Texila International Journal of Public Health
ISSN: 2520-3134
DOI: 10.21522/TIJPH.2013.12.03.Art027

A Comparative Study of Intraoperative Awareness Using Modified Brice Questionnaire in Patients Undergoing Emergency and Elective Surgery under General Anaesthesia

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Abstract

Intra-operative awareness sometimes referred to as awareness while under general anaesthesia, is a rare but noteworthy phenomenon in which patients experience consciousness during surgery. It can result in several long-term emotional disturbances, anxiety, and post-traumatic stress disorder (PTSD). One method for identifying intra-operative awareness in patients after surgery is the Modified Brice questionnaire. The main objective of the study was to facilitate a comprehensive evaluation of the level and presence of awareness during operation. The Patients were randomly categorized into two groups of 20 each; group elective and group emergency, modified Brice questions were asked to the patients and it is noted numerically as scores 1-6. The results were analysed using paired "t"-test, Chi-square test and ANOVA. The p-value <0.001 was statistically significant. Out of 40 patients, 20 undergoing emergency surgery have awareness in contrast to the other 20 undergoing elective surgery. The mean awareness of emergency surgery was significantly higher when compared with elective surgery. Because of unforeseen procedures, the need to take patients straight to the operating room without knowing their height, weight, or if they have any medication allergies, and the lack of appropriate and comprehensive diagnostic testing, intraoperative awareness is higher in emergency surgery than in elective surgery.

Keywords: *Elective Surgery, Emergency Surgery, Intra-Operative Awareness, Modified Brice Questionnaire.*

Introduction

Intraoperative awareness is an unexpected memory of intraoperative events [1]. Patient's interview reports were classified as (a) definite awareness (b) possible awareness (c) no awareness and (d) dreaming. A recalled event occurring during surgery or anaesthesia that was confirmed by the attending person present in the operating room was considered as definite awareness. A situation in which a patient was unable to remember any event during anaesthesia/surgery, yet memories could have been associated with the surgical procedure was defined as possible awareness. A lack of recalled intra-operative events with probable memories of situations associated with immediate pre or post-operative periods was classified as no awareness. Incidence of dreaming was also assessed and it would be classified as a separate event other than awareness. These definitions were adopted based on a previous study [2]. A side effect of general anaesthesia known as intra-operative

Received: 13.08.2024 ***Accepted: 01.09.2024*** ***Published on: 30.09.2024***

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consciousness is the patient's memory of an intraoperative event. Patients may spontaneously recollect an incident that happened during their anaesthetic experience, either later or sooner, or they may disclose the occurrences by questioning. The manner and timing of the questions appear to be particularly crucial in determining the occurrence. Consciousness under anaesthesia is hard to identify and characterize. Hemodynamic responses to pain should not vary, according to the surgeon and anaesthetist. Although the term "**accidental awareness during general anaesthesia**" has gained popularity recently, an episode of inadvertent consciousness under intentional general anaesthesia has long been referred to as awareness in anaesthetic literature. To conduct a quantitative evaluation, a tool like a questionnaire is employed to ensure that all patients receive the same questions and that their answers are graded rather than left unanswered. A sizable, randomized control experiment was conducted earlier using and validating the modified Brice questionnaire. Intra-operative use of an electroencephalogram (EEG)-based depth of anaesthesia monitor may give some indication that anaesthesia is inadequate, but once again, the output of such systems is not highly sensitive and specific for consciousness [3, 4]. The most widely used is the bispectral index (BIS) monitor (Covidien), which processes a single frontal electroencephalographic signal with the use of a proprietary algorithm to calculate a dimensionless number that is intended to indicate the patient's level of consciousness. BIS values range from 0, indicating the suppression of detectable brain electrical activity, to 100, indicating the awake state. A target range between 40 and 60 has been advocated both to prevent awareness and to reduce the dose of anaesthetic agent that must be administered [5]. The incidence of awareness in developed countries is found to be 0.1%–0.2% [6,7]. Therefore, the main objective of the study was to conduct a comprehensive evaluation of the level and presence of awareness during operation.

Materials and Methods

The study was conducted at Saveetha Medical College & Hospital after approval from the Institutional Review Board Committee and written informed consent was obtained from all patients. It is a prospective observational comparative study of 20 patients.

A total of 40 patients were randomly allocated into two groups of 20 patients each.

1. Group 1 = Elective Surgery.
2. Group 2 = Emergency Surgery.

Inclusion Criteria

ASA 1 and 2, Age between 18 – 80.

Exclusion Criteria

We excluded Patients who were not extubated after surgery, Patients who planned to transfer to the Intensive Care Unit, Surgery for more than 3 hours, Patients who were not willing for the study, who were not mentally well, ASA 3 and 4.

Routine pre-anaesthetic evaluations, including blood tests, were performed for all patients. The night before the surgery and the morning of the surgery, all patients were premedicated with oral pantoprazole 40 mg and midazolam 0.5 mg. As per ASA guidelines, the fasting protocol was followed. On shifting the patient to the operation theatre, intravenous access was checked and started on intravenous fluids. Basic monitors like ECG, NIBP, SpO_2 and capnography were connected and monitored. Before inducing anaesthesia, Induction anaesthesia was performed with adequate preoxygenation with 100% oxygen followed by Inj. Fentanyl 2mcg/Kg and Inj. Propofol 2mg/Kg intravenously. After confirming adequate mask ventilation, the patient was paralyzed with Inj. Atracurium 0.5 mg/Kg. The appropriate airway device was inserted after 3 minutes by an experienced anaesthesiologist with a minimum of 3 years' experience. The appropriate size of the device

was selected based on the subject bodyweight, height, and manufacturer guidelines in elective surgery. However, in emergency surgery, the dosage of drugs and the appropriate size of airway selection are difficult. The anaesthesia circuit was connected, and the patient's ventilation was assessed with both auscultation and capnography to ensure there were no obvious leaks. Mechanical ventilation was maintained with oxygen and nitrous oxide with FiO_2 along with 2% sevoflurane. All patients underwent intermittent positive pressure ventilation with a tidal volume of 7ml/kg and respiratory rate of 12-14 breaths per minute. The baseline peak airway pressures were noted. The accurate seating of the airway device was confirmed by the ability to see the complete glottis cupped by the cuff of the device. After the end of the surgical procedure and following adequate spontaneous efforts by the patient, neuromuscular blockade was reversed with Inj. Neostigmine 2.5 mg and Inj. Glycopyrolate 0.5 mg. The patient was then extubated after becoming awake and responsive. The patients were analysed by using a modified Brice Questionnaire. By asking questions to the patients post-operatively after the 1st hour and 24th hour. Then the questions are marked numerically 1-6, if the score is less than 3 denotes less awareness but a score is more than 3 denotes patients have awareness during general anaesthesia the data descriptive statistics frequency analysis, and percentage analysis was used for categorical variables and the mean and S.D were used for continuous variables. To find the significant difference between the bivariate samples in emergency surgery i.e. group 1 and the elective surgery group 2, the sample t-test was used. To find the significance in qualitative categorical data chi-square test was used. In all the above statistical tools, the probability value 0.01 is considered a significant level.

Limitation: We include patients aged between 18 to 80 years of age, patients undergoing less than 3 hours duration of surgical procedures, and Patients with ASA 1 and 2.

Results

Out of 40 patients, 20 undergoing emergency surgery have awareness in contrast to the other 20 undergoing elective surgery.

Modified Brice Questionnaire

1. What is the last thing you remember before going to sleep? –Being in the pre-op area
2. What is the first thing you remember after waking up?
3. Do you remember anything between going to sleep and waking up?
4. Did you dream during your procedure?
5. Were your dreams disturbing to you?
6. What was the worst thing about your operation?

Hypothesis testing for two means (equal variances)

Standard deviation in group I = 0.6

Standard deviation in group II = 0.7

Mean difference = 3.165

Alpha Error (%) = 5%

Power (%) = 80%

sided = 2

Required sample size per group = 20.

The variations in consciousness between the groups of elective and emergency procedures in the first hour are depicted in Figure 1. Group 2 represents emergency surgery, whereas Group 1 represents elective surgery. Compared to elective surgery, emergency surgery is more widely recognized. In Figure 2, which shows the disparities in awareness between the two groups at the 24-hour mark, group 1 stands for elective surgery and group 2 for emergency surgery. It is more common for emergency surgeries to be known than elective procedures. Table 1 Age-wise distribution of group 1. Table 2: Age-wise distribution of group 2. The comorbidities of the patients who have posted for surgery are shown in Figure 3 Compared to emergency surgeries, female patients who are having elective surgery have less comorbidities,

and male patients who are having elective surgery have greater comorbidities.

Table 3 BMI (Body Mass Index) distribution among groups. Figure 4 shows that ASA 2 patients are more frequently listed for both elective and emergency surgical procedures. The patients' sexes are depicted in Figure 5, and groups 1 and 2 respectively display elective and emergency procedures. When compared to emergency surgeries, there are more female patients listed for elective procedures and fewer male patients listed for surgeries. Table 4. The mean difference between types of surgery.

Discussion

In this prospective observational study, we applied the modified Brice questionnaire and asked guiding questions to Group 1 and Group 2. The incidence of intraoperative awareness was 0.6% in the first 1st hour of postoperative questioning, but the incidence decreased to 0.4% in the 2nd questioning after the 24th hour. In Group 2, we asked about anaesthesia satisfaction, and we did not detect any intraoperative awareness in any patient [8]. In the present study, two interviews were conducted with patients; intraoperative awareness was at the rate of 0.6% in the 1st interview and 0.4% in the 2nd interview. Some researchers have claimed that the probability of awareness detection increases with an early interview and decreases with a late interview [9,10]. When we compared the two groups, the patients in Group 2 had higher comorbidities than the patients in Group 1, which could have an impact on the patients' awareness of anaesthesia. When comparing the two groups, group 2 is more aware, and as time passes, the group's awareness changes. The patient can remember more in the first hour and less in the 24th. ASA 2 patients are more frequently listed for both group 1 and group 2 surgical procedures.

In many cases of awareness, the cause is obvious – for example, a technical failure or error – and is thus preventable by improved preparation and monitoring. Nonetheless, there remain cases where no rational explanation can be found for why someone receiving drugs known to be potently amnestic at sub sedative doses, should regain consciousness and subsequently be able to recall intra-operative events [11]. In our study, we have categorized intraoperative awareness with recall under general anaesthesia into definite awareness, possible awareness, and no awareness. If the patient had recalled more than one of the above positive responses, it was categorized under definite awareness, and if the patient had recalled one of the above positive responses or was unable to recall an event. Still, there was an indication of awareness, and the patient was categorized under possible awareness. Patients with no reported awareness were categorized under no awareness.

Awareness under anaesthesia, however, could be avoided if an adequate depth of anaesthesia is maintained during surgery. Monitoring by an experienced anaesthesiologist using hemodynamic variables (such as heart rate and blood pressure), and lacrimation has been done traditionally to maintain adequate depth of anaesthesia. Although effective, awareness can still occur without any variation in vital parameters. Similarly, BIS monitoring has been used to maintain an adequate depth of anaesthesia. It measures the specific electrical activity of the brain with electrodes placed on the patient’s forehead and generates a numerical value that ranges from 0 to 100. A BIS value of 40–60 has been associated with a low probability of awareness under anaesthesia [12, 13].

The dose selection of general anaesthetic drugs should be based on the patient’s requirements. Compared to adult patients, there is a 25% increase in minimum alveolar concentration (MAC) for volatile general anaesthetic agents in children and a 25% reduction in elderly patients. Similar to the MAC concept, there is a minimum inhibitory concentration (MIC) for intravenous drugs,

which has greater variability [14]. In our study, patients were given 2% of sevoflurane and, induction agents and skeletal muscle relaxants were administered based on the patient's weight in group 1; however, in group 2, the patient's weight was not apparent because of an emergency; therefore, the induction agent and muscle relaxant were not administered based on the patient's weight. Anesthesia was either not maintained by the MAC values or an insufficient dose of inhalational general anaesthetic drugs was given, which was inappropriate for the patient's weight. The occurrence of intraoperative awareness with memory during general anaesthesia was only significantly correlated with this one component.

Given that benzodiazepines are potent amnestic, and that current techniques of identification of AAGA rely critically on memory function, this is a significant confounder; likely, the proportion of patients receiving benzodiazepines will also influence the outcome.

However, most important are the differences in the study methodology used. Although the NAP5 study was unique in the fact that it involved two whole countries (and thus a vast number of patients), and in the rigour applied to the analysis and reporting of the suspected cases, it is likely that the study failed to identify 80% or more of the cases that occurred during the study period [15]. The degree of intraoperative awareness was higher in cases where the anaesthesia lasted more than three hours (>3 hours) than in shorter cases (<1 hour). This could be because the anaesthesia was not maintained to a sufficient depth during the procedure.

Over the past few decades, attention has been focused on the issue of AAGA by clinicians, academics and the lay press. In comparison with other areas of interest to academic anaesthetists, studies of awareness have included large numbers of patients from a multitude of hospitals and have resulted in highly read and cited publications [16-20]. The recall is assessed by a patient’s report of previous events, in particular, events that occurred during general anaesthesia. Explicit memory is assessed by the patient’s ability to recall specific events that took place during general anaesthesia. Implicit memory is assessed by changes in performance or behaviour without the ability to recall specific events that took place during general anaesthesia that led to those changes [21].

Conclusion

It can concluded that the unforeseen procedures, the need to take patients straight to the operating room without knowing their height, weight, or if they have any medication allergies, and the lack of appropriate and comprehensive diagnostic testing, intraoperative awareness is higher in emergency surgery than in elective surgery.

The majority of the Group 1 patients in Table 1 are older than 50 and fewer people between the ages of 31 and 40 were posted for surgery.

Table 1. Age-wise Distribution of Group 1

Age	Frequency	Percentage
<30	5	26.3
31-40	3	15.8
41-50	4	21.1
>50	8	36.8

Group 2 patient covers are primarily under 30 years old, as shown in Table 2. Patients who are older than fifty and those who are between the ages of thirty-one to forty are less likely to be posted for group 2 procedures.

Table 2. Age-wise Distribution of Group 2

Age	**Frequency**	**Percentage**
<30	8	38.1
31-40	3	14.3
41-50	6	33.3
>50	3	14.3

In Table 3, patients with a BMI of more than 25 are posted for group 2 surgery more often than those with a BMI of between 20.1 and 25. Patients with a BMI of between 15 and 20 were posted for group 1 surgery more frequently than those with a BMI of between 15 and 20 in group 2. Table 4 shows that the Mean difference between
Types of Surgery.

Table 3. BMI (Body Mass Index) Distribution among Groups

BMI	GROUP 1		GROUP 2	
	NO	%	NO	%
15-20	2	10	1	5
20.1-25	14	70	9	45
>25	4	20	10	50
TOTAL	20	100	20	100
MEAN ± SD	23.095 ± 2.831338		24.95 ± 3.946581	
P VALUE	0.001			
SIGNIFICANCE	Significant			

Table 4. Mean Difference Between Types of Surgery

Variables		Mean±S.D	p-value
RR	1	16.16±1.6	0.011*
	2	14.90±1.4	
1st	1	1.79±0.8	0.000*
	2	3.38±1.2	
24h	1	1.32±0.5	

	2	2.24±0.9	0.000*

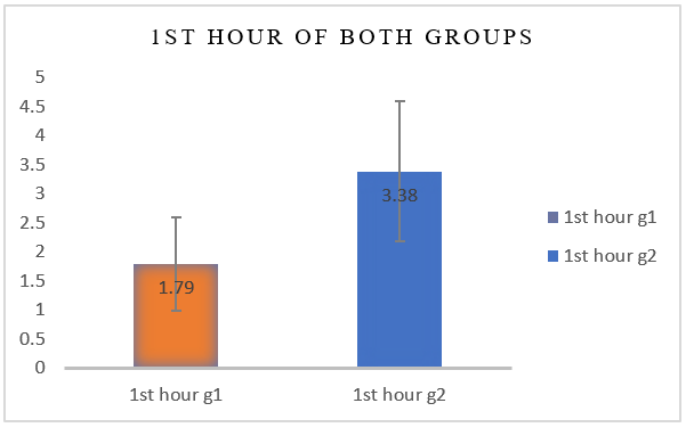

Figure 1. Difference of Awareness in both the Groups at 1st Hour

The variations in consciousness between the groups of elective and emergency procedures in the first hour are depicted in Figure 1. Group 2 represents emergency surgery, whereas Group 1 represents elective surgery. Compared to elective surgery, emergency surgery is more widely recognized.

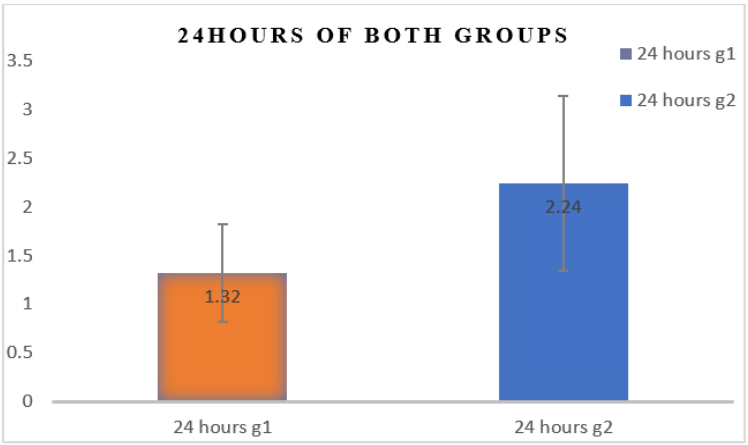

Figure 2. Difference of Awareness in both Groups at the 24th hour

In Figure 2, which shows the disparities in awareness between the two groups at the 24-hour mark, group 1 stands for elective surgery and group 2 for emergency surgery. It is more common for emergency surgeries to be known than elective procedures.

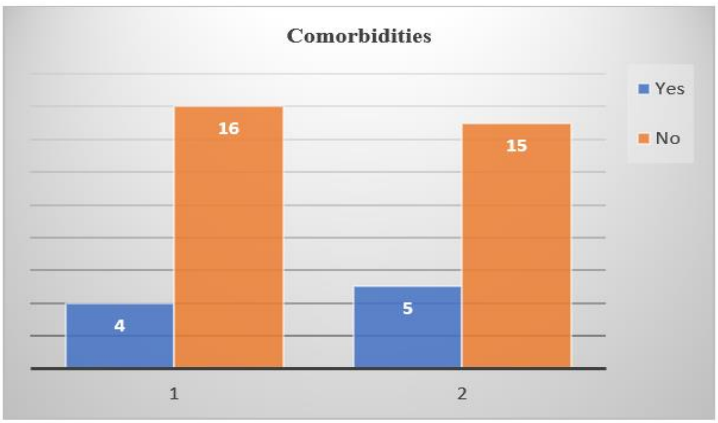

Figure 3. Comorbidities among both Groups

The comorbidities of the patients who have posted for surgery are shown in Figure 3, Compared to emergency surgeries, female patients who are having elective surgery have less comorbidities, and male patients who are having elective surgery have greater comorbidities.

Figure 4 shows that ASA 2 patients are more frequently listed for both elective and emergency surgical procedures.

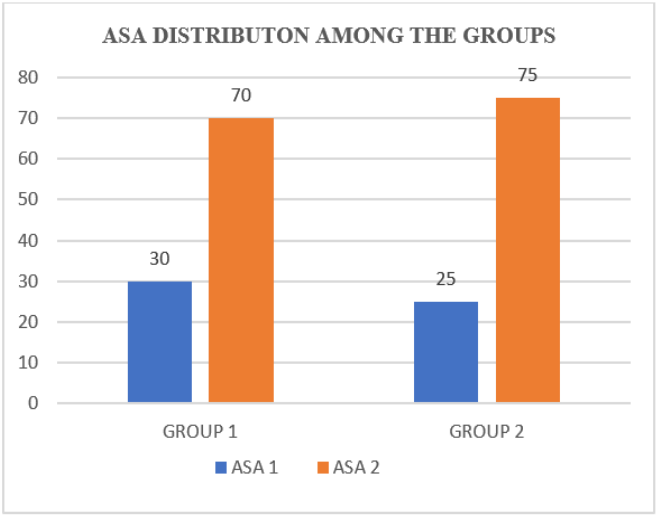

Figure 4. ASA (American Society of Anaesthesiologists) Distribution among the groups

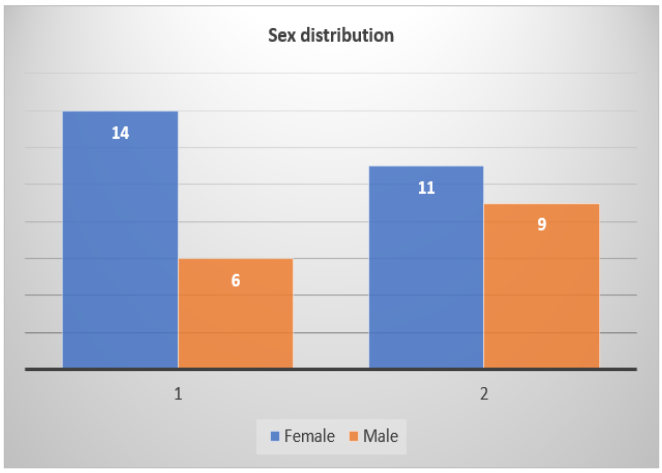

Figure 5. Sex-wise Distribution of both Groups

The patients' sexes are depicted in Figure 5, and groups 1 and 2 respectively display elective and emergency procedures. When compared to emergency surgeries, there are more female patients listed for elective procedures and fewer male patients listed for surgeries.

Conflict of Interest

The authors declared no conflict of interest in the manuscript.

Acknowledgements

We, the authors are thankful to Saveetha Medical College & Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS) Chennai-602105 for providing constant support to conduct the study.

Funding

The present study was supported by the Saveetha Medical College & Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS) Chennai-602105.

References

[1]. Macario, A., Weinger, M., Carney, S., et al. 1999, Which Clinical Anesthesia Outcomes are Necessary to Avoid. The Perspective of Patients. *Anesth Analg*, 89(3), 652–658 https://doi.org/10.1097/00000539-199909000-00022

[2]. Errando, C. L., Sigl, J. C., Robles, M., Calabuig, E., Garc´ıa, J., Arocas, F., et al., 2008, Awareness with Recall During General Anaesthesia: A Prospective Observational Evaluation of 4001 Patients. *Br J Anaesth*.101, 178–85 Doi: 10.1093/bja/aen144

[3]. Messner, M., Beese, U., Romstock, J., Dinkel, M., Tschaikowsky, K., 2003, The Bispectral Index Declines During Neuromuscular Block in Fully Awake Persons. *Anesthesia and Analgesia*, 97, 488-491 Doi: 10.1213/01.ANE.0000072741.78244.C0

[4]. Schuller, P. J., Newell, S., Strickland, P. A., Barry, J. J., 2015, Response of Bispectral Index to Neuromuscular Block in Awake Volunteers. *British Journal of Anaesthesia*, 115(Suppl. 1), i95-i103, Doi: 10.1093/bja/aev072

[5]. Punjasawadwong, Y., Boonjeungmonkol, N., Phongchiewboon, A., 2014, Bispectral Index for Improving Anaesthetic Delivery and Postoperative Recovery. *Cochrane Database Syst., Rev.,* 6, CD003843. Doi: 10.1002/14651858.CD003843.pub3.

[6]. Sebel, P. S., Bowdle, T. A., Ghoneim, M. M., et al., 2004, The Incidence of Awareness During Anesthesia: A Multicenter United States Study. *Anesth Analg*., 99(3), 833–839, Doi: 10.1213/01.ANE.0000130261.90896.6C.

[7]. Sandin, R. H., Enlund, G., Samuelsson, P., Lennmarken, C., 2000, Awareness during Anaesthesia: A Prospective Case Study. *Lancet*, 355(9205), 707–711 Doi: 10.1016/S0140-6736(99)11010-9

[8]. Mashour, G. A., Kent, C., Picton, P., Ramachandran, S. H., Tremper K. K., Turner, C. R., Shanks, A., Avidan, M. S. 2013, Assessment of İntraoperative Awareness with Explicit Recall: A Comparison of 2 Methods. *Anesthesia and Analgesia*, 116 (4): 889-891. https://doi.org/10.1213/ANE.0b013e318281e9ad

[9]. Errando, C. L., Sigl, J. C., Robles, M., Calabuig, E., Garcia, J., Arocas, F.,Higueras, R., Del Rosario, E., Lopez, D., Peiro, C. M., Soriano, J. L., Chaves, S., Gil, F., Garcia-Aguado, R., 2008, Awareness with Recall During General Anaesthesia: A Prospective Observational Evaluation of 4001 Patients. *British Journal of Anaesthesia*, 101(2), 178-185. https://doi.org/10.1093/bja/aen144

[10]. Singla, D., Mangla, M., 2017, Incidence of Awareness With Recall under General Anesthesia in Rural India: An Observational Study. *Anesthesia Essays and Research*, 11 (2): 489-494. https://doi.org/10.4103/aer.AER_44_17

[11]. Pandit, J. J., Andrade, J., Bogod, D. G., et al., 2014. 5th National Audit Project (NAP5) on Accidental Awareness During General Anaesthesia: Summary of Main Findings and Risk Factors. *British Journal of Anaesthesia* 113, 549–59, Doi: 10.1093/bja/aeu313

[12]. Flaishon, R., Windsor, A., Sigl, J., Sebel, P.S. 1997, Recovery of Consciousness After Thiopental or Propofol. Bispectral Index and Isolated Forearm Technique. *Anesthesiology*, 86(3), 613–619, Doi: 10.1097/00000542-199703000-00013

[13]. Glass, P. S., Bloom, M., Kearse, L., Rosow, C., Sebel, P., Manberg, P., 1997, Bispectral Analysis Measures Sedation and Memory Effects of Propofol, Midazolam, Isoflurane, and Alfentanil in Healthy Volunteers. *Anesthesiology*, 86(4), 836–847, Doi: 10.1097/00000542-199704000-00014

[14]. Tammisto, T., Tigerstedt I., 1997, The Need for Halothane Supplementation of N_2O-O_2-Relaxant Anaesthesia in Chronic Alcoholics. *Acta Anaesthesiol Scand*, 21(1), 17-23, Doi:10.1111/j.1399-6576.1977.tb01187.x

[15]. Absalom, A. R., Green, D., 2014, NAP5: the Tip of the Iceberg, or All We Need to Know? *British Journal of Anaesthesia*, 113, 527–30, https://doi.org/10.1093/bja/aeu349

[16]. Pandit, J. J., Andrade, J., Bogod, D. G., et al., (2014): 5th National Audit Project (NAP5) on Accidental Awareness during General Anaesthesia: Summary of Main Findings and Risk Factors. *British Journal of Anaesthesia*,113, 549–59 Doi: 10.1093/bja/aeu313

[17]. Myles, P.S., Leslie, K., McNeil, J., Forbes, A., Chan, M. T., 2004, Bispectral Index Monitoring to Prevent Awareness during Anaesthesia: The B-Aware Randomised Controlled trial. *Lancet*, 363 (9423), 1757–63 Doi: 10.1016/S0140-6736(04)16300-9

[18]. Avidan, M. S., Zhang, L., Burnside, B. A., Finkel, K. J., et al., 2008, Anesthesia Awareness and the Bispectral Index. *New England Journal of Medicine*, 358 (11), 1097–108 Doi: 10.1056/NEJMoa0707361

[19]. Avidan, M. S., Jacobsohn, E., Glick, D., et al., 2011, Prevention of Intraoperative Awareness In A High-Risk Surgical Population. *New England Journal of Medicine*, 365, 591–600**,** Doi: 10.1056/NEJMoa1100403

[20]. Mashour, G. A., Shanks, A., Tremper, K. K., et al., 2012, Prevention of Intraoperative Awareness with Explicit Recall in an Unselected Surgical Population: A Randomized Comparative Effectiveness Trial. *Anesthesiology*,117, 717–25, Doi: 10.1097/ALN.0b013e31826904a6

[21]. Schacter, D. L., 1987, Implicit Expressions of Memory in Organic Amnesia: Learning of New Facts and Associations. *Hum Neurobiol*, 6:107–18.