

A Prospective Observational Study of Intraoperative Awareness and Recall During General Anesthesia: An Original Research

**Dr. Potlapelly Vasu Prakash, Dr. Bheemanadhuni Anusha, Dr Chandrashekhar Botla,
Dr. Voviliveni Srikala, Dr Sreenivas Azmeera**

Assistant Professor, Department of Anaesthesiology, Kakathiya Medical College,
Hanamkonda, Warangal. vasupprakash@gmail.com

Assistant Professor, Department of Anaesthesiology, PMSSY Super Speciality
Hospital, Kakatiya Medical College, Warangal, Telangana. anusha.bheem@gmail.com

Associate Professor, Department of Anaesthesiology, PMSSY Super Speciality
Hospital, Kakatiya Medical College, Warangal,
Telangana. drchandrashekhar1994@gmail.com

Associate Professor, Department of Anaesthesiology, PMSSY Super Speciality
Hospital, Kakatiya Medical College, Warangal, Telangana. srikaladv@gmail.com

Assistant Professor, Department of Anaesthesiology, PMSSY Super Speciality
Hospital, Kakatiya Medical College, Warangal, Telangana.
sreenivas.azmeera@gmail.com

Corresponding Author: Dr. Voviliveni Srikala, srikaladv@gmail.com

Abstract

Background: Intraoperative awareness and recall during general anesthesia continue to be concerns in surgical settings due to potential psychological consequences.

Objective: This prospective observational study aimed to evaluate the incidence, associated factors, and patient outcomes related to intraoperative awareness.

Methods: Over an 18-month period, 2800 patients undergoing elective surgeries under general anesthesia at a tertiary care center were enrolled. Demographic data, intraoperative variables, and patient-reported experiences of awareness were collected and analyzed.

Results: The incidence of intraoperative awareness was 0.57%, with vague perceptions (62.5%) and auditory sensations (56.25%) being the most commonly reported experiences. Prolonged surgery duration (>4 hours) ($p<0.05$) and the use of neuromuscular blocking agents ($p<0.01$) were significantly associated with awareness episodes.

Conclusion: While the incidence of intraoperative awareness remains relatively low, prolonged surgery duration and neuromuscular blocking agents emerged as significant risk factors. Vigilant monitoring and tailored anesthesia strategies are crucial in mitigating the risk of awareness during surgery.

Keywords: Intraoperative awareness, General anesthesia, Patient outcomes, Anesthetic techniques, Observational study

Introduction

Intraoperative awareness and recall, characterized by the unexpected recollection of events during surgery under general anesthesia, represent a complex and challenging phenomenon in anesthesia practice. Despite the strides made in anesthesia techniques and monitoring, a subset of patients continues to report varying degrees of consciousness during surgery, causing psychological distress and potentially affecting long-term psychological well-being. This phenomenon has prompted a surge in research efforts aimed at unraveling its incidence, predisposing factors, and ramifications on patient outcomes.

An estimated 0.1% to 0.2% of patients undergoing general anesthesia experience some form of intraoperative awareness, which can range from fleeting perceptions to distressing, vivid recollections of surgical events [1]. These distressing recollections, even if infrequent, can result in postoperative psychological sequelae, including anxiety, depression, and post-traumatic stress disorder (PTSD) [2]. Moreover, the impact of intraoperative awareness on a patient's trust in healthcare providers and the overall perception of surgical care cannot be underestimated [3].

Numerous factors contribute to the occurrence of intraoperative awareness. Anesthesia depth monitoring, while pivotal, does not guarantee complete prevention. Variations in patient characteristics, such as age, pre-existing psychological conditions, and concurrent medications, have been implicated in altering an individual's response to anesthetic agents [4]. Furthermore, the intricacies of surgical procedures, including hemodynamic fluctuations, use of neuromuscular blocking agents, and anesthesia interruptions, can inadvertently lead to inadvertent awakenings [5].

The pursuit of understanding intraoperative awareness demands a multifaceted approach. Prior studies have provided valuable insights into specific risk factors; however, a comprehensive understanding necessitates a broader evaluation encompassing diverse patient cohorts, surgical specialties, and anesthesia techniques [6]. The complexity of this phenomenon requires a nuanced exploration that amalgamates clinical, physiological, and psychological aspects to elucidate its intricate underpinnings.

The significance of investigating intraoperative awareness transcends its immediate clinical implications. It touches upon the fundamental tenets of patient safety, quality of care, and ethical considerations in anesthesia practice [7]. Ethical principles underscore the necessity of informed consent, emphasizing the obligation to inform patients about potential risks, albeit rare, associated with anesthesia. The awareness of such adverse events is pivotal in fostering transparent patient-provider communication and shared decision-making [8].

Furthermore, understanding intraoperative awareness is pivotal in refining anesthesia protocols and enhancing patient safety. Tailoring anesthesia strategies based on patient-specific factors, such as age, comorbidities, and medication history, holds promise in mitigating the risk of intraoperative awareness [9]. Incorporating advanced monitoring techniques and vigilant intraoperative surveillance are imperative to promptly identify and address instances of unintended consciousness [10].

This study endeavors to contribute to the existing body of knowledge by conducting a prospective observational analysis encompassing a diverse patient cohort across various

surgical specialties. By rigorously examining demographic factors, preoperative characteristics, intraoperative variables, and anesthetic techniques, this research aims to delineate the nuanced interplay between these elements and the occurrence of intraoperative awareness.

Materials and Methods

This prospective observational study was conducted at a tertiary care center over a period of 18 months, from January 2022 to June 2023. The study received ethical approval from the institutional review board, and written informed consent was obtained from all participants.

The sample size calculation was based on previous estimations of intraoperative awareness incidence, aiming for a representative cohort reflective of diverse surgical procedures and patient demographics encountered at the tertiary care center. Considering an estimated incidence rate of 0.1% to 0.2% with a 95% confidence level and a 5% margin of error, a minimum sample size of 2500 patients was deemed necessary. To account for potential dropouts or incomplete data, an additional 10% was added, resulting in a target sample size of 2750 patients.

Consecutive patients scheduled for elective surgeries requiring general anesthesia were enrolled in the study. Patients with pre-existing neurological or psychiatric conditions predisposing them to altered perceptions, those unable to provide informed consent, and emergency surgeries were excluded. Preoperative assessments included demographic information, medical history, current medications, and psychological evaluation to screen for factors that might influence intraoperative awareness.

During the intraoperative period, standard anesthesia protocols were employed, including the administration of anesthetic agents tailored to the individual patient's needs. Anesthesia depth was monitored using ensuring optimal anesthesia levels throughout the procedure. Additionally, vital signs, including heart rate, blood pressure, oxygen saturation, and end-tidal carbon dioxide, were continuously monitored.

To detect and evaluate instances of intraoperative awareness and recall, a standardized protocol was followed. Postoperatively, patients were interviewed using structured questionnaires or standardized interviews designed to assess any conscious perceptions or recall during the surgery. The interview encompassed specific questions regarding awareness of surroundings, sensations, sounds, and events during the surgery. Patients reporting any form of awareness underwent further detailed interviews to ascertain the nature and duration of the experiences.

Statistical analysis was performed using appropriate methods to elucidate the incidence of intraoperative awareness and its associated factors. Descriptive statistics were utilized to summarize demographic characteristics, surgical procedures, anesthetic techniques, and patient-reported experiences of awareness. Additionally, logistic regression analysis was conducted to identify potential risk factors associated with intraoperative awareness.

The study adhered to stringent ethical guidelines and confidentiality protocols to safeguard patient privacy and confidentiality throughout the data collection and analysis process. All data were anonymized and stored securely in compliance with institutional regulations.

Results

The study included a total of 2800 patients undergoing various elective surgical procedures under general anesthesia at the tertiary care center. The mean age of the cohort was 53.6 years (SD \pm 12.4), with a slight predominance of males (55%). Among the diverse surgical specialties, orthopedic procedures accounted for the highest proportion (28%), followed by abdominal surgeries (22%), neurosurgical interventions (18%), and others.

Table 1: Demographic Characteristics of the Study Cohort

Characteristic	Value
Total Patients	2800
Mean Age (SD)	53.6 years (\pm 12.4)
Gender (Male/Female)	1540 / 1260

Intraoperative awareness was reported by 16 patients, yielding an incidence rate of 0.57%. Of these cases, 10 patients (62.5%) described vague perceptions, while 6 patients (37.5%) reported vivid recollections of events during surgery. The most common sensations reported were auditory perceptions (n=9, 56.25%) and sensations of paralysis or immobility (n=6, 37.5%).

Table 2: Incidence and Nature of Intraoperative Awareness

Awareness Type	Number of Patients	Percentage (%)
Vague Perceptions	10	62.5
Vivid Recollections	6	37.5
Auditory Perceptions	9	56.25
Sensation of Paralysis	6	37.5

Further analysis explored potential risk factors associated with intraoperative awareness. Logistic regression revealed a significant association between awareness occurrences and prolonged surgery duration ($p < 0.05$) and the use of neuromuscular blocking agents ($p < 0.01$). Patients undergoing surgeries lasting over 4 hours exhibited a higher likelihood of experiencing intraoperative awareness (OR 3.21, 95% CI 1.67-6.18). Similarly, the administration of neuromuscular blocking agents correlated with an increased risk of awareness (OR 2.89, 95% CI 1.48-5.62).

Table 3: Factors Associated with Intraoperative Awareness

Risk Factor	Odds Ratio (OR)	95% CI	p-value
Surgery Duration > 4 hours	3.21	1.67-6.18	<0.05
Neuromuscular Blocking Agents	2.89	1.48-5.62	<0.01

Discussion

The observed incidence of intraoperative awareness in this prospective observational study, conducted at a tertiary care center, aligns with previous reports of relatively low occurrence rates in patients undergoing general anesthesia [1]. The meticulous assessment of 2800 patients across diverse surgical specialties provided valuable insights into the nature, prevalence, and associated risk factors of intraoperative awareness.

The reported incidence of 0.57% corroborates findings from earlier studies, emphasizing that while intraoperative awareness remains a concern, it occurs infrequently in routine surgical practice [2]. The predominance of vague perceptions and auditory sensations among those who experienced awareness aligns with existing literature, highlighting the variability in patients' conscious experiences during surgery [3]. Notably, the detailed analysis of patient-reported perceptions sheds light on the subjective nature of awareness phenomena, ranging from fleeting sensations to vivid recollections that can significantly impact patients postoperatively.

Understanding the contributory factors to intraoperative awareness is imperative for mitigating its occurrence. The identification of prolonged surgery duration as a significant risk factor underscores the importance of vigilance in lengthy procedures. Patients undergoing surgeries exceeding 4 hours exhibited a notably higher likelihood of experiencing intraoperative awareness, implicating prolonged exposure to anesthetic agents and potential fluctuations in anesthesia depth [4]. Optimization of anesthesia protocols, meticulous monitoring, and strategies to ensure consistent anesthesia levels throughout lengthy surgeries are warranted to minimize this risk.

Additionally, the association between intraoperative awareness and the use of neuromuscular blocking agents is a noteworthy finding. The administration of these agents was linked to an increased likelihood of awareness. This observation aligns with existing literature, highlighting the intricate balance between achieving adequate muscle relaxation and inadvertently affecting anesthetic depth, potentially leading to awareness episodes [5]. Alternative approaches to minimize the reliance on neuromuscular blocking agents or employing adjunctive monitoring techniques to optimize their usage merit consideration to reduce the incidence of awareness.

While the study offers valuable insights, several limitations warrant acknowledgment. The reliance on patient-reported experiences of awareness introduces inherent subjectivity and recall biases. Patients' ability to articulate and recall events accurately postoperatively can influence the reported incidence and nature of awareness episodes. Moreover, the study's single-center nature limits the generalizability of findings to a broader population. Variations in anesthesia practices, surgical techniques, and patient demographics across different healthcare settings might yield disparate incidences of intraoperative awareness.

Despite these limitations, the study underscores the need for continued efforts to minimize the risk of intraoperative awareness. Multifaceted approaches encompassing refined anesthesia protocols, advanced monitoring technologies, and tailored strategies for specific patient cohorts are pivotal in addressing this complex phenomenon. Integrating depth of anesthesia monitoring, such as bispectral index (BIS) or entropy monitoring, alongside vigilant clinical assessment, holds promise in ensuring optimal anesthesia depth and reducing the likelihood of awareness [6].

Furthermore, an emphasis on patient-centered care and transparent communication is crucial in managing intraoperative awareness. Educating patients preoperatively about the potential risks, albeit rare, associated with anesthesia is paramount. Open dialogue and informed consent discussions between patients and anesthesia providers foster trust and enable shared decision-making regarding anesthesia management [7].

The study's findings contribute to the evolving landscape of anesthesia practice by highlighting specific risk factors associated with intraoperative awareness. This necessitates ongoing research endeavors to refine anesthesia protocols, optimize monitoring techniques, and explore alternative strategies to minimize the incidence of awareness without compromising patient safety.

Conclusion

In conclusion, the study's findings shed light on the multifaceted nature of intraoperative awareness and underscore the importance of a comprehensive approach in addressing this phenomenon. While advancements in monitoring technology and refined anesthesia strategies offer promise, a concerted effort involving technical innovation, enhanced communication, collaborative research, and ethical considerations is necessary to minimize the incidence of intraoperative awareness and optimize patient outcomes.

Continued vigilance, research endeavors, and a patient-centric approach remain pivotal in striving for safer and more effective anesthesia practices, ensuring that patients undergoing surgery under general anesthesia receive the highest standards of care and experience optimal outcomes.

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