Title: Noninvasive Hemoglobin Measurement with Masimo Radical & in two Children with Sickle Cell Disease

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Introduction

Sickle cell disease (SCD) is a chronic hemolytic anemia that includes the hemoglobin (Hb) variants SS, SC, S-beta thalassemia, SO Arab, SD, and other rare S-Hb genotypes. Patients with SCD undergo frequent Hb analyses which involve invasive blood draws that are painful and frightening, especially in children.

Total hemoglobin (Hb) is one of the most frequently ordered laboratory tests, both in the hospital and physician's office. These baseline Hb levels guide many clinical diagnoses and therapeutic interventions that are patient specific. While anemia detection is the primary reason for ordering the test, serial assessments are often made to track disease progression, blood loss, and the efficacy of therapies designed to restore Hb values to normal levels.

Hb measurements have traditionally required an invasive blood draw. The blood is then subjected to analysis by a laboratory device, such as a Coulter counter. More recently, invasive Hb measurements have also been performed with point-of-care devices.

The new 'Rainbow Technology' pulse oximeters developed by Masimo Corporation have advanced one step further in Hg analysis and now permit the noninvasive measurement of Hb (SpHb), as well as carboxyhemoglobin and methemoglobin. The accuracy of SpHb measurement in children with sickle cell disease is not known.

We present two patients with SCD which have been monitored intraoperatively with the Masimo Rainbow Radical 7 and compared Hb blood samples that were analyzed by more traditional means.

Case 1

10 y/o, 47 kg, with SCD, resented with acute onset abdominal pain and fever. He was tachycardic, tachypneic, febrile (38.2^0 C) and had a baseline Hb of 10.1 g/dl. On exam his skin was icteric; the abdomen was tender with the spleen enlarged (crossing midline to mid right abdomen). With the diagnosis of splenic sequestration, the patient was scheduled for a splenectomy. During the three hour procedure, we continuously monitored the patient's SpHb and compared it to two samples analyzed with the Hemocue. The mean SpHb during the procedure was 11.0, (SD± 0.71). When the Hemocue measured Hb was compared simultaneously with the SpHg, the Hemocue Hg measurements were 11.6 and 12g/dl, whereas the SpHb were 11.4 and 11.7 g/dl respectively at those times.

Case 2

12 y/o, 37 kg with SCD, obstructive sleep apnea, and asthma was scheduled for a tonsilectomy and adenoidectomy under general anesthesia. His SCD course had been complicated by a pain crisis and two transfusions during the previous year. His preoperatively Hb was 10.4 g/dl, hematocrit 30.5% and reticulocytes at 3.0%. During the surgical procedure the SpHb was continuously monitored and a blood sample was analyzed with both Hemocue and in the laboratory with a Coulter method. When the three methods were compared simultaneously, the Hb results with the SpHb, Hemocue and Coulter counter were 10.1, 10.0 and 9.9 g/dl respectively.

Discussion

A good Hb correlation between the noninvasive measurement of SpHb and the traditionally invasive Hb measurements could decrease the amount of blood draws and the stress related with them, especially in children with SCD.

Coulter counter and point-of-care devices (like Hemocue) that are commonly used to measure Hb have been shown to vary up to ±1.2 and ±1.3 g/dL, respectively.[1] Our observed measurements demonstrate an excellent correlation between the SpHb readings and those obtained from Hemocue and/or Coulter counter in pediatric patients with SCD. Further studies are needed to confirm these results and to correlate the SpHb readings with the percentage of SS hemoglobin.

Ref Gehring H et al. Anesth Analg 2007; 105: S24-30,

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