Impact of Motion and Low Perfusion on SpO2 & Pulse Rate in Three New Generation POs in Volunteers.

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Introduction

The problem of accuracy of Pulse Oximeters (PO) during patient movement or in the presence of low perfusion states in the OR, PACU, and ICU, still persist. Nellcor's N-600 is the latest of the new generation PO. We undertook the following study to compare N-600 with two other new generation POs during motion and low perfusion in volunteers.

Methods

Following informed consent, 10 ASA-I volunteers (5F & 5M) between 18-40 years old, were enrolled. POs tested were Nellcor N-600 (V1.1.2.0), Masimo Radical (V5.0), 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 to16-18°C to reduce peripheral perfusion. A 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 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. Parameters analyzed were % of time when SpO2 was off by 7% and PR was off by 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 was performed, with a Fischer's post hoc test, to compare the off 7% (SpO2), off 10% (PR), and Zero Out (both SpO2 and PR) results for the three oximeters. $P<0.05$ level (*) was considered statistically significant.

Results

There were a total of 160 motion tests (80 with machine generated, and 80 with self-generated); 40 with desaturations and 120 on room air.

Off 7% (SpO2), Off 10% (PR), Zero Out and PI during MG and SG

MACHINE GENERATED MOTION (MG)						
DEVICE	SpO2 off 7% total min.	SpO2 Performance Index %	SpO2 Zero Out (%)	PR off 10% total min.	PR Performance Index (%)	PR Zero Out (%)
Masimo Radical (V5.0)	4.6	97.5	0	31.7	82.9	0#
Nellcor N-600 (V 1.1.2.0)	42.1*	72.3	9.3	50.4	61.0	22.2
Datex-Ohmeda TruSat	29.9*	83.2	1.3	37.3	78.0	1.7#
SELF GENERATED MOTION (SG)						
DEVICE	SpO2 off 7% total min.	SpO2 Performance Index %	SpO2 Zero Out (%)	PR off 10% total min.	PR Performance Index (%)	PR Zero Out (%)
Masimo Radical (V5.0)	2.8	98.5	0#	21.3	88.5	0##
Nellcor N-600 (V 1.1.2.0)	33.6*	73.1	16.4	39.7	60.3	33.9
Datex-Ohmeda TruSat	31.9*	81.9	1.7#	44.6	73.6	4.4##

*, # $p<0.05$ compared to Masimo. ## $p< 0.005$ compared to Nellcor.

Conclusions

Masimo Radical performed the best in this vigorous testing schedule for both SpO2 and PR, followed by Datex-Ohmeda TruSat, and Nellcor N-600 (V1.1.2.0). Furthermore, all three POs performed better for SpO2 compared to PR. It appears that Masimo Radical will give reliable SpO2 & PR values for a greater period of time as compared to Datex-Ohmeda TruSat and Nellcor N-600 in the OR, PACU, and ICU.