

Non-Invasive Detection of Hemoglobin Concentration by Pulse CO-Oximetry in Severely Traumatized Patients

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Background and Goal of Study

Using transcutaneous spectrophotometry the Masimo Radical-7 (Masimo Corp., USA) Pulse CO-Oximeter non-invasively computes hemoglobin concentration (SpHb)1. SpHb was compared to Co-Oximeter readings (tHb) of arterial samples in trauma surgery patients.

Materials and Methods

Twenty six patients were enrolled. Masimo R1 25L (Revision F) adult adhesive sensors were attached to the ring finger of the hand where the arterial canula was placed. Before start and every 30 min until end of surgery SpHb and corresponding tHb values were documented. Linear regression and Bland Altman Plot analysis was performed to determine correlation and agreement between the two methods. Sensitivity and specificity of changes in SpHb to predict changes of Hb were calculated. Multivariate regression analysis was performed to identify significant predictors of SpHb bias.

Results and Discussion

A total of 102 data points were analyzed. Simple regression analysis for correlation showed a correlation coefficient (r) of 0.85 and a coefficient of determination (r²) of 0.73. The mean difference of tHb and SpHb was -0.9 g/dL with a standard deviation of 1.13g/dL. Bland Altman analysis showed a mean bias (with limits of agreement) of -0.9 (+1.36; -3.16) g/dl (Fig 1). Sensitivity and specificity to detect changes of tHb was 0.50 and 0.74 and 0.59 and 0.83 for changes over 0.5g/dL. The correlation coefficient for trend accuracy was 0.57 and r² 0.32 (Fig 2). Removal of clinically irrelevant changes < 0.5 g/dL resulted in an r value of 0.65 and an r² of 0.43. Significant predictors (p< 0.05) for the bias were CVP (r = 0.534; p < 0.0001) and subject position (supine, prone) with p =0.045.

Conclusion(s)

SpHb strongly correlated with tHb values, but agreement was moderate with considerable overestimation the Hb by SpHb, which could be corrected with the new in vivo adjustment feature. Trend accuracy was moderate but significant and improved with removal of clinically irrelevant changes in reference values below 0.5 g/dL. Additional refinements to the current technology are necessary to further improve performance of noninvasive Hb measurement.

References

1Macknet MR, et al. *Anaesth &Analg* 2010; 111:1424-6.