

Analysis of Pulse Oximeters for Detection of SpO₂ and Pulse Rate Variation during Motion Artifact.

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Background

Pulse oximeters (PO) have frequent SpO₂ and pulse rate (PR) false alarms due to artifact conditions. New generation PO incorporates various technologies to minimize false alarms. Simulators, such as the Biotek Index 2p, have been developed which produce standardized PO artifact signals. We tested the hypothesis: POs will accurately report SpO₂ and PR during simulated motion artifact.

Methods

Using this simulator, set for no-motion (n) and 2 different motion artifacts (low frequency (lf) and high frequency (hf)), 11 POs were tested from SpO₂ 70-98% and PR 45-180 bpm. POs tested included Nellcor Puritan Bennett N200 and NPB 295, Datex Ohmeda 3700, 3900, and AS/3, Hewlett-Packard model 66, Criticare Poni, Novamatrix Oxypleth, Nonin 8600, BCI 3304 and Masimo SET. Results are presented as the bias +/- precision and number of failures to report.

Results

Agreement varied considerably between PO models. For SpO₂ the 3700 and AS/3 had bias >5% at n. All POs, except the Masimo SET, had bias >9% at lf and hf. For PR, at n, all POs were accurate within 1 +/- 1 bpm. All POs, except the AS/3 and Masimo SET, had bias > 50 bpm (PR > 50 bpm higher than set simulator PR) at both lf and hf. 6 POs, including the N200, N295, AS/3, Poni, Oxypleth, BCI 3304 and Nonin 8600 had multiple SpO₂ and PR failures during lf and hf.

SpO₂ bias and precision (Prec) for all oximeters tested at no motion (n) and both low frequency (lf) and high frequency (hf) motion artifacts.

OXIMETER	No Motion			Motion lf			Motion hf		
	Bias	Prec	Fails	Bias	Prec	Fails	Bias	Prec	Fails
N200	-1	1	0	-24	5	0	-28	6	1
N295	-1	1	0	-18	6	1	-22	4	2
3700	-6	3	0	-29	4	0	-31	5	0
3900	0	1	0	-17	5	0	-17	4	0
AS-3	-8	5	0	-23	6	0	-18	6	1
HP-66	-1	1	0	-27	7	0	-	-	10
PONI	-3	1	0	-25	3	0	-12	14	1
Oxypleth	-1	1	0	-9	9	2	-	-	10
BCI 3304	-1	1	0	-21	4	0	-	-	10
Nonin 8600	0	2	0	-15	7	0	-	-	10
Masimo SET	0	1	0	1	1	0	0	1	0

Conclusions

The Masimo SET was the only pulse oximeter able to accurately report both SpO₂ and PR during motion artifact.