Original article :

A Prospective Evaluation of Intraoperative Depth of Anesthesia on Postoperative Pain and Use of Analgesics at a Tertiary Care Hospital

Dharavath Babu Rao[1], Tayade Himanshu Panditrao[2]

[1]Assistant Professor, Department of Anesthesiology, Velammal Medical College Hospital and Research Institute, Madurai, Tamil Nadu, India.

[2]Associate Professor, Department of Pharmacology, Mamata Medical College, Khammam, Andhra Pradesh, India.

Corresponding Author: Dr. Tayade Himanshu Panditrao, Associate Professor, Department of Pharmacology, Mamata Medical College & General Hospital, Khammam, Andhra Pradesh, India.

Abstract

Background: Anaesthetic depth is the degree to which the central nervous system (CNS) is depressed by a general anaesthetic agent, depending on the potency of the anaesthetic agent and the concentration in which it is administered. The present study was conducted to evaluate the effect of intraoperative depth of anesthesia on postoperative pain and use of analgesics.

Materials & Methods: 50 female subjects were enrolled. Complete demographic and clinical details of all the patients were obtained. A preanesthetic checkup was done to assess the fitness for the proposed surgical procedure under general anesthesia. Patients were randomly assigned to either the BIS Titrated group (Group 2), where depth was adjusted to a BIS value of 45 to 40, with extra propofol infusion if necessary, or the conventional Practice group (Group 1), where depth was modified in accordance with conventional practice and BIS value was recorded. There were four levels of sedation: 0 for fully awake, 1 for occasionally drowsy but rousable, 2 for frequently sleeping but rousable, and 3 for both asleep and unrousable. At the end of the 24-hour period, the total amount of analgesics used, including tramadol and morphine, was noted. All the results were recorded in Microsoft excel sheet and were subjected to statistical analysis using SPSS software.

Results: Mean age of the patients of Group 1 and Group 2 was 40.2 years and 41.7 years. Mean duration of surgery among patients of Group 1 and Group 2 was 53.9 mins and 50.7 mins respectively. Mean BIS value among patients of Group 1 and Group 2 was 54.7 and 49.3 respectively; on comparing the results were found to be statistically significant. Mean time to eye opening was significantly higher among patients of Group 2 in comparison to Group 1. Also, overall rescue morphine requirement was significantly higher in group 1. Overall, VAS was significantly higher in group 1.

Conclusion: By maintaining BIS value of 45 to 40 during surgical procedure, postoperative pain and requirement of rescue analgesia could be decreased.

Keywords: Anesthesia, Depth, Postoperative pain.

INTRODUCTION

Anaesthetic depth is the degree to which the central nervous system (CNS) is depressed by a general anaesthetic agent, depending on the potency of the anaesthetic agent and the concentration in which it is administered. Arthur Ernest Guedel (1937) described a detailed classification of anaesthetic state based on the use of a sole inhalational anaesthetic agent diethyl ether. The signs of this classical Guedel's classification depended on the eyelash reflex, respiration, eyeball movements, pupillary size, and muscular movements among others.[1- 3] Though the action of general anaesthesia (GA) drugs on the cortex and the thalamic area of brain leading to loss of consciousness is well known, the exact

mechanism by which these drugs produce anaesthetic state is not really well understood. A successful GA is defined as a reversible triad hypnosis, analgesia, and abolition of reflex activity. In a balanced anaesthetic technique that uses multiple drugs, the classical stages of anaesthesia are concealed. An inadequate GA can lead on to intraoperative awareness with or without recall, while overdosage results in delayed recovery and possible postoperative complications.[4- 6] Campagna et al have recently provided a review of current understanding of the molecular mechanisms of anaesthesia, summarizing evidence showing that inhaled anaesthetics achieve immobilization by depressing the spinal cord, whereas amnesic actions are mediated within the brain. Their documents indicate that subtle differences in the clinical actions of inhaled anaesthetics may be attributed to distinct actions on a number of critical molecular targets. Although this evidence makes it clear that neuronal actions and interactions at many different levels and in many different brain tissues are altered or disrupted by anaesthetic drugs, it does not explain why these different more or less discrete effects have the common global effect of causing Loss of consciousness.[7] Hence; the present study was conducted to evaluate the effect of intraoperative depth of anesthesia on postoperative pain and use of analgesics.

MATERIALS AND METHODS

The present study was conducted to evaluate the effect of intraoperative depth of anesthesia on postoperative pain and use of analgesics. 50 female subjects were enrolled. Complete demographic and clinical details of all the patients were obtained. A preanesthetic checkup was done to assess the fitness for the proposed surgical procedure under general anesthesia. Patients were randomly assigned to either the BIS Titrated group (Group 2), where depth was adjusted to a BIS value of 45 to 40, with extra propofol infusion if necessary, or the conventional Practice group (Group 1), where depth was modified in accordance with conventional practice and BIS value was recorded. Following the conclusion of the procedure, patients were extubated when their breathing became regular and sufficient, the remaining neuromuscular block was reversed, and the infusion of isoflurane and propofol was stopped. During the induction of anesthesia, the isoflurane BIS, HR, MAP, and MAC values were recorded at 1-minute intervals. During the maintenance phase, these values were then recorded at 5-minute intervals. The recovery period was measured as the time it took to wake up after stopping isoflurane and tramadol, and then as the time it took to get to zero hours in the post-anesthesia care unit (PACU). The observer who was blindfolded used the VAS score to evaluate postoperative discomfort. There were four levels of sedation: 0 for fully awake, 1 for occasionally drowsy but rousable, 2 for frequently sleeping but rousable, and 3 for both asleep and unrousable. At the end of the 24-hour period, the total amount of analgesics used, including tramadol and morphine, was noted.

All the results were recorded in Microsoft excel sheet and were subjected to statistical analysis using SPSS software.

RESULTS

The mean age of the patients of Group 1 and Group 2 was 40.2 years and 41.7 years. Mean duration of surgery among patients of Group 1 and Group 2 was 53.9 mins and 50.7 mins respectively. Mean BIS value among patients of Group 1 and Group 2 was 54.7 and 49.3 respectively; on comparing the

results were found to be statistically significant. Mean time to eye opening was significantly higher among patients of Group 2 in comparison to Group 1. Also, overall rescue morphine requirement was significantly higher in group 1. Overall, VAS was significantly higher in group 1.

Table 1: Demographic and clinical data

Variable	Group 1	Group 2	p-value
Mean age (years)	40.2	41.7	0.12
Mean duration of surgery (mins)	53.9	50.7	0.28
Mean BIS value	64.7	49.3	0.001*
MAC of isoflurane	0.92	0.95	0.64

*: Significant

Table 2: Postoperative variables

Postoperative variables	Group 1	Group 2	p-value
Time to eye opening (mins)	8.13	11.32	0.001*
Tramadol (mg)	263.7	258.1	0.820
VAS overall	7.1	5.9	0.001*
Rescue morphine (mg)	2.6	1.4	0.000*

*: Significant

DISCUSSION

Many surgical procedures would not be possible without the patient entering a state of general anaesthesia (GA). The essential features of a successful GA, displayed by the patient, are a reversible loss of consciousness with a lack of movement, a lack of awareness, unresponsiveness to painful stimuli and a lack of recall of surgical intervention. Inadequate GA may lead to intraoperative awareness with recall (due to patient underdosage) or to prolonged recovery and an increased risk of postoperative complications for the patient (due to overdosage).[7] An important contributing factor to inadequate GA is our current limited ability to evaluate the levels of consciousness. The incidence of awareness has been reduced from about 1–2% in unselected patients in the 1980s to about 0.1% at present. However, certain surgical procedures (for example caesarean section or cardiac surgery) or high-risk patients have a substantially increased risk of awareness. The consequences of intraoperative awareness range from an absence of prolonged after-effects to a post-traumatic stress disorder.[8- 10] Hence; the present study was conducted to evaluate the effect of intraoperative depth of anesthesia on postoperative pain and use of analgesics.

The mean age of the patients of Group 1 and Group 2 was 40.2 years and 41.7 years. Mean duration of surgery among patients of Group 1 and Group 2 was 53.9 mins and 50.7 mins respectively. Mean BIS value among patients of Group 1 and Group 2

was 54.7 and 49.3 respectively; on comparing the results were found to be statistically significant. Schneider G et al investigated whether a BIS baseline between 50 and 60 prevents awareness reaction to endotracheal intubation. After approval by the university's Ethics Committee, 20 consenting patients were enrolled in the study. Midazolam (0.1 mg/kg PO) was given 30 minutes before induction. Anesthesia was induced with alfentanil (10 mcg/kg, followed by 2 mcg/kg(-1) x min(-1)) and propofol infusion was adjusted to a BIS target level between 50 and 60. Propofol infusion rate was maintained constant for 5 minutes with constant BIS. Prior to intubation, patients were tested in one-minute intervals for awareness using Tunstall's isolated forearm technique. Three minutes after endotracheal intubation, the study period ended, and surgery was performed. After intubation, 8 of 20 patients showed an awareness reaction, squeezing the investigator's hand in response to a command. No patient had recall. Comparison of patients with and without awareness reaction revealed no differences in BIS before or after intubation. Their study showed that a BIS value between 50 and 60 prior to intubation is inadequate to prevent an awareness reaction to endotracheal intubation during propofol/ alfentanil anesthesia.[11]

Mean time to eye opening was significantly higher among patients of Group 2 in comparison to Group 1. Also, overall rescue morphine requirement was significantly higher in group 1. Overall, VAS was significantly higher in group 1. Davidson A et al investigated the relationship between BIS and a defined measure of airway reactivity. Sixty-two children scheduled for direct laryngoscopy and bronchoscopy were enrolled in this prospective nonrandomized blinded study. They were induced and maintained with either sevoflurane or halothane. When depth of anaesthesia was judged deep enough on clinical grounds, the cords were sprayed with 2% lidocaine. Using an A2000 monitor, the BIS was recorded at the moment of spraying the cords. Using logistic regression there was a significant correlation between BIS and cord closure for halothane but not for sevoflurane (halothane Pseudo r2 = 0.5, P = 0.003; sevoflurane Pseudo r2 = 0.0004, P = 0.9). Although the study was not specifically designed to test for it, no difference was detected between agents in the incidence of cord closure (halothane 38%, sevoflurane 36%), or secondary endpoints (halothane 29%, sevoflurane 29%). The BIS may be useful to help prevent unwanted airway reflexes when using halothane but not with sevoflurane.[12]

CONCLUSION

By maintaining BIS value of 45 to 40 during surgical procedure, postoperative pain and requirement of rescue analgesia could be decreased.

REFERENCES

1. Bhargava AK, Setlur R, Sreevastava D. Correlation of bispectral index and Guedel's stages of ether anesthesia. Anesth Analg. 2004;98:132–4.
2. Kissin I. Depth of anesthesia and bispectral index monitoring. Anesth Analg. 2000;90:1114–7.
3. Liu WH, Thorp TA, Graham SG, Aitkenhead AR. Incidence of awareness with recall during general anaesthesia. Anaesthesia. 1991;46:435–7.

4. Woolf CJ, Chong MS. Preemptive analgesia- treating postoperative pain by preventing the establishment of central sensitization. Anesth Analg 1993;77:362-79.

5. Henneberg SW, Rosenberg D, Jensen EW, Ahn P, Burgdorff B, Thomsen LL. Peroperative depth of anaesthesia may influence postoperative opioid requirements. Acta Anaesthesiol Scand 2005;49:293-6.

6. Gurman GM, Popescu M, Weksler N, Steiner O, Avinoah E, Porath A. Influence of the cortical electrical activity level during general anaesthesia on the severity of immediate postoperative pain in the morbidly obese. Acta Anaesthesiol Scand 2003;47:804- 8.

7. Wen, P. Consciousness, EEG and depth of anaesthesia monitoring. Australas Phys Eng Sci Med 2012;35: 389–92. https://doi.org/10.1007/s13246-012-0176-7

8. Rungreungvanich M, Lekprasert V, Sirinan C, Hintong T. An analysis of intraoperative recall of awareness in Thai Anesthesia Incidents Study (THAI Study) J Med Assoc Thai. 2005;88:S95–S101.

9. Ghoneim MM, Block RI. Learning and memory during general anaesthesia, an update. Anaesthesiology. 1997;87:387.

10. Braz LG, Braz DG, Cruz DS, Fernandes LA, Módolo NSP, Braz JRC. Mortality in anesthesia: A systematic review. Clinics. 2009;64:999–1006.

11. Schneider G, Wagner K, Reeker W, Hänel F, Werner C, Kochs E. Bispectral Index (BIS) may not predict awareness reaction to intubation in surgical patients. J Neurosurg Anesthesiol. 2002 Jan;14(1):7-11.

12. Davidson A. The correlation between bispectral index and airway reflexes with sevoflurane and halothane anaesthesia. Paediatr Anaesth. 2004 Mar;14(3):241-6. doi: 10.1046/j.1460-9592.2003.01181.x. PMID: 14996263.