Resuscitation With 100% Oxygen: Should We Change Our Ways?

A review of: Vento M, Asensi M, Sastre J, *et al.* 2001 Resuscitation with room air instead of 100% oxygen prevents oxidative stress in moderately asphyxiated term newborns. Pediatrics 107:642–647

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Over the last several years, new guidelines have been developed for resuscitation of term newborns with the use of 100% oxygen continuing to be considered standard of care (1). However, there has been increased emphasis on the role of reactive oxygen species in the pathogenesis of a wide variety of neonatal insults, most notably ischemia/reperfusion injury associated with perinatal asphyxia. This has led investigators to question the validity of using 100% oxygen in neonatal resuscitation.

In a recent issue of Pediatrics, Vento and colleagues (2) randomized 40 newborns needing resuscitation at birth to room air (RAR) or 100% oxygen (OR) and compared them to control infants. Their findings are quite provocative and are similar to those reported by Saugstad et al. (Resair 2 Study) (3) with RAR infants demonstrating significantly less time to onset of first cry and a sustained ventilatory pattern, as well as better five minute Apgar scores. The investigators then analyzed reduced (GSH) and oxidized (GSSG) glutathione concentrations and the activities of the antioxidant enzymes superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GPX) in red blood cells. Infants requiring resuscitation had evidence of increased oxidant production in utero, characterized by increased concentrations of prooxidants (GSSG) and cord blood antioxidant enzyme activities. While both resuscitation groups continued to have higher GSSG and antioxidant enzyme activity at 72 hours, only the OR infants still demonstrated these abnormalities at 28 days.

While these findings favor RAR, there are several issues that limit their applicability. Despite the use of the term moderate asphyxia, the authors describe a population that is better labeled infants with poor transition. These infants do not appear to meet the current American College of Obstetrics and Gynecology criteria for asphyxia since umbilical artery pH was 7.09–7.11 and median Apgar scores were 9 at ten minutes in the RAR and OR groups. None of the infants appeared to require intubation and mechanical ventilation and there is no mention of multisystem organ damage. The utility of these findings and medical-legal implications for truly asphyxiated infants (the most vulnerable population) must be questioned. In fact, recent studies in asphyxiated newborn piglets suggest that OR promotes more rapid cardiovascular stability compared to RAR (4).

It is intriguing that the prooxidant changes in red blood cells persisted for 28 days in the OR group despite the apparently mild nature of the in utero insult. The authors speculate that hyperoxygenation may set up an inflammatory process that persists for 28 days. Whatever the pathophysiology, the clinical relevance of these findings is unclear, since no differences were found in either clinical or neurologic follow-up at 28 days. However, as recent long-term follow-up studies on the use of dexamethasone in premature infants have shown, 28 days may not be sufficient to predict neurodevelopmental outcome in the future.

1. American Academy of Pediatrics and American Heart Association. 2000 Manual of Neonatal Resuscitation
2. Vento M, Asensi M, Sastre J, Garcia-Sala F, Pallardo F, Vina J 2001 Resuscitation with room air instead of 100% oxygen prevents oxidative stress in moderately asphyxiated term newborns. Pediatrics 107:642–647
3. Saugstad O, Rootwelt T, Aaalen, O 1998 Resuscitation of asphyxiated newborn infants with room air or oxygen: an international controlled trial: the Resair 2 study. Pediatrics 102(1) URL:http://www.pediatrics.org/cgi/content/full/102/1/el
4. Solas A, Kalous P, Davis J, Saugstad O 2001 The effects of recombinant superoxide dismutase (rh-SOD) and reoxygenation with 21% or 100% O_2 in asphyxiated newborn piglets. Pediatr Res 49:307A.

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