INCREASES IN HUMAN FETAL HEMOGLOBIN OXYGEN SATURATION DURING INTRAUTERINE STRESS. J. Van Hook, C. Harvey, G. Anderson, T. Shailer, L. Troyer. Dept. OB/GYN, 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 interventional fetal pulse oximetry study who subsequently developed late decelerations during labor. A Nellcor N-400 refleximetric 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 electrode and fetal ECG signals were used to validate fetal plethysmographic data. Tocodynamometers were employed to record 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 presentations in active labor. Mean gestational age (±SD) was 39.4 weeks (±2.5). 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 12 fetuses during late decelerations; baseline and maximal saturations were 56.3±12.6 and 71.3±10.6, respectively. Nineteen fetuses demonstrated decreased saturation during late decelerations; baseline and maximal saturations for this group were 56.4±10.3 and 56.3±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 preductal 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.

THE EFFECTS OF MATERNALLY-ADMINISTERED OXYGEN ON HUMAN FETAL SPO2 VALUES DURING LABOR. G. Anderson, C. Harvey, J. Van Hook, T. Shailer, L. Troyer. Dept. OB/GYN, University of Texas Medical Branch, Galveston, TX.

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: Material: 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 > 55% for a minimum of one hour as measured by a Nellcor N-400 fetal pulse oximeter and FS-10 reflectance sensor applied to the fetal presenting part. Oxygen was administered to the mother via non-rebreathing face mask at 1L/min for 20 minutes and discontinued. Continuous fetal SpO2 data were obtained and recorded during therapy and 30 minutes post therapy.

RESULTS: Six mother-fetus pairs met the study criteria. One pair was excluded from analysis due to delivery during the study period. Of the 5 completed studies, mean fetal SpO2 at baseline prior to oxygen therapy was 55.2% (range 43-70%). Oxygen therapy produced individualized responses in the fetal subjects with 2 increasing SpO2 values and 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 14.5 percentage points for an 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 varied and dependent upon multiple variables. The physiologic mechanism(s) that produced significantly lower fetal SpO2 values remain unclear. Hypothesized explanations include hyperoxia, acidosis of the mother and/or direct alteration 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 dimension 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 Diode (LED) combination of 660/890 nm (Nellcor, CA) and a new combination of 735/890 nm (Nellcor, CA).

STUDY DESIGN: Under general anaesthesia (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 gasmixture from 30% O2 to 5%.

RESULTS: The figure shows the results of the 660/890 nm and 735/890 nm RPOX sensors, respectively. The overall precision was 12.9% (n=199) for the currently used 660/890 nm sensor. The overall precision for the new 735/890 nm sensor was 5.4% (n=176) and showed a very good correlation between 28-100% SaO2.

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.