

ORIGINAL ARTICLE

Sedation with propofol during combined spinal epidural anesthesia: Comparison of dose requirement of propofol with and without BIS monitoring

R. K. Verma, MBBS, DA, MD*, Anil K Paswan, MBBS, MD**,
Shashi Prakash, MBBS, MD***, Surender K. Gupta****,
P.K. Gupta, MBBS, DA, MD*

Professor; *Assistant Professor; ****Senior resident
All India Institute of Medical Sciences, New Delhi (India)*

***Assistant Professor
Department of Anesthesiology, Institute of Medical Sciences, Banaras Hindu University, Varanasi-221005 (India)*

Correspondence: Dr Anil K Paswan, Department of Anesthesiology, Institute of Medical Sciences, Banaras Hindu University, Varanasi-221005 (India); Mobile: +919794855871; E-mail: dranil1973@gmail.com

ABSTRACT

Background: Bispectral (BIS) monitoring provides an objective, non-invasive measure of the level of consciousness in sedated patients. Sedation has been shown to increase patient satisfaction during regional anesthesia. Propofol is extensively being used as a sedative, providing sedation while patients remain cooperative and can be easily aroused. In this study, we sought to determine whether BIS is a useful adjunctive manoeuvre to reduce the sedative dose of propofol by using BIS.

Methodology: Forty patients of ASA grade I and II, weighing between 30 to 60 kg, undergoing elective gynecological surgery of about 60 minutes duration were included in the study, and randomly divided into two groups. All patients received combined spinal epidural anesthesia (CSEA). The patients in Group-P (n=20) received propofol without BIS monitoring and those in Group-PB (n=20), received propofol under BIS monitoring. Total doses of propofol consumed in all patients were calculated and compared using paired t-test. A p-value <0.05 was considered to be significant.

Results: The mean total dose of propofol consumed was 130.25 mg \pm 46.95 without BIS monitoring (Group-P) compared to 68.49 mg \pm 12.59 in patients (Group-PB) in which BIS was used to monitor the desired sedation level ($P < 0.001$). Mean dose to reach required level of sedation was also reduced (68.35 \pm 21.10 vs 29.01 \pm 9.45, $P < 0.001$).

Conclusion: Use of BIS during propofol infusion reduces requirement of propofol for sedation during regional anesthesia

Keywords: Propofol, Bi-spectral index; BIS; Combined spinal epidural anesthesia; Regional anesthesia; Gynecological surgery; Sedation level; Ramsay sedation score

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INTRODUCTION

Majority of the gynecological surgeries are being performed under regional anesthesia. For surgery under spinal as well as combined spinal epidural anesthesia, sedation is a valuable tool to make it more comfortable for the patient, the surgeon and the anesthetist. Propofol, midazolam and many other sedative agents

are commonly used for this purpose during regional anesthesia, especially in young adults.^{1,2} Many previous studies have proved that subarachnoid bupivacaine enhances the hypnotic effects of midazolam, thiopentone and propofol.^{3,4} Due to decrease in dose requirement during subarachnoid block, it is essential to precisely titrate the amount of drug actually needed,

because spinal anesthesia with conventional sedative doses may lead to respiratory and cardiac complications and even some cases of cardiac arrest have also been reported.⁵ BIS correlated well with the level of responsiveness and provided an excellent prediction of the loss of consciousness⁶. Bispectral (BIS) monitored guidance has a significant role in titrating the dose of intravenous sedative agents.⁷

We conducted this prospective study to compare the dose requirement of propofol, recovery time, recall and the cost, with or without using BIS monitoring during gynecological surgeries under combined spinal epidural anesthesia.

METHODOLOGY

After obtaining approval by the Hospital Ethics Committee, we studied 40 ASA grade I & II patients, in the age group of 30-50 yrs and weighing 30 to 60 kg, scheduled for elective gynecological surgery of about 60 minutes duration, in this prospective, randomized controlled trial. Written informed consent was taken from every patient enrolled in the study. Patients having history of allergy to propofol, any contraindications to spinal anesthesia, patients with known psychiatric illness or any previous neurological deficit were excluded from the study.

Patients were randomized, by sealed envelopes, to receive propofol infusion without (Group-P, n=20) or with BIS monitoring (Group-PB, n=20). No sedative premedication and antiemetics were given to the patients. In the operating room, monitors including ECG, pulse oximetry and non-invasive blood pressure were attached. In Group-PB, electrodes (BIS™ Sensor; Aspect™ Medical Systems, Inc., Newton, MA, USA) were applied to the patients' forehead to monitor the BIS (A-2000 BIS™ monitor, System rev.2.1, Aspect™ Medical Systems). BIS smoothing rate was set at 15 S. 10 ml/kg of normal saline solution was infused through 18G intravenous cannula to each patient as a preloading fluid before giving subarachnoid block. Baseline values of mean arterial pressure (MAP), heart rate (HR), peripheral oxygen saturation (SpO₂) and BIS were recorded. Combined spinal epidural needles (B.Braun, Melsungen AG, Germany) were used in the lateral decubitus position at L3-4 or L4-5 interspace and 4-5cm catheter was inserted in the epidural space. Anesthetic level was evaluated by the pin-prick method ten minutes after giving the block and propofol infusion (1%) was started. Patients in Group-P received propofol 1% infusion at 5 mg/kg/hr. After reaching Ramsay sedation score 3 (Ramsay sedation score)⁸, the dose was reduced to 3 mg/kg/hr. Patients in Group-PB received 1% infusion starting with 5 mg/kg/hr, till

BIS value reached 75 and then the dose was reduced and titrated to maintain BIS level of 65-85. MAP was maintained within 20% of baseline values using ephedrine 5 mg boluses. Bradycardia (HR < 60 beats/min) was treated with atropine 0.5 mg IV. If oxygen saturation dropped < 94%, oxygen was administered at 6 lit/hr using a face mask. Propofol infusion was started by an anesthesiologist, who was blinded to the study. Surgery was started immediately after achieving the required level of sedation (Ramsay sedation score 3). Onset time and the propofol dose required for the onset of required level of sedation were recorded. Heart rate, mean arterial blood pressure and oxygen saturation were recorded at 15 minutes intervals. Propofol infusion was stopped about ten minutes before completion of surgery and recovery time (BIS value 90, or Ramsay sedation score 2) was noted.

Statistical analysis: After completion of the study, the data were entered into the statistical software package using Smith Statistical Package (SSP) Version 2.80. Data are presented as mean \pm SD or percentage as appropriate. Comparisons between groups for patient characteristic data, onset and recovery time and propofol doses were compared using independent student's t-test. In between two groups, comparison of incidence of complications e.g. bradycardia/tachycardia, hypoxemia, hypotension/hypertension, restlessness, Fisher's exact probability test was applied because sample size was very small, and p-value < 0.05 was expressed as statistically significant at two-tailed test. The sample size provided 80% power to detect a 20% difference between two groups.

RESULTS

There was no statistically significant differences in the groups with respect to age and weight ($p > 0.05$) (Table-1). Anesthetic level was T6-T7 in both the groups. Time to reach required level of sedation was significantly less in Group-PB as compared to Group-P [5.85 ± 1.35 vs 16.15 ± 2.29 min; ($p < 0.01$)] (Table-1). Mean dose to reach required level of sedation was lower in Group-PB [29.01 ± 9.45 Vs 68.35 ± 21.10 mg ($p < 0.01$)]. Mean dose to maintain sedation was also lower in Group-PB [39.49 ± 8.76 Vs 61.9 ± 41.15 mg ($p < 0.005$)]. Mean total dose was lower in Group-PB [68.49 ± 12.59 Vs 130.25 ± 46.95 mg ($p < 0.001$)] (Table-2). There was a reduction in the dose of propofol by about 47% by using BIS monitoring. Duration of infusion was comparable in both groups (Table-2). Recovery time was delayed in Group-PB [9.41 ± 3.41 Vs 4.35 ± 2.01 min ($p < 0.001$)] (Table-2). Parameters e.g. heart rate, mean arterial pressure and oxygen saturation were comparable in both groups. There was no statistically

Table 1: Demographic Data

Groups	Group-P N = 20	Group-PB N = 20	t-value	p-value
Mean age ± SD (years)	38.8 ± 10.44	39.45±6.48	0.24	> 0.05
Mean weight ± SD (kg)	47.5 ± 7.15	48.87±7.51	0.59	>0.05
Time to reach required level of sedation (Min)	16.15 ± 2.29	5.85±1.35	17.32	<0.001
Level of sensory block	T6-T7	T6-T7	0	0

significant difference in the incidence of various complications between the two groups ($p > 0.05$) (Table-3). However complications were more common in Group-P.

DISCUSSION

The BIS,⁹ an EEG derivative, has been shown to be a sensitive and simple monitor to assess the hypnotic component of anesthesia, and the level of consciousness during propofol sedation.^{6,10} Our study showed that during regional anesthesia BIS monitoring is useful in reduction in dose of propofol needed for sedation by 47%. Mean dose to reach desired level of sedation is also decreased.

Spinal anesthesia itself has some sedating properties, which has been proved in many studies.¹¹ Pollock and colleagues¹² reported that in volunteers, spinal anesthesia leads to a significant decrease in BIS level. Several studies have shown that the interaction between spinal local anesthetics and sedatives leads to an augmentation of the sedation causing a decrease in the required dose of intravenous anesthetic agents.^{3,4} Even intramuscular injection of lignocaine or bupivacaine has some sedative effect, due to which requirement of thiopentone was decreased.¹³ This interaction can be explained by systemic effects of absorbed local anesthetics,¹⁴ rostral spread of local anesthetic with direct action on brain and deafferentation.¹⁵ Most speculated mechanism for sedation during spinal anesthesia is a deafferentation phenomenon. However intravenous anaesthetic agents like propofol, thiopentone and

midazolam are associated with many complications e.g. allergic reactions, local tissue irritation, hypotension, bradycardia, apnoea and pain on injection etc. Hence, there is a need to know the minimum amount of these drugs needed to provide adequate sedation with minimum side effects. We have used BIS monitoring in our study for this purpose. Titration of anesthetic agents by BIS index appears to decrease the incidence of intraoperative awareness, currently estimated at 0.2% in healthy patients undergoing general anesthesia and 1.14% in patients undergoing cardiac surgery.^{12,16} BIS and auditory evoked potential (AEP) monitor (A-line AEP monitor) have been shown to be superior to the classic electroencephalographic and hemodynamic variables for predicting anesthetic conditions.¹⁷ A good correlation of BIS index and level of awareness has been demonstrated by many authors.^{9,10}

There are some studies in which the investigators have found that BIS guided anesthesia is cost effective.^{7,18} Murlidhar K and colleagues¹⁸ reported that BIS guided anesthesia for CABG was associated with 35.2% reduction in anesthetic agent (isoflurane) and 32% reduction in propofol requirement in another group. In the present study we noted a reduction in propofol requirement by 47%. The difference could be due to differences in BIS scoring level; in their study they kept it in between 45-55, and we kept it in between 65-85.^{18,19}

We found that target sedation was achieved faster in the BIS guided group than the other group. This could have been due to an advantage of continuous graphical

Table 2: Doses, duration of infusion and recovery time.

Groups	Group-P N = 20	Group-PB N = 20	t-value	p-value
Mean dose to reach required level of sedation	68.35 ± 21.10	29.01±9.45	7.61	<0.001
Mean dose to maintain sedation	61.9 ± 41.15	39.49±8.76	2.38	<0.05
Mean total dose	130.25 ± 46.95	68.49±12.59	5.68	<0.001
Duration of infusion (Min)	51.8 ± 4.351	54.65±7.64	1.46	>0.05
Recovery time (Min)	4.35 ± 2.01	9.41±3.41	5.72	< 0.001

Table 3: Comparison of complications in two groups

Complication	Group-P (n = 20)	Group-PB (n = 20)	p-value
Restlessness	4(20)	3 (15)	>0.05
Awareness	3 (15)	2 (10)	
O ₂ supplementation (SPO ₂ < 94%)	2 (10)	2 (10)	
Hypotension	2 (10)	1 (5)	
Nausea / vomiting	0	2 (10)	
Pain in arm	0	1 (5)	

monitoring with BIS monitor, while the sedation scores assessed in the other group were by qualitative method. We found that recovery time is prolonged in the BIS guided group; this could be due to the fact that most of the patients in our group were having BIS around 70, that's why recovery was delayed and took time in reaching BIS of around 90 and without BIS monitoring recovery was comparatively better and statistically significant might be due to frequent awakening of patient intraoperatively to maintain Ramsay sedation

score-3 and awakening and awareness maintained postoperatively also. However, we assume that it would be unethical to keep the patients unседated.

Limitations: The study sample size was very small and plasma level of propofol was not monitored.

CONCLUSION

On the basis of this study we can conclude that BIS should be used for monitoring the level of sedation in regional anesthesia. as it is associated with a reduction of total propofol required and hence is cost effective. Further studies should be done in this direction with a larger sample size.

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