

Evaluation of Noninvasive and Continuous Hemoglobin Monitoring in Children with Sickle Cell Disease.

Szmuk P., Pickering B., Farris L., Rogers Z.R., Buchanan G.R. *Proceedings of the 2011 Annual Meeting of the American Society of Anesthesiologists*. A408.

Introduction

Hemoglobin monitoring is frequently required for children with sickle cell disease (SCD) but needle sticks are painful and can have negative effects on quality of life. Pulse CO-Oximetry allows noninvasive and continuous measurement of total hemoglobin (SpHb) concentration. SpHb has shown good correlation (Bias 0.-15 and precision of 0.92) with laboratory hemoglobin measurements in adult volunteers undergoing hemodilution (1). We sought to evaluate the accuracy of the SpHb measurement by Pulse CO-Oximetry in children with SCD.

Methods

With IRB approval, patients with SCD, aged 1-18 years old, presenting to the Hematology Outpatient Clinic and scheduled to have a complete blood count (CBC) were included. A single use, SpHb finger sensor (pediatric ReSposable, rev E) was applied to the ring or middle finger of either hand and connected to the Masimo Rainbow Radical-7 Pulse CO-Oximeter, sv 7604 (Masimo Corp, Irvine, CA). SpHb was recorded for at least 5 minutes to ensure a stable reading. Blood draw for hemoglobin (Hb) was analyzed with Sysmex XE Series Analyzer (Sysmex America, Inc., Mundelein, IL.) SpHb were recorded within 20 minutes of blood draw. Bias, defined as the mean difference between the SpHb and Hb data pairs, and precision, defined as one standard deviation of the bias, were calculated and a Bland Altman plot was created.

Results

150 patients were enrolled, but 6 were eliminated because no SpHb data was recorded. Age of patients ranged from 1 year to 18 years, and 59% (88/150) were male. Mean SpHb was 9.1 g/dL (range 4.2-13) and mean Hb was 8.2 g/dL (range 5.6-12.4). From the 144 data pairs collected, the mean bias between SpHb and Hb was 0.8 g/dL with a standard deviation of 1.3 g/dL and limits of agreement of -1.8 to 3.4 g/dL. (Fig 1) SpHb values were within 1.7 g/dL of the Hb value 76% of the time. When 40 paired measurements associated with low SIQ (a SpHb signal quality indicator), were removed from the data set, the bias and precision were similar.

Discussion

The bias and precision of SpHb to Hb in our patients was higher than that found in healthy volunteers. This might be due to the different sensors used in adults and children, or may be due to the presence of sickle hemoglobin in our patients. Further studies are needed to clarify this issue.

References: 1. Macknet MR et al. *Anesth Analg* 2010;111 (6) 1424-26.

Bland Altman SpHb

