Correlation of Abdominal NIRS Oximetry with Gastric Tonometry: Measurement of Splanchnic Oxygenation in Neonates and Infants with Congenital Heart Disease.

Author(s): J Kaufman, RH Friesen, MC Almodovar, J Zuk

Affiliation: Children's Hospital and University of Colorado, Denver, Colorado

Introduction: Cerebral oximetry as measured by near infra-red spectroscopy (NIRS) has been shown to correlate well with mixed venous oxygen saturation obtained from in-dwelling catheter. Splanchnic hypo-perfusion and impaired oxygenation is a recognized complication of the post-operative course in single ventricle patients who have undergone cardiopulmonary bypasss. Gastric tonometry measures gastric mucosal pH and is considered the standard for measuring splanchnic oxygenation (1,2); however it is cumbersome and invasive. We hypothesized that NIRS sensors placed over the abdomen would correlate with gastric tonometry as measurement of splanchnic oxygenation, as well as with serum lactate and mixed venous oxygenation (SvO2), which are systemic indicators of oxygenation and perfusion.

Methods: After IRB approval and informed consent, 17 neonates and infants who had undergone congenital cardiac surgery for either univentricular (n=7) or biventricular repair (n=10) were monitored for 24 to 48 hours utilizing gastric tonometry and NIRS oximetry sensors. We measured regional oxygenation via the NIRS (Somanetics) over the splanchnic and renal beds. NIRS values were recorded along with paired points of intramucosal gastric pH by the tonometer, systemic arterial pH, serum lactate and systemic mixed venous saturation. We sought to correlate the NIRS oximeter on the abdominal site with gastric tonometry, serum lactate and SvO2.

Results: In both univentricular and biventricular subjects, strong correlation was observed between the abdominal NIRS and gastric mucosal pH as measured by tonometry, systemic mixed venous saturation measured from an in-dwelling catheter, and serum lactate.

Correlation of Abdominal Somatic NIRS Oximetry Values in Univentricular Infants

	R	R^2	P
Gastric Tonometry	0.88	0.78	<0.0001
SvO2	0.87	0.76	<0.0001
Lactate	-0.82	0.68	<0.0001

Discussion: We conclude that the NIRS oximeter, placed over the abdomen of an infant with a congenital cardiac defect, either with single or biventricular physiology, is a valid tool for monitoring splanchnic oxygenation. The NIRS monitor may be utilized to obtain an easy, immediate and non-invasive measurement of regional, splanchnic oxygenation in the infant congenital cardiac population.

References:

1. Fiddian-Green RG et al. Crit Care Med 1987;15:153-6.
2. Gutierrez G et al. Lancet 1992;339:195-9.