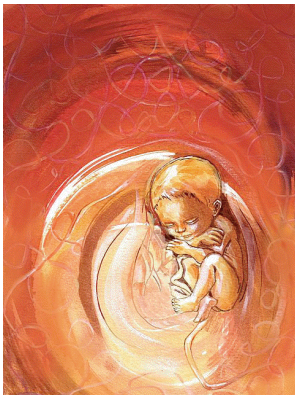




Enough is Enough

While a parturient is undergoing cesarean section under neuraxial anesthesia does it make much of a difference to the fetus if she receives supplemental oxygen via nasal cannula at 2 liters per minute or by way of a venturi mask at 10 liters per minute?



Surprisingly, evidence seems to tell us that it makes very little difference to the fetus whether she breathes room air or receives an FiO_2 of 1.0. Underpinning this contention is a study which randomized forty-four healthy parturients to breathe either 21% (air group) or 60% oxygen (oxygen group) intraoperatively via a ventimask. What this study revealed was that at delivery, the oxygen group in comparison to the air group had a greater but really not significantly or clinically different umbilical venous PO_2 [4.8 vs 4.0 kPa*; mean difference 0.8 kPa, 95% confidence interval 0.0–1.5 kPa, $P=0.04$] (1). A companion study reinforced this finding when it was shown that mean umbilical venous oxygen content during general anesthesia for cesarean section at delivery was 7.6 kPa vs 4.7 kPa vs 4.0 kPa when the parturient received a FiO_2 of either 1.0, 0.5 or 0.3, respectively. Again the difference in the values was considered clinically and statistically insignificant. Moreover apgar scores as well as neonatal neurologic and adaptive capacity scores were similar between the groups (2). And if this is not enough to give you pause, consider that recent reports have speculated that supplemental maternal O_2 during C/S may actually be detrimental to both mother and fetus because high inspired oxygen concentrations tend to increase free radical formation and lipid peroxidation. Frankly I'm not certain what this means but those in the know seem to feel that free radicals may cause depletion of the neonate's intrinsic antioxidant systems and thus weaken the infant's ability to withstand any subsequent neonatal insult (3).

Okay, fair enough. Does this mean that the parturient should never be given supplemental oxygen? Well, not to my way of thinking especially when it has been shown that supplemental oxygen given to the parturient under epidural anesthesia improves fetal oxygen stores and acid-base status during cesarean section (4). And in my mind, if the fetus has been compromised at any time during the parturient's labor, I'm going to do my best to improve fetal well being and if giving oxygen to mother offers that hope, then that is what I'm going to do. But how much oxygen does one give?

Well, fortunately researchers have actually set out to answer this question. One study in particular(4) examined the effects of administering various concentrations of oxygen to 40 healthy patients undergoing elective cesarean sections under lumbar epidural anesthesia. In this study, patients were divided into four equal groups and each group inhaled oxygen at a FIO₂ of 0.21, 0.47, 0.74 (in nitrogen), or 1.0. What they found reinforces my contention that under neuraxial anesthesia, the parturient should minimally receive an FiO₂ of 60%. What they found was that at delivery, even though maternal PaO₂ levels increased from 96 +/- 4 (1 SE) torr during exposure to a FIO₂ of 0.21 to 232 +/- 6, 312 +/- 16, and 423 +/- 6 torr while breathing FIO₂ of 0.47, 0.74 and 1.0, respectively, umbilical vein PO₂ levels increased from 28 +/- 1 to 36 +/- 1.5, 41 +/- 1.3 and 47 +/- 1.2 . Not a big increase, you say? Consider that under normal conditions, that is, when the parturient is walking around, not in labor or under the influence of anesthesia, fetal umbilical venous PO₂ is about 35mmHg. But labor and any anesthetic intervention changes this maternal-fetal dynamic. Umbilical venous content begins to fall. And it behooves us, as anesthesia practitioners, to maintain umbilical venous PO₂ to as close as normal as possible and giving 2 liters per minute nasal oxygen just doesn't fit the bill. And by the way, the concern about producing oxygen free radicals by administering high FiO₂ is, in my opinion, being a bit too obsessive when you consider that there are several alternative pathways to producing free radicals. For example, increased concentrations of lipid peroxides have occurred during prolonged labour, fetal distress, oligohydramnios and tight nuchal cord entanglement (5-10). Furthermore, I think the study by Khaw et al. (11) assuages this concern about too much oxygen. In their study of 131 women undergoing emergency c-section using regional anesthesia, 60% oxygen administered via a venturi-type face mask to the parturients not only increase umbilical venous blood oxygen content but failed to produce lipid peroxidation** in either the mother or fetus.

**1 kPa = 7.5 mm Hg*

*** researchers measured 8-isoprostane, which is produced in vivo through free radical-catalysed peroxidation of arachidonic acid and reflects oxidative stress,*

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