Trending, Accuracy, and Precision of Noninvasive Hemoglobin Monitoring During Human Hemorrhage and Fixed Crystalloid Bolus.

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BACKGROUND: Automated critical care systems for enroute care will rely heavily on noninvasive continuous monitoring. It has been reported that noninvasive assessment of blood hemoglobin via CO-oximetry (SpHb) assessed by spot measurements lacks sufficient accuracy for clinical decision making in trauma patients. However the precision and utility of trending of continuous hemoglobin has not been evaluated in hemorrhaging humans. This study measured the trending and concordance of SpHb changes during dynamic variations resulting from controlled hemorrhage with concomitant fluid infusion.

METHODS: With IRB approval and informed consent, 12 healthy volunteers under general anesthesia were subjected to hemorrhage (10 ml/kg over 15 minutes) accompanied by lactated Ringer`s infusion (30 ml/kg over 20 minutes). SpHb was measured continuously by the Masimo Radical-7, while total hemoglobin (tHb) was measured by arterial blood sampling.

RESULTS: Trend analysis, assessed by plots of SpHb over time of 12 subjects, shows consistent falls in SpHb during hemodilution without exception. Four-quadrant concordance analysis was 95.4% with an exclusion zone of 1 g/dl. Spot comparisons of 106 data pairs (SpHb and tHb) showed that 50% exhibited error > 1g/dl with bias of 1.08 ± 0.82 g/dl, 95% LOA -0.5; 2.6.

CONCLUSION: Both trend analysis and concordance analysis suggest high precision of pulse CO-oximetry during hemodilution by hemorrhage and fluid bolus in human volunteers. However, accuracy was similar to other studies and therefore the use of pulse CO-oximetry alone is likely insufficient to make transfusion decisions.