Comparison of Four Pulse Oximeters on Pediatric Patients during Anesthesia and the Initial Phases of Recovery: Does the New Generation Offer an Advantage?

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Introduction

We compared 4 oximeters [1 conventional (N-200) vs. 1 designed to recognize and reject motion artifact (N-295) vs 2 designed to recognize and read through motion artifact (N-395)(N series = Nellcor Puritan Bennett) & Ohmeda EnGuard™ 2000 with Masimo SET® software (IVY Biomedical Systems)] to determine if new technology improves monitoring.

Methods

After IRB approval & consent, children 1-12 Y were enrolled. The 4 sensors were randomly applied to the fingers of 1 hand. Each digit's sensor was isolated with an opaque shield. Outputs were downloaded to a computer. A research nurse observed and keyed in events and descriptions. Blinded color-coded printouts were reviewed by 3 anesthesiologists to determine if a possible "event" or desaturation (saturation $\leq 92\%$) had occurred and its duration. If 2/3 or 3/3 agreed the event was included. Events diagnosed by the computer were correlated with the interpretation by the anesthesiologists. Receiver Operator Characteristic (ROC) curves were calculated for each device. Kruskal-Wallis nonparametric ANOVA and Tukey's HSD test were used for statistical analysis of drop-out time mean percentages ($p < 0.05$ was considered significant).

Results

95 children were studied (age 5.2 ± 2.8 Y, wt 20.7 ± 9.9 kg) for 4,766 min. 194 events were recorded. All 3 evaluators agreed prior to debate on 178/194 and 187/194 after debate. All 4 devices were connected 99.8% of the time. 66 events in 40 patients were labeled as a desaturation (33 patients with & 26 without motion). Devices performed similarly 96.9% of the time. However, 3.1% of time (during desaturation events) there was a difference. Overall the N-290 had less drop-out compared with the 3 other systems ($p < 0.05$). When a desaturation event occurred, the IVY system dropped out more than the other 3 devices ($p < 0.05$). When there was a desaturation event associated with motion the IVY had more drop-out than the N-290 or the N-395 ($p < 0.05$) (Table) but not more than the N-200.* $p < 0.05$ compared with N-200, N-290 & N-395. ** $p < 0.05$ compared with N-290 & N-395

Conclusions

All devices performed equally well during general anesthesia. The IVY had a higher drop-out rate compared with the other systems during desaturation events without associated patient motion. 2 systems (N-200 & IVY) performed less well during desaturation events with motion. Under the clinical conditions of this study it would appear that the N-290 provided the most information during all conditions.

Drop-out time (percent) (no data output) during desaturation events				
Device	**IVY**	**N-200**	**N-290**	**N-395**
All Desaturation Events (N=40)	9.73*	2.27	0	0.61
Desaturation&Motion (N=34)	9.87**	3.25	0	0.77
Desaturation&No Motion (N=26)	10.04*	0.39	0	0