Optimizing oxygenation of the preterm infant directly at birth: focus of future studies

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To the Editor:

The optimal oxygen concentration during stabilization of extremely preterm infants at birth was recently discussed by Saugstad et al.[1] The authors comment on the findings of our randomized clinical trial, which compared commencing stabilization of extremely preterm infants with 100% vs 30% O_2.[2] With careful titration, commencing with 100% O_2 increased respiratory effort and did not increase the risk of hyperoxia.[2] Saugstad et al question the implication of these findings and recommend against initiating stabilization with 100% O_2. However, this recommendation is partly opinion-based and appears to overlook that the lung's oxygen exchange capacity gradually increases as the lung aerates.[3] Therefore, a higher oxygen pressure gradient is initially needed when the gas exchange regions are mostly liquid-filled. In a study cited by Saugstad et al, very preterm infants were resuscitated with either 90% or 30% oxygen, which produced identical changes in oxygen saturation levels.[4] This must have resulted from a large discrepancy in ventilation, lung aeration, or cardiac function between the 2 groups because the partial pressure of oxygen at the gas exchange surface will be ~670 mm Hg with 90% and ~210 mm Hg with 30% oxygen. Such a discrepancy has been observed previously because of a big difference (~20 cm H_2O) in the applied airway pressure support.[5] Saugstad et al also suggest that larger trials are warranted to demonstrate the effect of initial fraction of inspired oxygen (FiO_2) on neurodevelopmental outcomes. Although we do not disagree with this sentiment, this outcome is remote from the intervention and subject to a myriad of complicating factors that undermine the outcome. Thus, large trials with large sample sizes are needed that are both time- and cost-consuming. Perhaps we should acknowledge that an initial high FiO_2 improves respiratory effort and focus future studies on how to titrate FiO_2 optimally instead.

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Reply

To the Editor:

We agree with Dekker et al that their small, randomized trial did not show an increase in the risk of hyperoxia with the use of 100% oxygen.[1] We acknowledge that in this trial, respiratory effort was improved in the 100% oxygen group (as shown in the graphic abstract). We also agree that the gradient between PiO_2 (partial pressure of inspired oxygen), PaO_2 (partial pressure of alveolar oxygen), and PaO_2 (partial pressure of arterial oxygen) is high soon after birth and improves with time and emphasized this in Figure 3 of the commentary. In addition, we want to point out that there is a potential for significant discrepancy in the relationship between PaO_2 and preductal oxygen saturation (SpO_2) in neonates.[2]

The letter questions the discrepancy between SpO_2 achieved during the first few minutes in a previous study by Vento et al comparing 30% and 90% inspired oxygen[3] and the Dekker et al study comparing 30% and 100% oxygen.[1] The infants in the 90% arm of the Vento et al study were of lower gestational age (26.3 ± 1.3 vs 27.3 ± 1.9 weeks) and birth weight (902 ± 195 vs 1000 ± 291 g) and higher need for intubation (61% vs 0%) compared with the 100% arm of the Dekker et al study. By protocol, all infants <27 weeks of gestation in the Vento et al study requiring positive pressure ventilation were intubated. Identical pressures (5-8 cm H_2O) were used in the high