Continuous noninvasive hemoglobin monitoring estimates timing for detecting anemia better than clinicians: a randomized controlled trial.


BACKGROUND: Hemoglobin measurement is important for transfusion decision-making. Pulse CO-Oximetry provides real-time continuous hemoglobin (SpHb) monitoring. The triage role of SpHb trends based on hemoglobin measurements was investigated.

METHODS: In this diagnostic randomized controlled trial, 69 patients undergoing spine or cytoreductive surgery were randomly enrolled into SpHb-monitoring and standard-care groups. Diagnostic blood samples were drawn for CO-oximetry Hb (CoOxHb) when the SpHb decreased by 1 g/dl or at the clinician's discretion in the standard-care group. The positive predictive value (PPV) was defined as the ability to detect a decrease in CoOxHb > 1 g/dl or a CoOxHb < 10 g/dl; the PPVs were compared using Fisher's exact test. The SpHb and trend accuracies were calculated. The transfusion units and postoperative hemoglobin levels were compared.

RESULTS: The PPV of a decrease in CoOxHb > 1 g/dl was 93.3% in the SpHb group vs 54.5% without SpHb monitoring (p = 0.002). The PPV of CoOxHb < 10 g/dl was 86.7% vs. 50.0% for these groups (p = 0.015). The CoOxHb was never < 7 g/dl with SpHb monitoring. Sixty SpHb-CoOxHb data pairs and 28 delta pairs (ΔSpHb-ΔCoOxHb) were collected. The bias, precision and limits of agreement were -0.29, 1.03 and -2.30 to 1.72 g/dl, respectively. When ΔSpHb and ΔCoOxHb were > 1 g/dl, the concordance rate for changes in hemoglobin reached 100%. The delta pairs revealed a positive correlation [ΔSpHb = 0.49 * ΔCoOxHb - 0.13; r = 0.69, 95% confidence interval (0.53, 0.82)]. No significant differences were found in the transfusion volume or postoperative anemia state.

CONCLUSIONS: The SpHb trend tracked changes in hemoglobin satisfactorily during surgery and more accurately estimated the appropriate timing for invasive hemoglobin measurements than the clinicians.