



Results Utilizing Absolute Cerebral Oximetry Monitoring Suggest the Need for Tailored Patient Management During Cardiac Surgery



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Introduction

Due to the high incidence of adverse cerebral outcomes found in post-surgical cardiac surgery patients, pro-active cerebral protective strategies are needed. Cerebral Oximetry has the potential to overcome the limitations of current monitoring devices in measuring oxygen saturation levels in the brain. Cerebral Oximetry is a continuous, non-invasive, optically based technology that utilizes near infrared spectroscopy (NIRS) to measure cerebral tissue oxygen saturation (SctO₂). Studies utilizing trend-only cerebral oximeters suggest that patient management, guided by relative changes in SctO₂, improves patient outcomes.^{1,2}

Recently, an absolute cerebral oximeter (FORE-SIGHT™, CAS Medical Systems) was developed and validated in healthy volunteers in a controlled environment.³ We report the preliminary results of a study using this monitor in patients undergoing elective thoracic aortic surgery with deep hypothermic circulatory arrest (DHCA) and antegrade selective cerebral perfusion (SCP).

Methods

With IRB approval and informed consent, patients undergoing elective thoracic aortic surgery with deep hypothermic circulatory arrest (DHCA) and antegrade selective cerebral perfusion (SCP) were monitored intraoperatively using the FORE-SIGHT Cerebral Oximeter. Two sensors were placed bilaterally on the subject's forehead for continuous monitoring of SctO₂. There was no alteration in surgical technique or in routine clinical monitoring.

Results

As of this submission, 16 subjects were monitored. Post induction SctO₂ was 68.6±6.0%. During cooling on CPB, a rise in SctO₂ was found in most subjects. During deep hypothermia, with core temperatures at 12-15 degrees C, we observed that SctO₂ values increased in most subjects to above 80% (84.4±4.9% - 12/16 subjects), and in some cases above 90% (2/16 subjects). The rate of SctO₂ increase tended to match the rate of core cooling. As expected, after onset of DHCA, SctO₂ decreased as a function of DHCA duration (Figure 1). SctO₂ decreased to an average value of 59.4 ± 8.9% then returned to near pre-DHCA levels during selective cerebral perfusion.

Unusual SctO₂ patterns in two subjects revealed a failure of SctO₂ to rise with cooling. Echocardiography monitoring indicated that the SctO₂ decrease in one subject might be caused by air emboli. In the other subject, the SctO₂ decrease was probably related to the hemodynamic management of the patient. MAP for this subject was maintained at a about 50mmHg on CPB, comparable to subjects with normal SctO₂ patterns. Post operative analysis showed that, unlike other subjects, the SctO₂ variation corresponded to dynamic fluctuations of mean arterial pressure (MAP) for this patient (Figure2).

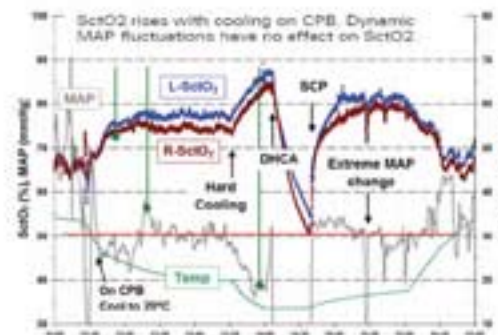


Figure 1

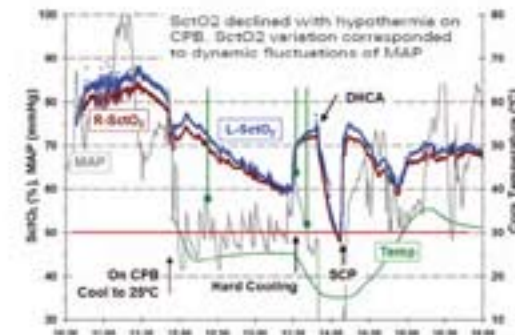


Figure 2

Discussion

Like others, our findings suggest that:

- Patient management on CPB needs to be tailored to the individual patient
- Maintaining MAP at 50-60mmHg during hypothermic CPB is tolerated by most patients, but this level seems to be inadequate for certain patients
- The absolute cerebral oximeter could be used as a guide for patient management during cardiac surgery

References

1. Owen-Reece, et al, Near Infrared Spectroscopy, *Br J Anaesth.* 1999 Mar; 82:418-26
2. Murkin et al, Improving clinical outcomes:multidisciplinary management, metabolism, and monitoring, *Semin Cardiothorac Vasc Anesth.* 2005 Jun;9(2):113-4.
3. MacLeod et al, Validation of the CAS Adult Cerebral Oximeter during Hypoxia in Healthy Volunteers, *Anesth Analg;* 2006;102:5-162.