

Impact of Continuous and Noninvasive Hemoglobin Monitoring on Intraoperative Blood Transfusions

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Background

Blood transfusions continue to pose real patient risk in the form of adverse outcomes such as postoperative infection, cancer recurrence, impaired pulmonary function, as well as increased length of stay and mortality.¹⁻⁹ Additionally, transfusion is a costly and a significant contributor to the expense of surgical care.¹⁰ Laboratory hemoglobin (Hb) values are a primary indicator of the need for blood transfusion, but testing is intermittent and results are often delayed. Continuous, noninvasive hemoglobin (SpHb) monitoring is now possible with a Pulse CO-Oximeter and multi-wavelength adhesive sensor. We hypothesized that SpHb monitoring could reduce intraoperative blood transfusions.

Methods

We undertook a prospective, randomized, controlled trial to assess the impact of SpHb monitoring upon transfusions in patients undergoing elective orthopedic surgery during a six month period. Patients were randomized to receive either standard care alone or standard care plus SpHb monitoring (Radical-7 Pulse CO-Oximeter and R1-25 Rainbow Adhesive Sensor, Revision E, Masimo, Irvine, CA). The frequency of intraoperative transfusions and mean number of blood units transfused were compared, along with the frequency of laboratory Hb testing and agreement between SpHb and laboratory Hb values. Complication rates for each group were assessed at 30 days post-surgery as a safety endpoint.

Results

A total of 327 patients were enrolled (157 standard care, 170 SpHb). Procedures included hip replacement (31%), knee replacement (29%), and spinal surgery (14%). There were no differences between the standard care and SpHb groups in ASA physical status (2.2 vs. 2.2), age (60.8 vs. 61.9 yrs), male gender (54 vs. 48%), pre-operative lab hemoglobin (13.6 vs. 13.5 g/dL), surgical duration (127 vs 114 minutes), or surgical type. More patients received intraoperative transfusions in the standard care group compared to the SpHb group (4.5% vs. 0.6%, $p=0.03$). The mean number of units of blood transfused was also higher in the standard care group compared to the SpHb group (0.10 vs. 0.01, $p=0.0001$). No patient from either group received a transfusion during the immediate 12 hour post-operative period. The frequency of patients receiving intraoperative Hb testing and the mean number of Hb tests performed were similar in the standard care and SpHb groups (16.3% vs. 11.8%, $p=ns$, and 0.21 vs. 0.24 tests per case, $p=ns$, respectively). Intraoperative SpHb and laboratory Hb values showed good agreement (mean difference 1.1 +/- 0.68 g/dL). There was no difference between groups in 30-day complication rates.

Conclusion

Use of SpHb monitoring resulted in fewer intraoperative blood transfusions.

Table 1: Transfusions by Group

	Standard Care Group (N=157)	SpHb Group (N=170)	P value
Patients receiving a transfusion, N (%)	7 (4.5%)	1 (0.6%)	0.03
Total units transfused, N (mean)	15 (0.10)	2 (0.01)	0.0001

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