Study to Assess the Performance of Continuous Non-invasive Hemoglobin Measurement during Cesarean Delivery

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Background: Pulse CO-Oximetry™ (Masimo Corp., Irvine, CA) is a recently developed technology using multi-wavelength spectrophotometry for non-invasive and continuous hemoglobin monitoring (SpHb). (1) Blood loss estimation in an obstetric setting is often inaccurate, (2) thus this technology offers the potential for improving the assessment of maternal anemia and transfusion decision-making in an obstetric setting. The aim of this study was to assess the performance of this device in patients undergoing elective cesarean delivery (CD).

Methods: After IRB approval, 50 healthy term parturients undergoing elective CD with neuraxial anesthesia were enrolled in this prospective, controlled study. SpHb and venous hemoglobin values were compared prior to anesthesia, immediately post-CD and at 24 hours post-CD using Students t-test and Bland Altman Analyses (range of agreement defined as mean bias ± 2 SD). SpHb values were recorded at 10 time points from pre-CD to 48 hr post-CD. Correlation analyses were performed between hemoglobin (both SpHb and venous hemoglobin) and estimated blood loss as well as total volume of I.V. fluids (Pearson/Spearman correlations as appropriate). Secondary longitudinal analysis of SpHb changes over time was performed using mixed-effects regression modeling (with SAS PROC MIXED), due to non-uniformity of measurement intervals across the study period. P <0.05 as statistically significant.

Results: The mean bias ± 2 SD between SpHb and venous hemoglobin was 1.3±2.5 g/dl, 0.2±2.6 g/dl and 1.4±1.9 g/dl in the pre-operative, immediate post-CD and 24 hours post-CD (Figure). There were no statistically significant correlations between percentage hemoglobin change and estimated blood loss as well as intravenous fluids administered P>0.05. We observed a significant decrease in SpHb values over the study period (-0.098 g/dl in SpHb for each time point) after controlling for total estimated blood loss and total volume of iv fluids at 24 hours post surgery in the mixed model.

Conclusion: Pulse CO-Oximetry-based SpHb measurement was relatively accurate compared to laboratory hemoglobin measurement in patients undergoing elective CD. However we observed a positive and variable bias towards higher hemoglobin values with SpHb compared to venous hemoglobin values. Future studies are needed to validate SpHb values in the setting of acute and massive peripartum blood loss.