

Research Article

Open Access

Monitoring of Sedation during Neuroaxial Blockade

Guerrero OrriachJose Luis^{1,2*}, Matute Emilio³, Alsina Estibaliz⁴, Del Blanco Brezo⁵ and Gilsanz Fernando^{4,6}

¹Department of Anesthesiology, Virgen de la Victoria Hospital, Malaga, Spain

²PostgraduateResearch, Universidad Autónoma de Madrid, Facultad de Medicina, Spain

³Department of Anesthesiology, Hospital Sanitas La Moraleja, Madrid, Spain

⁴Department of Anesthesiology, Hospital La Paz, Madrid, Spain

⁵Department of Anesthesiology, HospitalInfanta Leonor, Madrid, Spain

⁶Department of Surgery, Universidad Autónoma de Madrid, Facultad de Medicina, Spain

Abstract

Study objective: The arousal state changes during spinal anesthesia. It is not clear if BIS and others devices could monitor the induced neuroaxial blockade sedation. Our objective was evaluate BIS and entropy values when spinal anesthesia is done.

Design: We developed a prospective study. Patients: 40 patients were included in this study, ASA I-III, over 60 years old, undergoing spinal anesthesia, without premedication scheduled for orthopedics procedures.

Intervention: Spinal anesthesia was performed with the unseated volunteer in the lateral decubitus position with a 25-gauge Whitacre needle at L2-L3 space, andanesthesia was done with 12 mg of 0.5% hyperbaric bupivacaine. Patients were positioned supine for 5 min after spinal anesthesia.

Measurements: Observer's Assessment of Alertness/Sedation OAA/S, response (RE) and state entropy (SE) and BIS, and standard hemodynamic measures.

Main results: Statistical analysis were performed by Wilcoxon test or ANOVA, p<0.05 was considered statistically significant.RE and BIS showed a better correlation with the OAA/S scale values (Pk 0.81 and 0.82) than SE (Pk 0.69). The OAA/S, RE and SE showed significative differences from basal values after 30 min of neuroaxial anesthesia (ANOVA p<0.05). BIS showed differences after 40 min (ANOVA p<0.05). There were no differences between BIS and RE values along the study (ANOVA p>0.05).

Conclusions: The spinal anesthesia decreased the cortical activity and these were founded by OAA/S scale and depth anesthetics monitors. OAA/S was a more sensitive value of this induced sedation. BIS and RE showed a better correlation with OAA/S scale than SE.

Keywords: Entropy; BIS; Neuroaxial; Hypnosis

Introduction

The neuroaxial blockade is often used as an anesthetic technique to abolish nociceptive stimuli during surgical procedures. Some articles published recently suggest that neuroaxial techniques are related to decrease of the anesthetics requirements. This level of sedation after neuroaxial anesthesia could be related to sensory input to a reticular activating system decrease because of deep sensory blockade [1-3]. Neuroaxial anesthesia has been done, usually, with intravenous sedation; but if neuroaxial anesthesia gets a good level of sedation, the administration of hypnotic drugs could have adverse effects.

Several monitors based on the quantitative EEG have been tested to check their ability to find the changes in the state of consciousness in the patients were neuroaxial anesthesia was done, with different results [2-4]. Entropy monitors the level of hypnosis of patients through two parameters: state entropy and response entropy [5,6].

Our objective was evaluate BIS and entropy values when spinal anesthesia is done, trying know if entropy monitor was better than BIS when we evaluate the level of sedation in neuroaxial anesthesia. The first aim of our research has been study the relation between the change in the state of consciousness following spinal anesthesia and BIS, RE and SE values; and which of them is more sensitive to detect changes in the level of sedation after a neuroaxial anesthesia.

Materials and Methods

This prospective study was approved by the institutional review

board of our hospital. 40 patients were included and informed about the nature of the study and gave written informed consent.

Inclusion criteria were age over 60 yr, American Society of Anesthesiologists physical status classification I, II or III scheduled for orthopedic hip and knee surgery. Excluded from the study were patients with history of any disabling central nervous or cerebrovascular disease, coagulation disorders, patients who had received central nervous system–active drugs and patients with a history of drugs or alcohol abuse and allergic to local anesthetics.

No sedative premedication was used.

After arrival in the OR, an intravenous line was inserted into a large forearm vein and an infusion of lactated Ringer's solution infused at 15 ml per kg before anesthesia was started and the standard monitorization

*Corresponding author: José Luis Guerrero Orriach, Department of Anesthesiology, Hospital Universitario Virgen de la Victoria, Campus Universitario Teatinos, C.P. 29010, Spain, Tel: 951032051; Fax: 951032051; E-mail: guerreroorriach@terra.es

Received April 17, 2013; Accepted June 21, 2013; Published June 24, 2013

Citation: Luis GO, Emilio M, Estibaliz A, Brezo DB, Fernando G (2013) Monitoring of Sedation during Neuroaxial Blockade. J Anesthe Clinic Res 4: 324. doi:10.4172/2155-6148.1000324

Copyright: © 2013 Luis GO, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

was done pulse oximetry, electrocardiography, and non-invasive arterial blood pressure recordings every 5 min.

Electroencephalogram was recorded using the Aspect A-2000 BIS® monitor version XP Aspect Medical Systems, Newton, MA and the Datex-Ohmeda S/5 Entropy Module Datex-Ohmeda Division, Instrumentarium Corp, Helsinki, Finland.

Spinal anesthesia was performed with the unseated volunteer in the lateral decubitus position with a 25-gauge Whitacre needle at the L2-L3 space, and the injection with 12 mg 0.5% hyperbaric bupivacaine was done. Patients were positioned supine for 5 min.

Block height and motor block were measured with alcohol and Bromage scale assessed after neuroaxial anesthesia and during the surgery, every 5 min for the first 30 min and then every 10 min until block resolution.

Heart rate (HR), non-invasive mean arterial blood pressure (MAP), and oxygen saturation were measured and registered at every point of measurement AS/3; Datex-Ohmeda Division, Instrumentarium Corp. The OAA/S score was also recorded every five minutes. BIS, RE and SE were recorded every 5 min.

We have done statistical analysis to evaluate if EEG variables, hemodynamic variables, had changed after neuroaxial anesthesia. For this purpose, the EEG variables differences between pre-anesthesia values and intraoperative were analyzed using the Wilcoxon signedranks test. Differences between BIS, RE and SE pre-anesthesia and intraoperative were analyzed by two-way ANOVA. The correlation between OAA/S and SE, RE and BIS was done with the model independent prediction probability Pk. Graph-Pad Prism 3.0 Graph-Pad Software, San Diego, CA, USA was used for the statistical analyses. Data are expressed as median and range, unless otherwise indicated.

Data for times of surgical procedures and duration of spinal anesthesia were normally distributed and are expressed as mean \pm SD.

Results

All patients had successful spinal anesthesia and did not require any additional analgesic or sedative drugs.

The median of surgical procedure time was 53 min range 45-72.

BIS, SE and RE had significant variation between pre and postneuroaxial anesthesia ANOVA p<0.05 (Figure 1).

OAA/S decreased from five at baseline to four ranges 3–5 after 30 minutes P<0.05.

Median level of spinal anesthesia was T10 rangeT8-T11; arterial pressure had not significant variation.

RE and BIS demonstrate a better correlation with the OAA/S scale values (Pk 0.81 and 0.82 respectively) than SE (Pk 0.69). The OAA/S, RE (basal value: 97 \pm 6; after 30 min.: 81 \pm 16) and SE (basal value: 89 \pm 5; after 30 min: 77 \pm 12) shows a significant differences from basal values after 30 min of neuroaxial blockade. The BIS (basal value: 98 \pm 5; after 40 min.:82 \pm 13) show differences after 40 min.

Discussion

Our study found changes in the values of the hypnosis monitors RE, SE, BIS, after spinal anesthesia, because the increase in the state of sedation. The physiological mechanism is that spinal anesthesia blocks ascending somatosensory driven onto reticular-thalamus-



Page 2 of 3

RE and SE shows a significant differences (*) from basal values after 30 min of NB, the BIS show differences (*) after 40 min . (*: p<0.05)

Figure 1: RE, BIS and SE values after neuroaxial anesthesia.

Age (vr)	71 (60-83)
Weight (kg)	69 (60-81)
Height (cm)	1.64 (1.61-1.69)
Gender (male/fenale)	20 (12/8)
ASA (I/II/III)	4/10/6
Hip surgery/Knee surgery	32/8
Duration of surgery	64 (42-78)

Table 1: Demographic data (n=40). Values are median (range) or n.

cortical projection pathways, reducing their excitability and decreasing the arousal level of the brain [1,7]. Ben-David et al. found a lower requirements of benzodiazepines in patients who neuroaxial anesthesia was done for the same level of sedation, when them were compared with patients in which spinal anesthesia hadn't been done [8] and a decrease in sevoflurane requirements in those patients under general anesthesia combined with epidural analgesia [9].

Several studies have tried to assess the possibility of measuring this state of sedation through various monitors of hypnosis BIS, PSI, reaching contradictory conclusions [10,11].

We have tried to evaluate if RE, SE and BIS are able to show the level of hypnosis after neuroaxial anesthesia when compared with a sedation scale (OAA/S) [12]. We have found that the results between the hypnosis monitors values and the level of sedation are not correlated. We have done a statistical prediction of probability analysis PK not included in previous studies, because in our opinion this would be the best valid test in order to compare the two sedation scales. PK is a measure suited to evaluating and comparing aesthetic depth indicators showing the probability that an indicator can predict correctly the rank order of an arbitrary pair of distinct observed aesthetic depths. Our results show significant variations of the 3 parameters of hypnosis. Bispectral index and response entropy get the highest Pk values pK BIS: 0.81, pK RE: 0.82. SE was the worst parameter pK SE: 0.69. BIS and RE changed with the changes of level of sedation, but these relations are not strong enough because the accuracy of these monitors in sedation state is weaker than in anesthesia levels. Vanluchene published that BIS and entropy were not able to evaluate with accuracy the change for the sedation states without a loss of the conscience level, between levels 5 to 3 in the OAA/S scale, but in the anesthesia state prediction of the probability of both monitors was excellent [13].

It seems contradictory to conclude that there is a change in level of consciousness and SE is a less valid indicator to detect this change. A possible explanation would be that changes in the EEG pattern in the

stages of light sedation are with high frequency waves. The state entropy does not collect some of these waves. This may be one of the reasons why prediction of probability of BIS and RE is more accurate than SE.

Ishiyama et al. showed as epidural anesthesia decreases the BIS during general anesthesia, but in epidural in which the sensory block reached high thoracic sensory blockade but in our study we don't get high thoracic levels, so that is the difference between our findings and Ishiyama's result [14].

On the other hand, we wanted to know if changes obtained in BIS, RE and SE values had a good relation with the changes in levels of sedation [6].

Limitation of our study is an observational one and not a randomized and blinded trial, because we did not use a control group. Other limit is that we did it while surgery was taking place, but neuroaxial anesthesia was not finished and we could not know how hypnosis monitors would correlate with the recovery of neuroaxial anesthesia.

In conclusion, the spinal anesthesia decreased the cortical activity after 30 min, as measured by OAA/S and depth anesthetics monitors. OAA/S was a more sensitive value of this induced sedation. BIS and RE showed a good correlation with OAA/S scale but it was worse than general anesthesia. SE does not seem to have a good correlation with the induced sedation state.

References

- Antognini JF, Jinks SL, Atherley R, Clayton C, Carstens E (2003) Spinal anaesthesia indirectly depresses cortical activity associated with electrical stimulation of the reticular formation. Br J Anaesth 91: 233-238.
- Kurup V, Ramani R, Atanassoff PG (2004) Sedation after spinal anesthesia in elderly patients: a preliminary observational study with the PSA-4000. Can J Anaesth 51: 562-565.

- Eappen S, Kissin I (1998) Effect of subarachnoid bupivacaine block on anesthetic requirements for thiopental in rats. Anesthesiology 88: 1036-1042.
- Pollock JE, Neal JM, Liu SS, Burkhead D, Polissar N (2000) Sedation during spinal anesthesia. Anesthesiology 93: 728-734.
- Viertiö-Oja H, Maja V, Särkelä M, Talja P, Tenkanen N, et al. (2004) Description of the Entropy algorithm as applied in the Datex-Ohmeda S/5 Entropy Module. ActaAnaesthesiolScand 48: 154-161.
- Smith WD, Dutton RC, Smith NT (1996) Measuring the performance of anesthetic depth indicators. Anesthesiology 84: 38-51.
- Antognini JF, wei Wang X, Carstens E (2000) Isoflurane action in the spinal cord blunts electroencephalographic and thalamic-reticular formation responses to noxious stimulation in goats. Anesthesiology92:559-566.
- Ben-David B, Vaida S, Gaitini L (1995) The influence of high spinal anesthesia on sensitivity to midazolam sedation. AnesthAnalg 81: 525-528.
- Hodgson PS, Liu SS, Gras TW (1999) Does epidural anesthesia have general anesthetic effects? A prospective, randomized, double-blind, placebo-controlled trial. Anesthesiology 91: 1687-1692.
- Doufas AG, Wadhwa A, Shah YM, Lin CM, Haugh GS, et al. (2004) Blockdependent sedation during epidural anaesthesia is associated with delayed brainstem conduction. Br J Anaesth 93: 228-234.
- Hermanns H, Stevens MF, Werdehausen R, Braun S, Lipfert P, et al. (2006) Sedation during spinal anaesthesia in infants. Br J Anaesth 97: 380-384.
- Chernik DA, Gillings D, Laine H, Hendler J, Silver JM, et al. (1990) Validity and reliability of the Observer's Assessment of Alertness/Sedation Scale: study with intravenous midazolam. J ClinPsychopharmacol 10: 244-251.
- Vanluchene AL, Struys MM, Heyse BE, Mortier EP (2004) Spectral entropy measurement of patient responsiveness during propofol and remiferatinal. A comparison with the bispectral index. Br J Anaesth 93: 645-654.
- 14. Ishiyama T, Kashimoto S, Oguchi T, Yamaguchi T, Okuyama K, et al. (2005) Epidural ropivacaine anesthesia decreases the bispectral index during the awake phase and sevoflurane general anesthesia. AnesthAnalg 100: 728-732, table of contents.

Page 3 of 3