

# StO<sub>2</sub> Sensor

A forum for trends and tissue oxygen monitoring in trauma and critical care

Issue 5 — January 2008

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## InSpectra™ StO<sub>2</sub> Clinical Users Provide First-hand Insight at HTI's 2007 Directors' Forum

For the fifth consecutive year, Hutchinson Technology sponsored a forum for the discussion of tissue perfusion monitoring at the annual meeting of the American Association for the Surgery of Trauma (AAST), held in Las Vegas, Nevada, September 2007.

While previous forums focused on tissue perfusion research and related topics, this year's event featured two trauma surgeons and an anesthesiologist describing their clinical use of the **InSpectra StO<sub>2</sub>** Tissue Oxygenation Monitor to assess a patient's perfusion status.

Here is a summary of what attendees heard at the forum:

### Joseph Cuschieri, MD

*Associate Professor, University of Washington; Director of Surgical Critical Care, Harborview Medical Center, Seattle, Washington*

Dr. Cuschieri first described, in his view, the shortcomings of other monitoring technology. "Other methods are indiscriminately poor at determining who's in shock, both because of poor sensitivity and the resulting poor positive predictive value," he said. "And the other laboratory studies or parameters we use, such as base deficit and SvO<sub>2</sub>, require invasive procedures."

Compensated shock, in particular, can be problematic, according to Dr. Cuschieri. Eventually, it can lead to rapid cardiovascular collapse even in cases where a patient initially presents normal hemodynamics. What's more, he said that even in cases where it's easy to recognize a patient who's in shock—for example, one who comes in with a blood pressure reading of 60—it is not always

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Joseph Cuschieri, MD



Robert D. Barraco,  
MD, MPH



Richard P. Dutton,  
MD, MBA

## Directors' Forum, Continued

so easy to determine when the problem has been corrected, and when the patient has been resuscitated.

The two patient populations that interested Dr. Cuschieri, as he evaluated the **InSpectra™ StO<sub>2</sub>** Monitor, were the elderly and those who came in initially hypotensive. He wanted to see how well the device helped his team identify when those patients had achieved resuscitation end points.

*"This is a device I put on the hand and I get an instant reading. There is no delay."*

Joseph Cuschieri, MD

"Obviously, the elderly come in with multiple co-morbidities including cardiac, pulmonary, and renal insufficiency, where urine output and other measures may be detrimentally affected," Dr. Cuschieri said. "They also present with various medications, including beta-blockers, so some of their initial signs such as tachycardia are lost." Meanwhile, he noted that patients who present with marked hypotension due to ongoing, uncontrolled

resuscitation may develop abdominal compartment syndrome and, if they're not resuscitated fully, can experience organ dysfunction.

In the actual cases he described, Dr. Cuschieri said there was a good correlation between **InSpectra StO<sub>2</sub>** and base deficit. In addition: "The **InSpectra StO<sub>2</sub>** monitoring device is point-of-care, as opposed to base deficit, which you have to spend time to get. You have information at the time that you're looking at the patient. There are trends you can follow, and looking at the trends is highly important and can actually lead to a potential improvement in outcomes."

### **Robert D. Barraco, MD, MPH**

*Chief, Sections of Pediatric and Geriatric Trauma, Lehigh Valley Hospital, Allentown, Pennsylvania*

Dr. Barraco began his presentation by saying he had seen a lot of noninvasive monitors over the years that were touted as "the next big thing." So when the **InSpectra™ StO<sub>2</sub>** Tissue Oxygenation Monitor came to his attention, Dr. Barraco didn't embrace it immediately. Instead, he evaluated it with a limited number of patients. But after the evaluation, he said, "We're pretty much jumping on board with this because it certainly seems to have more accuracy than any of the other devices we've previously worked with."

*"We're pretty much jumping on board with this because it certainly seems to have more accuracy than any of the other devices."*

Robert D. Barraco, MD, MPH

Dr. Barraco went through a case of a 40-year-old, obese male motorcyclist who had crashed into brush at 45 mph, and came in complaining of shoulder and chest pain. "We put the **InSpectra StO<sub>2</sub>** Monitor on, and the initial reading was 75%, so we thought we were okay. But after giving him sedation, he didn't start taking deep breaths. And before the oxygen saturation monitor changed, his **InSpectra StO<sub>2</sub>** dropped to the high 60s. It was unclear whether this was the result of pneumothorax, or a bit of obstruction from his morbid obesity, but I was impressed that the **InSpectra StO<sub>2</sub>** Monitor reflected the change before the oxygen sat monitor did." Conversely, after O<sub>2</sub> was increased and a chest tube was placed, the **InSpectra StO<sub>2</sub>** reading moved up to 77 and stayed there for the ensuing time. Dr. Barraco's reaction: "Again, I was struck by the fact that the **InSpectra StO<sub>2</sub>** was sensitive to therapeutic interventions, including, seemingly, embolization, stopping bleeding, intervening with oxygen and intervening with the chest tube."

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## Directors' Forum, Continued

Lehigh Valley Hospital's adopted protocol, according to Dr. Barraco, is to place the **InSpectra StO<sub>2</sub>** Monitor on all Code Reds—those patients who meet ACS physiologic criteria, with a systolic blood pressure less than 90, and penetrating neck/torso trauma. In addition, **InSpectra StO<sub>2</sub>** Monitors will be placed on trauma alerts who are intubated or where clinical judgment says they may be unstable.

### **Richard P. Dutton, MD, MBA**

*Associate Professor of Anesthesiology, University of Maryland; Director, Trauma Anesthesia and Director, Clinical Operations, R Adams Cowley Shock Trauma Center, Baltimore, Maryland*

Dr. Dutton, an anesthesiologist, has been at Shock Trauma Center for 15 years and said he first became interested in the **InSpectra™ StO<sub>2</sub>** Tissue Oxygenation Monitor five years ago, when a previous generation of the device was first introduced. But when he evaluated that model for a couple months, he told Hutchinson Technology, "It's not ready for prime time."



*"Speed wins in the hemorrhage business and the sooner you identify the problem, the sooner you fix it."*

Richard P. Dutton, MD, MBA

Last year, it was a different story. Dr. Dutton evaluated the new **InSpectra StO<sub>2</sub>** model 650 and pronounced it "ready."

Dr. Dutton, too, used actual case studies to illustrate his opinions about the value of the **InSpectra StO<sub>2</sub>** Monitor. The first case was a 25-year old male, ejected in a motor vehicle collision. When the patient arrived in the operating room, he was essentially normotensive, but his tissue oxygenation was "terrible," and, in fact, he was looking distressed on the whole. Opening his

abdomen and restoring his intravascular fluid volume restored his **InSpectra StO<sub>2</sub>** and, as Dr. Dutton reported, "We were very impressed because this was the first case where we put the tissue oxygenation monitor on and it really seemed to track what was going on with the patient. It provided a nice correlation of what was happening with him."

In another case involving a motor vehicle collision, what impressed Dr. Dutton was the micro-variations in the tissue oxygenation reading over time. When a bolus of red cells and calcium was injected, for example, the monitor indicated a rise in the tissue oxygenation immediately.

"We've been very impressed with its use in the operating room over the last couple months. As a trend monitor, the ups and downs really seem to track nicely with what's going on with the patient. So, we're continuing to use it. It's much simpler to use than the first-generation model was. We can put it on the patient and can get data quickly. It seems to track well with what's going on with the patient. And as an adjunct to our thinking, it is something that gives us early warning that a problem is developing, or gives us ongoing reassurance that things are getting better. In the long run, it is going to cut down on the number of invasive procedures we do, the number of lab tests we order, and ultimately is going to become part of our practice."



## Laying the Foundation: The Economics of Hemorrhagic Shock

The price paid for not recognizing hemorrhagic shock, not treating shock appropriately, or over-resuscitating trauma patients can be significant, both in terms of patient outcomes and associated costs.

This is precisely why better-informed resuscitation makes sense. Helping to reduce the occurrence of hemorrhagic shock in trauma patients and resuscitating appropriately when it does occur can produce economic benefits for cost-stressed trauma programs.

Some recent studies, summarized here, have looked at the relationships of hemorrhagic shock and low **InSpectra™ StO<sub>2</sub>** Monitor readings with patient length of stay and cost of care.

**The Nathens/Rosengart NTDB Study**  
Avery Nathens (Director of Trauma, St. Michael's Hospital, Toronto) and Matt Rosengart (Attending Trauma Surgeon, University of Pittsburgh Medical Center) have prepared and submitted a manuscript based on a retrospective research study of National Trauma Data Bank (NTDB) files. The NTDB files contain researchable data on over two million trauma cases from 600 hospitals. The authors compared trauma patients presenting with hemorrhagic shock to those trauma patients without hemorrhagic shock in order to determine the financial burden of hemorrhagic shock. Although

the full discussion of the study will not be available until it is published, they authorized Hutchinson Technology Inc. to share the overall conclusions of their research:

- The mean length of stay for a trauma hemorrhagic shock patient was four times longer than a trauma patient without hemorrhagic shock

- Critically injured patients with hemorrhagic shock required four times the normal care expense

### **The InSpectra™ StO<sub>2</sub> Trauma Study**

The Trauma Study was a prospective observational clinical trial to identify the role that **InSpectra StO<sub>2</sub>** monitoring could play in hemorrhagic shock and resuscitation. **InSpectra StO<sub>2</sub>** could not be used in that study to improve the patient's situation or help the physician resuscitate—it wouldn't have allowed the validation of the parameter as a true measure of perfusion status. The study concluded that the **InSpectra StO<sub>2</sub>** parameter could statistically predict a bad outcome—Multiple Organ Dysfunction Syndrome (MODS). The study also concluded that:

- Low **InSpectra StO<sub>2</sub>** was associated with longer ICU LOS and increased ventilator days
- Patients with **InSpectra StO<sub>2</sub>** at or above 75% for greater than eight hours in a 24-hour period had significantly shorter ICU LOS and fewer ventilator days

[NOTE: These are statistical relationships proving that low **InSpectra StO<sub>2</sub>** is truly something that should be avoided. This type of research does not support the conclusion that the use of **InSpectra StO<sub>2</sub>** to inform resuscitation produced those reductions—the data suggests that further research is warranted to see if the use of **InSpectra StO<sub>2</sub>** information during resuscitation could have that type of clinical and economic benefit.]

### **Hutchinson Technology Cost Savings Estimator Spreadsheet**

Hutchinson Technology has created a fill-in-the-blank cost savings estimator spreadsheet that can be constructed with a hospital's own assumptions of patient sensor use rates, incidence of patient benefit, time and materials saved (e.g. blood products), and length of stay possible reductions. To receive a copy of this spreadsheet, contact your Hutchinson Technology representative or our Customer Service Center at 800-419-1007.

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## Case Data Lives on in New Software

In order to help customers better understand **InSpectra StO<sub>2</sub>** data in context with other measurements, Hutchinson Technology Inc. introduced the new **InSpectra StO<sub>2</sub>** Case Graphing Software that allows users to easily export **InSpectra StO<sub>2</sub>** data from the **InSpectra StO<sub>2</sub>** Monitor and create graphs of patient **InSpectra StO<sub>2</sub>** tracings.

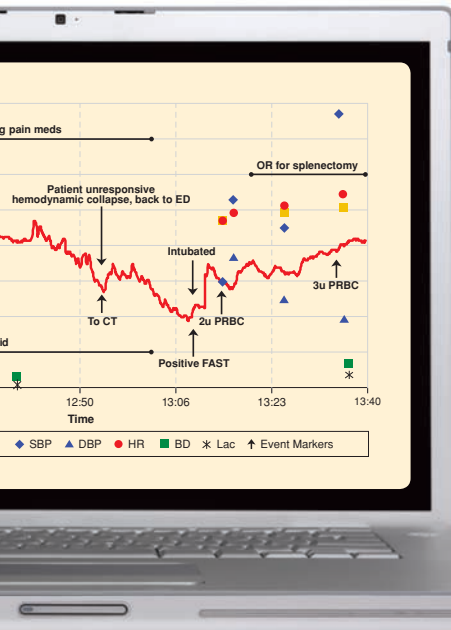
"With this software, our customers will be able to better evaluate the relationship between **InSpectra StO<sub>2</sub>** and other parameters such as blood pressure and base deficit," says Kristi Rice, Senior Product Specialist with the company's BioMeasurement Division. "It will also facilitate the sharing of this information with colleagues." With two clicks in the Windows®-based application, users can download up to 96 hours of **InSpectra StO<sub>2</sub>** data from the **InSpectra StO<sub>2</sub>** System and graph that data in intervals ranging from 2 to 12 seconds.

Other features of the **InSpectra StO<sub>2</sub>** Case Graphing Software:

- An interactive zoom feature enables viewing of specific segments of the **InSpectra StO<sub>2</sub>** tracing
- Users can select from more than 15 hemodynamic parameters, and add up to five user-defined parameters to display the full patient case
- Event markers can be placed in the graph to indicate interventions
- A text box provides space to assist in documenting a patient's clinical course

Adds Rice, "The **InSpectra StO<sub>2</sub>** Case Graph, and all of the added parameters within it, can be copied and pasted into other applications such as Microsoft PowerPoint®, for sharing."

In conjunction with the **InSpectra StO<sub>2</sub>** Case Graphing Software, Hutchinson Technology is also introducing a field upgrade increase in the **InSpectra StO<sub>2</sub>** Monitor storage capacity from 24 hours to 96 hours in order to provide additional time for clinicians to extract the **InSpectra StO<sub>2</sub>** data before it is erased.



To learn more about **InSpectra™ StO<sub>2</sub>** Case Graphing Software, contact your Hutchinson Technology representative or our Customer Service Center at 800-419-1007.

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### The Economics of Hemorrhagic Shock, Continued

#### The Haas/Rosengart/Nathens MODS Billing Comparison from the **InSpectra™ StO<sub>2</sub>** Trauma Study

One of the sub-studies resulting from the **InSpectra™ StO<sub>2</sub>** Trauma Study data was economics-oriented. This study was presented as an abstract at this year's AAST meeting. The study analyzed the LOS and overall cost difference between trauma patients who go on to develop MODS and those that do not develop MODS. The conclusions:

- MODS patients have an ICU LOS 3x longer than non-MODS patients (21 vs. 7 days)
- MODS patient ventilator days are almost 4x longer than ventilated non-MODS patients (19 vs. 5 days)
- MODS patients have a median hospital cost 2x greater than non-MODS patients (\$312K vs. \$148K)

#### The Take-Away Message

Any new technology or procedure that can aid clinical decision-making to help reduce or treat the incidence of hemorrhagic shock more effectively can have a major economic impact on a trauma hospital. Likewise, any new technology or procedure that can aid clinical decision-making to help reduce the chance of a patient developing MODS unnecessarily can have a major economic impact on a trauma hospital.

A growing, hospital-by-hospital body of real world experience shows that hospitals stand to gain financially by having better information to (a) identify the need for resuscitation; (b) track the progress of treatment; and (c) assist in determining when to stop fluid therapy.



Join Us at SCCM  
at Booth #736

**2008 Trauma and Emergency  
Medicine Forum:  
Sponsored by Hutchinson  
Technology Inc.**

Monday, February 4  
Hilton Hawaiian Village  
Honolulu, HI  
5:30–9:00 p.m.

**Monitoring the Shock  
Patient's Perfusion Status  
with InSpectra StO<sub>2</sub>**

Moderator: **Emanuel Rivers,  
MD, MPH, IOM**

Presentations:

- ED Monitoring of Perfusion Status in Undifferentiated Shock Patients (Otero, Detroit)
- Incorporating **InSpectra StO<sub>2</sub>** into Hemodynamic Monitoring (Ahrens, St. Louis)
- Guiding Fluid Resuscitation of Trauma Patients with **InSpectra StO<sub>2</sub>** (Duranteau, Paris)

RSVP by January 29, 2008  
1.800.419.1007 or  
biom.usa@hti.htch.com  
Seating is limited to 100.

## Look for us at these US and International Meetings

**Eastern Association for the Surgery  
of Trauma (EAST) 20th Annual  
Scientific Assembly**  
January 15–19, 2008  
Amelia Island Plantation  
Jacksonville, FL

**South California Chapter of ACS  
Annual Scientific Meeting**  
January 18–20, 2008  
Four Seasons Biltmore  
Santa Barbara, CA

**Winter Workshop Intensive Care**  
January 20–26, 2008  
Villars, France

**Society of Critical Care Medicine  
(SCCM) 36th Critical Care Congress**  
February 2–6, 2008  
Hawaii Convention Center  
Honolulu, HI

**Symposium Intensivmedizin**  
February 20–22, 2008  
Bremen, Germany

**Lehigh Valley Hospital & Health  
Network Trauma 2007: A  
Continuum of Care Conference**  
March 6–7, 2008  
DeSales University Conference Center  
Center Valley, PA

**National Foundation for Trauma Care  
Annual Membership Meeting**  
March 6–7, 2008  
Embassy Suites–Market Center Hotel  
Dallas, TX

**Jepu Anathesie – Reanimation**  
March 14–15, 2008  
Paris, France

**USC & Keck School of Medicine 46th  
Annual Critical Care, Trauma, and  
Emergency Medicine Symposium**  
March 16–20, 2008  
Caesar's Palace  
Las Vegas, NV

**ISICEM International Symposium  
on Intensive Care & Emergency  
Medicine**  
March 18–21, 2008  
Brussels, Belgium

**Baylor College of Medicine Trauma,  
Critical Care & Acute Care Surgery**  
March 24–26, 2008  
Caesar's Palace  
Las Vegas, NV



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**InSpectra® StO<sub>2</sub> Indications for Use**  
TISSUE OXYGENATION MONITOR **Model 650**

The **InSpectra StO<sub>2</sub>** Tissue Oxygenation Monitor is intended for use as a noninvasive monitoring system that measures an approximated value of percent hemoglobin oxygen saturation in tissue (StO<sub>2</sub>).

The **InSpectra StO<sub>2</sub>** Tissue Oxygenation Monitor is indicated for use in monitoring patients during circulatory or perfusion examinations of skeletal muscle or when there is a suspicion of compromised circulation.