

Title: Measurement of Absolute Viscerosomatic Tissue Oxygen Saturation: Preliminary Results

Author(s): RJ Ing, DB MacLeod, K Ikeda, WA Ames, SR Schulman.

Affiliation(s): Department of Anesthesiology, Duke University Medical Center, Durham, NC.

ABSTRACT BODY:

Introduction: The purpose of this study is to validate the FORE-SIGHT NIRS cerebral oximeter (CAS Medical Systems, Branford CT USA) when used to determine absolute viscerosomatic tissue oxygen saturation against weighted co-oximetry viscerosomatic venous and systemic arterial oxygen saturation.

Methods: After Institutional Review Board approval and informed consent, pediatric subjects (<18 years of age and 2.5 kg and 40 kg weight) underwent elective diagnostic cardiac catheterization. Four FORE-SIGHT medium or large size sensors, depending on subject weight, were placed on the subject:

- one sensor below the right subcostal margin
- one in the right 8th intercostal space (mid-axillary)
- one over the lower anterior abdominal wall (subumbilical)
- one on the forehead.

Venous (SVC, IVC, Hepatic vein [HV]) and arterial (femoral or radial) blood samples were taken with the subject typically breathing air ($FiO_2 = 0.21$). Adherence to standard anesthetic practice limited the potential confounding effects of anesthetic agents. Blood samples were analyzed by a co-oximeter to obtain SaO_2 (femoral or radial) and SvO_2 for the target organ.

For the liver, a hepatic tissue oxygen saturation (CX ShtO₂) value was determined from co-oximetry measurements:

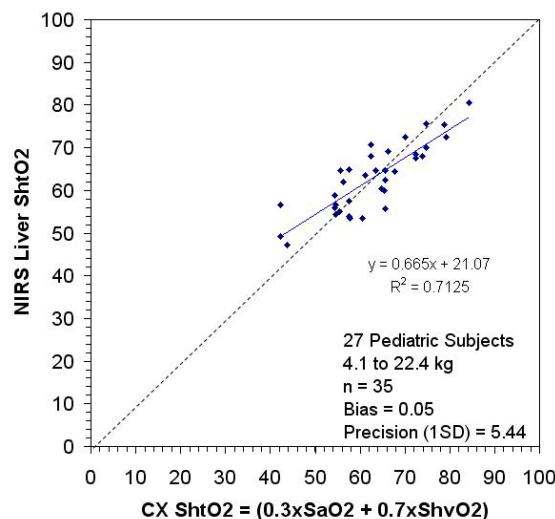
$$CX\ ShtO_2 = [0.3 \times SaO_2] + [0.7 \times ShvO_2]^{(1)}$$

The NIRS optically-derived ShtO₂ will be compared to CX ShtO₂ using linear regression.

Results: To date 27 subjects have completed the study using the Medium sensor (17M/10F; 18 Caucasian /5 African American/1 Hispanic/3 unknown; Age: 0.25-9.3 y; Weight 4.1-22.4 kg). 35 data points were analyzed (two Medium NIRS sensors were placed on the liver for some subjects). Correlation by linear regression of NIRS optically-derived ShtO₂ and CX ShtO₂ was $R^2 = 0.71$ (figure). The bias and precision (1 SD) were 0.05 and 5.44, respectively. A preliminary analysis shows a high correlation ($p = 2E-10$) between NIRS ShtO₂ vs CX ShtO₂

Discussion: These preliminary results demonstrate the ability of NIRS to estimate absolute tissue oxygen saturation of the liver. The provision of accurate regional brain and viscerosomatic tissue oxygen saturations by non-invasive measurement could be of important clinical value in both the OR and ICU when treating critically ill pediatric patients.

Figure 1.



Reference: Pang CC, J Pharmacol Toxicol Methods. 2000;44(2):341-60.

Disclosure of Relevant Financial Relationships