Validation of Non-Invasive Hemoglobin Measurement by Pulse CO-Oximeter in Newborn Infants with Birth Weight of Less Than 3000 Grams

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Background

Total hemoglobin measurement (tHb) is one of the most commonly performed laboratory tests in patients admitted to the neonatal intensive care unit (NICU). The availability of noninvasive hemoglobin monitoring would greatly impact the care of neonates by minimizing blood sampling, and therefore reducing the need for blood transfusions. Studies performed in adults to compare hemoglobin (Hb) obtained with the use of noninvasive Hb monitor and laboratory co-oximeter have shown a clinically acceptable accuracy of noninvasive Hb measurements; however little data are available on the accuracy and reliability of Hb obtained by pulse co-oximeter (SpHb) in newborns.

Objective

To compare the accuracy of hemoglobin obtained with pulse co-oximeter (SpHb) with tHb from laboratory co-oximeter during routine blood sampling in newborn infants with birth weight (BW) <3000 grams.

Design/Methods

Infants admitted to LAC+USC Medical Center NICU with BW <3000 grams were included. We recorded SpHb using Masimo Radical-7 (Masimo Corp., Irvine, CA) and compared with tHb measured during routine sampling for blood gases. A total of 3 data sets (tHb and SpHb) at 3 time points were obtained for each patient. Regression analysis and Bland-Altman analysis were performed.

Results

Twenty-seven patients (BW 1201±652 g, gestational age 29.0±4.5 weeks, median postnatal age 3 days [25th - 75th percentile 1-5 days]) were enrolled and 76 paired samples were obtained. Twenty of the 27 enrolled patients had a BW of less than 1500 g. The mean SD tHb value was 14.3±1.9 g/dL (range 10.7 - 18.9 g/dL) and the mean SpHb was 14.3±2.4 g/dL (range 9.7 - 18.9 g/dL). There was good correlation between SpHb and tHb ($r=0.75$, $p=0.001$) and a good agreement between paired hemoglobin values. The bias and precision for the tHb and SpHb values were 0.10±1.56 g/dL (p = NS).

Conclusions

Our preliminary results suggest that noninvasive SpHb may be used successfully as an alternative to invasive tHb measurements in newborn infants <3000 grams. Additional studies in large number of patients are needed to more definitively determine if the agreement persists between these two measurements.