

# Noninvasive cerebral oxygenation may predict outcome in patients undergoing aortic arch surgery

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## Objective

Surgical repair of the aortic arch remains technically challenging and is associated with considerable morbidity and mortality. Cerebral oximetry is a noninvasive technology that can monitor the regional oxygen saturation of the frontal cortex. We hypothesized that **magnitude and duration of decreased intraoperative regional oxygen saturation was associated with postoperative organ dysfunction**. Additionally, we sought to identify regional oxygen saturation threshold values that are predictive of organ dysfunction.

## Patients

31 patients undergoing **elective thoracic aortic surgery** with deep hypothermic circulatory arrest (DHCA), with or without antegrade selective cerebral perfusion (SCP), were monitored intraoperatively using the **ForeSight cerebral oximeter**.

## Protocol

After the induction of general anesthesia, 2 sensors were placed on the subjects' foreheads bilaterally for continuous monitoring of SctO<sub>2</sub> starting after induction of anesthesia until the end of surgery.

SctO<sub>2</sub> minutes and the area under the threshold (AUT) spent beneath the absolute threshold limits of 50%, 55%, 60%, and 65% were computed for both left and right sensors during the entire intraoperative period.

Major complications were defined as death, stroke with persisting neurologic deficits at time of discharge, new onset of impaired myocardial function, respiratory failure, sepsis, delirium, new onset renal failure, gastrointestinal complication and severe volume overload.

Minor or no complications included new onset of atrial fibrillation, minor volume overload, phlebitis, or no complication.

Postoperative complications, extubation time, intensive care unit (ICU) length of stay (LOS), and hospital LOS data were collected and compared with SctO<sub>2</sub> data and DHCA time.

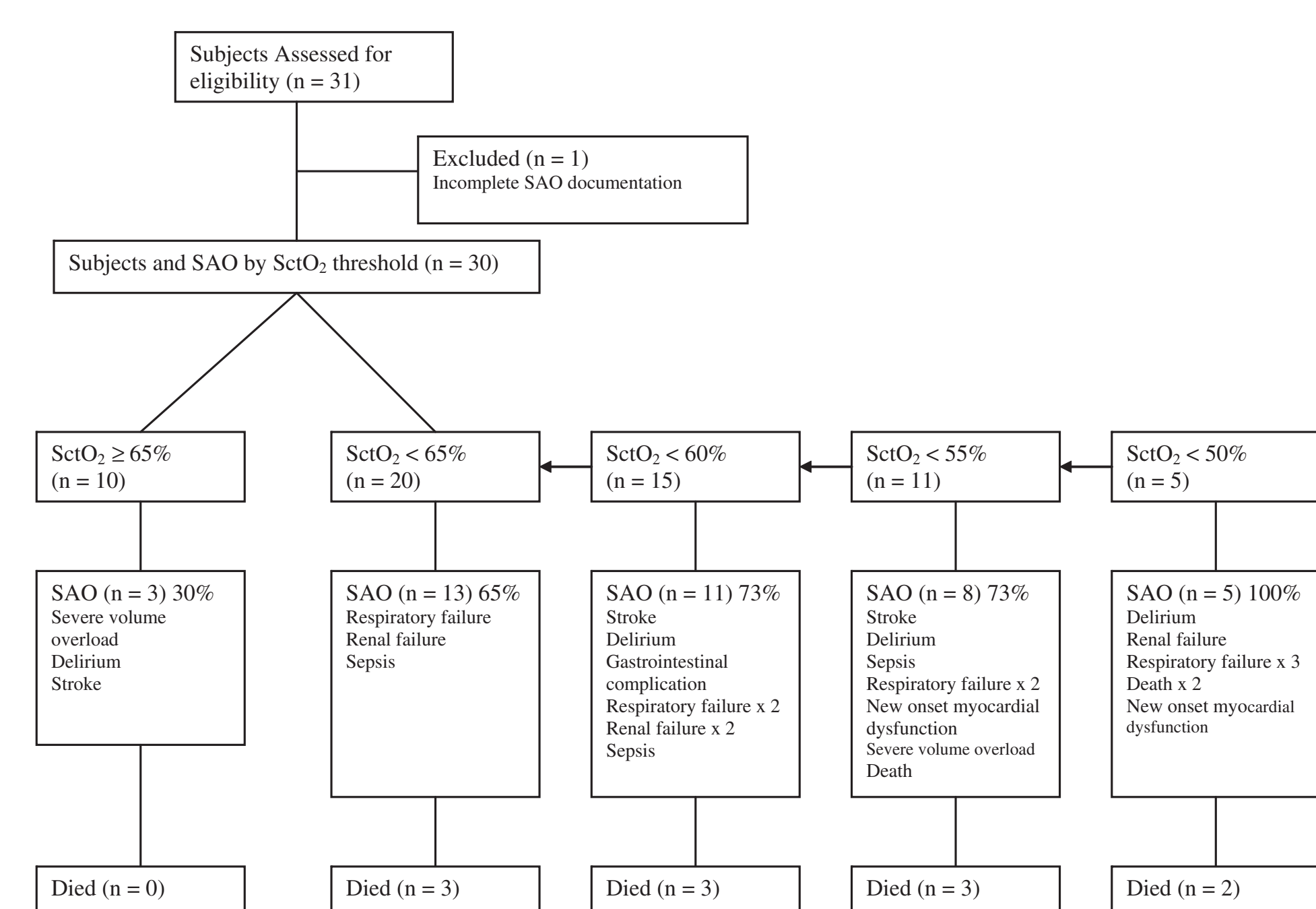
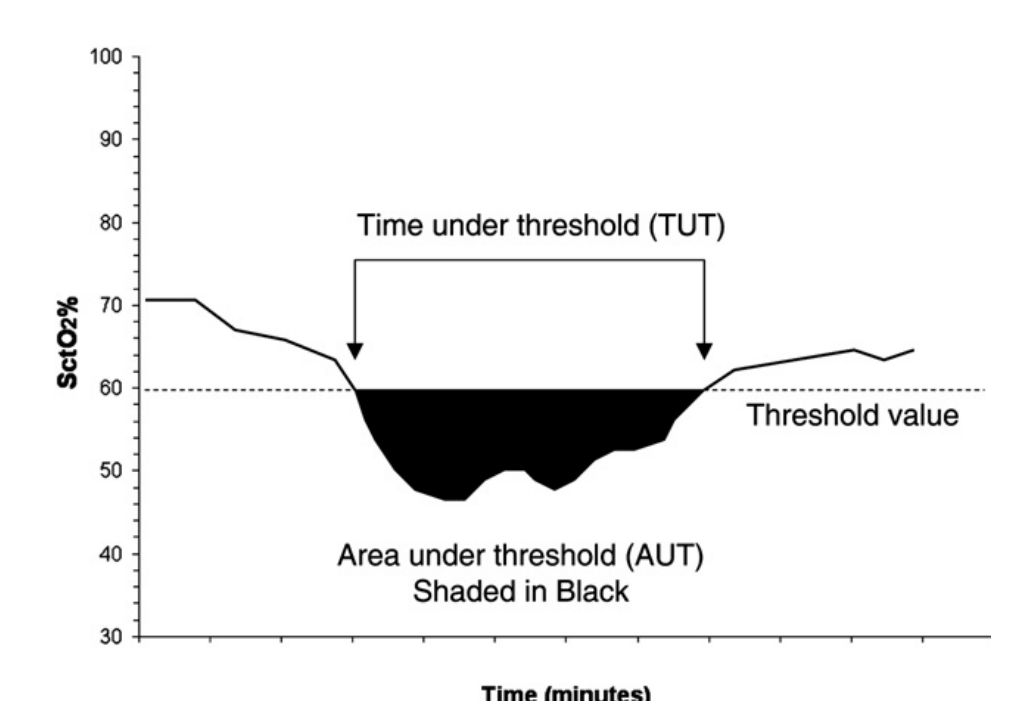
## Results

Among the 30 patients, 30 major and 29 minor complications were identified. Sixteen (53.3%) patients had at least 1 major complication, 8 (26.6%) had at least 1 minor complication, and 6 (20%) had no complications reported. For the purpose of analysis, we defined a severe adverse outcomes (SAO) as having 1 or more major postoperative complications.

Logistic regression was used to investigate the relationship between SAO and SctO<sub>2</sub> exposure time under a given threshold (TUT). There were statistically **significant associations between TUT and SAO incidence for SctO<sub>2</sub> thresholds of 60% and 65%**.

Finally, we explored the financial burden posed on our institution as a direct result of prolonged ICU and hospital LOS. For the purpose of illustration, we applied the predictive model to patients who spent more than 30 minutes beneath the SctO<sub>2</sub> threshold value of 60% as opposed to patients who did not. Median LOS was predicted to be 3 days longer (6 vs 3) in the ICU, and the total hospital stay was 4 days longer (13 vs 9), of which 2 days were attributable to ICU stay and 1 to non-ICU stay. The **total cost of this additional stay was calculated to be \$8300** at our institution using hospital financial estimates of cardiac surgical inpatient costs.

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## Conclusions of the authors

Decreased SctO<sub>2</sub> values were associated with major complications, prolonged postoperative mechanical ventilation, and prolonged ICU and hospital LOS. Both the nadir of SctO<sub>2</sub> and the integral of low SctO<sub>2</sub> over time were associated with severe adverse outcomes. Each additional decade of life was associated with doubled risk of severe adverse outcome (SAO).

## Key message

Study findings lend evidence to support the association of decreased perioperative cerebral oxygenation values with poor outcomes after aortic arch surgery.

Additionally, decreased cerebral oxygenation values are associated with an increased length of ICU and hospital stay.

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<https://www.ncbi.nlm.nih.gov/pubmed/20579669>

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