

Pulse Oximetry Evaluation in Hypoperfused ICU Patients.

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Introduction

Patients with low perfusion present a challenge to pulse oximetry monitoring. It is often unsuccessful or inaccurate as compared to arterial blood gases. Newer technology with improved algorithms and ability for signal acquisition at other non-conventional sites (forehead) is now available. Leading oximeters (Masimo Radical-7 and Nellcor OxiMax N-600), were evaluated in our ICUs to determine their response in hypoperfused patients.

Method

Patient criteria established as mean arterial pressure < 60 mmHg and/or inability to capture a signal or unreliable signal from our standard pulse oximetry technology (Phillips, Inc). 20 patients were evaluated with capillary refill >3 Sec. Digit sensors were placed as per manufacturer recommendations. Finger jackets utilized to prevent crosstalk. Initial forehead sensor placement rotated between manufacturers from patient to patient to eliminate bias and a minimum of 5 min was allowed for signal stabilization. ABG sample was then drawn with co-oximetry analysis as per the standard of care to evaluate oxygenation and correlation with pulse oximeters. Simultaneously, as the ABG was drawn, readings from pulse oximeters were recorded by a separate therapist to ensure accuracy. Immediately after acquisition of the ABG, the forehead sensor was switched to the other manufacturer and then signals were recorded.

Results

In 20 patients where standard technology was unable to pick up a signal, the newer technology with forehead monitoring capability was able to reliably obtain SpO₂ readings on 80% of the patients with the Nellcor vs. 25% with Masimo (within + 2 SaO₂ points)(See Bland-Altman plot). As per Masimo recommendation, SpO₂ readings with PI (perfusion index) of < 0.25 are unreliable/questionable, therefore, they were excluded. In comparison, Nellcor results were 20% more accurate than Masimo.

Conclusion

Newer digit technology was superior to present technology, but not as accurate as forehead sensing technology. Forehead technology is clearly superior to present technology. Nellcor OxiMax Forehead was more accurate than Masimo Radical-7 Forehead. Nellcor results had more points closer to the gold standard (ABG) as compare to Masimo. Clinical implication: Maximum sensitivity needed to pick up a signal in our pts. During the evaluation as we swapped forehead sensors between manufacturers, we noted that the Masimo continued to display readings when the sensor was off the patient laying on the sheet or pillow.