

## **Utility of Continuous Pulse Co-Oximetry for Hemoglobin Monitoring in Pediatric Patients with Solid Organ Injuries at Level 1 Trauma Centers: A Pilot Study**

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**Introduction:** Hemorrhage is a major cause of preventable death in injured children. Monitoring after admission often requires multiple blood draws, which have been shown to be stressful in pediatric patients. The Rainbow-7 device is a continuous pulse co-oximeter that measures multiple wavelengths of light, permitting continuous estimation of the total hemoglobin level. The purpose of this study was to evaluate the utility of the noninvasive hemoglobin measurement for monitoring pediatric trauma patients admitted with solid organ injury (SOI).

**Methods:** This is a prospective, dual-center, observational trial for patients under age 18 admitted to a Level I pediatric trauma center. Following admission, blood was routinely measured as per current SOI protocols. Noninvasive hemoglobin monitoring was initiated after admission. Time-synced data for hemoglobin levels was compared to that taken using blood draws. Data was evaluated using bivariate correlation, linear regression, and Bland-Altman analysis.

**Results:** Over a 1-year period, 39 patients were enrolled. Mean age was 11 ( $\pm 3.8$ ) years. Forty-six percent ( $n = 18$ ) of patients were male. Mean ISS was  $19 \pm 13$ . The average change in hemoglobin levels between laboratory measurements was  $-0.34 \pm 0.95$  g/dL and the average change in noninvasive hemoglobin was  $-0.12 \pm 1.0$  g/dL/measurement. Noninvasive hemoglobin values were significantly correlated with laboratory measurements ( $p < 0.001$ ). Trends in laboratory hemoglobin measurements were highly correlated with changes in noninvasive levels ( $p < 0.001$ ). Bland-Altman analysis demonstrated similar deviation from the mean throughout the range of hemoglobin values, but the differences between measurements was increased by anemia, African American race, and elevated SIPA score and ISS.

**Conclusion:** Noninvasive hemoglobin values demonstrated correlation with measured hemoglobin concentration as isolated measurements and trends, although results were affected by skin pigmentation, shock, and injury severity. Given the rapid availability of results and the lack of requirement of venipuncture, noninvasive hemoglobin monitoring may be a valuable adjunct for pediatric solid organ injury protocols. Further study is required to determine its role in management