, in preparation.


OBJECTIVE: RPOX is a non-invasive method to estimate the arterial oxygen saturation (SaO2) continuously and may become a monitoring technique during labor. We investigated the accuracy of 2 types of RPOX sensors, the currently used sensor with a light emitting diodes (LEDs) combination of 660/890 nm (Nellcor, CA) and a new combination of 735/890 nm (Nellcor, CA).

STUDY DESIGN: Under general anesthesia (0.6% enflurane in 50/50 O2 and N2O) 6 Dutch piglets were instrumented. Sensors were placed randomly left or right on the groin. Saturation values of the prototype Nellcor N-400 oximeter (SpO2) were compared to blood sample SaO2 values obtained from the carotid artery. Stepwise desaturation levels were achieved by changing the gas mixture from 30% O2 to 7%.

RESULTS: The figure shows the results of the 660/890 nm and 735/890 nm (Nellcor, CA). The oesophageal-cord-pH at delivery and the Apgar score, SpO2-values during the last 60, 30 and 10 minutes and the last minute of labor were correlated to the fetal outcome. Cases with bad fetal outcome were checked on periods of low O2-saturations.

CONCLUSION: The new 735/890 nm RPOX sensor has a much better performance than the old 660/890 nm sensor in piglets, which could be of great advantage for the development of accurate fetal RPOX systems.