

SFAR 2011 – Submission of abstracts

Topic: Anesthesia/pain – Cardiovascular

Abstract No.: SFAR11-1701

Study of changes in cerebral oximetry by NIRS under general anesthesia and placement in knee-chest position

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Introduction: Anesthesia and position changes can induce changes in cerebral blood flow and have ischemic episode-type consequences. The repercussions of such variations can be indirectly quantified by studying regional brain oxygen saturation (rSO₂) using an Equanox Near Infrared Spectrometry (NIRS) system (Nonin Medical, Plymouth, MN, USA). The aim of our study was to screen for such episodes after placing patients in knee-chest (KC) position under general anesthesia (GA).

Materials and Methods: This was a prospective, descriptive, observational study of consecutive patients. For enrollment, patients had to be 18-65 years of age, ASA 1-2, and undergoing spinal surgery in KC position. The exclusion criteria were a cerebrovascular history and patient refusal to participate. After premedication with 100 mg of hydroxyzine, each patient received 500 ml of Ringer's solution before induction of standardized GA: sufentanil (0.3 µg/kg), propofol (2.5 mg/kg), and cisatracurium (0.15 mg/kg). Sevoflurane was used for maintenance. Ventilation was set for a PetCO₂ between 33 and 37 mmHg. The NIRS sensor was placed at the left frontal lobe. The rSO₂ values were read before starting the anesthesia procedure, 5 minutes after induction of anesthesia in dorsal decubitus, and then 10 minutes after placing the patient in KC position. The rSO₂ as well as hemodynamic and respiratory parameters were studied.

Results: A total of 20 patients were enrolled. A significant increase in rSO₂ was observed after induction. There was a significant decrease in mean blood pressure (MBP) after induction regardless of position, and a significant decrease in rSO₂ after placing the patient in KC position compared with the dorsal decubitus position.

Table: changes in SpO₂, MBP, and rSO₂ in aDD, DD, and KC position

	SpO ₂ (%)	MBP (mmHg)	rSO ₂
aDD n = 20	97.5 ± 0.5	101 ± 10.3	67.6 ± 5.2
DD n = 20	99.2 ± 0.5	77.6 ± 13.6	76.6 ± 4.9
KC n = 20	99 ± 0.5	71.7 ± 11.7	70.9 ± 4.2
<i>p</i> ₁	< 0.001	< 0.0001	< 0.0001
<i>p</i> ₂	1	0.241	< 0.0001

Mean ± SD; aDD: awake in dorsal decubitus; DD: dorsal decubitus; KC: knee-chest position.

*p*₁ and *p*₂: paired *t* tests with Bonferroni correction (*p*₁: difference aDD - DD, *p*₂: difference DD - KC)

Discussion: The increase in rSO₂ after induction was a reflection of preoxygenation before induction, despite a significant decrease in MBP. This seems to be associated with the decrease in cerebral oxygen metabolism during anesthesia. The significant decrease in rSO₂ after placing the patient in KC position, while the MBP remained stable, suggests that rSO₂ may be a more sensitive and more quickly accessible indicator than repeated MBP measurement for detecting a decrease in oxygen transport associated with a decrease in cerebral perfusion pressure.

References: [1] Br J Anaesth 2009; 103 (Suppl. 1): i3-i13

Key words: Near Infrared Spectrometry, cerebral oximetry