

Advantages of New Technology Pulse Oximetry with Adults in Extremis

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Introduction

Patient safety and human error factors, particularly latent errors, are a major concern in the delivery of health care today. Pulse oximetry is a critical monitor, which has been shown to fail in many critical situations. Oximetry failures can lead to potentially adverse patient outcomes. Failure to acquire and maintain reliable oximetry signals also increases the costs by necessitating more costly and invasive testing such as ABG analysis. The authors “chose to test the ability of the Masimo SET (MSO) technology, to acquire and maintain reliable pulse oximetry signals in critically ill, postoperative patients in whom conventional pulse oximetry (CPO) technology was unable to provide reliable monitoring.”

Methods

The authors prospectively evaluated MSO in their thoracic and cardiovascular postoperative (TCVPO) unit. Patients were enrolled if clinicians were unable to acquire a reliable pulse oximetry signal using CPO (Ohmeda 3740). Immediately following failure of CPO, an oximeter incorporating Masimo SET technology was used to acquire a pulse oximetry signal. ABGs were obtained for validation of the SpO₂ and the pulse rate was confirmed with ECG heart rate.

Results

Thirteen postoperative cardiothoracic surgery patients (age range 53 - 81) were identified. In 12 of 13 (92.3%) patients who had failed CPO, MSO obtained pulse oximetry readings. The SaO₂ to SpO₂ difference was 1.1% + 1.0% (mean + SD) for these patients. In the patient in whom the authors were unable to obtain a MSO reliable value, they were also unable to obtain ABG data as the patient suffered cardiac arrest and required chest compressions.

SpO₂ measured in 13 patients with Masimo SET pulse oximetry, who had failed conventional pulse oximetry.

ABG (calculated) SpO ₂ [%]	Masimo	CPO SpO ₂ [%]	CPO Condition
99	100	0	Failed SpO ₂
99	98	0	Failed SpO ₂
97	98	0	Failed SpO ₂
93	92	89	Failed PR (!)
99	99	Low Signal Quality	Failed SpO ₂
98	98	Low Signal Quality	Failed PR (!)
(*)	Pulse Search	Low Signal Quality	Failed SpO ₂
91	88	100	High SpO ₂
98	98	0	Failed SpO ₂
88	85	100	High SpO ₂
94	93	82	Failed SpO ₂
97	97	81	Failed SpO ₂
95	97	Low Signal Quality	Failed SpO ₂

(!) = lack of correlation for Pulse Rate and ECG heart rate, causing clinician to question SpO₂ accuracy

(*) = patient expired prior to obtaining arterial blood gas

Authors' Discussion and Conclusions

Causes of CPO failures are numerous. In this study population, CPO failure resulted from several factors including significant hypotension, poor peripheral perfusion, shivering due to hypothermia, and the presence of an intra-aortic balloon pump (IABP) producing an alteration of the arterial pressure waveform. Two patients in this study exhibited CPO SpO₂ values that were inaccurately high, even in these cases the MSO was able to obtain a reliable, accurate SpO₂ value. The impacts of monitor non-function are several. **Monitors providing no data or false alarms distract caregivers and require attention to troubleshoot the monitor. This decreases caregiver efficiency and increases costs. Ultimately, patient safety is affected. The authors conclude that the “ability of the MSO to provide reliable monitoring provides the bedside caregivers the ability to devote their time and attention to the patient and not to the monitoring system.”** The 92.3% success rate in obtaining readings allowed for continuous, accurate monitoring of SpO₂ using the MSO in critically ill, unstable postoperative patients where CPO failed, thereby resulting in a significant increase in patient safety and caregiver efficiency.”