Fetal Pulse Oximetry Before and After Rupture of Membranes

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Introduction: Monitoring fetal oxygen saturation in utero by means of fetal pulse oximetry (FPO) presents important challenges to instrument design. The selection of an effective monitoring site on the fetus is essential. FPO performed on the scalp (as the presenting part of the fetus) or other parts of the head and neck has numerous problems. Among these are caput, variability in pressure at the cervix and pelvis, the presence of superficial pulsating vessels (temporal, mandibular, and carotid arteries), and difficulty in monitoring breech presentation. These devices require rupture of membranes prior to monitoring, limiting the potential application of fetal pulse oximetry throughout difficult or worrisome labor.

The fetal torso offers an alternative site for monitoring fetal oxygen saturation that is larger than the sites on the head/neck, free of pulsating superficial vessels, and not subject to the same degree of compression as the presenting part of the fetus. The OB Scientific™ OBS-900 Fetal Oxygen Saturation sensor is designed for intrauterine placement on the fetal torso, preferably the auscultatory triangle on the back. The sensor is designed to permit extraovular placement, that is, monitoring fetal oxygen saturation with membranes intact.

Method: A retrospective review of recent cases employing the OBS-900 sensor was conducted to examine the efficacy of monitoring after extraovular sensor placement. Clinical trial records provided the trends and availability of fetal SpO_2 and pulse rate, and the percentage of their availability. By analyzing files from a database of full-resolution sensor signals corresponding to these cases, it was also possible to compute the trend of detected versus emitted light intensity (I_d/I_e) for both red and infrared wavelengths. These parameters were compared for the period of labor just before and after rupture of membranes.

Results: A total of eight cases out of the sixteen available represented extraovular sensor placement and offered sufficient data before and after rupture of membranes for analysis. SpO_2 and pulse rate were both found to be significantly lower in the period of time after rupture. Availability of these parameters and signal intensities were not found to be significantly different. Results for the three cases with notable meconium were substantially the same.

Conclusions: The review confirmed our qualitative impression from a larger sample ($n > 100$) that extraovular placement was an effective way to monitor fetal oxygen saturation without rupture of membranes. Possible reasons for a downward trend in values include artifact, physiological changes associated with rupture itself, and changes seen later in labor independent of time of rupture. The lack of significant differences in light intensities makes shunting through membranes and/or fluid an unlikely explanation. Further studies will explore this question as well as comparing results for sensor placement before versus after rupture of membranes.