

Accuracy of Continuous and Noninvasive Hemoglobin Monitoring during Prolonged Surgery

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Background

Monitoring hemoglobin concentration during surgery currently requires repeated blood draws and a variable time delay to receive results. A new technology, Pulse CO-Oximetry, provides a continuous noninvasive estimate of hemoglobin concentration (SpHb) from a sensor placed on the finger. The clinical impact of SpHb monitoring has been reported during surgery (1) and in the ICU (2). However, there are no reports regarding intra-operative SpHb monitoring during prolonged surgery. We evaluated the accuracy of SpHb compared with laboratory CO Oximetry measurements of total hemoglobin (Hb) during prolonged oral surgery.

Materials and Methods

After obtaining approval from the ethics committee of our institution, 7 patients scheduled for prolonged oral surgery were enrolled in this study. Patients received general anesthesia and had arterial catheters in place for blood pressure monitoring and blood sampling. Additionally, patients had continuous, noninvasive hemoglobin monitoring by Pulse CO-Oximetry with a SpHb sensor (R2-25, rev G) connected to a Radical-7 (SET software 7.6.2.1, Masimo, Irvine CA, USA). The sensor was placed on either the index finger. Blood samples taken at the discretion of attending anesthesiologists and analyzed for Hb with laboratory CO-Oximetry. When an arterial blood sample was drawn, the value of SpHb was recorded. To compare SpHb to Hb values, the correlation coefficient, bias and precision were calculated and a -Altman graph was constructed to assess agreement between 2 methods of measurement (3). Additionally, the percent error of SpHb measurements compared with Hb measurements was calculated by dividing 2 standard deviations of the bias of SpHb to Hb by the mean of the range of Hb.

Results

Seventy-three Hb values were compared to SpHb. The correlation coefficient was 0.74. Bias and precision were 0.86 g/dL and 1.17 g/dL, respectively. Percent error was 22.4%. Bland-Altman analysis showed limits of agreement of -1.43 to 3.15 g/dL. (Figure 1)

Conclusion(s)

The accuracy of SpHb monitoring during prolonged surgery was clinically acceptable, as shown by the low bias, precision and moderate limits of agreement when compared to laboratory values, although percent error exceeded normal range slightly.

References: (1) *Anesth Analg* 2011; 113: 1396-402. (2) *Crit Care Med* 2011; 39: 2277-82. (3) *J Biopharm Stat* 2007; 17:571-82.