CASMED®
FOR WHAT'S VITAL

ABSOLUTE NEWS

ISSUE 1 SPRING, 2011

This issue

Welcome

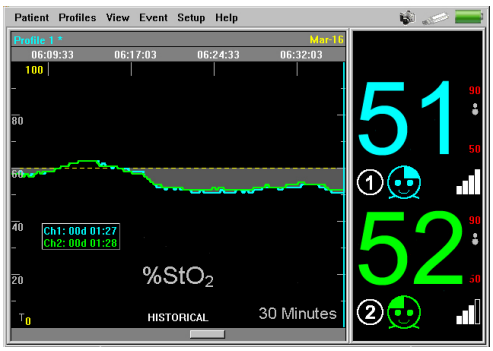
Welcome to the inaugural edition of "Absolute News" – CASMED's publication of exciting information related to tissue oximetry ("StO_2") and our FORE-SIGHT Absolute Tissue Oximeter. Improving patient care is a core value at CASMED. As such, we are committed to educating clinicians regarding tissue oximetry monitoring and the impact it can have to improve outcomes. We've launched this publication as one small part of that commitment. We hope you find these articles helpful to your practice, and we welcome your feedback.

Thomas M. Patton
President & CEO

Size and Time Matter: Assessing Cerebral Desaturation Events through AUT and TUT

In a new study by Fischer et al[1], an association was found between the cumulative duration and magnitude of decreased perioperative cerebral tissue oxygenation ($SctO_2$) values and major complications. The results show that the patient had a greater risk of major complications with increasing duration of $SctO_2$ below a given threshold. Using this information, patients whose $SctO_2$ data are in the borderline zone (<60%) for prolonged periods are at a significantly higher risk for adverse outcomes than those whose saturation values remain above this threshold. Conversely, it is suggested that patients can tolerate profound but brief (or transient) cerebral desaturations without consequences. Thus, it appears that the cumulative effect of these prolonged desaturation events indexed over time is key to predicting poor postoperative outcomes. To allow the clinician to quantify and visualize this concept in real time, **Time Under Threshold (TUT) and Area Under Threshold (AUT)** [also known as Area Under Curve (AUC)], were recently added as a FORE-SIGHT feature. More studies are underway to further substantiate the AUT and TUT boundaries.

AUT and TUT are unique to FORE-SIGHT with software version 6.0 or higher. When determining threshold values, the increased accuracy of an absolute monitor is beneficial, allowing the clinician to have more confidence in the values displayed. Fischer and his colleagues stated their belief in this new feature in combination with FORE-SIGHT accuracy: "*A potential advantage of absolute brain tissue oxygenation is that threshold values may be more strongly associated with adverse outcomes than trends.*"



Citation:

Fischer GW, Lin HM, Krol M, Galati MF, Di Luozzo G, Griepp RB, Reich DL. Noninvasive cerebral oxygenation may predict outcome in patients undergoing aortic arch surgery. *J Thorac Cardiovasc Surg* 2011;141(3):815-21.

How are AUT and TUT calculated and displayed ?

- TUT (units: minutes): Accumulated TUT is the sum of the duration of time for every event when $SctO_2$ values drop below the assigned threshold.
- AUT (units: minute-%): For every $SctO_2$ data point below the selected threshold, this value is subtracted from the threshold, and multiplied by the duration of time below the selected threshold. AUT is the sum of these values. FORE-SIGHT updates $SctO_2$, TUT, and AUT every two seconds.

The FORE-SIGHT TUT and AUT setting is activated by following these steps in the user interface:

1. Turn the FORE-SIGHT rotary knob to select the Setup menu and select Preferences.
2. Turn the rotary knob to the Analysis Threshold and press the knob to select the threshold level.
3. To activate a visual TUT calculation, select the View menu and then select Threshold Analysis.
4. The TUT values appear in the trace area in the same color as the channel Trace & Numerics. The TUT is displayed as xxd hh:mm; where xx is days, hh is hours and mm is minutes where the channel data are below the threshold. AUT is shown as a shaded area below the threshold. TUT and AUT values can be accessed by activating the FS DATA review features.

Important

- The TUT threshold must be set **before** patient data is collected.
- Once there is patient data in the system, the TUT cannot be re-set to a different threshold.
- If there is patient data in the system, the selection under Preferences is not displayed.

Case Study

Doctor's Corner

Dr. Gregory W. Fischer of Mt. Sinai Medical Center in New York will be giving a presentation entitled, "Current Update on Cerebral Oximetry", at the World Anesthesia Congress in Rome, Italy in April 2011.

Testimonial

The FORE-SIGHT Absolute Oximeter is the biggest revelation in patient safety monitoring during the last five years. FORE-SIGHT has consistently provided reliable data so we know when and how much to intervene. This brain information is not available from monitoring other routine parameters. In many short procedures, we rely on FORE-SIGHT as the most important brain monitoring device. In long complex procedures, FORE-SIGHT is an essential part of our monitoring system that drives our care strategy.

Jan Van Hemelrijck, M.D., Ph.D.
Department of Anesthesiology
Cardiac Anesthesia
University Hospitals Leuven,
Leuven, Belgium.

Recognition of an Inadvertently Unilateral Intubation using FORE-SIGHT

by Thomas M. Hemmerling, MD

We present a patient with advanced gastric cancer scheduled for gastro-esophagectomy and partial hepatectomy. Anesthesia was induced using propofol, fentanyl and rocuronium; endotracheal intubation was performed using a double-lumen tube. Intermittent positive pressure ventilation was maintained with breathing gas mixture of 50% oxygen-air to maintain $PETCO_2$ of 30 – 40 mmHg.

Monitoring consisted of standard monitoring (intra-arterial pressure, ECG, peripheral oxygen saturation, bispectral index monitoring, blood gas analysis every 15 minutes) and absolute cerebral oximetry with FORE-SIGHT. For the first part of surgery (abdominal approach and resection of stomach), the patient was placed in the supine position and both lungs were ventilated. During this period, a gradual drop of $SctO_2$ similar to the drop seen during SLV (Single Lung Ventilation) was noticed, without changes in peripheral saturation. A blood gas analysis was performed, which did not show any abnormality.

The anesthetist decided to verify the double-lumen position via fiberoptic bronchoscopy. This revealed that the tube had been advanced too far into the left bronchus, causing unilateral ventilation. This unintended single-lung ventilation was then corrected by pulling the tube back and into the right position under fiberoptic control, permitting adequate double-lung ventilation.

A unilateral position – endobronchial intubation – happens more often with double-lumen tubes; however, even with normal endotracheal intubations, this can happen. Very often, this is only noticed by accident, when an x-ray is performed or – a late sign – the peripheral oxygen saturation drops. The use of cerebral oximetry with FORE-SIGHT can help us to detect this complication earlier and correct the problem.

Thomas M. Hemmerling, MD, DEAA
Associate Professor,
Department of Anesthesiology, McGill University
Institut de Genie Biomedical
Université de Montréal, Montreal Canada

Recently published article

Cerebral Oxygen Desaturation Events Assessed by Near-Infrared Spectroscopy During Shoulder Arthroscopy in the Beach Chair and Lateral Decubitus Positions

Summary by CASMED

The beach chair position has been used for shoulder surgery for over 20 years and has gained popularity because it offers a number of technical advantages over the lateral decubitus position. Patients undergoing shoulder surgery in the beach chair position may be at risk for adverse neurologic events due to cerebral ischemia, which has been associated with cerebral oxygen desaturations. This study, led by Glenn S. Murphy, MD of the Department of Anesthesiology at the Evanston/NorthShore University HealthSystem of the University of Chicago Pritzker School of Medicine, found that significant reductions in $SctO_2$ occur in patients in the beach chair position despite the use of a protocol designed to maintain systemic blood pressure and ventilation parameters. A strong correlation was found between cerebral desaturation events and a multi-fold increased incidence of post-operative nausea and vomiting.

Citation:

Murphy GS, Szokol JW, Marymont JH, Greenberg SB, Avram MJ, Vender JS, Vaughn J, Nisman M. Cerebral oxygen desaturation events assessed by near-infrared spectroscopy during shoulder arthroscopy in the beach chair and lateral decubitus positions. *Anesth Analg* 2010; 111(2): 496-505.

FORE-SIGHT® Absolute Tissue Oximetry – Setting the Standard

- **Actionable accuracy** using Near Infrared Spectroscopy (NIRS) to assess cerebral and tissue oxygen saturation
- **Continuous and consistent** real-time data with spot check capability
- **Precise** measurement in adults, children and babies
- **Patient-tailored algorithm** to account for individual differences including age, weight and skin pigmentation

FORE-SIGHT has always been the standard of absolute tissue oximetry, because the clinician deserves absolute accuracy substantiated by consistent clinical evidence. CASMED's constant pursuit of new science is raising the expectations for all NIRS devices.

A Look at FORE-SIGHT Around the World

The Blackpool Victoria Hospital was the first hospital in the UK to purchase the FORE-SIGHT Absolute Tissue Oximeter. Their Lancashire Cardiac Centre now routinely uses this technology to monitor cerebral oximetry for those patients undergoing complex heart surgery. The Centre is part of Blackpool, Fylde and Wyre Hospitals NHS Foundation Trust, which provides heart and lung treatment for the people of Lancashire, Cumbria and beyond. Since its installation at Blackpool two years ago, FORE-SIGHT has been used for more than 1,400 patients during coronary, valve or major aortic surgery. In a 26-March-2010 hospital press release, Consultant Cardiothoracic Anaesthetist, Dr. Mike Hartley said, "Cardiac surgery is increasingly complex and is being offered to older and sicker patients, and we are constantly striving to increase the safety of the procedure for the patient. Most cardiac surgery is performed utilising cardiopulmonary bypass, where the function of the heart and lungs is provided by a machine, and, until now, we have had no way of ensuring that the brain is supplied with sufficient oxygen during this procedure. This technology [FORE-SIGHT] is very easy to use and continuously informs us of levels of oxygen in the brain. If the level of oxygen falls at any time, we are informed immediately and can institute a series of simple steps to correct the fall before any serious damage is done." Dr. Hartley commented further, "There is no doubt that the use of this technology has allowed us to avoid serious outcomes, including stroke, in several patients, and has probably contributed to improved recovery for a number of our other patients. We are very privileged to be the first cardiac centre in the country to have adopted this as a standard of care."

Blackpool Victoria Hospital
Lancashire Cardiac Centre
United Kingdom

The Lancashire Cardiac Centre team has demonstrated in their follow-on work that use of FORE-SIGHT specifically benefitted patients. In two peer-reviewed publications, they shared the results of several clinical cases. In a paper[1] entitled, "A novel application of cerebral oximetry in cardiac surgery," authors commented that FORE-SIGHT was used, "during cardiopulmonary bypass to monitor cerebral perfusion where iatrogenic compromise could arise from occlusion of a persistent left superior vena cava (PLSVC). It allowed easy, safe, and effective monitoring of the effect of occlusion of the PLSVC." Furthermore, "Cerebral oximetry during PLSVC occlusion allowed monitoring of left hemispheric oxygen saturation by comparison with the right to ensure that iatrogenic compromise did not arise." In a paper[2] entitled, "Using cerebral oximetry to prevent adverse outcomes during cardiac surgery," the authors commented that, "FORE-SIGHT alerted the operating team to an unexpected drop in cerebral oxygen saturation levels when all other monitoring was within normal parameters… As well as the ability of acting as a `warning device', the FORE-SIGHT also allows cardiopulmonary bypass to be tailored for each specific patient."

The cardiac surgeons, cardiothoracic anaesthetists and perfusionists at Blackpool Victoria Hospital are relying on these FORE-SIGHT Absolute Tissue Oximeter data to understand the complexities of a surgical case and to rapidly respond to falls in cerebral oxygenation.

Citations:

1. Hassan MAA, Rozario C, Elsayed H, Morcos K, Millner R. A novel application of cerebral oximetry in cardiac surgery. *Ann Thorac Surg* 2010;90(5):1700-1.
2. Faulkner JT, Tang A, Hartley M. Using cerebral oximetry to prevent adverse outcomes during cardiac surgery. *Perfusion* 2010 Dec 20. [Epub ahead of print]

Standard of Care at Children's Hospital Boston

Non-invasive monitoring for children following cardiac surgery using near infrared spectroscopy (NIRS) enables an important assessment of cerebral and somatic oxygen delivery. This type of monitoring does not rely on pulse detection and provides an assessment of oxygen delivery during critical phases of recovery. Further, there is emerging data that changes in cerebral oxygen saturation as measured by NIRS may be related to brain MRI changes and neuro-developmental assessment at 12 months of age following pediatric cardiac surgery. As such, ***NIRS is rapidly becoming a standard of care. This is certainly the case in the Cardiac Intensive Care Unit at Children's Hospital Boston, where cerebral NIRS is routinely monitored in the post operative period.*** *There are still many questions to answer and while there is no clear industry standard for the method of monitoring oxygen saturation in tissue beds, over recent years we have studied and now routinely use the FORE-SIGHT monitor. Not only are we able to obtain valuable continuous and consistent trend data, more importantly the laser diode (narrower bandwidth) and algorithm incorporating four wavelengths of light (instead of two), provides an absolute brain tissue oxygen saturation ($SctO_2$) in adult and pediatric patients. This information allows us to more accurately target treatment to optimize cerebral perfusion and oxygen delivery.*

Dr Peter C. Laussen MB, BS
Chief, Division Cardiovascular Critical Care
Department of Cardiology
DD Hansen Chair in Pediatric Anesthesia
Department of Anesthesia
Children's Hospital Boston
Professor of Anesthesia
Harvard Medical School
Boston, Massachusetts, USA

FORE-SIGHT Clinical Corner

What are your peers saying?

Visit us at www.casmed.com. Click on the "FORE-SIGHT Clinical Corner" on our website for notes on recently published papers.

If you have a suggestion or idea or if you would like to be considered for an article submission in CASMED'S Absolute News, please call 203.315.6953 or email us at fore-sight@casmed.com

Latest News

New Indication for Use

FORE-SIGHT now has expanded FDA labeling for monitoring skeletal muscle of infants, children and adolescents weighing between 5 and 50 kg. Software for monitoring of skeletal muscle is now standard on all new monitors. Older monitors may be updated at no additional cost. Contact your clinical specialist or customer service (custsrv@casmed.com) to arrange an upgrade.

New CASMED Europe Office

We are very excited to announce the opening of our new CASMED office in Europe!

Address: Industriestraat 2, B-1910 Kampenhout, Belgium

Phone number: +32 16 60 98 61

Upcoming Conferences in 2011

For a full list of our upcoming conferences, please visit our website www.casmed.com

Apr 11 - 15	NWAC World Anaesthesia Congress, Rome, Italy • Dr. Gregory W. Fischer will be presenting "Current Update on Cerebral Oximetry"
Apr 14 - 16	AmSECT 49th International Congress, New Orleans, LA, USA
Apr 28 - 30	Baylor College of Medicine 8th Current Trends in Cardiothoracic Surgery, Houston, TX, USA
Apr 30 - May 5	Society of Cardiovascular Anesthesiologists (SCA) 33rd Annual Meeting, Savannah, GA, USA
Apr 30 - May 3	Pediatric Academic Societies Annual Meeting, Denver, CO, USA • Dr. Pia Wintermark will be presenting "Near-Infrared Spectroscopy Versus Magnetic Resonance Imaging To Study Brain Perfusion in Newborns with Hypoxic-Ischemic Encephalopathy"
May 8 - 10	American Association of Thoracic Surgery (AATS), Philadelphia, PA, USA
May 14 - 17	German Anaesthesia Congress (DAC), Hamburg, Germany
May 20 - 22	60th European Society for Cardiovascular Surgery (ESCVS), Moscow, Russia
May 21 - 24	International Anesthesia Research Society (IARS) 2011 Annual Meeting, Vancouver, Canada
Jun 1 - 3	14th Annual Neonatal APN Forum, Washington, DC, USA
Jun 1 - 4	26th Annual European Association of Cardiothoracic Anaesthesiologists (EACTA), Vienna, Austria • Dr. Gregory W. Fischer will be presenting "Current Update on Cerebral Oximetry"
Jun 11-14	Euroanaesthesia (ESA), Amsterdam, Netherlands
Jun 11 - 14	21st Congress of the World Society of Cardiothoracic Surgeons, Berlin, Germany
Jun 24 - 28	Canadian Anesthesiologists' Society Meeting, Toronto, Canada
Aug 6 - 10	American Association of Nurse Anesthetists (AANA), Boston, MA, USA
Aug 18 - 20	3rd Joint Scandinavian Conference in Cardiothoracic Surgery, Tampere, Finland

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