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

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**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:** The study population will include 65 pediatric subjects  $\leq 18$  years of age and  $\geq 2.5$  kg and  $\leq 40$  kg weight undergoing diagnostic cardiac catheterization at Duke pediatric cardiac catheterization laboratory. Four FORE-SIGHT medium or large size sensors, depending on subject weight, will be 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) and one on the forehead. Venous (SVC, IVC, Hepatic vein [HV]) and arterial (femoral or radial) blood samples will be taken with the subject typically breathing air ( $F_iO_2 = 0.21$ ).

Adherence to standard anesthetic practice will limit the potential confounding effects of anesthetic agents.

Blood samples will be analyzed by a co-oximeter to obtain  $S_aO_2$  (femoral or radial) and  $S_vO_2$  for the target organ. For the liver, a hepatic tissue oxygen saturation (CX  $S_{ht}O_2$ ) value will be determined from co-oximetry measurements:

$$CX S_{ht}O_2 = [0.3 \times S_aO_2] + [0.7 \times S_{hv}O_2](ref).$$

The NIRS optically-derived  $S_{ht}O_2$  will be compared to CX  $S_{ht}O_2$  using linear regression. We will determine the relationship between viscerosomatic oxygen saturation to mixed venous (SVC) and cerebral oxygen saturations.

**Results:** To date 4 subjects have completed the study (2M/2F; 3 Caucasian /1 African American; Age: 0.6-3.9 y; Weight 6.6-15.0 kg) 5 data points were analyzed (two NIRS sensors were placed on the liver for subject #4). A preliminary analysis shows a high correlation ( $p = 0.002$ ) between NIRS  $S_{ht}O_2$  and CX  $S_{ht}O_2$  (Figure).

[figure1]The table shows the measured oxygen saturation values for each subject. Of note, the hepatic  $S_{ht}O_2$  values were lower than the brain  $S_{ct}O_2$  values, as measured by NIRS, for 3 of 4 subjects.[figure2]

**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.

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

From Proceedings of the 2009 Annual Meeting of the American Society Anesthesiologists.

## Figure 1

Figure 1: Comparison of Liver NIRS ShtO2 to Co-oximetry derived ShtO2

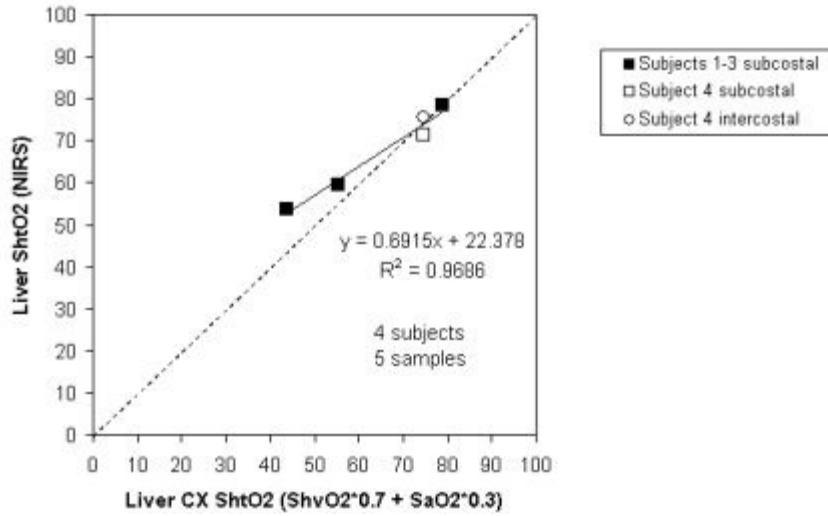


Figure 2

Subject	Weight (kg)	Age (yr)	Co-oximeter Measured				NIRS Measured	
			SaO2	IVC	HV	SVC	ScT02	ShtO2
1	6.6	7m	76.5	62.8	45.9	57.7 <sup>a</sup>	68.3 <sup>a</sup>	59.5
2	13.2	2	90.8	30.2	23.6	51.5	66.3 <sup>a</sup>	53.6
3	15.0	3	98.0	85.0	70.6	74.7	68.3 <sup>a</sup>	78.3
4	13.9	2	97.4	80.0	65.0	80.0	78.4	73.5 <sup>a</sup>

<sup>a</sup> = averaged value of two samples (blood co-oximetry or NIRS values)

