S_{pO_2} Histograms in Preterm Infants: A Helpful Tool for Neonatologists?

In recent years, oxygen targeting has become a relevant topic in neonatal intensive care medicine.[1] Despite large S_{pO_2} targeting trials including numerous subjects and the available results of a meta-analysis of these data,[2,3] there is still an ongoing debate on the optimum S_{pO_2} target range in preterm infants. Both conditions, hyperoxia as well as hypoxia, frequently occur in extremely low birthweight infants[4] and may contribute to the development of retinopathy of prematurity,[5] bronchopulmonary dysplasia,[6] and impaired neurodevelopmental outcome[7] in this population. In addition, the duration and severity of hypoxemic episodes during the neonatal period might be associated with late death or neurological impairment at 18 months corrected age.[8] It has been shown that some preterm infants only spend about half of the time within a specific S_{pO_2} target range.[9] This might be a crucial point in the ongoing discussion about the optimum saturation ranges in preterm infants. Pulse oximetry monitoring without frequent surveillance of the obtained data (ie, percentage of time in target saturation range, detection of prolonged hypoxemic/hyperoxemic episodes) may diminish the possible benefits of oxygen targeting. *How can we reach the target, if the target is out of sight?*

Standard monitoring in the neonatal intensive care unit includes S_{pO_2} monitoring, and target oxygen saturation ranges are usually well defined, whereas the documentation of these data differs from unit to unit. Hand-transcribed S_{pO_2} documentation is still a widespread practice in neonatal intensive care units despite the evidence that this may underestimate S_{pO_2} fluctuations.[10] Therefore, regular visualization and comparison of S_{pO_2} data over time seems to be a promising approach to guide therapeutic interventions (eg, adjustment of respiratory support, faster adjustment of F_{IO_2}, and/or adapting methylxanthine treatment) and may improve neonatal outcome.

In the current issue of RESPIRATORY CARE, Viscardi et al[11] used S_{pO_2} histograms, provided by pulse oximetry, to visualize the percentage of time infants spent within specific oxygen saturation ranges. This approach may help to predict failure to wean from noninvasive respiratory support in preterm neonates. The authors were able to show that infants who spent ≥15% of time with S_{pO_2} <86% in the

SEE THE ORIGINAL STUDY ON PAGE 416

24 h before transitioning were more likely to fail the transition from CPAP or high-flow nasal cannula to less invasive modes of oxygen delivery or room air. As the authors point out in their article, there is no clear indicator or general agreement on how to wean from noninvasive support CPAP and other modes of noninvasive support are mainly used to treat respiratory distress syndrome/chronic lung disease by stabilizing functional residual capacity, avoiding mechanical ventilation, and improving oxygenation. Therefore, it seems conclusive to use a parameter of oxygenation including S_{pO_2} to evaluate readiness for weaning from CPAP. The stability of S_{pO_2} adds important information to the whole picture. Clearly, it should be mentioned that the final decision to wean cannot be based on a single parameter only, especially since the outcome parameter of this study has very high specificity but low sensitivity. Judgment on how to wean should be based on the overall clinical condition of the baby and may also include parameters such as respiratory effort, apneic episodes, gestational age, and F_{IO_2} requirements.[12]

Nevertheless, the authors of this study were assessing an important tool that might not only affect weaning success. Frequent assessment of S_{pO_2} measurements, including the percentage of time infants spend within their desired target oxygen saturation range and the number of prolonged hypoxemic events could be an important and valuable strategy to adapt and reflect the intensity of therapeutic interventions and improve neonatal outcomes. This study, along with the recent findings of the large oxygen targeting trials, are encouraging in this regard.

Lars Mense MD
Division of Neonatology
Department of Pediatrics
Children's Hospital of Eastern Ontario
Ottawa, Ontario, Canada
Department of Neonatology and Pediatric Intensive Care Medicine
Medizinische Fakultät Carl Gustav Carus
TU Dresden, Dresden, Germany

The authors have disclosed no conflicts of interest.

Correspondence: Lars Mense MD, Division of Neonatology, Department of Pediatrics, Children's Hospital of Eastern Ontario, 401 Smyth Road, Ottawa, Ontario K1H 8L1, Canada. E-mail: Lars.Mense@uniklinikum-dresden.de.

DOI: 10.4187/respcare.04771

Markus Waitz MD
Division of Neonatology
Department of Pediatrics
Children's Hospital of Eastern Ontario
Ottawa, Ontario, Canada

REFERENCES

1. SUPPORT Study Group of the Eunice Kennedy Shriver NICHD Neonatal Research Network, Carlo WA, Finer NN, Walsh MC, Rich W, Gantz MG, et al. Target ranges of oxygen saturation in extremely preterm infants. N Engl J Med 2010;362(21):1959-1969.
2. Saugstad OD, Aune D. Optimal oxygenation of extremely low birth weight infants: a meta-analysis and systematic review of the oxygen saturation target studies. Neonatology 2014;105(1):55-63.
3. Manja V, Lakshminrusimha S, Cook DJ. Oxygen saturation target range for extremely preterm infants: a systematic review and meta-analysis. JAMA Pediatr 2015;169(4):332-340.
4. Martin RJ, Wang K, Köroğlu O, Di Fiore J, Kc P. Intermittent hypoxic episodes in preterm infants: do they matter? Neonatology 2011;100(3):303-310.
5. Di Fiore JM, Bloom JN, Orge F, Schutt A, Schluchter M, Cheruvu VK, et al. A higher incidence of intermittent hypoxemic episodes is associated with severe retinopathy of prematurity. J Pediatr 2010; 157(1):69-73.
6. Madurga A, Mizíková I, Ruiz-Camp J, Morty RE. Recent advances in late lung development and the pathogenesis of bronchopulmonary dysplasia. Am J Physiol Lung Cell Mol Physiol 2013;305(12):L893–L905.
7. Janvier A, Khairy M, Kokkotis A, Cormier C, Messmer D, Barrington KJ. Apnea is associated with neurodevelopmental impairment in very low birth weight infants. J Perinatol 2004;24(12):763-768.
8. Poets CF, Roberts RS, Schmidt B, Whyte RK, Asztalos EV, Bader D, et al. Association between intermittent hypoxemia or bradycardia and late death or disability in extremely preterm infants. JAMA 2015;314(6):595-603.
9. Hagadorn JI, Furey AM, Nghiem TH, Schmid CH, Phelps DL, Pillers DA, et al. Achieved versus intended pulse oximeter saturation in infants born less than 28 weeks' gestation: the AVIOx study. Pediatrics 2006;118(4):1574-1582.
10. Ruiz TL, Trzaski JM, Sink DW, Hagadorn JI. Transcribed oxygen saturation vs oximeter recordings in very low birth weight infants. J Perinatol 2014;34(2):130-135.
11. Mascoll-Robertson KK, Viscardi RM, Woo HC. The objective use of pulse oximetry to predict respiratory support transition in preterm infants: an observational pilot study. Respir Care 2016;61(4):416-422.
12. Todd DA, Wright A, Broom M, Chauhan M, Meskell S, Cameron C, et al. Methods of weaning preterm babies <30 weeks gestation off CPAP: a multicentre randomised controlled trial. Arch Dis Child Fetal Neonatal Ed 2012;97(4):F236–F240.