

The Accuracy of Non-Invasive Hemoglobin Monitoring Following Phlebotomy in a Pediatric Population.

Winch P.D., Naguib A., Rice J., Tobias J. *Proceedings of the 2011 Annual Meeting of the American Society of Anesthesiologists*. A411

Introduction

At Nationwide Children's Hospital, we utilize phlebotomy prior to incision as a method for reducing the need for blood product transfusions. As the blood is removed, it is replaced with crystalloid only as indicated to maintain hemodynamic stability. Recent advances in pulse oximetry technology have resulted in the development of non-invasive pulse oximeters which provide a continuous read-out of not only oxygen saturation, but also hemoglobin values. The purpose of this study was to analyze the correlation in hemoglobin between the Masimo pulse oximeter and the standard AVOX point-of-care derived value in a pediatric population in the setting of acute blood loss, before and following phlebotomy.

Methods

Following the induction of anesthesia with standard monitoring tools, the Masimo pulse oximeter (Radical 7) was placed on the patient's finger (adult & pediatric Resposable Rev E R2-20 & R-25, and Adhesive Rev E R1-20L). Hemoglobin values from the AVOX device were performed and this value was then compared with the value on the Masimo pulse oximeter. Phlebotomy was completed, with the blood volume removed based on the patient's weight and starting hemoglobin. Fluid replacement during this period was accomplished with crystalloid as indicated to maintain consistent end-organ perfusion. At the completion of hemodilution, a second hemoglobin value was obtained using the AVOX device.

Results

The data was collected following institutional IRB approval and includes 33 patients with 65 paired samples, ranging in age from 2 months to 50 years, and with weights between 4.9 and 120 kilograms. In analyzing all data points including both high confidence and low confidence readings as noted on the Masimo device, the bias was 0.1 and the precision was +/- 1.5 g/dL. This is depicted in figure 1, with the average of hemoglobin values (averaged between the AVOX and Masimo) plotted on the X axis, and the standard deviation on the Y axis. Nearly all data points fall within a standard deviation of +/- 1.96. It should be noted that 10 points reported low signal quality. Removing these values resulted in 55 data points with a bias of 0.2 and precision of +/- 1.3 g/dL. These results are consistent with a paper published in 2008 by Macknet et al, (A&A, Dec. 2010, Vol 111:6, 1424-26) which evaluated the accuracy of the Masimo pulse oximeter in an adult population undergoing acute blood loss. They determined that a Bland-Altman plot looking at 335 patients had a bias of -0.15, a precision of 0.92, and that the difference between hemoglobin values was <2.0 g/dL for 97% of the measurements.

Conclusions

The Masimo pulse oximeter provided hemoglobin estimates that correlated with the AVOX device, in the setting of pediatric patients and acute blood loss. We are aware of no other study which evaluates the utility of this technology in a pediatric population undergoing phlebotomy. Any device offering accurate and continual real time data which can thereby inform medical care merits further consideration.

