Comparison of Haemoglobin Measurement Methods in the Operating Theatre

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Background

Various methods of haemoglobin (Hb) measurement are available to guide transfusion including several methods that allow for measurement at the bedside. This study directly compared their absolute and trend accuracy compared with values from the central lab (reference method).

Methods

Adult patients undergoing surgery with expected blood loss wore a rainbow ReSposable sensor connected to a Radical-7 Pulse CO-Oximeter (SpHb). Arterial samples were analysed with a haematology analyser (HbLab), a satellite CO-Oximeter (HbSat), and a point-of-care haemoglobinometer (HemoCue; HcueArt). Concomitantly, ear capillary blood was tested using the same haemoglobinometer (HcueCap). Absolute accuracy and the clinical significance of error were assessed with Bland-Altman plots and three-zone error grids. Trend analysis was performed using a modified polar plot, testing both directionality and magnitude of Hb changes compared with the reference.

Results

Two hundred and nineteen measurements from 53 patients with HbLab ranging between 6.8 and 16.3 g dl-1 (4.2 and 10.1 mmol litre-1) were recorded. Compared with the reference method, bias (precision) was 0.2 (0.2) g dl-1 [0.1 (0.1) mmol litre-1] for HcueArt, 0.8 (0.3) g dl-1 [0.5 (0.2) mmol litre-1] for HbSat, 0.5 (0.5) g dl-1 [0.3 (0.3) mmol litre-1] for HcueCap and 1.0 (1.2) g dl-1 [0.6 (0.7) mmol litre-1] for SpHb. None of the devices tested would have led to unnecessary or delayed transfusion according to 2006 ASA transfusion criteria. Trend accuracy was better for HcueArt and HbSat than for HcueCap and SpHb.

Conclusion

Bedside Hb measurement methods differ in their agreement to a laboratory haematology analyser but none would have led to transfusion errors. Trial Registry NumberRCB 2009-AO1144-53.