

Non-Invasive Hemoglobin Monitoring During Cardiovascular Surgery.

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Introduction

Hemoglobin (Hb) is frequently monitored intraoperatively to optimize oxygen-carrying capacity and delivery. A new multi-wavelength spectrophotometric method offers continuous, non-invasive hemoglobin monitoring (SpHb). In this observational study, we compared SpHb CO-oximetry values with arterial hemoglobin blood samples in cardiovascular surgery patients (n=8).

Methods

The Radical-7 Pulse CO-Oximeter (Masimo, Irvine, CA) measurements of SpHb were recorded concurrent with Hb results from arterial blood samples at regular intervals throughout the operation at the discretion of the anesthesiologist. Linear regression analysis and Bland-Altman plots were used to compare the results.

Results

In vascular patients (n=5), SpHb was highly correlated with Hb ($\text{SpHb} = 1.01 \pm 0.10 \times \text{Hb} - 0.05 \pm 1.14$, $R^2 = 0.91$) when the pulse oximeter was set to arterial; in contrast, venous setting introduced a bias of +3.04 g/dl in SpHb over Hb. In addition, preliminary results from cardiac surgery patients (n=3) suggest that SpHb overestimates Hb by 3 to 4 g/dl, even when set to arterial.

Discussion

Continuous SpHb monitoring may offer advantages over traditional arterial blood gas sampling by avoiding complications from invasive catheter placement and maintenance, frequent blood draws and by providing real-time resolution, thus decreasing overall costs and risks and increasing patient comfort and safety. Our data suggest a reasonable agreement between non-invasive SpHb and Hb in major vascular surgery patients within 1 g/dl. Its accuracy during cardiac surgery remains to be determined. In contrast to ICU patients,¹ the need for improved accuracy and validation in different surgical patients is in line with studies in healthy volunteers,² emergency room patients³ and patients undergoing Cesarean sections,⁴ abdominal,⁵ cardiac⁶ or spine surgery⁷ where decreased peripheral perfusion was identified as an important limitation to obtain reliable SpHb values, and overestimation of Hb by SpHb was noted at lower Hb levels.^{7,8} At this point, SpHb may serve as a useful adjunct to other clinical monitoring, provided that its current limitations are understood and addressed. Further studies are necessary to determine its usefulness in different patient populations.

References

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