Comparison of the Masimo Rad-57 Pulse Oximeter with SpCO Technology against a Laboratory CO-Oximeter Using Arterial Blood.

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Introduction

Pulse oximeters estimate arterial oxygen saturation from pulsatile absorption signals. The principle is based on the fact that oxyhemoglobin and deoxyhemoglobin have different absorption spectra. A major limitation of current devices is the inability to differentiate oxyhemoglobin from red dyshemoglobins. Masimo recently introduced a pulse oximeter which distinguishes functional oxyhemoglobin (SpO2) from carboxyhemoglobin (SpCO). This device, if proven accurate, would be helpful in clinical practice for detection of carboxyhemoglobin and related gas exchange abnormalities. Hypothesis: The Masimo Rad-57 pulse oximeter accurately measures oxyhemoglobin (SpO2) and carboxyhemoglobin (SpCO) when compared with a multi-wavelength laboratory CO-Oximeter which directly measures arterial saturation (SaO2) as well as dyshemoglobins (i.e. COHb, MetHb).

Methods

Blood samples from 31 subjects, for whom arterial blood gas tests were ordered for clinical evaluation, were compared with pulse oximetry results. The Masimo Rad-57 pulse oximeter finger probe was placed according to manufactures instructions and once adequate signal was achieved the arterial blood gas sample was drawn. During blood sampling, the SpO2 and SpCO data from the oximeter were recorded. The arterial blood samples were analyzed within 15 minutes using a pre-calibrated and quality-controlled Radiometer ABL 725 analyzer according to standard laboratory practice. The data were analyzed using a Student paired t-test.

Results

	SaO_2 (ABL)	SpO_2 (Rad-57)	SaCO (ABL)	SpCO (Rad57)
Mean	90.8 ± 5.4 SD	93.8 ± 4.2 SD	2.0 ± 1.8 SD	2.5± 2.0 SD
Maximum	97.5	99	9.3	11
Minimum	74.6	80	0.8	1
P value	< 0.001	< 0.015		

Conclusion

The Masimo Rad-57 pulse oximeter measures functional oxyhemoglobin (SpO2) ($p < 0.001$) and SpCO ($p < 0.015$) accurately. There does appear to be a systematic bias in the lower ranges (SaCO < 4%) where the Masimo Rad-57 tends to overestimate SaCO, but the clinical significance of this bias is yet to be determined. Regardless, the device does appear to identify elevated SaCO and would be helpful in clinical scenarios where noninvasive assessment of SaCO is beneficial. In the subject where SaCO was very significant, subtracting the SpCO value from the function oxyhemoglobin value (SpO2) would have yielded a SpO2 that was clinically useful (SpO2 94% - SpCO 11% = Adjusted SpO2 83%, fractional SaO2 = 86.7%). Additional data in the higher COHb ranges would be helpful in assessing the accuracy of this device.