Intraoperative Awareness Among Patients Following General Anaesthesia - A Descriptive, Cross - sectional study.

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Abstract

Introduction: Operative awareness with recall refers to recalling of the intra operative events in the post-operative period by the patients which may have significant psychological and legal implications. Bispectral index (BIS) analysis is a processed EEG that can be used to monitor the depth of anaesthesia, titrate the dose of anaesthetic agents and hence prevent intraoperative awareness.

Methods: It is a prospective, cross-sectional, observational study, where total of 103 cases operated under general anaesthesia were included. BIS score was monitored intraoperatively at various points of time during the surgery and Modified Brice questionnaires was used in post-operative to illicit intraoperative awareness.

Results: The maximum and minimum BIS score was 97.46 ± 0.84 before induction and 50.20 ± 7.43, 30 minutes after intubation. None of the patients remembered anything between going to sleep and waking up indicating there was no incidence of awareness. However, 55.4% remembered "seeing the operating room before going to sleep", 71.8% remembered "hearing voices" first thing after waking up and 59.3% were worried about pain in the post-operative period.

Conclusion: There were no incidence of intraoperative awareness among the patients during surgery under general anaesthesia.

INTRODUCTION

Intraoperative awareness during general anaesthesia may lead to psychological disorders like anxiety and post-traumatic stress in patients on one hand and may be the major medicolegal liability to anesthesiologists on other hand.[1,2] Intraoperative awareness occurs when the depth of anaesthesia is inadequate to achieve a state of unconsciousness.[3]

Bispectral Index Analysis (BIS) is a processed electroencephalogram (EEG)[4] used to monitor the level of consciousness among patient receiving general anaesthesia and sedation.[5,6] BIS index is a number between 0 and 100 with a value of 100 corresponding to completely awake state, 80 to light / moderate sedation, 60 to general anaesthesia, 40 to deep hypnotic state, 20 to burst suppression whereas 0 corresponding to a profound state of coma or unconsciousness.[7] Modified Brice questionnaire is standard questionnaire used to illicit awareness among patient under general anaesthesia.

This study was planned to use BIS scoring intraoperatively to determine the level of consciousness and Brice questionnaire post-operatively to illicit awareness.

METHODS

It is a prospective, cross-sectional, observational study, conducted on the patients undergoing surgery under general anaesthesia, at Shree Birendra Hospital, a teaching

hospital of Nepalese Army Institute of Health Sciences (NAIHS), Chhauni, Kathmandu, Nepal. The study was conducted from June 2022 to December 2022 after getting ethical approval from Institutional Review Committee (IRC-NAIHS, Regd. No:613). Patients with ASA physical status-I, females, aged between 20 - 60 years, undergoing elective laparoscopy cholecystectomy were included in the study. Patients refusing to be the part of the study, using psychiatric medications, alcohol consumption were excluded from the study. The non-probability convenience sampling methods was used in which 103 patients, who underwent laparoscopic cholecystectomy during the study period were included. Data collected were recorded in a proforma containing demographic and other essential details including modified Brice questionnaire. BIS score was recorded from a Nihon Kohden monitor with BIS module and BIS sensor. The data collected were filled in the excel sheet and analyzed using SPSS version-27. BIS value was measured by anaesthesiologist or the resident on duty. It was measured before and after induction, after intubation and every 15 minutes during the process of general anaesthesia, 5 and 10 minutes after administration of reversal agent, at the time of tongue protrusion, at the time of eye opening and at the time of head lift by the patient. In the post-operative ward patients were interviewed based on modified Brice questionnaire[8] six hours after the surgery by either anesthesiologist or resident on duty.

Modified Brice questionnaire:

1	What is the last thing you remember before going to sleep?
2	What is the first thing you remember after waking up?
3	You remember anything between going to sleep and waking up?
4	Did you dream during the surgery?
5	where you dream disturbing you?
6	What was the worst thing about your operation?

Any complications during or after the surgery were managed as per the institutional protocol by the team of the physicians who were involved in the treatment of the patient.

RESULTS

We included total of 103 patients in our study. The mean age of the patients was 37.03 ± 10.67 years with minimum age being 19 years and maximum age was 50 years. Similarly, mean weight was 60.45 ± 7.16 kgs which ranged from 50 - 74 kg. Mean duration of the surgery was 61.88 ± 8.29 minutes. The average BIS recoding at various time interval during the surgery is tabulated in table 1.

Table 1: BIS index score of the patients

BIS Level	
Time intervals	Mean ± SD
Before induction	97.46 ± 0.84
After induction	63.17 ± 6.13
After intubation	54.96 ± 7.54
15 min after intubation	53.87 ± 5.61
30 min after intubation	50.20 ± 7.43
45 min after intubation	51.80 ± 5.90
Before reversal agent	74.04 ± 3.84
At the time of tongue protrusion	81.39 ± 3.52
At the time of eye opening	81.97 ± 3.45
At the time of head lift	89.07 ± 2.84

Regarding the answers of the questions pertaining to Modified Brice Questionnaire, there was variations in answers. In the question "What is the last thing you remember before going to sleep?", the replies given by the patients are tabulated in table 2

Table 2: Answer to the question "What is the last thing you remember before going to sleep?"

Component	Number (%)
Being in the pre-op area	0
Being with family	0
Feeling mask on face	17 (16.5)
Burning or stinging in the IV line	25 (24.3)
Seeing the operating room	57 (55.4)
Hearing voices	4 (3.8)
Smell of gas	0
Others (Please write)	0

Similarly, replies to the question" What is the first thing you remember after waking up?" are mentioned in table 3

Table 3: Answers to the questions, "What is the first thing you remember after waking up?"

Component	Number (%)
Hearing voices	74 (71.8)
Feeling mass and phase	4 (3.9)
Seeing the operating room	0
Being with the family	0
Nothing	0
Feeling breathing tube	4 (3.9)

Feeling pain	11 (10.7)
Being in the recovery room	10 (9.7)
Being in the ICU	0
Others (Please write)	0

Regarding the third question of the Modified Brice questionnaire, which talks about "remembering anything between going to sleep and waking up", none of the patients remembered anything between these periods. Similarly, none of the patients had any kinds of dreams during the surgery. However, responses to the last questions of the modified Brice Questionnaire, the answers are mentioned in table 4.

Table 4: Responses to the question" What was the worst thing about your operation?"

Component	Number (%)
Anxiety	6 (5.8)
Recovery process	6 (5.8)
Awareness	14 (13.6)
Pain	61 (59.3)
Unable to carry out usual activities	16 (15.5)
Others (please write below)	0
Total no of patients	103

DISCUSSION

In this study, we utilized BIS monitor and modified Brice questionnaire to detect intraoperative awareness and recall if any. As intraoperative awareness has significant implications in anaesthesiology practice, achieving the state of unawareness and amnesia are important aspects. Intraoperative awareness is patient being aware and recalling intraoperative events in post-operative period. Amnesia refers to removing of the memory of the patients of intraoperative period. Ideally depth of anaesthesia and appropriate medications are used to achieve amnesia. In our study, we used BIS to measure the depth of anaesthesia intraoperatively and Modified Brice questionnaire in the post-operative period to find out whether patient had any kind of intraoperative awareness.

We noticed maximum BIS score before induction of anaesthesia which was about 97.46. Similarly, the BIS score was high after patient was given reversal agent and the score was in increasing trend as the time passed after reversal. The BIS score was higher before induction in comparison to after awaking from anaesthesia, which is probably due to residual anaesthetic effect after waking up. The trend of decrease in BIS score was seen maximum after 30 to 45 minutes after anaesthesia was given. BIS score began to increase at the end of the surgery when the addition of anaesthetic agent was stopped and patient was prepared for extubation.

With regards to Modified Brice Questionnaire, none among 103 patients remembered anything between going to sleep and waking up. The BIS score between, patient going to sleep and waking up remained maximum after induction around score of 63. After intubation till waking up it remained well below 55. So, we believe that maintaining the BIS score at the level of surgical anaesthesia i.e around 60 avoided intraoperative awareness in our cases. However, after termination of the anaesthesia, maximum number of the patients mentioned about "hearing voices", followed by "feeling pain", "being in the recovery room", "feeling breathing tube in mouth" and "feeling mask on the face". In our study, before giving reversal agents the average BIS score was 74 and 3.9% mentioned about feeling breathing tube which may have corresponded to the BIS score of 74 or more.

The incidence of intraoperative awareness in our study was zero, even though as per the literature, the global incidence of the intraoperative awareness has been reported to be between 0.1% and 0.2% in the general surgical population and up to 1 - 2% of patients at high risk for this complication.[9]

In a study conducted by Chhanwal et al[10] to evaluate the intraoperative awareness during general anaesthesia, the reported incidence of intraoperative awareness was 2% in patients in whom BIS was used and 8% in whom BIS was not used. A study conducted by Avidan et al[11] regarding prevention of intraoperative awareness in high risk patients, the incidence of intraoperative awareness was found to be 0.24% in those patients in whom BIS was used intraoperatively. This study did a comparison between use of BIS and end-tidal anaesthetic agents' concentration (ETAC) as a guided in prevention of intraoperative awareness and found that BIS was not superior to ETAC technique.

Similar study conducted by Ambulkar et al[9] among 600 cancer patients undergoing surgery under general anaesthesia in India, BIS was utilized in order to find the incidence of intraoperative awareness. This study concluded the incidence of intraoperative awareness to be 0.33%. Another study, conducted by Norton et al[12] among 118 Portuguese speaking patients, Brice questionnaire was utilized in eliciting in intraoperative awareness. This study showed that only seven patients mentioned about dreaming in the intraoperative period and only one patient had intra operative awareness. Myles et al[13] conducted prospective randomized, multicentre trial among 1225 patients. The study reported that only two patients had intraoperative awareness in BIS group and 11 patients had

intraoperative awareness in the non-BIS group.

The present study noted no incidence of intraoperative awareness because we included small number of cases and we did not include the cases which have higher incidence of intraoperative awareness such as emergency surgeries, cardiac surgeries or surgeries in pregnant women. Also, titration of the anaesthetic agents based on the BIS score may have played role in reducing the incidence of intraoperative awareness.

This study is a relatively small sampled study conducted in a single centre. The present research excluded the types of surgeries where the probability of intraoperative awareness is high. Hence, application of our findings may not be feasible in all surgical cases.

CONCLUSION

BIS can be used to measure the level of consciousness during general anaesthesia. BIS guided anaesthesia has resulted in decrease in the incidence of intra-operative awareness, reduction in anaesthetic requirements and shortening of recovery period. Maintaining adequate depth of anaesthesia can prevent intraoperative awareness and recall in the postoperative period.

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