

Validation of a Non-Invasive Hemoglobin Estimation in Whole Blood Donors

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Introduction

Pre-donation screening of blood donors are currently based on venous or capillary blood sampling. Adoption of a non-invasive hemoglobin estimation may increase blood donor recruitment. Masimo Pronto-7 Pulse CO-oximetry device is a spectrophotometry based device used to estimate the hemoglobin (Hb) level non-invasively, waiving the need of blood sampling. It has not been validated in normal blood donors. The primary objective of our study was to validate the pulse CO-oximetry based hemoglobin estimation in normal blood donors.

Methods

We conducted a prospective observational study on 106 whole blood donors attending the blood bank of a tertiary care center over 4 weeks. We estimated a Spot Hemoglobin (Sp Hb) concentration using Masimo Pronto-7 Pulse CO-oximetry device (two measurements per donor) and compared it to a venous sample Hb (Reference Hemoglobin; Ref Hb) measured using Abbott CELL-DYN Sapphire hematology analyzer. We calculated Pearson correlation coefficient and coefficient of determination (R^2). The multivariable linear regression model of predicting the estimation differences included age, gender, weight, height, blood pressure and reference hemoglobin.

Results

We enrolled 106 donors (98 males, 8 females) with a mean age of 27 years (SD 6.2; 18-49) and a mean Ref Hb of 14.2 g/dL (SD 1.2; 11.5-17). The mean Sp Hb was 14.4 g/dL (SD 1.2; 11.3-16.7). The correlation coefficient between the Sp Hb and Ref Hb was 0.46 ($R^2 = 21\%$) with a mean difference of 0.2 g/dL (SD 1.2; -4.5 to 3). In the multivariable model, height ($p = 0.015$) and Ref Hb level ($p < 0.001$) were statistically significant predictors of the difference in measurement. There was a strong correlation between the two CO-oximetry Hb measurements (correlation coefficient 0.78, $R^2 = 60\%$).

Conclusions

Our study demonstrated the validity of the CO-oximetry Hb measurement in normal blood donors and with good reproducibility. Larger prospective studies are needed to confirm our findings.