

Assessment of 2 New Generation Pulse Oximeters during Low Perfusion in Children.

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Introduction

The Nellcor 395 (N) and Masimo Radical (R), pulse oximeters designed to perform under conditions of low perfusion, have not been clinically tested in children with this condition. *Hypothesis:* Pulse oximeter saturations (SpO₂) obtained with the N and R are neither accurate nor precise when compared to co-oximetry-measured oxygen saturations (SaO₂) of the whole blood of children with low perfusion.

Methods

N and R pulse oximeter probes were applied to the same distal extremity of children undergoing cardiopulmonary bypass (CPB) to repair congenital heart defects. Simultaneously obtained SaO₂ and SpO₂ were recorded in the OR post-CPB when serum lactic acid was ≥ 2 mmol/L. Chi square test was used to detect a significant difference in percentage of SpO₂ failures. Wilcoxon signed ranks test was used to detect for differences between SpO₂ and SaO₂ (i.e., accuracy $\pm$ precision), pulse oximeter heart rate (HR) and cardiac monitor HR, and the absolute differences between SpO₂ and SaO₂ for SaO₂ < 90% vs. $\geq 90\%$ for each pulse oximeter.

Results

25 children, with median (range) ages of 5 mo (0 – 95) had a total of 61 SaO₂ recorded. Core temps were 36.2° C (33.1 – 38.9). The median SaO₂ was 98% (62 – 100), with 17/61 (28%) being < 90%. SpO₂ failures were 40% (25/61) for the N vs. 10% (6/61) for the R (p < .001). See table.

Variable (mean $\pm$ 1 sd)	<u>N</u>	<u>p value</u>	<u>R</u>	<u>p value</u>
SpO ₂ – SaO ₂ *	1.1 $\pm$ 3.3	.09	-0.2 $\pm$ 3.3	.89
Oximeter HR – monitor HR	0.6 $\pm$ 6.6	.29	-2.3 $\pm$ 13.1	.04
Absolute SpO ₂ – SaO ₂				
when SaO ₂ < 90% vs.	4.9 $\pm$ 4.7		4.1 $\pm$ 2.9	
when SaO ₂ $\geq$ 90%	1.4 $\pm$ 1.6	.02	1.3 $\pm$ 1.6	< .001

*p = .99 when comparing absolute N SpO₂ – SaO₂ vs. R SpO₂ – SaO₂

Conclusions

There was no significant difference in SpO₂ – SaO₂ for either oximeter but the N failed significantly more often than the R in children with low perfusion. The R HR was significantly lower than the monitor HR was. The absolute difference between SaO₂ and SpO₂ was significantly greater for both pulse oximeters when SaO₂ was < 90% compared to SaO₂ of > 90%.