

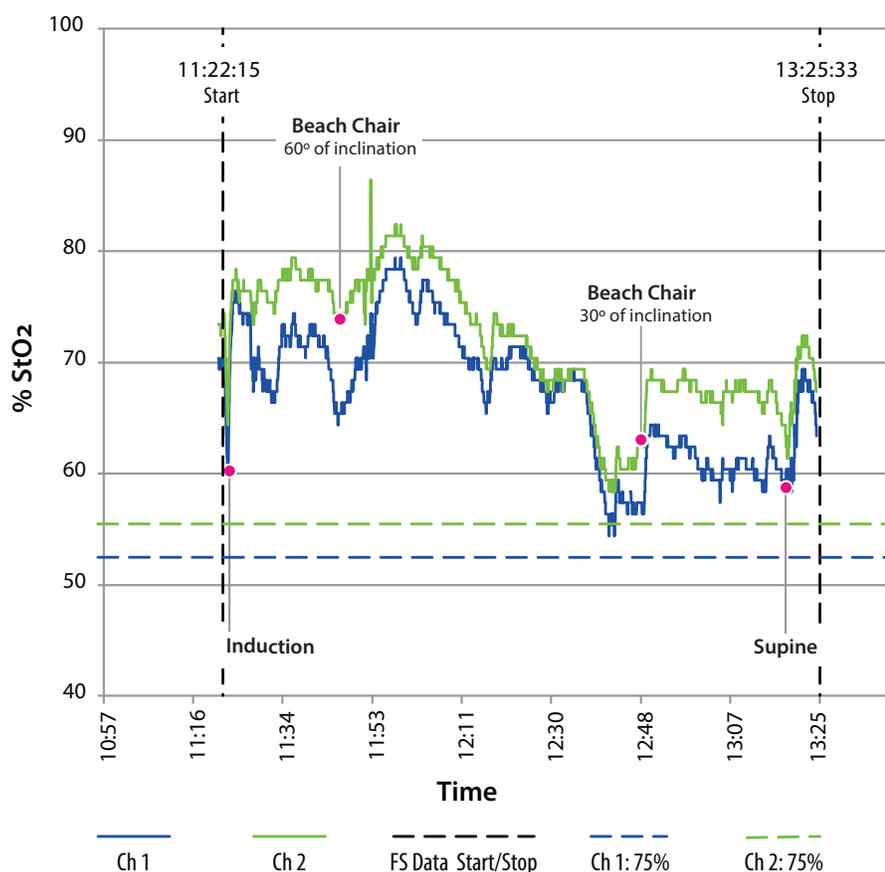
● FORE-SIGHT® Cerebral Oximeter Was the Only Patient Monitor That Detected Threatening Cerebral Desaturation during Shoulder Surgery in the Beach Chair Position

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This is a case report of a patient who exhibited significant decreases in cerebral oxygen saturation during shoulder arthroscopy using general anesthesia in the beach chair position. Cerebral desaturation was only revealed by direct assessment of cerebral oxygenation using a FORE-SIGHT cerebral oximeter. All other monitors reflecting cerebral oxygen delivery indicated acceptable values and failed to identify the threatening physiologic abnormality.

A 59 year-old, 6' 3", 296 lb man was scheduled for ambulatory right shoulder arthroscopy and rotator cuff repair. History was notable for hypertension and an allergy to Avalox. His pre-induction vital signs were: BP - 185/84 mmHg, HR - 68, room air SpO₂ - 98%, temp 97.8 °F. His neck anatomy and extension were unremarkable and his airway was Class II. The anesthetic plan incorporated general anesthesia with a pre-induction, single-shot interscalene nerve block for post-operative analgesia. After sedation with 2 mg of midazolam, an uncomplicated interscalene block was performed via a posterior approach using 20 ml of 0.5% Ropivacaine. In the OR, standard ASA monitors, and a FORE-SIGHT cerebral tissue oximeter (CAS Medical Systems, Branford CT) were applied.

At 11:23, pre-induction vital signs in supine position were: BP - 150/65 mmHg, HR - 70/min, SpO₂ - 99%, FORE-SIGHT cerebral oxygen saturation 71%/78% (R/L channels). General anesthesia was induced with propofol 200 mg IV and fentanyl 100 mg IV. A #5 Laryngeal Mask Airway was placed and anesthesia was maintained using Sevoflurane 3% in 100% O₂ with spontaneous ventilation supplemented by pressure support ventilation. Post-induction BP decreased to 104/61 mmHg with HR at 80/min, SpO₂ maintained at 97% and FORE-SIGHT values of 71%/73%.



At 11:48, the OR table was adjusted into the beach chair position with approximately 60 degrees of inclination. Although BP decreased transiently to 88/54 mmHg, the SpO₂ remained at 97%. The FORE-SIGHT cerebral oximeter values remained relatively constant throughout the temporary decrease in BP, which quickly improved with fluid administration and adjustment of anesthetic level. Surgery proceeded with the vital signs in the ranges of BP 120/60 mmHg, HR 75, SpO₂ 100% and FORE-SIGHT 70%/75%.

Approximately 80 minutes after induction, the FORE-SIGHT values decreased rapidly over a few minutes to 55%/57%. During this decrease, all blood pressure, heart rate, SpO₂, end-expired CO₂, and peak airway pressure were unchanged. Nothing unusual was observed on evaluation of the FORE-SIGHT sensor contact with the forehead. The Sevoflurane concentration was decreased to 2% in 100% oxygen. The FORE-SIGHT

values continued to decrease slowly to 54%/55%. At 12:50, the beach chair position angle of inclination was decreased to approximately 30 degrees. Soon after this position change, the FORE-SIGHT cerebral oximeter readings improved to 65%/68%, again with no change in BP, HR, SpO₂, end-expired CO₂ or peak airway pressure. Ephedrine 10 mg IV was administered to assess impact of a small increase in BP on the cerebral oximeter readings. BP increased transiently to 150/65 mmHg and HR 85/min but the FORE-SIGHT values did not change. Surgery was completed at 13:15 and the patient was placed in supine position. With this positional change, the FORE-SIGHT cerebral saturation values improved to 73%/75%. Subsequent emergence from anesthesia was uneventful. The postoperative neurologic examination did not reveal any deficits, and the patient was discharged without complications.

Discussion

This 59 year-old man underwent a right shoulder arthroscopy in steep beach chair position using general anesthesia with a pre-induction interscalene nerve block for postoperative analgesia. During surgical manipulation in the beach chair position, the patient exhibited significant decreases in cerebral oxygen saturation despite acceptable readings from all other devices commonly used to monitor key determinants of cerebral oxygen delivery (e.g., systemic BP/HR, SpO₂, end-expired CO₂, peak airway pressure). Threatening cerebral oxygen desaturation persisted until the beach chair angle of inclination was altered from approximately 60 degrees to 30 degrees. It was not possible to assess whether any change in head position or in lateral neck pressure by the operating surgeon occurred during this positional change. An attempt to increase cerebral perfusion pressure had no obvious effect on cerebral oxygenation. Cerebral saturation did not return to baseline values until the patient was returned to the full supine position with the head oriented in the midline.

This case illustrates that cerebral desaturation can occur during surgical manipulation in the beach chair position without any evident change in other monitored parameters.

Direct assessment of cerebral oxygenation using the FORE-SIGHT cerebral oximeter was crucial to detect what was most likely cerebral hypoperfusion, which would have gone unrecognized by assessment with conventional monitors. In addition, this case illustrates that increasing the cerebral perfusion pressure does not necessarily result in an improvement in cerebral oxygenation. In this circumstance, a change in surgical position was required to restore cerebral oxygenation values into an acceptable range. It is not possible to say with certainty whether this improvement was caused by a decrease in the angle of inclination, by adjustment of lateral head positioning, by a change in pressure against the great vessels of the neck, or by some combination of these factors. Regardless, use of FORE-SIGHT cerebral oximetry identified inadequate cerebral oxygen delivery that was not obvious on any other monitor, avoiding a potentially prolonged interval of cerebral anoxia that might have resulted in serious anoxic neurologic injury.

For further reading on the subject:

1. 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 Aug;111(2):496-505.
2. Fischer GW, Torrillo TM, Weiner MM, Rosenblatt MA. 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.

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