Is Pulse Search Technology a Predictor of Unreliable Saturation Monitoring?

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Background

To clarify the presence of true desaturation, techniques have been developed to discern the validity of a monitor alarm. Data validity warnings have been developed such as the Pulse Search (PS) warning on the Nellcor N395 and N595 and the Low Signal IQ (LowSIQ) warning on the Masimo SET Radical. According to the N-395 product manual: "If the acquired pulse is lost during monitoring, the N-395 enters Pulse Search. During Pulse Search, the monitor attempts to detect a pulse from which to take a measurement." These warning indicators should provide clinicians information to determine the validity of pulse oximetry saturation readings and thereby avoid the potential harm in false oxygen titration or other unnecessary therapeutic interventions. We set out to determine the reliability of these indicators to warn of the validity of desaturations reported by the pulse oximeters.

Methods

To study the effectiveness of these warning technologies, we monitored an at risk population of 19 infants in the NICU. The N-395, N-595, and Masimo SET pulse oximeters were attached to separate limbs randomly and rotated to eliminate the possible effect of localized decreased limb perfusion associated with positioning, patent ductus arteriosus, or other interfering influence. All oximeters were connected to a data collection computer system. When a false desaturation to < 85% was noted and confirmed by lack of central cyanosis and presence of normal readings on the other oximeters, presence or absence of the warning indicator (PS or LowSIQ) was recorded. When false desaturation occurred without the presence of a warning indicator, the desaturation was classified as "Unwarned." Conversely, if the false desaturation occurred with the presence of a warning indicator it was classified as "Warned". The duration of the warning indicator was noted and compared to the duration of the associated false desaturation event. Data was compared for statistical significance by ANOVA and a p value < 0.05 was considered significant.

Results

6811 minutes of oximetry data were studied. A significant difference in the reliability of the warning indicators to indicator false events occurred.

Comparison of Pulse Search and Low Signal IQ to Warn of False Desaturation Events

	"Warned"			"Unwarned"	
	# events	Total Time	Duration of LowSIQ/PS indicator	#events	Total Time
		(Seconds)	(% of total time)		(seconds)
Masimo Radical	45	835	96.2	11	65
N-595	15	1150	33.0	67	1036
N-395	19	510	28.0	37	635

* ANOVA analysis showed a statistically significant difference between the Pulse Search events and duration comparing N-395/N-595 and the Masimo Radical Low Signal IQ measure for $p < 0.001$

Conclusion

Significant differences in total warned time, duration of warning indicator and unwarned time for detecting false desaturation events are evident between Masimo Radical and the N-395 and N-595 oximeters. The Masimo Radical Low Signal IQ measurement was more reliable in its ability to discern potentially confounding false desaturation.