Detection of Hyperoxaemia in Neonates: Data from Three New Pulse Oximeters

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Introduction

The researchers objective was to investigate the ability of new generation pulse oximeters to detect hyperoxemia by maintaining a high degree of sensitivity [ability to detect hyperoxemia (too much oxygen in the blood)] while maintaining an acceptable level of specificity (ability to not falsely indicate hyperoxemia) while monitoring neonates. Reliable detection of hyperoxemia in neonates is important in minimizing the risks of acute and chronic oxygen toxicity, such as Retinopathy of Prematurity (infant eye disease or blindness).

Methods

Fifty-six (56) term and preterm infants were enrolled in the study. The median age at time of study was six (6) days (range 1 - 149) and the median study weight was 2680 g (range 430 to 5800). Pulse oximeters used in the study were the Masimo SET, Philips (Agilent) Viridia, and Nellcor Oxismart. The sensors used were the Masimo LNOP Neo PT and the Nellcor N-25 for the Philips and Oxismart pulse oximeters. In addition to standard monitoring equipment, 46 infants had one and 10 infants had two additional sensors attached to a hand and/or foot; the clinical characteristics of the infants in these subgroups were similar. Whenever an arterial blood sample was taken for clinical reasons, the SpO_2 readings on the pulse oximeters were recorded (the SpO_2 had to be stable for 20 seconds prior to blood draw). PaO_2 was measured on a Radiometer ABL 505 blood gas analyzer and functional SaO_2 was measured with a Radiometer OSM-3 CO-Oximeter.

Results

A total of 280 SpO_2/SaO_2/PaO_2 determinations were performed for the Philips (Agilent) Viridia, and 291 each for the Masimo SET and Oxismart pulse oximeters, with 105 (112 for Philips) in 27 (24) patients showing a PaO_2 > 80 mm Hg. Bias and precision (SaO_2 - SpO_2) calculations were: Masimo SET -0.06 ± 2.5%, Philips Viridia -0.25 ± 2.5, Nellcor Oxismart -0.91 ± 2.6%. The table below shows sensitivity and specificity at an upper alarm limit of 95%. The specificity for the Masimo SET pulse oximeter was 73% greater than the Nellcor Oxismart, and 50% greater than the Philips/Agilent Viridia technologies. NOTE: at this upper limit for SpO_2 the Masimo SET pulse oximeter had comparable specificity as the laboratory CO-Oximeter (OSM-3).

Upper Alarm Limit of 95%	Radiometer OSM- 3	Masimo SET®	Philips Viridia	Nellcor Oxismart
Sensitivity	99	94	93	95
Specificity	46	45	30	26

Authors' Discussions and Conclusions

The authors stated, "Sensitivity can be increased by decreasing the upper alarm limit, but the specificity, which is already low, will then decrease even further. This carries the risk of keeping infants hypoxemic if priority is given to the avoidance of hyperoxemia." They concluded, "With regard to specificity, the MaS [Masimo SET oximeter] seemed to perform better than the other two instruments, which may be related to differences in measurement bias. Although these differences were small (< 1%), they may still be relevant, as small changes in SaO_2 may be associated with large changes in PaO_2 in the hyperoxic range."