Increasing Error of Non-Invasive Hemoglobin Measurement after Cardiopulmonary Bypass

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Introduction

A novel multi-wavelength spectrophotometric device offers continuous, non-invasive hemoglobin monitoring (SpHb). In this IRB-approved observational study, we compared SpHb CO-Oximetry values with arterial hemoglobin (Hb) blood samples in cardiac surgery patients (n=18) before and after cardiopulmonary bypass (CPB).

Methods

Hb results from arterial blood samples taken at the discretion of the anesthesiologist were compared to concurrently measured SpHb values (Radical-7™ Pulse CO-Oximeter; Masimo, Irvine, CA) using linear regression analysis and Bland-Altman plots. Data are mean±SEM, *P<0.05.

Results

For all data together, the regression was SpHb = 2.65±1.13* + 0.89±0.11* x Hb, R2 = 0.52. While before CPB, the regression was similar with SpHb = 2.91±1.48 + 0.86±0.14* x Hb, R2 = 0.49, after CPB it changed to SpHb = –4.14±3.77 + 1.70±0.44* x Hb, R2 = 0.50. Bland-Altman analysis not only showed a bias of +1.40±0.25* and +1.86±0.37* before and after CPB, respectively, but also a proportional error of SpHb steeply increasing with higher Hb after CPB.

Discussion

Although continuous SpHb monitoring may offer a variety of advantages over discontinuous invasive arterial blood gas sampling during cardiac surgery including real-time resolution, it not only overestimates true Hb in cardiac surgery patients before and after CPB, but may be entirely unreliable after CPB. This observation supports the findings of other studies1-3 and suggest that altered peripheral perfusion after CPB may be an important limitation to non-invasive SpHg monitoring.

References 1. Anesth Analg 2011;113:1052-7. 2. Anesth Analg 2011;112:858-63. 3. Med Hypotheses 2011;77:665-7.