Sudden Severe Hypotension During Induction Of Anesthesia For Carotid Endarterctomy (CEA): The Utility Of NIRS. A Case Report.

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Citation

A Piacentini. *Sudden Severe Hypotension During Induction Of Anesthesia For Carotid Endarterctomy (CEA): The Utility Of NIRS. A Case Report.*. The Internet Journal of Anesthesiology. 1999 Volume 4 Number 4.

Abstract

We report a case of a 69 year old male undergoing elective endarterectomy. He developed severe postinduction hypotension. Near infrared spectroscopy was used throughout the case to measure rSO2 values. The technology is briefly discussed and the influence of hypotension in regard to rSO2 is reported.

CASE REPORT

A 69 year old male (70 kg body weight), ASA class 3, with unilateral stenosis of the left internal carotid (75-80% recognized by selective arteriography) presented for elective endarterectomy. The patient had a biventricular pace-maker at a fixed frequency of 80 bpm.

He was pre-medicated with intramuscular diazepam (5mg) and atropine (0,5mg). He received extensive monitoring including: BP (invasive), ECG, SaO2, HR, ("Anestesia/Std.", Hewlett Packard Gmbh) and rSO2 (Somanetics INVOS 4100, Troy MI).

Figure 1

Image 1: Somanetics INVOS 4100 connected to the patient

Data collected in the awake patient were:

MAP=98 mm Hg, HR= 81 bpm, SaO2= 97 %, rSO2= 67 %.

Induction was performed with Sodium Penthotal (300 mg), Fentanyl (50mcg) and Vecuronium 8 mg/IV. He was mecanically ventilated with O2/N20 (ratio of 40/60) and anesthesia was mantained with isofluorane at 06-0.8%. Peak airway pressure was of 14 cm of H2O.

A few minutes after induction, the patient developed severe hypotension. Isoflurane was immediately discontinued and O2/N2O converted in O2/air. Despite rapid infusion of colloids (Eufusin 500ml) via large bore cannula in the antedecubital vein (16 gauge) and sustained inotropic support with dopamine the hypotensive period lasted for about twenty minutes.

The awakening period was also prolonged.

Figure 2

Image 2: Somanetics INVOS 4100 monitoring and recording device on anesthesia machine

We normally utilize EEG and consider this the "gold standard" monitoring device for this kind of procedure. However, it was not available at the time of this event. Therefore, data on cortical cerebral perfusion were only obtained from a somatosensor positioned on the left frontal hemisphere.

Figure 3

Image 3: EEG as "gold standard" and bilateral Somanetics INVOS probes for monitoring during routine CEA procedure

During mask ventilation with 100% oxygen we usually see a normal increase in rSO2. In our case rSO2 raised to 87 (MAP = 100 mmHg). During the hypotensive period the "trended" rSo2, developed a downward path reaching the minimal absolute value of 52% (MAP = 62 mmHg). Both, MAP and rSO2 increased slowly during the awakening period until the pre-operative values were reached.

DISCUSSION

The patient had a variety of risk factors for developing acute hypotension:

- ASA 3 patient with a basal BP of 150/80 mmHg,
- therapy with enalapril
- ventricular pace-maker at a fixed setting

Induction was the most probable cause for "iatrogenic" hypotension. Pharmacological inotropic support was necessary to mantain an adequate cerebral perfusion. No end-organ developed any dysfunction (cardiac, reanal, neurological) and all hematological values remained within normal limits (ABGA: pO2 131.5 and pCO2 35.3). Several neurological objective examinations performed at the end of the procedure didn't demonstrate any signs of cerebral hypoperfusion. The MMSE was also unchanged.

Once the patient was completely awake he was informed about the induction problem. He was rescheduled in the subsequent week for CEA with locoregional anesthesia technique and rSO2 monitoring.

CONCLUSIONS

Near infrared spectroscopy is a novel technique that Jobsis first utilized in 1977 to measure the NIR absorption spectrum of light passing through an infant's head from temple to temple. ($_1$) The large size of adult human brain precluded transillumination. It was therefore necessary to measure the hemoglobin oxygen saturation using NIR reflected back to the scalp in the vicinity of the light source. ($_2$)

The reflectance cerebral oximetry, NIR, "injects" photons into the skin over the forehead. After scattering by skin, skull dura and brain some fractions of the injected photons return to the skin surface. By measuring the quantity of returning photons as function of wavelenght, one can characterize the spectral absorption of the underlying tissues and make sequential determinations of the average regional hemoglobin oxygen saturation (trended rSO2).

The device we utilize is the INVOS 4100 Cerebral Oximeter. It uses two wavelenghts of 724 and 810 nm to measure changes in regional hemoglobin oxygen saturation.

Figure 4

Image 4: Somanetics INVOS 4100 with recording device (storage of intraoperative data on regular floppy disk for subsequent analysis)

The rSO2 monitoring in patients undergoing CEA is a novel technique that appears promizing. ([3], [4], [5]). In our case values remained >50 in absolute value and showed a loss in less than 23% (loosing 15 points) during the hypotensive period. rSO2 threshold values indicating critical cerebral ischemia are: absolute value less than 50 and percentual loss more of 25%.

We like to use this relatively new technique in critical periods like induction, awakening, and transport of hemodynamically unstable patients. The easily transportable rSO2 monitoring device seems to be an excellent non invasive alternative for patient monitoring when EEG is not available or when data collection is impossible due to artifacts or shivering.

We found the method also very useful for the postoperative period in the recovery room. Nursing staff was able to use this device and monitor our patients sufficiently after a brief training period.

Figure 5

Image 5: Somanetics INVOS 4100 and laptop for analysis of the measurements

ABBREVIATIONS

1. CEA: Carotid endarterectomy
2. NIRS: Near InfraRed Spectroscopy.
3. BP: Blood pressure.
4. BPM: Beats per minute
5. ECG: Electrocardiogram.
6. EEG: Electroencephalogram
7. SaO2%: Arterial HbO2 saturation.
8. HR: Heart rate.
9. rSO2: Regional HbO2 saturation.
10. MMSE: Mini Mental Status Examination (psyichiatric mental test score)
11. ABGA: Arterial blood gas analysis

References

1. Jobsis FE. Noninvasive, infrared monitoring of cerebral and myocardial oxygen sufficiency and circulatory parameters. Science 198: 1264-1267, 1977.
2. Ferrari M., Zanette E., Giannini I., Effects of carotid artery compression test on regional cerebral blood volume, hemoglobin oxygen saturation, and cytochrome c oxidase redox level in cerebrovascular patients. Adv Exp Med Biol 1986; 200: 213-220.
3. Roy I., Davidovitch, BA; Solomon Aronson, M.D.; Diane Suarez, R., EEG T; Lewis B. Scwartz, M.D.: James F. Mc Kinsey, M.D. Correlation of systolic blood pressure (sbp) and trnscutaneous cerebral oximetry (tco) during carotid

endarterectomy (cea). Anesthesiology V91, n.3A Sep 1999
4. Allen K., Sils Jr., M.D., Shelia Dalrymple, RN (Memphis, TN), Wayne Hamm. "Transcranial cerebral oximetry as non invasive monitor of cerebral perfusion during cea. Presentation type: oral, AANS 2000 Meeting San Francisco
5. Cerebral monitoring by means of oximetry and seps during cea. Hun Cho, M. Nemoto. Et Al. neurosurg 89: 533-538, 1998.

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