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## Choosing A Cerebral Oximeter, Is It Really A No-Brainer?

Cerebral oximetry is rapidly becoming the standard of care in many health care institutions. The accuracy of a device is paramount to patient outcomes, safety and care. When given the growing number of cerebral oximetry devices available, clinicians will need to make important decisions as to which device will best fit the needs and accuracy in their practice. Pertinent questions are critical in this decision process. Clinicians need to understand that each system is not equal in respect to technologies or their algorithmic processing. These inherent differences in technologies can and do impact the device accuracy, but also the utility and reliability in your clinical practice. So, what questions should clinicians ask? What do you need to know and understand? What test or evaluation should be conducted in the patient setting?

Here at St. Francis, Dr. George McCluskey performs around 800 shoulder repairs a year in the beach chair position and is one of the leaders in this field of orthopedic surgery. Two-thirds of arthroscopic and open shoulder procedures in the US are performed in this sitting position. Although the safety in this position has been well-documented, rare catastrophic neurological events have been reported. Evidence-based literature highly recommends the use of cerebral oximetry during and before this procedure.

In the early part of 2010, Dr. McCluskey and the anesthesiologist began monitoring these patients with the Somanetics Invos NIRS technology. The patients were pre-evaluated in the pre-op holding area both in the supine and sitting position. Frustration and questions occurred when patients were being cancelled because of extremely low readings. Many of these patients had no pre-existing co-morbidities that would demonstrate these findings. These patients were consequently arranged to have full cardiovascular and vascular studies performed for clearance for their surgery. One patient in particular was cancelled for a reading of 15 on both the left and right side.

He was a young gentleman who works in the field of aerospace design. His subsequent workups were negative.

Following this, Dr. McCluskey approached Perfusion.com (PDC) to set up an evaluation and further studies in assessing all the existing technologies of cerebral oximetry. All three cerebral oximetry companies were contacted to participate in this evaluation. Nonin, Somanetics, and CasMed all graciously came in to give a complete overview of their technologies to the board of physicians. All three corporations agreed to participate in the evaluation process. The evaluation was set up to evaluate and collect data on thirty patients, all arthroscopic shoulder repairs in the beach chair position.

There were twenty five Caucasians, four African Americans and one Hispanic. The age of the patients ranged from nineteen to eighty-nine years of age. Co-Morbidities included nine patients with diabetes, fifteen with chronic hypertension, and eight patients with sleep apnea. All three devices were measured in the pre-operative area, both in the supine and sitting position. Rotation of the monitors was established in order to measure and collect data on ten patients with each device in the intra-operative surgical arena. Data was collected in the surgical suite at baseline, pre induction and post induction. Also data was collected on the lowest values recorded and corrective action using the Denault treatment algorithm. A staff evaluation form was provided in order to receive direct feedback on sensor design, reliability, ease of use, functionality, and data management.

Remember the patient that had the fifteen reading on both right and left side? He was contacted and gladly came in for further evaluation using all three devices. The devices either did not give a reading at all or failed to provide a clinically meaningful reading on this young man. Computer models from one of the companies device showed that the light waves were entering the subject but were either being absorbed

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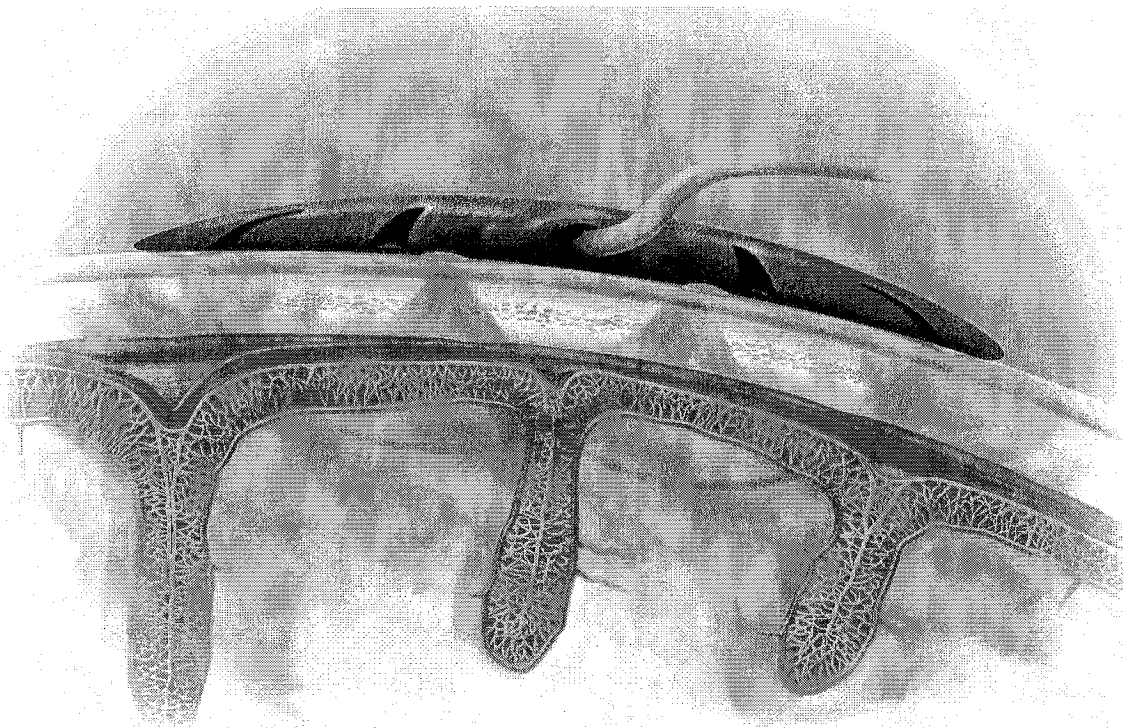
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or fragmented and therefore their systems was unable to obtain an adequate signal for measurement.

These findings led to a lot of unanswered questions. What unknown patient factors are affecting the rSO<sub>2</sub> readings? How do we as practitioners move forward with the patient care when low rSO<sub>2</sub> reading occur? How would we avoid legal ramifications if we were to proceed? Will new technology rectify these encountered problems?

Near the end of this evaluation process, Nonin announced the release of a new four wavelength sensor for their Equanox monitor. Nonin stepped up to the plate and hit a

grand slam with their new "Advance" fourwave length sensor. For the fourth time our dedicated patient, now a friend, returned to be put to the test. His quote when he came " I want to help in understanding this technology and hopefully improve patient care and outcomes for those patients in the future". Low and behold the new Equanox Advance four wavelength sensor worked where no other system had worked before. With this system the patient readings were 54 on the left and 56 on the right. Had this technology been available at the facility at the time of his surgery, the case would not have been cancelled nor the patient put through the ringer with expensive workups.



Why did the Nonin Equanox four wavelength sensor work where other systems were unable? We believe the answer is a combination of factors that all work together:

- The four wavelengths allow for removing variations in light absorption and fragmentation
- Dual emitter/dual detector sensor design minimizes effects of shallow tissue
- Highly refined signal processing algorithms that minimize noise
- Advanced ambient light tolerance

Combined, these factors provide for a technology that allows reliable performance in the most challenging patients and conditions.

Finally, I would like to summarize the results of our evalua-

tion. On a scale of one to five and five being the best, the Nonin device overall score was 4.9 - a point and a half higher than any of its competitors. Reviewing all data collected on the thirty patients the Nonin device had minimal variations or outliers, and provided superior correlations during the procedures. Further details of this evaluation study will be presented at the AmSECT meeting in April, 2011.

We finalized the evaluation by bringing the initial physician board back in to review the results of our evaluation on cerebral oximetry. All six physicians unanimously voted to move to the new Nonin Advance Equanox technology due to the accuracy, reliability and user satisfaction to best provide service for our patient population.

In conclusion, I would like to stress to the reader audience that all devices are not the same and that each facility can and should undertake their own evaluation of competing technologies to assess what will meet their individual facility and practice needs. It should be noted that assessment of true clinical accuracy is complex and likely not feasible in the typical clinical arena given it requires both jugular bulb venous blood sampling and patients to be maintained in a stable state. However, other factors - signal integrity, interface factors, functionality - can easily be assessed as we did in this trial. As I mentioned earlier, this trial was done with the knowledge and cooperation of all three companies. Our goal was to better appreciate the technology capabilities and potential and to identify an optimal solution for our practice.

Again, I would like to thank each company for their support and also the patient that dedicated his time to this endeavor.

#### **References**

- Denault, et al. A Proposed Algorithm for the Intraoperative Use of Cerebral Near-Infrared Spectroscopy. *Seminars in Cardiothoracic and Vascular Anesthesia*. 2007 Dec. 11 (4): 274 – 281.
- Dippmann C, et al. Severe cerebral desaturation during shoulder arthroscopy in the beach-chair position. *Arthroscopy*. 2010 Sep;26(9 Suppl):S148-50.
- Fischer GW, Torrillo TM, et al. The use of cerebral oximetry as a monitor of the adequacy of cerebral perfusion in a patient undergoing shoulder surgery in the beach chair position. *Pain Pract*. 2009 Jul-Aug;9(4):304-7.
- Murphy GS, et al. Cerebral oxygen desaturation events assessed by near-infrared spectroscopy during shoulder arthroscopy in the beach chair and lateral decubitus positions. *Anesth Analg*. 2010 Aug;111(2):496-505.