The Accuracy of Noninvasive Hemoglobin Measurement by Multiwavelength Pulse Oximetry after Cardiac Surgery.

Nguyen B.V., Vincent J.L., Nowak E., Coat M., Paleiron N., Gouny P., Ould-Ahmed M., Guillouet M., Arvieux C.C., Gueret G. *Anesth Analg*. 2011 Nov;113(5):1052-7.

Background

In March 2008, a new multiwavelength pulse oximeter, the Radical 7 (Rad7; Masimo Corp., Irvine, CA), was developed that offers noninvasive measurement of hemoglobin concentration. Accuracy has been established in healthy adults and some surgical patients, but not in cardiac surgery intensive care patients, a group at high risk of postoperative bleeding events and anemia in whom early diagnosis could improve management.

Methods

In this prospective, observational study conducted in a cardiovascular intensive care unit, we compared hemoglobin concentrations shown by the Rad7 with arterial hemoglobin concentrations determined by an automated hematology analyzer, XE-2100 (Roche, Neuilly sur Seine, France). Two software versions of Rad7 (V 7.3.0.1 [42 points of comparison in 14 patients] and the updated V 7.3.1.1 [61 points of comparison in 27 patients]) were studied during two 1-week periods. Bias, defined as the difference between the 2 methods (Masimo SpHb - XE-2100 laboratory hemoglobin), was calculated. A negative bias indicated that the Masimo underestimated hemoglobin compared with the laboratory analyzer. Correlation between the perfusion index given by Rad7 and the hemoglobin bias was also studied.

Results

Correlations between Rad7 and XE-2100 were weak for both software versions ($R(2) = 0.11$ for V 7.3.0.1 and $R(2) = 0.27$ for V 7.3.1.1). Mean bias was -1.3 g/dL for V 7.3.0.1 and -1.7 g/dL for V 7.3.1.1, with wide 95% prediction intervals for the bias (respectively, -4.6 to 2.1 g/dL and -5.7 to 2.3 g/dL). The absolute hemoglobin bias tended to increase when the perfusion index decreased. For the V 7.3.0.1 software, the average absolute bias was 1.9 g/dL for perfusion index <2 and 0.8 g/dL for perfusion index >2 ($P = 0.03$). For V 7.3.1.1, the mean absolute bias was 2.1 g/dL when the perfusion index was <2, and 1.6 g/dL when the perfusion index was >2 ($P = 0.26$).

Conclusions

Our study demonstrates poor correlation between hemoglobin measured noninvasively by multiwavelength pulse oximetry and a laboratory hematology analyzer. The difference was greater when the pulse oximetry perfusion index was low, as may occur in shock, hypothermia, or vasoconstriction patients. The multiwavelength pulse oximetry is not sufficiently accurate for clinical use in a cardiovascular intensive care unit.