

Noninvasive Continuous Hemoglobin Monitoring in Combat Casualties: A Pilot Study

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Clinical Aspects

Objective: To describe the accuracy and precision of noninvasive hemoglobin measurement (SpHb) compared with laboratory or point-of-care Hb, and SpHb ability to trend in seriously injured casualties.

Methods: Observational study in a convenience sample of combat casualties undergoing resuscitation at two US military trauma hospitals in Afghanistan. SpHb was obtained using the Masimo Rainbow SET (Probe Rev E/Radical-7 Pulse CO-Oximeter v 7.6.2.1). Clinically indicated Hb was analyzed with a Coulter or iStat and compared with simultaneous SpHb values.

Results: Twenty-three patients were studied (ISS 20 ± 9.8 ; age 29 ± 9 years; male 97%; 100% intubated). Primary injury cause: improvised explosive device (67%) or gunshot (17%). There were 49 SpHb-Hb pairs (median 2 per subject). Bias: 0.3 ± 1.6 g/dL (95% LOA $-2.4, 3.4$ g/dL). The SpHb-Hb difference $< \pm 1$ g/dL in 37% of pairs. Eighty-six percent of pairs changed in a similar direction. Using an absolute change in Hb of >1 g/dL, a concurrent absolute change in SpHb of >1 g/dL had a sensitivity: 61%, specificity 85%, positive predictive value: 80%, and a negative predictive value: 69%. The SpHb signal was present in 4643 of 6137 min monitored (76%).

Conclusions: This was the first study to describe continuous SpHb in seriously injured combat casualties. Using a threshold of 1 g/dL previously specified in the literature, continuous SpHb is not precise enough to serve as sole transfusion trigger in trauma patients. Further research is needed to determine if it is useful for trending Hb changes or as an early indicator of deterioration in combat casualties.