Regional Oxygen Saturation of the Brain during Birth Transition of Term Infants: Comparison between Elective Cesarean and Vaginal Deliveries

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Objective To evaluate differences in regional oxygen saturation of the brains of term infants of vaginal or cesarean deliveries.

Study design Vaginal delivery (n = 63) and elective cesarean delivery infants were prospectively evaluated for the first 10 minutes after delivery. Peripheral arterial oxygen saturation (SpO_2) and heart rate were measured on the right hand using pulsoximetry with near infrared spectroscopy. Regional oxygen saturation of the brain (rSO_2brain) was measured. Fractional tissue oxygen extraction was calculated for each minute.

Results From 4 to 8 minutes, SpO_2 values for cesarean delivery infants were significantly lower than for vaginally delivered infants. Heart rate of the cesarean delivery infants was significantly lower throughout the whole observation period. There was no difference between groups in rSO_2brain. Fractional tissue oxygen extraction only differed at minute 10.

Conclusions Although SpO_2 and heart rate were significantly lower in cesarean-delivered infants, there were no differences in rSO_2brain with respect to mode of delivery. *(J Pediatr 2011;159:404-8)*.

The transition from fetus to newborn is a complex physiological process. In recent years, interest has grown in the use of pulsoximetry to monitor arterial oxygen saturation during this transitional period.[1-3] All newborn infants have oxygen desaturation at birth. A newborn infant undergoing normal postnatal transition needs more than 5 minutes to attain an arterial oxygen saturation >80% and almost 10 minutes to reach 90%. Several studies have shown that there are significant differences in the time course of arterial oxygen saturation (SpO_2) according to the mode of delivery. Newborn infants after elective caesarean delivery have lower SpO_2 values during transition compared with infants after vaginal delivery.[1-3]

There is an ongoing discussion about the use of supplemental oxygen during neonatal resuscitation because it is not known which oxygen concentration is appropriate for preterm and term infants during resuscitation.[3,4] Because the brain is the most vulnerable organ system of the infant, a more direct way to assess its oxygenation in a simple noninvasive way would be useful. A new approach to cerebral oxygenation is to measure regional oxygen saturation using near infrared spectroscopy (NIRS).

Spatially resolved spectroscopy, a new NIRS method, was recently introduced for evaluation of regional oxygen saturation (rSO_2).[5] With this technology, it is possible to measure regional tissue oxygen saturation in different organ systems (brain, kidney, liver, muscle, and others) or body regions (preductal and postductal peripheral tissues). There are some reports of regional oxygen saturation of the brain (rSO_2brain) on the first day of life,[6-10] during the first weeks, and during birth transition.[11-13]

A question remains as to whether rSO_2 of the brain shows significant differences during transition according to mode of delivery in analogy to SpO_2 behavior. Therefore, we measured rSO_2 brain in newborn infants after vaginal delivery and elective cesarean delivery to evaluate whether there was a significant difference.

Methods

In this prospective, observational study, we included newborn infants >37 weeks gestational age delivered after an uncomplicated pregnancy. Two groups were formed according to the mode of delivery, either vaginal delivery or delivery by elective cesarean delivery. All infants with malformations were excluded. Only infants after uncomplicated vaginal delivery were included. Infants from vacuum-assisted or forceps deliveries were excluded. All infants in need of any respiratory support or supplemental inspired oxygen during transition were excluded. Only infants with uncomplicated transitional periods were included.

CBF	Cerebral blood flow
HR	Heart rate
NIRS	Near infrared spectroscopy
rSO_2	Regional oxygen saturation
rSO2 brain	Regional oxygen saturation of the brain
SpO_2	Peripheral arterial oxygen saturation

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