The Accuracy of Non-Invasively Continuous Total Hemoglobin Measurement by Pulse CO-Oximetry Undergoing Acute Normovolemic Hemodilution and Reinfusion of Autologous Blood

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Background

Non-invasively continuous total hemoglobin (SpHb) measurement has not been assessed adequately in acute bleeding and rapid blood transfusion during surgery. Thus, we have assessed the efficacy of SpHb during both acute normovolemic hemodilution (ANH) and autologous blood transfusion (ABT).

Methods

Twenty-four patients undergoing urological and gynecological surgery were enrolled. ANH was induced by withdrawing blood of 800 g with simultaneous fluid administration. When surgical hemostasis was completed, collected blood was reinfused. Measurement of SpHb, perfusion index (PI) and real total Hb (tHb) were done before and after each 400 ml blood removal (-0, -400, -800 ml) and reinfusion (+0, +400, +800 ml).

Results

A Bland-Altman analysis for repeated measurements showed a bias (precision) g/dl of 1.12 (1.25), 1.43 (1.24) and 1.10 (1.23) for all data, during ANH and during ABT, respectively. Additionally, a bias (precision) increased with a reduction in tHb (g/dl): ≥10.0; 0.74 (1.30), 8.0-10.0; 1.15 (1.12) and <8.0; 1.60 (1.28). Although the difference between SpHb and tHb was almost zero before anesthesia induction, it became significant just before ANH and did not change further by ANH and ABT. Significant correlations between SpHb and tHb for all data ($r = 0.75$, $n = 228$, $p < 0.001$) were observed. PI slightly correlated with the difference between SpHb and tHb ($r = 0.38$, $n = 216$, $p < 0.001$). Furthermore, before and after induction of anesthesia, PI also correlated with the difference between SpHb and tHb ($r = 0.42$, $n = 23$, $p = 0.048$ and $r = 0.51$, $n = 22$, $p = 0.016$, respectively).

Conclusions

The present data suggest that SpHb may overestimate tHb during ANH and ABT. In addition, PI and tHb levels had an impact on the accuracy of SpHb measurements.