

Comparison of Three New Generation Pulse Oximeters during Routine ICU Monitoring of Ventilated Patients.

Branson R., Lyons E., Johannigman J., Davis K., Tsuei B. *Resp Care* 2006; 51(11):251.

Background

Pulse oximetry is ubiquitous to the ICU. Oximeters can be stand-alone devices or incorporated into bedside physiologic monitors. We compared the accuracy of SpO₂ and pulse rate (PR) from two stand-alone oximeters (Masimo SET Radical, & Nellcor OxiMax N-600) and one integrated oximeter (Phillips Intellivue Fast-SpO₂) to measured SaO₂ (IL-1735, CO-oximeter) and ECG heart rate (Phillips Intellivue).

Methods

The protocol was IRB approved and consent was obtained from the patient's LAR. The Nellcor and Masimo finger probes were placed on the first and second digit of the same hand and each covered with a hood of photographic tape to prevent cross talk or interference from ambient light. The ICU oximeter was in place prior to the study for clinical care, this site was not changed. After probe placement ECG HR, PR and SpO₂ was recorded 10, 5, & 1 minute prior to blood sampling to assure stability. If values were stable, all values were recorded at the time of an arterial blood sample. Data from oximeters was continuously recorded to a PC. Data was also captured 5 min after the blood draw. Blood samples were immediately sent to the lab for ABG analysis and CO-Oximetry. Patient demographics, vital signs, and medications were also recorded. Data for SpO₂ and SaO₂ were compared using Bland-Altman for determination of bias and precision. Bias between devices was compared using a t-test and precision with an F-test. Accuracy calculated as the root mean square of the differences (ARMS) and 95% confidence intervals were also determined. PR was compared to ECG heart rate using Pearson's Correlation Coefficient. Additionally, Fisher's Exact test was used to determine the number of times PR from each monitor was > 10 bpm different than ECG.

Results

A total of 50 patients (27 males & 23 females; 42 Caucasian, 8 African American; 12/50 on vasoactive medications) had 69 comparisons. Table 1 demonstrates the bias and precision for each oximeter vs. measured SaO₂ and A_{RMS} results.

	<u>Masimo</u>	<u>Nellcor</u>	<u>Phillips</u>
Bias	2.1#	1.4*\$	2.5\$
Precision	1.6	2.0	1.9
A _{RMS}	2.6	2.4	3.1
A _{RMS} 95% CI	2.3-3.0	2.1-2.8	2.8-3.5

* M vs. N, P, p = 0.0016, #M vs. P, p = 0.0234, \$ N vs P, p = 0.0001; Differences in precision and A_{RMS} were NSS.

Signals were obtained in all 50 patients. Mean SaO₂ was 95 ± 2.28 (89.7 - 98.7). There were NSS differences in PR and ECG heart rate between devices.

Conclusions

Our results demonstrate comparable bias and precision of the Nellcor and Masimo oximeters. The integral Phillips oximeter had a statistically greater bias than either of the stand-alone devices. The clinical differences between devices was small.