# REFERENCE LIST
# NEONATAL AND INFANT APPLICATIONS
**Cerebral Oximetry (Near Infrared Spectroscopy, NIRS) Monitoring**

**FORE-SIGHT is the only Absolute Cerebral Oximeter on the market that has FDA clearance for Neonatal and Infant Applications. FORE-SIGHT has been validated in human neonates and in neonatal animal models against co-oximetry measurements of invasive blood samples from the brain (sagittal sinus or jugular bulb).**

## Validation Study:


1) Rais-Bahrami K, Rivera O, and Short BL, Department of Neonatology, Children's National Medical Center, Washington, DC, USA

   **Validation of a noninvasive neonatal optical cerebral oximeter in veno-venous ECMO patients with a cephalad catheter.**

   *Journal of Perinatology*, 2006 Oct; 26(10):628-35

2) Benni PB, Chen B, Dykes FD, Wagoner SF, Heard M, Tanner AJ, Young TL, Rais-Bahrami K, Rivera O, and Short BL, CAS Medical Systems, Inc., Children's National Medial Center, Washington, DC

   **Validation of the CAS neonatal NIRS system by monitoring VV-ECMO patients: preliminary results.**

   *Advances in Experimental Medicine and Biology* 2005; 566: 195-201.

3) Paul B. Benni, Bo Chen, William Dyckman, and Elio Morgan. CAS Medical Systems, Branford, CT USA; Hartford Hospital, Hartford CT USA.

   **Animal model validation of the CAS neonatal NIRS System, including effects of extracerebral interference**

   *31st Annual Meeting of the International Society on Oxygen Transport to Tissue*, Rochester, New York, USA, August 2003


## Pediatric Heart Surgery (preoperative, intraoperative and postoperative monitoring):

### A. Prevention of Potential Catastrophic Events:


4) Sakamoto T, Duebener LF, Laussen PC, Jonas RA. Department of Cardiac Surgery, Children's Hospital, Harvard Medical School, Boston, MA, USA.

   **Cerebral ischemia caused by obstructed superior vena cava cannula is detected by near-infrared spectroscopy**.

   *J Cardiothorac Vasc Anesth.* 2004 Jun;18(3):293-303.

   > "SVC cannula obstruction causes cerebral ischemia with no change in blood pressure or venous oxygen saturation. In view of the difficulties and risks of CVP monitoring in babies, it is recommended to use other monitoring modalities such as NIRS to assess adequacy of cerebral perfusion if bicaval cannulation is used in neonates and infants."

5) Rossi M, Tirotta CF, Lagueruela RG, Madril D. Division of Cardiac Anesthesia, Congenital Heart Institute of Miami Children's Hospital and Arnold Palmer Hospital for Women and Children, Miami, FL 33155, USA.

   **Diminished Blalock-Taussig shunt flow detected by cerebral oximetry.**

   *Paediatr Anaesth.* 2007 Jan;17(1):72-4

6) Felix DE, Munro HM, DeCampli WM.

   **Near infrared spectroscopy used to detect preoperative aortic obstruction.**

   *Paediatr Anaesth.* 2007 Jun;17(6):598-9.

7) Han SH, Kim CS, Lim C, Kim WH. Division of Cardiac Anesthesia, Congenital Heart Institute of Miami Children's Hospital and Arnold Palmer Hospital for Women and Children, Miami, FL 33155, USA.

   **Obstruction of the superior vena cava cannula detected by desaturation of the cerebral oximeter.**

   *J Cardiothorac Vasc Anesth.* 2005 Jun;19(3):420-1

8) Scholl FG, Webb D, Christian K, Drinkwater DC. Division of Pediatric Cardiac Surgery, Monroe Carrell Jr Children's Hospital at Vanderbilt, Vanderbilt University Medical Center, Nashville, Tennessee 37232-9292, USA.

**Rapid diagnosis of cannula migration by cerebral oximetry in neonatal arch repair.**

*Ann Thorac Surg.* 2006 Jul;82(1):325-7.

9) T . Dominguez , G . Wernovsky , J . Gaynor

**Cause and Prevention of Central Nervous System Injury in Neonates Undergoing Cardiac Surgery.**

*Seminars in Thoracic and Cardiovascular Surgery*, Volume 19 , Issue 3 , Pages 269 - 277

## B. Improve Overall Patient Outcomes:

10) Sujata Chakravarti, Shubhika Srivastava, and Alexander J. C. Mittnacht

**Near Infrared Spectroscopy (NIRS) in Children**

*Seminars in Cardiothoracic and Vascular Anesthesia.* 2008; 12:70-79.
"As additional studies are performed and as technologic advancements are made, NIRS will continue to provide important insights into the hemodynamics and pathophysiology of neonates and children, and it will likely find its way into routine clinical practice."

11) Hoffman GM, Department of Anesthesiology and Critical Care Medicine, Children's Hospital of Wisconsin, Medical College of Wisconsin, Milwaukee, Wisconsin

**Neurologic monitoring on cardiopulmonary bypass: What are we obligated to do?**

*Ann Thorac Surg* 2006; 81:S2373-80.

> "Specific neurologic monitoring techniques that can be used during cardiopulmonary bypass include near-infrared spectroscopy, transcranial Doppler ultrasonography, and electroencephalographic techniques. Of these, only near-infrared spectroscopy provides a continuous quantitative signal of the physiologic variable most related to injury and most amenable to intervention."

12) McKenzie ED, Andropoulos DB, DiBardino D, Fraser CD Jr., Texas Children's Hospital, 6621 Fannin, MC-WT19345H, Houston, TX 77030, USA.

**Congenital heart surgery 2005: the brain: it's the heart of the matter.**

*Am J Surg.* 2005 Aug;190(2):289-94

13) Andropoulos DB, Stayer SA, Diaz LK, Ramamoorthy C. Department of Pediatric Cardiovascular Anesthesiology, Texas Children's Hospital, Baylor College of Medicine, 6621 Fannin WT19345H, Houston, TX 77030, USA.

**Neurological monitoring for congenital heart surgery.**

*Anesth Analg.* 2004 Nov;99(5):1365-75

14) Ghanayem NS, Mitchell ME, Tweddell JS, Hoffman GM. Department of Pediatrics, Division of Cardiothoracic Surgery, Medical College of Wisconsin 53122, USA.

**Monitoring the brain before, during, and after cardiac surgery to improve long-term neurodevelopmental outcomes.**

*Cardiol Young.* 2006 Sep;16 Suppl 3:103-9

15) Hoffman GM. Department of Anesthesiology and Pediatrics, Medical College of Wisconsin, Pediatric Anesthesiology and Critical Care Medicine, Children's Hospital of Wisconsin, Milwaukee, WI 53226, USA.

**Pro: near-infrared spectroscopy should be used for all cardiopulmonary bypass.**

*J Cardiothorac Vasc Anesth.* 2006 Aug;20(4):606-12

16) Toet MC, Flinterman A, Laar I, Vries JW, Bennink GB, Uiterwaal CS, Bel F. Department of Neonatology, KE 04.123.1, University Medical Center Utrecht/ Wilhelmina Children's Hospital, P.B. 85090, 3508 Utrecht, The Netherlands.

**Cerebral oxygen saturation and electrical brain activity before, during, and up to 36 hours after arterial switch procedure in neonates without pre-existing brain damage: its relationship to neurodevelopmental outcome.**

*Exp Brain Res.* 2005 Sep;165(3):343-50. Epub 2005 Jun 7.

17) Hagino I, Anttila V, Zurakowski D, Duebener LF, Lidov HG, Jonas RA. Department of Cardiovascular Surgery, Children's Hospital Boston, Harvard Medical School, MA, USA

**Tissue oxygenation index is a useful monitor of histologic and neurologic outcome after cardiopulmonary bypass in piglets.**

*J Thorac Cardiovasc Surg.* 2005 Aug;130(2):384-92.

18) Li J, Zhang G, Holtby H, Guerguerian AM, Cai S, Humpl T, Caldarone CA, Redington AN, Van Arsdell GS. Heart Center, the Hospital for Sick Children, Toronto, Ontario, Canada. jia.li@sickkids.ca

**The influence of systemic hemodynamics and oxygen transport on cerebral oxygen saturation in neonates after the Norwood procedure.**

*J Thorac Cardiovasc Surg.* 2008 Jan;135(1):83-90, 90.e1-2.

19) Berens RJ, Stuth EA, Robertson FA, Jaquiss RD, Hoffman GM, Troshynski TJ, Staudt SR, Cava JR, Tweddell JS, Bert Litwin S. Medical College of Wisconsin, Children's Hospital of Wisconsin, Milwaukee, WI, USA.

**Near infrared spectroscopy monitoring during pediatric aortic coarctation repair.**

*Paediatr Anaesth.* 2006 Jul;16(7):777-81

## Neonatal Intensive Care Applications:

20) Benni, P., Chen, B., Fenik, J. et.al., CAS Medical Systems, Inc., Children's National Medial Center, Washington, DC

**Cerebral and Pulse Oximetry Monitoring of Newborns – Clinical Observations**

*International Symposium on Innovations and Advancements in Monitoring Oxygenation and Ventilation (ISIAMOV 2007)*

> "Pulse oximetry is often unreliable as an indicator of arterial blood oxygenation during low or zero perfusion events, especially during circulatory arrest due to diminished or non-existent pulsatile arterial blood flow. Pulse oximetry is not a direct indicator of cerebral tissue oxygen saturation. Cerebral oximetry offers a direct method to measure cerebral tissue oxygen saturation and potentially predicts brain injury caused by an impaired balance between cerebral oxygen supply and demand. These results demonstrate the value of cerebral oximetry to monitor the effectiveness of CPR in situations in which pulse oximetry is unreliable. Cerebral oximetry is a promising modality for bedside monitoring in the NICU and is complementary to pulse oximetry."

21) Toet MC, Lemmers PM, van Schelven LJ, van Bel F. Department of Neonatology, University Medical Center Utrecht/Wilhelmina Children's Hospital, Utrecht, The Netherlands.

**Cerebral oxygenation and electrical activity after birth asphyxia: their relation to outcome.**

*Pediatrics.* 2006 Feb;117(2):333-9.

> Cerebral oxygen saturation, fractional cerebral tissue oxygen extraction measured by NIRS seem to reflect secondary energy failure after severe birth asphyxia.

22) Naulaers G, Morren G, Van Huffel S, Casaer P, Devlieger H. Department of Paediatrics, University Hospital Leuven, Belgium.

**Cerebral tissue oxygenation index in very premature infants.**

*Arch Dis Child Fetal Neonatal Ed.* 2002 Nov; 87(3):F189-92.

> "Cerebral TOI increases significantly in the first 3 days of life in premature babies. This increase probably reflects the increase in cerebral blood flow at this time."

23) Tsuji M, Saul JP, du Plessis A, Eichenwald E, Sobh J, Crocker R, Volpe JJ. Joint Program in Neonatology, Harvard Medical School, Boston, Massachusetts, USA.

**Cerebral intravascular oxygenation correlates with mean arterial pressure in critically ill premature infants.**

*Pediatrics.* 2000 Oct;106(4):625-32.

24) Wong FY, Leung TS, Austin T, Wilkinson M, Meek JH, Wyatt JS, Walker AM. Ritchie Centre for Baby Health Research, Monash Medical Centre, 246 Clayton Rd, Clayton, Victoria 3168, Australia.

**Impaired autoregulation in preterm infants identified by using spatially resolved spectroscopy.**

*Pediatrics.* 2008 Mar;121(3):e604-11. Epub 2008 Feb 4.

25) Hüning BM, Horsch S, Roll C. Department of Paediatrics, University Children's Hospital, Essen, Germany.

**Blood sampling via umbilical vein catheters decreases cerebral oxygenation and blood volume in preterm infants.**

*Acta Paediatr.* 2007 Nov;96(11):1617-21.

26) Soul JS, Hammer PE, Tsuji M, Saul JP, Bassan H, Limperopoulos C, Disalvo DN, Moore M, Akins P, Ringer S, Volpe JJ, Trachtenberg F, du Plessis AJ. Department of Neurology, Children's Hospital Boston and Harvard Medical School, Boston, MA 02115, USA.

**Fluctuating pressure-passivity is common in the cerebral circulation of sick premature infants.**

*Pediatr Res.* 2007 Apr;61(4):467-73.

27) Tsuji M, duPlessis A, Taylor G, Crocker R, Volpe JJ. Joint Program in Neonatology, Harvard Medical School, Boston, Massachusetts 02115, USA.

**Near infrared spectroscopy detects cerebral ischemia during hypotension in piglets.**

*Pediatr Res.* 1998 Oct;44(4):591-5.

28) Underwood MA, Milstein JM, Sherman MP. Division of Neonatology, Department of Pediatrics, Davis School of Medicine, University of California, Davis, CA 95616, USA.

**Near-infrared spectroscopy as a screening tool for patent ductus arteriosus in extremely low birth weight infants.**

*Neonatology.* 2007;91(2):134-9. Epub 2006 Nov 20.

29) Baenziger O, Stolkin F, Keel M, von Siebenthal K, Fauchere JC, Das Kundu S, Dietz V, Bucher HU, Wolf M. Department of Neonatology, University Hospital Zurich, Zurich, Switzerland.

**The influence of the timing of cord clamping on postnatal cerebral oxygenation in preterm neonates: a randomized, controlled trial.**

*Pediatrics.* 2007 Mar;119(3):455-9.

"Delayed clamping of the umbilical cord improves cerebral oxygenation in preterm infants in the first 24 hours."