

The Accuracy of Noninvasive and Continuous Total Hemoglobin Measurement by Pulse CO-Oximetry Undergoing Hemodilutional Autologous Transfusion.

Saito J., Kitayama M., Kudo T., Hashimoto H., Hirota K. *Anesth Analg* 2012; 113; S-268.

Introduction

Monitoring of total hemoglobin levels is one of the most essential indicator of the need for blood management during surgery. Recently new technology, pulse CO-Oximetry with SpHb (SpHb) provides noninvasive and continuous hemoglobin measurement. The SpHb may enable a more rapid detection of clinically significant blood loss. However few studies showed accuracy of the SpHb during acute Hb change, normovolemic hemodilution or rapid blood transfusion^{1,2}. We then evaluated the accuracy of SpHb compared with invasive laboratory CO-Oximetry (tHb) undergoing acute normovolemic hemodilution and the following autologous blood transfusion

Methods

After receiving IRB approval and written informed consent, twenty four patients were enrolled in this study. They were scheduled to undergo urological or gynecological surgery, in which a blood loss of about 500 ml or more was anticipated. After induction of general anesthesia, two units of blood, approximately 800 ml were drawn and stocked in pair of blood correction bags through a central venous catheter. Replacement of the corrected blood was done with 1,000 ml of lactate Ringer solution included 3% dextrane40 taking care that normovolemic state was maintained all the time. Blood samples were obtained from a radial artery catheter three times, pre-, during and post- of each phase, hemodilution and autologous transfusion, in which acute tHb level changed dramatically. During surgery blood samples were obtained every 30 min. In the same point, SpHb, Perfusion index and Pulse variability index were continuously monitored and manually recorded.

Results

Two hundred twenty eight bloods samples for tHb measurement were corrected with equal number of paired SpHb measurements. Liner regression analysis of all SpHb and tHb values is shown in Figure 1. A Bland-Altman plot is shown in Figure 2. Mean bias and precision of 228 SpHb and tHb values were 1.12 g/ dl and 1.25 g/dl, respectively. There was no significant difference in SpHb accuracy parameter between acute hemodilutional phase and autologous transfusion phase.

Discussion

Compared to previous studies in healthy subjects, this study revealed the tendency of SpHb values higher than tHb values. This discrepancy in SpHb may be affected by several factors, peripheral digital perfusion, intravascular volume and acute changes in tHb³). Furthermore this study indicates that general anesthesia may also affect accuracy of SpHb measurement. In future investigations, we could use this new noninvasive monitor as clinical decision making to guide transfusion therapy with to gain better insights into these limitations.

References

1) *Anesth Analg* 2010;111:1424-6 2) *Crit Care Med* 2011;39:2277-82 3) *Anesth Analg* 2011;112:858-63

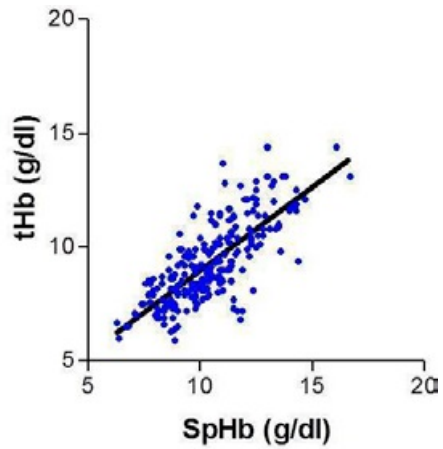


Figure 1. A scatterplot of 228 hemoglobin values as determined by SpHb and tHb collected from 24 patients ($r^2=0.56$, $n=228$, $p<0.0001$).

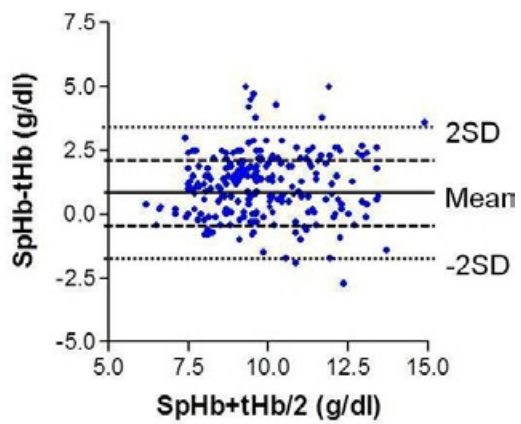


Figure 2. A Bland-Altman plot of 228 hemoglobin values as determined by SpHb and tHb collected from 24 patients (Bias=1.12 g/dl, Precision=1.25 g/dl).