

Incidence of Accidental Awareness with Recall during General Anaesthesia: A Prospective Observational Study in a Tertiary Care Hospital

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ABSTRACT

Background

Accidental awareness during general anaesthesia, though rare, is a serious issue. It could lead to potential harmful psychological consequences. It has been reported that general surgical population has an incidence of awareness ranging from 0.1 to 0.2%.

Objective

To determine the incidence of awareness with recall under general anaesthesia by using modified Brice questionnaire in post-operative care unit.

Method

This was an observational study conducted on adult patients in a tertiary care hospital. A modified Brice questionnaire was used for the post-operative interview in 1,120 patients following the written informed consent. They were of American society of anaesthesiologists' physical status I to III and had surgeries under general anaesthesia. The incidence of intraoperative awareness with recall was the primary outcome of the study.

Result

Among the total 1,120 patients, 678 patients were female and 442 were males. Most patients, 785 were of American society of anaesthesiologists' physical status I, while 316 were II and 19 were III. While 1071 (95.6%) patients underwent elective surgery, 49 (4.3%) patients had emergency surgeries. The mean age of the study population was 40.31 years with standard deviation of 12.12. Of the 1120 patients, two of them had definitive awareness.

Conclusion

The incidence of intraoperative awareness with recall after general anaesthesia in patients from a tertiary care hospital was 0.13%.

KEY WORDS

General anaesthesia, Intraoperative awareness, Modified brice questionnaire

INTRODUCTION

General anaesthesia is a pharmacologically induced, reversible state, composed of unconsciousness, amnesia, analgesia, and immobility along with physiological stability.¹ While these goals are attained in majority of cases, in rare instances they are not “completely” obtained. This can lead to unintentional consciousness resulting in subsequent recall of intraoperative events define as Accidental awareness during general anaesthesia (AAGA).²

It's an uncommon but serious and avoidable complication that can cause significant psychological aftereffects like, anxiety, and post-traumatic stress disorder.³ Incidence rates of AAGA vary across different countries and institutions, influenced by individual anaesthetic practices and patient populations. Over time, the incidence has decreased from 1-2% in all patients in the 1980s to about 0.1% today with variations in the subspecialties and certain groups of patients.³⁻⁶

Conventional clinical monitoring modalities are ineffective in detecting and preventing awareness during anesthesia, while monitors utilizing the Bispectral Index (BIS) in preventing awareness remains unclear.⁷⁻⁹ Numerous studies that have assessed intraoperative awareness with recall using the modified Brice interview have consistently reported an incidence of 1 to 2 per 1000 or higher.¹⁰

This study aimed to assess and document the occurrence of accidental awareness with recall during general anaesthesia under our current practice.

METHODS

Eleven hundred twenty patients who underwent elective surgery under general anaesthesia participated in this observational study after the approval from institutional review committee of the hospital (reference no. 09062023/02) and the study period was from August 2023 to July 2024. The study included adult patients aged 18 to 75 years of American society of anaesthesiologists' physical status (ASA-PS) I to III who underwent elective and emergency surgery from various specialties over a twelve month period in Kathmandu Medical College Teaching Hospital. They did not have neuropsychological disorders that prevents them from answering the questionnaire. The study excluded participants who were hard of hearing or unable to speak. Also, those who could not respond due to poor medical condition, not being extubated after surgery, or being transferred to an Intensive Care Unit were excluded. Patients with postoperative delirium or altered mental status were excluded. So were those with mental retardation, cognitive dysfunctions, or neuropsychological disorders. The study also excluded neurosurgery patients.

Sample size was determined using the formula, $n = [z^2 * p(1-p)] / e^2 / 1 + [z^2 * p(1-p)] / e^2 * N]$, where n = sample

size, N = population size (2250) average of total patients under general anaesthesia over a period of twelve months. z = z -score (1.96), e = margin of error (3%), p= standard of deviation (0.5), n=1018 With 10% dropout, n= 1120.

There was no modification made to standard clinical practice for this study. The choice of anaesthesia for a surgery was determined by the experience of the anaesthesia consultant, general health of the patient, and nature of the procedure. The anaesthesia was administered with or without re-gional anaesthesia however, all the patients in this study had general anaesthesia with endotracheal intubation or laryngeal mask airway. Vitals signs were recorded and monitored in all patients throughout the anaesthesia process in accordance with current recommendations. Following the completion of surgical procedure, anaesthesia was reversed, extubated, and shifted to post anaesthesia care unit (PACU) after adequate return of consciousness.

The study noted the patient's general information which included age, gender, ASA-PS, body mass index (BMI), type and nature of surgery (elective or emergency), anaesthetic technique used, history of chronic drug intake or substance abuse, premedication with benzodiazepines or alpha-2 agonists and any previous history of awareness, difficulty of intubation was noted from the anaesthesia record form.

A modified Brice Questionnaire (Table 1) was used to determine the prevalence of intra-operative awareness.¹¹ Patients who were conscious, co-operative and aware of time, place, and people were interviewed within the first 24 hours following surgery in the PACU. if the first interview revealed that the patient may have been aware during the procedure, another anaesthesia consultant re-interviewed the patient for the confirmation.

Table 1. Modified Brice Questionnaire

What is the last thing you remember before going to sleep?
What is the first thing you remember after waking up?
Do you remember anything between going to sleep and waking up?
Did you dream during your procedure? If so, was it disturbing?
What was the worst thing about your operation?

Following completion, the questionnaire was analysed, and categorized as either having (a) definite awareness (b) possible awareness (c) no awareness and (d) dreaming. A recollection of an incident that happened during surgery or anaesthesia that was confirmed by the attending anaesthesiologist in the operating room was deemed to be definite awareness. A situation in which patient was not able to recall specific events that occurred during anaesthesia/surgery, but had memories connected to the process was defined as possible awareness. No awareness was defined as the inability to recall specific intraoperative events along with likely memories of situations associated with immediate pre- or post-operative period. Dreaming

was evaluated as well, as it would be categorized as an independent event apart from awareness. Dreams were categorized as pleasant, unpleasant, and 'do not remember'. These definitions were adopted on the basis of a previous study.¹² The collected data was entered in excel spreadsheet on Microsoft and later analysed using statistical package for the social sciences (IBM SPSS) version 26 for analysis. Continuous variables, presented as mean standard deviation, and frequency and percentage were utilized to express the variables.

RESULTS

The study included 1120 patients with ASA-PS I to III. The baseline characteristics of the study participants are presented in table 2, wherein 60.5 % of the participants were female, 70% were ASA-PS I, and 4.46% had body mass index (BMI) of > 30 kg/m². The mean age of the study population was 40.31 years with standard deviation (SD) of 12.12 and 95.6% of procedures were performed as an elective surgery.

Table 2. Patient characteristics (N=1120)

Variables	Number (%)
Gender	
Male	442 (39.46)
Female	678 (60.54)
ASA-PS	
I	785 (70.10)
II	316 (28.20)
III	19 (1.70)
BMI	
> 30 Kg/m ²	50 (4.46)
< 30 Kg/m ²	1070 (95.54)

All the patients received propofol as an inducing agent and inhalational anaesthetic for the maintenance of general anaesthesia. Muscle relaxant was used for both the intubation and maintenance of anaesthesia in 96% of the patients. In 82.5% of the cases, benzodiazepine was administered.

In this study, 1071 (95.6%) patients underwent elective surgery whereas 49 (4.3%) patients had emergency surgeries. 1038 (96.69%) patients had an easy intubation while it was difficult in 82 (7.3%) patients. The average duration of surgery was of 1-2 hours in 43%. Table 3 displays the distribution of patients according to the type of surgery, difficulty in intubation, duration of surgery.

To the first question of Modified Brice's Questionnaire (Fig. 1), 321 (28.6%) patients reported feeling a mask on their faces, 252 (22.5%) reported being in an operating room (OR), and 225 (20%) reported hearing voices before going into anaesthesia.

Table 3. Type of surgery, intubation difficulty, surgical duration

Variables	Number (%)
Type of surgery	
Elective	1071 (95.60)
Emergency	49 (4.40)
Difficulty in intubation	
Easy	1038 (96.68)
Difficult	82 (7.32)
Duration of surgery	
> 2 hours	173 (15.45)
1-2 hours	486 (43.39)
30-60 minutes	461 (41.16)

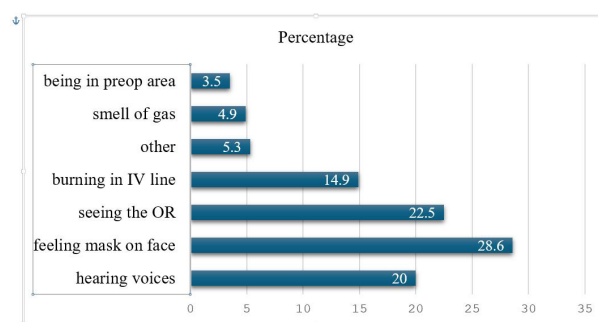


Figure 1. What is the last thing you remember before going to sleep?

When asked a second question (Fig. 2), 446 (39.8%) patients recalled being in the post operative care unit and 349 (31.1%) patients remembered hearing voices.

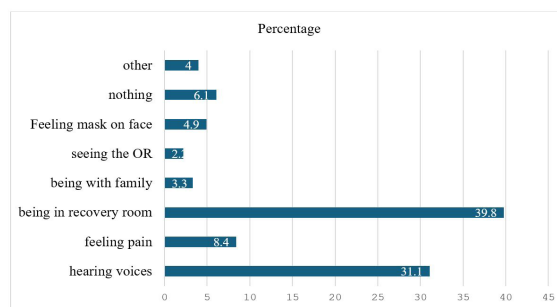


Figure 2. What is the first thing you remember after waking up?

Regarding the third question, "Do you remember anything between going to sleep and waking up?", two (0.17%) patients reported having recollections of intraoperative events. And 1118 (99.8%) patients were completely unconscious while under anaesthesia.

In response to fourth question, "Did you dream during your procedure? if so, was it disturbing?", out of 1120 participants, 21 (1.87%) had dreams during the procedure but was not upsetting to them.

As to the last question about the worst thing of the procedure (Fig. 3), a range of answers were obtained which was categorized as "other". And 401 (35.8%) patients

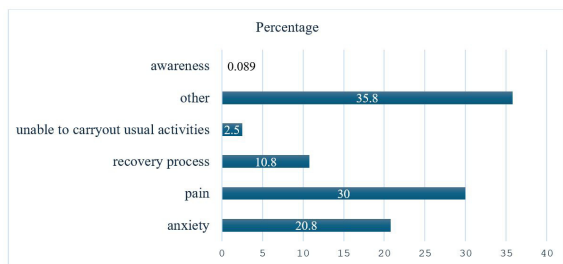


Figure 3. What was the worst thing about your operation?

reported of difficulty in breathing, movement difficulties, cold, sore throats, discomfort from the urinary catheter, dizziness, while 336 (30%) patients complained pain as the worst thing.

One patient each in emergency and elective surgical procedure developed awareness during an-aesthesia with recall (Table 4).

Table 4. Awareness during anaesthesia by surgery type

Variables	Number (%)	Surgery types	
		Elective	Emergency
Awareness during anaesthesia			
No awareness	1118(99.82)	1070	48
Definite awareness	2(0.17)	1	1

Patients with definite awareness gave detailed explanations that were characterized as definite awareness (Table 5).

DISCUSSION

Intraoperative awareness is a subjective sensation, while the classification and verification of patient reports are dependent on the standards determined by the physician evaluating the incident. Positive responses typical of awareness include factual recollection of sounds, conversations, tactile sensations, sense of pain or discomfort, muscle paralysis that can be associated with the intraoperative phase.^{13,14}

This study shows that the incidence of awareness with recall following general anaesthesia was 0.13%, which is similar to what has been reported in other studies.^{2,3,6,14} Therefore, regardless of geographic location or potential variations in the anaesthetic techniques, awareness during anaesthesia seems to be a universal phenomenon occurring at an incidence of 1 to 2 per 1000 cases.

Intraoperative awareness is difficult to detect since it is based more on patient reports than on quantitative measurements. The interview’s methodology, scheduling, and technique, all affect its ability to identify awareness. When compared to the method that rely solely on spontaneous patient reports, prospective methods that use structured questionnaires detect a significantly higher number of events of awareness.¹⁴ We adopted a modified

Table 5. Description of awareness

Age / Sex	ASA-PS	BMI	Op-erative procedure	Surgical urgency	Dura-tion of sur-gery	Description of awareness
33/F	II	>30	Cae-sarean section	Emer-gency (failed sub arach-noid block turned to general anaes-thesia)	1-2 hours	Patient fell asleep, and then heard people talking. She felt her stomach. She fell asleep again, saw a dream about her family and hometown. She sensed the tube in her mouth, re-called suctioning and removing it. The patient felt no pain and did not consider the experiences to be traumatic.
27/M	I	<30	Trans-ab-dom-inal pre-peri-toneal patch (TAPP)	Elective	> 2 hours	The patient stated that he was in pain and was unable to move when he woke up from the sleep. He recalled hearing sounds from monitor and people talking. He was anxious and perceived it as a traumatic experi-ence.

Brice questionnaire for the detection of intraoperative awareness. After comparing the modified Brice with quality assurance questioning, Mashour found that the incidence of awareness was 0.1% in the modified Brice and 0.02% in the quality assurance questioning. Similarly, studies employing modified Brice as a research methodology has documented intraoperative awareness ratio variations ranging from 0.12%-52%.^{15,16} It is challenging to distinguish between true and false awareness regardless of method used for detection but there are times when a patient report describes intraoperative experiences, events, or discussions in such a detail and specificity that all can agree that awareness had definitely occurred.⁵

In addition, there is a debate about a best time to conduct a postoperative interview in order to gauge the awareness with recall under general anaesthesia. A study by Brice et al. have demonstrated that early interviewing raises the incidence, and late interviewing decreases the incidence according to Errando et al. and his colleagues.¹¹⁻¹³ Sandin et al. reported that patients experienced awareness during the second or third interview at postoperative 1-3 and postoperative 7-14 days respectively.¹⁷ In contrast to Sandins’ findings, a study by Bektas et al. concluded that

the incidence of awareness was higher in the first but lower in the second interview after 24 hours but was not statistically significant.¹⁸ In our study, the patients were interviewed only once, within 24 hours before discharging the patient from PACU.

Dreams are reported more often than awareness, and it's not well known how significant intraoperative dreaming is. According to the study by Samuelsson et al. intraoperative dreams were not an early interpretation of delayed awareness.¹⁹ Dreaming is thus regarded as a separate entity. In our study, 1.87% of the patients reported having dreams. Dreams were more common in studies carried out by Parete et al. where prevalence of dream was 12.5% and 2.5% in study by Lakshmi et al.^{20,21} This discrepancy may have resulted from variations in the medication regimen or dosage that are implicated across different hospitals. Like our study, the patients in abovementioned both studies reported that dream was not upsetting.

Based on the results of various studies, light anaesthesia was the most common cause for the awareness. In some situations, like certain emergency surgeries, procedures involving significant blood loss and hemodynamic instability, in patients with low cardiac reserve, it is not possible to avoid inadequate anaesthetic dose. This issue may also occur in certain patients who require higher doses of anaesthetic agents, regular administration of muscle relaxant, particularly if they are used prior to hypnotics.¹² Inadequate anaesthetic delivery due to empty or improperly calibrated vaporizers, poor connection between intravenous cannula and extravascular parts of apparatus and other causes may also result in inadequate anaesthetic delivery.^{5,22} Light anaesthesia in caesarean section is the primary cause of occurrence of awareness. Because of the objective fear of uterine atony, reduced

blood flow to the placenta, and respiratory depression in the newborn, light anaesthesia is used to lessen these negative effects of anaesthetics to mother and the foetus. Reduced induction dosage and hesitancy to employ higher concentration of halogenated agents could be contributing factors. One of the factors that made regional anaesthesia a preferred choice in obstetric is accidental awareness during general anaesthesia.²³

The risk of awareness can be reduced by a qualified anaesthesiologist who administers anaesthesia in accordance with the current knowledge of pharmacology, patient characteristics, and surgical techniques supported by clinical signs and monitoring. Avoiding light anaesthesia, learning more about patients' anaesthetic needs and developing techniques to identify consciousness during anaesthesia are all steps taken to prevent awareness.

The single centered study design, smaller number of cases compared to other studies, lack of BIS to monitor the depth of anaesthesia and conducting questionnaire with patients during postoperative period only once are the study's limitations.

CONCLUSION

Of the patients, 0.13% experienced accidental awareness under general anaesthesia with recall. Significant number of patients experienced unpleasant sensations following surgery, including anxiety, pain, and discomfort. To enhance the anaesthetic care, we should devote more attention to address these unpleasant events. However, it is imperative that all anaesthesiologists should establish a protocol to reduce the frequency of awareness.

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