

Use of Pulse Oximetry in Automated O₂ Delivery to Ventilated Infants

Urschitz MS, Von Einem V, Seyfang A, Poets CF. *Anesthesia and Analgesia* 2002;94(S1):S37-40

Introduction

“Oxygen delivery to premature and/or critically ill infants should be closely controlled to achieve adequate tissue oxygenation while minimizing side effects.” O₂ therapy usually occurs by manual adjustments against a desired pulse oximeter SpO₂ range. Some pulse oximeters have a history in neonates of alarming falsely, causing many clinicians to set very loose SpO₂ alarm limits. This practice results in overuse of oxygen, which adds cost, patient stay and, more importantly, increases the risks of retinopathy of prematurity and chronic lung disease. The researchers tested an automated system for delivery of oxygen therapy using Masimo SET pulse oximetry as the physiologic endpoint.

Methods

The authors reviewed the history of close-loop O₂ titration in neonates, which has been linked to undesirable change in therapy (largely due to poor pulse oximetry). 126 hours of Masimo SET recordings obtained in 10 preterm infants were used to test their new artificial intelligence controller. The same recordings were used to determine what a clinician would have done given the same pulse oximetry values and condition of the child. All of the controller- and clinician-based adjustments were inspected critically and independently by a NICU nurse and two neonatologists.

Results

The automated, controller-based oxygen therapy changed 148 times (median 1.15/h; range 0.12-2.37), while the clinician-based review made 519 changes (3.83/h; range 1.37-6.50). The 70% reduction in changes/hour was the result of more precise delivery of discrete amounts of oxygen. Additionally, they found their controller-based system was more accurate than older controller techniques, thereby reducing the risk of over and undershooting oxygen delivery.

They also randomly selected 223 desaturations, as measured by Masimo SET, to determine the specificity for a signal quality threshold predictive of false desaturations. 217 of 223 desaturations (97.3%) were determined to be real. Only 6 episodes were found false and all were associated with a Signal IQ < 0.30, the threshold for the Masimo “Low Signal IQ” prompt. The researchers reported that four of the six hypoxemias were missed due to the sensor being off the patient’s skin. Signal IQ was further investigated and found to have excellent specificity (75%) and sensitivity (100%). Reading with a Signal IQ < 0.3 were rare (8/233, 3.5%) and confirmed that below this value, the likelihood of artifactual measurements was high (6/8, 75%) whereas above it, erroneous measurements did not occur in their sample. Signal IQ is Masimo’s unique signal identification and quality indicator, that helps clinicians identify readings of questionable validity due to extremely challenging motion and low perfusion conditions. “Thus we were able to confirm the validity of using a Signal IQ < 0.3 to warn of potentially unreliable measurement conditions.”

Masimo SET®	True	False
Tested Desaturations (n=223)	217	6
“Low Signal IQ” prompt	0	6
Sensitivity of measurement	97.3%	100%

Authors’ Discussion and Conclusions

“The new F_iO₂ controller algorithm evaluated in this study appears to lead to a more stable assessment of a patient’s oxygenation than previous approaches in this field, probably reducing the risk of false responses resulting from erroneous SpO₂ data. **The latter risk may be further reduced by incorporating information from a signal quality indicator such as Masimo’s Signal IQ into this algorithm. This may help to optimize oxygen delivery to premature and/or critically ill infants.**”