

Comparison of Three New Generation Pulse Oximeters during Motion & Low Perfusion in Volunteers.

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Introduction

Pulse Oximeter (PO) accuracy is often compromised by low perfusion states and motion artifacts that can jeopardize patient's safety in the OR, PACU, and ICU. PO manufacturers keep improving their technology to solve this problem, and Nellcor's N-600 is the latest improvement. This study compares Nellcor's N-600 with two other new generation POs, Masimo Radical and Datex-Ohmeda TruSat, under conditions of low perfusion and motion in hypoxic and normoxic states in volunteers.

Methods

Following informed consent, 10 ASA-I volunteers (5F & 5M) between 18-40 years old, were enrolled. POs tested were Masimo Radical (V5.0), Nellcor N-600 (V1.1.2.0), and Datex Ohmeda TruSat. Sensors were randomly placed on index, middle, and ring fingers of left hand (test), and right hand (control), and were optically shielded. The room temperature was lowered to 16-18°C to reduce peripheral perfusion. A Masimo Radical PO on the right ear served as the control during hypoxia. During separate room air and desaturation (employing a disposable re-breathing circuit with a CO₂ absorber to a SpO₂ of 75% on control PO, and the subject was then given 100% oxygen until the control SpO₂ reached 100%) events, motion consisted of random tapping (with sensor disconnect/reconnect) and random rubbing. Motions were machine generated (MG) and self-generated (SG). The sensors were rotated laterally and tested on all three fingers during the room air events. A computer recorded SpO₂ & pulse rate (PR) data. A missed event (false negative/sensitivity) was defined as the inability of the PO to detect desaturation and/or recover from a desaturation by the time the control reached 100%. A false alarm (false positive/specificity) was recorded during the normoxic phase, and defined as a SpO₂ ≤ 90% during motion. ANOVA, with a Fischer's post hoc test, and Chi-square analysis, as appropriate, were used to compare the Sensitivity and Specificity for the three oximeters. P < 0.05 was considered statistically significant.

Results

There were a total of 160 motion tests; 40 with desaturations and 120 on room air. Missed events were counted out of 40 (20 with MG, and 20 with SG), and false alarms were counted out of 120 (60 with MG, and 60 with SG) motions.

Sensitivity and specificity of POs during MG and SG

MACHINE GENERATED MOTION (MG)				
DEVICE	MISSED EVENT	SENSITIVITY	FALSE ALARM	SPECIFICITY
Masimo Radical (V5.0)	0/20	100	4/60	93
Nellcor N-600 (V1.1.2.0)	7/20	65*	20/60	67*
Datex-Ohmeda TruSat	16/20	20*	10/60	83*
SELF GENERATED MOTION (SG)				
DEVICE	MISSED EVENT	SENSITIVITY	FALSE ALARM	SPECIFICITY
Masimo Radical (V5.0)	1/20	95	2/60	97
Nellcor N-600 (V1.1.2.0)	10/20	50*	14/60	77*
Datex-Ohmeda TruSat	17/20	15*	11/60	82*

* P < 0.05 compared to Masimo.

Conclusions

During hypoxic/normoxic and low perfusion states, Nellcor N-600 (V1.1.2.0) and Datex Ohmeda TruSat performed inferior to Masimo Radical (V5.0) with respect to maintaining accurate readings during both machine generated and self-generated motions. It appears from this study that Masimo Radical may work better for patient safety, especially at critical times in OR, PACU, and ICU.