

Performance Evaluation of Masimo SET Pulse Oximeter during Mild Hypothermic Cardiopulmonary Bypass

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Introduction


Masimo SET pulse oximetry has been shown to work at lower perfusion levels than conventional pulse oximeters.^{1,2} This group of researchers studied Masimo SET's ability to accurately measure arterial oxygen saturation compared to a conventional pulse oximeter during the hypoperfusion that occurs during cardiopulmonary bypass (CPB).

Methods

Patients undergoing cardiac surgery using mild hypothermic CPB were enrolled in the study. CPB was accomplished via a roller pump and non-pulsatile flow. However, a pulse pressure of approximately 12 mm Hg was measurable on the arterial pressure tracing. The PaO₂ was maintained at 250 to 300 mm Hg during CPB. Pulse oximeter sensors were applied to randomly chosen fingers of the same hand and connected to Masimo SET Radical and Nihon Kohden AY-900 pulse oximeters. Pulse oximeter failure was defined as an inability to detect a pulse wave and/or of displaying SpO₂ values less than 97%.

Results

Eighteen (18) patients were studied. CPB and aortic cross clamping (AoX) durations were 203±78 min and 135±66 min, respectively. Minimum bladder temperature during CPB was 31±11.0°C. Fourteen patients had pulse oximetry failures > 3 min with the Nihon Kohden pulse oximeter. Four of those also had failures with the Masimo (p=0.0022, Chi-square test). The duration of pulse oximetry failure during CPB also differed, 6±15% with Masimo and 36±31% with Nihon Kohden (p = 0.0006, t-test). Pulse oximetry failure duration during AoX was 5±15% with Masimo, and 46±43% with Nihon Kohden (p=0.0005). Pulse wave was not detected during AoX for 4±12% with Masimo and 36±39% with Nihon Kohden (p=0.002). Poor pulse oximetry performance typically occurred immediately after the initiation of CPB or just after AoX. The minimum MABP during which Masimo displayed SpO₂ of a 100% value ranged from 25 to 56 mmHg (36±10 mmHg). Typical baseline Perfusion Index (Masimo) was 1% immediately pre-bypass. CPB produced measurable pulsations of 0.1% (Masimo Perfusion Index) at approximately 1.6 Hz.

Pulse Oximeter	Failure during CPB	Failure during AoX	t-test
 Masimo SET	6 ± 15%	5 ± 15%	p = 0 .0006
CPO	36 ± 31%	46 ± 43%	p = 0 .0005

Authors' Discussion and Conclusion

The Masimo SET pulse oximeter displayed accurate SpO₂ values significantly longer than the Nihon Kohden pulse oximeter during mild hypothermic CPB, indicating that the Masimo SET pulse oximeter is more useful for monitoring SpO₂ during hypoperfusion. Although non-pulsatile flow was used during CPB, the roller pump generated sufficient pulsatility so the Masimo SET pulse oximeter was able to display SpO₂ even at extremely low mean arterial blood pressure.

(1) Gangitano ES, Taschuk RD, Liberman RL. Near Continuous Pulse Oximetry During Newborn ECLS. *ASAIO Journal* 1999;45(2):125
 (2) Barker SJ, Novak S, Morgan S. The Performance of Three Pulse Oximeters During Low Perfusion in Volunteers. *Anesthesiology* 1997;87(3A):A409