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

Introduction

Many pulse oximeter (PO) technologies claim to give accurate readings during conditions of patient motion and low perfusion. Accurate and reliable pulse oximetry monitoring is an increasingly essential clinical tool throughout the hospital with the trend of moving patients earlier from the ICU onto the general care floor. In order to determine which of three new generation pulse oximetry technologies provide the most reliable and accurate readings during difficult patient conditions, these researchers compared the specificity (ability to reject false alarms) and sensitivity (ability to detect true alarms) of the Masimo Radical, the Nellcor N-600 and the Datex Ohmeda TruSat on healthy volunteers during periods of normoxia and hypoxia during motion and induced low perfusion.

Methods

To test the performance of three pulse oximetry technologies; the Masimo Radical (V5.0), the Nellcor N-600 (V1.1.2.0) and the Datex Ohmeda TruSat) optically shielded sensors were randomly placed on index, middle, and ring fingers of left hand (test), and right hand (control) of 10 healthy volunteers Low peripheral perfusion was induced by lowering the room temperature to 16-18°C. The motions were random self generated (SG) and machine generated (MG) with the test hand attached to a motion table. A rebreathing circuit with a CO_2 absorber was used to induce desaturation to approximately 75%. The subject was then given 100% O_2 until the control pulse oximeters reached a SpO_2 of 100%. The sensors were rotated laterally and tested on all three fingers during the room air events. A computer recorded SpO_2 and pulse rate (PR) data. A missed event 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 was recorded during the normoxic phase, and defined as a $SpO_2 \leq 90\%$ 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. A $p < 0.05$ was considered statistically significant.

Results

One hundred and sixty (160) motion tests were performed; 120 on room air and 40 during desaturation. Missed events (sensitivity) were counted for the desaturation episodes (20 with MG and 20 with SG). False alarms were counted for the 120 room air motions (60 with MG and 60 with SG). The results are shown in the table below.

Machine and Self Generated Motion					
Device		**Missed Event**	**Sensitivity**	**False Alarm**	**Specificity**
MasimoSET® Radical (v5.0)	MG	0/20	100	4/60	93
	SG	1/20	95	2/60	97
Nellcor N-600 (v1.1.2.0)	MG	7/20	65*	20/60	67*
	SG	10/20	50*	14/60	77*
Datex-Ohmeda TruSat	MG	16/20	20*	10/60	83*
	SG	17/20	15*	11/60	82*

p< 0.05 compared to Masimo

Authors' 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."