Impact of Motion and Low Perfusion on the Performance of Three New Generation Pulse Oximeters for Spo2 and Pulse Rate in Volunteers

Shah N., Patel V., Estanol L. *Anesth Analg.* 2006;102:S-148.

Introduction

The problem of accuracy of Pulse Oximeters (PO) during patient movement or in the presence of low perfusion states still persists. New generation PO manufacturers claim superior performance, hence we undertook the following study to compare three brands of POs during motion and low perfusion in volunteers.

Methods

Following informed consent, 11 ASA-I volunteers (5F & 6M) between 18 & 40 were enrolled. POs tested were Masimo Radical V4.5, Nellcor N595 V3100 and Datex-Ohmeda TruSat. Sensors were randomly placed on index, middle, and ring fingers of left hand (test) and right hand (control) and optically shielded. The room temperature was 16-18oC to reduce peripheral perfusion. A TOSCA (PtcCo2 + Masimo Radical PO) placed 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 abosorber 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 and tested on all three fingers during the room air events. A computer recorded SpO2 & pulse rate (PR) data. Parameters analyzed were % of time when SpO2 was off by 7% (off 7) and PR was off by 10% (off 10), performance index (PI) (Defined as % of time when SpO2 was within 7% of control and PR was within 10% of control), and zero out (defined as % of time when the POs zero out SpO2 and/or PR). A "Zero Out" is defined as when the monitor either displays "--" or a zero. ANOVA and Fischer's post hoc test was performed with $p<0.05$ considered statistically significant.

Results

There were a total of 176 motion tests; 44 with desaturations and 132 on room air. For oximeters performance, see Table.

Conclusion

Masimo Radical performed the best in this vigorous testing schedule for both SpO2 and PR followed by Datex-Ohmeda TruSat and then Nellcor N-595. Furthermore, Nellcor N-595 performed inferiorly for detection of PR compared to SpO2.

Off 7% (SpO2), Off 10% (PR), Zero Out and PI during MG and SG							
Device		SpO_2			Pulse Rate		
Pulse Oximeter		Off 7 (%)	Performance Index %	Zero Out (%) (SpO_2)	Off 10 (%)	Perfor-mance Index (%)	Zero Out (%)(PR)
Masimo Rad-ical (v4.5)	MG	1.0	99.0	0	5.8	94.2	0
Masimo Rad-ical (v4.5)	SG	1.0	99.0	0	14.1	85.9	0
Nellcor N-595 (v3100)	MG	13.8*	84.8	1.4 *	25.3*	69.6	4.8 *
Nellcor N-595 (v3100)	SG	16.3*	79.0	4.7 *	25.8*	57.4	16.8 *
Datex-Ohm-eda TruSat	MG	10.8*	89.2	0	17.8*	82.1	.1
Datex-Ohm-eda TruSat	SG	7.5*	92.0	0.5	21.6*	77.9	0.5

p= <0.01 vs. Masimo Radical