

## **Can perioperative hemodilution be monitored with non-invasive measurement of blood hemoglobin?**

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### **Background**

Trends in non-invasive measurements of blood hemoglobin (Hb) may be useful for identifying the need for transfusion in the perioperative period.

### **Methods**

Crystalloid fluid (5–20 mL/kg) was administered intravenously or by mouth to 30 volunteers and 33 surgical patients in five non-randomized clinical studies where Hb was measured on 915 occasions by non-invasive (Radical-7™) and invasive methodology. The hemodilution curves were compared by volume kinetic analysis and linear regression, with the slope and scattering of the data as key outcome measures.

### **Results**

The slope was 1.0, indicating unity between the two modes of measuring Hb when crystalloid fluid was infused in volunteers; however, only 40–45% of the variability in the non-invasive Hb could be explained by the invasive Hb. Patients undergoing major surgery, who showed the most pronounced hemodilution (median 24 g/L); non-invasive Hb explained 72% of the variability but indicated only half the magnitude of the invasive Hb changes (slope 0.48,  $P < 0.001$  versus the volunteers). Simulations based on volume kinetic parameters from the volunteers showed 25% less plasma volume expansion after infusion when based on non-invasive as compared to invasive Hb, while no difference was found during infusion.

### **Conclusions**

In volunteers the non-invasive Hb had good accuracy (low bias) but poor precision. In surgical patients the non-invasive Hb had good precision but systematically underestimated the hemodilution. Despite severe limitations, the non-invasive technology can be used to follow Hb trends during surgery if supported by occasional invasive measurements to assure acceptable quality of the hemodilution curve.