Accuracy of continuous noninvasive hemoglobin monitoring for the prediction of blood transfusions in trauma patients.

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Early detection of hemorrhagic shock is required to facilitate prompt coordination of blood component therapy delivery to the bedside and to expedite performance of lifesaving interventions. Standard physical findings and vital signs are difficult to measure during the acute resuscitation stage, and these measures are often inaccurate until patients deteriorate to a state of decompensated shock. The aim of this study is to examine a severely injured trauma patient population to determine whether a noninvasive SpHb monitor can predict the need for urgent blood transfusion (universal donor or additional urgent blood transfusion) during the first 12 h of trauma patient resuscitation. We hypothesize that trends in continuous SpHb, combined with easily derived patient-specific factors, can identify the immediate need for transfusion in trauma patients. Subjects were enrolled if directly admitted to the trauma center, >17 years of age, and with a shock index (heart rate/systolic blood pressure) >0.62. Upon admission, a Masimo Radical-7 co-oximeter sensor (Masimo Corporation, Irvine, CA) was applied, providing measurement of continuous non-invasive hemoglobin (SpHb) levels. Blood was drawn and hemoglobin concentration analyzed and conventional pulse oximetry photoplethysmograph signals were continuously recorded. Demographic information and both prehospital and admission vital signs were collected. The primary outcome was transfusion of at least one unit of packed red blood cells within 24 h of admission. Eight regression models (C1-C8) were evaluated for the prediction of blood use by comparing area under receiver operating curve (AUROC) at different time intervals after admission. 711 subjects had continuous vital signs waveforms available, to include heart rate (HR), SpHb and SpO2 trends. When SpHb was monitored for 15 min, SpHb did not increase AUROC for prediction of transfusion. The highest ROC was recorded for model C8 (age, sex, prehospital shock index, admission HR, SpHb and SpO2) for the prediction of blood products within the first 3 h of admission. When data from 15 min of continuous monitoring were analyzed, significant improvement in AUROC occurred as more variables were added to the model; however, the addition of SpHb to any of the models did not improve AUROC significantly for prediction of blood use within the first 3 h of admission in comparison to analysis of conventional oximetry features. The results demonstrate that SpHb monitoring, accompanied by continuous vital signs data and adjusted for

age and sex, has good accuracy for the prediction of need for transfusion; however, as an independent variable, SpHb did not enhance predictive models in comparison to use of features extracted from conventional pulse oximetry. Nor was shock index better than conventional oximetry at discriminating hemorrhaging and prediction of casualties receiving blood. In this population of trauma patients, noninvasive SpHb monitoring, including both trends and absolute values, did not enhance the ability to predict the need for blood transfusion.