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Original Research Article

Retrospective analysis of the adverse events during intra-operative and post-operative period in patients who received anesthesia at a tertiary care center in India

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ABSTRACT

Background: Anesthesia is a critical component of modern surgical procedures ensuring patient comfort and safety during surgery. With the increase in life expectancy, more and more geriatric population with various systemic comorbidities have been coming for surgeries.
Along with the newer advances in surgical fields, there is increasing demand on the anesthetists to handle complicated cases with innovative solutions. Despite all efforts by a skillful anesthetist, adverse events are bound to occur which needs to be analysed to prevent such adverse events in the future. Hence, this study aims to analyse the adverse events occurring in intra-operative and post-operative period who received anesthesia in our tertiarycare centre.
Methods: This study is a retrospective cross-sectional study of 5-year duration from January 2018 to January 2023 done at Bhaktivedanta hospital and research institute post obtaining approval from the institutional ethics committee. A total of 163 patients who developed perioperative adverse events were included in the study and their nature of adverse events were analysed. The data was obtained from the registers of the anesthesia department and descriptive statistical analysis of the data was done accordingly.
Results: Most common adverse events were of cardiovascular and respiratory origin, followed by miscellaneous and regional anesthesia adverse events and then, very few drug-related adverse events. The patients who developed these adverse events were evidently of ASA grade I and II, implying no direct correlation between adverse events and grading.
Conclusions: Reporting and analysis of the adverse events will help better understanding of the lacunae of the reporting system as well as in the development of quality improvement strategies in the future.

Keywords: Anesthesia, Adverse events, ASA grading, Critical incidents reportingsystem

INTRODUCTION

Anesthesia is a complex specialty that requires various technical skills and multidisciplinary approaches, right from the preoperative assessment of the patient and patient care during surgery to postoperative pain management in the patient.[1]

An anesthetist also manages postoperative pain, chronic

pain of cancer, labor analgesia, and complicated cases in cardiac and respiratory resuscitation.[2]

To control risks and prevent damage to the patient, the planning of individualized patient care by a multidisciplinary team is of paramount importance. "An appreciably harmful or unpleasant reaction, resulting from an intervention related to the use of a medicinal product, which predicts hazard from future administration and warrants prevention or specific treatment, or alteration of the dosage regimen, or withdrawal of the product" is defined as an adverse reaction (AR).[3]

An adverse event during anesthesia is defined as an event that may result in the patient harm and occurs either due to the system failures, patient factors, or the human factors.[4]

With the rise in the geriatric population and new technological advancements in various surgical fields, innovative, complicated surgeries are being conducted with different surgical approaches in patients, which challenges the competency as well as decision-making of the anaesthetists. In spite of all the expertise of anesthetists to handle complicated cases, adverse events are bound to happen, though small ones at times. Most of the adverse events can be managed pharmacologically; however, a few adverse events can cause substantial harm to thepatient. Adverse drug reactions can cause significant morbidity and mortality in patients, of which the most dangerous are anaphylaxis and the malignant hyperthermia.[5]

Hence, documentation and analysis of the adverse events have become crucial various countries have established anaesthesia-related incident reporting systems for documenting such adverse events so that physicians can benefit from the experiences of their team members.[6]

In China, a study was conducted where, using plan-do-study-act cycles of the improvement model, there was a successful reduction in the percentage of respiratory adverse events in the post-anesthesia care unit.[7]

Thus, analysis of the adverse events will help in reducing perioperative complications and improving the patient's safety. Reporting and analysis of the adverse events will help in comprehending the cause behind them and further creating quality improvement strategiesand guidelines for clinical practice. this study aims to analyse the adverse events occurring in intra-operative and post operative period who received the anesthesia in our tertiary care centre.

METHODS

This present study is a retrospective cross-sectional study of 5-year duration, conducted at Bhaktivedanta hospital and research institute, Mira Road, Thane. The study was conducted from January 2018 to January 2023 after obtaining approval from the institutional ethics committee of the Bhaktivedanta hospital and research institute. A total of 163 patients who developed peri-operative adverse events were included in this study, and the type and nature of these adverse events were analyzed. The patients who did not develop any peri-operative adverse events or those who had minor changes in vital signs that spontaneously recovered were excluded. The data was obtained from the registers of the anesthesia department, which contained the records of the patients who developed adverse events related to anesthesia. Relevant clinical data, such as demographics, ASA grade of the patients, name of the surgery, name, and type of adverse event, was also obtained from the registers of the anesthesia department. A descriptive statistical analysis of the data was done accordingly.

RESULTS

A total of 163 cases of adverse events out of a total of 26061 cases over period of 5 years were analyzed. Out of the which 55.21% were male and 44.79% were female. Majority of adverse event occurred in age group of 41 to 50 years (18.40%) followed by 51-60 years of age group (17.79%) (Table 1). Amongst them, 59 cases (36.20%) were of cardiovascular origin, followed by 58 cases (35.58%) of respiratory adverse events, 23 cases (14.11%) of miscellaneous adverse events, 19 cases (11.66%) of adverse events related to regional anesthesia, and 4 cases (2.45%) of drug-related adverse events (Table 2).

Out of the patients who developed these adverse events, 78 cases (47.85%) belonged to ASA grade I patients, followed by 58 cases (35.58%) of ASA grade II patients, followed by remaining ASA grade III and IV patients in decreasing order (Figure 1).

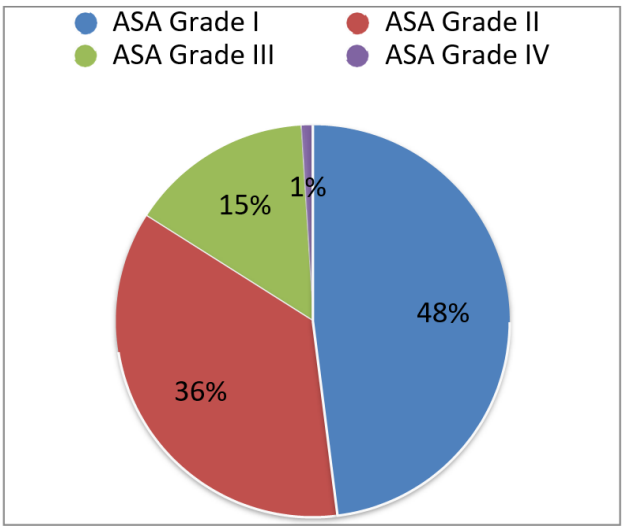

Figure 1: ASA grading of the patients developing adverse events.

Table 1: Demographic details of the patients.

Variables	N (%)
Gender wise distribution	
Male	90 (55.21)
Female	73 (44.79)
Age wise distribution (in years)	
Below 10	8 (4.91)
10 to 20	9 (5.52)
21 to 30	26 (15.95)
31 to 40	23 (14.11)
41 to 50	30 (18.40)
51 to 60	29 (17.79)
61 to 70	24 (14.72)
71 to 80	9 (5.52)
81 and above	5 (3.07)

Table 2: Classification of the adverse events related to anesthesia.

Types	N	Percentage (%)
Cardiac adverse events	59	36.20
Subtypes		
Arrythmia	6	10.17
Bradycardia	22	37.29
Cardiac arrest	8	13.56
Hypertension	1	1.69
Hypotension	16	27.12
Tachycardiac	6	10.17
Respiratory adverse events	58	35.58
Subtypes		
Airway edema	1	1.72
Bronchospasm	25	43.10
Haemothorax	1	1.72
Hypoxemia	8	13.79
Laryngospasm	13	22.41
Lung collapse	2	3.45
Pneumothorax	1	1.72
Pulmonary edema	7	12.07
Regional anesthesia adverse events	19	11.66
Subtypes		
Brachial block on wrong side	1	5.26
Thigh numbness following postop epidural infusion	1	5.26
High spinal	2	10.53
Post interscelene block silateral diaphragmatic paralysis	1	5.26
Post dural puncture headache	14	73.68
Drug reaction adverse events	4	2.45
Miscellaneous adverse events	23	14.11

DISCUSSION

Anesthetists remain an indispensable part of healthcare, known for their technical skills and crucial decision-making capacity at each and every step of the operative procedure.[1] A multidimensional teamwork of anesthetists and surgeons is required for the smooth functioning of any operation. An anesthetist is responsible for conducting the preoperative assessment of the patient, calculating and monitoring the drug dosage, maintaining the level of consciousness of the patient, managing chronic pain, and providing ventilatory support to acutely ill patients.[2] Though relatively new, the specialty has changed in recent years as a result of the rise in complex surgery demand and the introduction of new technologies.[2] Yet, with newly emerging demands of patient care, adverse events do occur despite the best of equipment and anesthetist's skills.[9]

With the emergence of increasing litigation against healthcare professionals, it is necessary to analyze these adverse events to improve patient safety in the anaesthesia specialty, where risks are multifold compared to other specialties, being it of more acute and severe nature. In June 2010, the Helsinki declaration for patient safety in anesthesiology was signed by the European board of anesthesiology (EBA) and the European society of anesthesiology (ESA) to prevent such adverse events and translate them into improvements in clinical practice.[8] Hence, we conducted a retrospective study to analyze the occurrence of adverse events in the peri-operative period of anesthesia procedures, which could further solidify the quality improvement strategies in the anesthesia department of the hospital.

In this analysis, cardiovascular adverse events were seen predominantly, i.e., 36% of the total cases, under which bradycardia (37.29%) and hypotension (27.12%) were evidenced in the majority of the patients. In respiratory adverse events, which accounted for 35.58% of total cases, the majority were bronchospasm (43.10%), followed by laryngospasm (22.41%), and hypoxemia (13.79%). This stands in contrast to an integrated review study that analyzed 21 studies published from 1997 to 2017 reviewing perioperative adverse events. This integrated review found aspiration and difficult intubation to be the most common respiratory adverse events, as well as haemorrhage and arrhythmia as the most common cardiovascular adverse events.[9] Another retrospective study conducted in Ethiopia showed difficult intubation >3 attempts and hypotension as the most common cardio-respiratory adverse events.[10]

Cardiovascular adverse events such as bradycardia and hypotension could be due to the delay in the identification of the alterations in the vitals, also depending on the inter- personnel reporting of the adverse event based on one's clinical judgment. Preoperative assessment is a crucial step necessary to identify high-risk candidates who would prove to be difficult to

intubate, later leading to adverse events such as bronchospasm.[11] Identifying patients with risk factors such as snoring, obesity, mouth opening, anatomical deformities, and the presence of airway disease and then development of an individualized plan of care is essential. Even with the development of capnography and pulse-oximetry devices, clinicalknowledge and practice is important to analyze the high-risk patients prone to develop such perioperative adverse events.

Post-dural puncture headache (PDPH) was a unique finding seen in 14 patients in our study during the postoperative period, classified as one of the common regional anesthesia adverse events, not seen frequently in other studies.[9,10] A prospective observational cohort study in Kuwait showed that younger age, female gender, lower BMI, pre-procedural headache, previous history of PDPH, and number of lumbar puncture attempts were found to be independent risk factors for developing PDPH.[12] Drug-related adverse events were seen in only 4 cases (2.45%) of the total study population, proving reduced medication errors in study. Proper identification of the drug ampoules, correct dose management, and reduced distraction by the professionals during medication preparation are necessary to prevent such drug-related adverse events. Maintaining a straightforward, linear system with redundancy and uniformity is necessary to avoid adverse drug-related incidents.[13]

As per the ASA grading system, among the patients who developed perioperative adverse events in our study, 78 cases (47.85%) belonged to ASA grade I, followed by 58 cases (35.58%) of ASA grade II, followed by the remaining ASA grades III and IV in decreasing order.[21] This proves that the ASA grade of the patient is not directly proportional to the development of adverse events in the perioperative period. Though the higher incidence of adverse events in ASA I and ASA II patients may be a result of a higher proportion of ASA I and II patients coming for surgeries overall compared to ASA III, IV, and V at our center. A study in China showed that the proportion of anesthesia grade II and III was significantly higher than that of grade I, IV, and V, which, according to them, may be related to the proportion of surgical patients of grade II and III in the hospital.[14]

A retrospective study proved that a large proportion of the adverse events (42.8%) may have been preventable. Specifically, respiratory and medication adverse events were often preventable if proper actions were taken.[15] In India, most hospitals do not have a centralizedsystem for adverse event and critical incident reporting. Another challenge in reporting adverse events is the perception that the physician might be blamed by colleagues for his or her mistakes. Out of fear of being targeted and being labelled as negligent, many clinicians may not be recording and reporting adverse events. Also, what and which incidences are recorded under the heading of adverse events may vary from institute to institute. Hence, it iscrucial to implement a unified system such as electronic medical records (EMR) for standardization of reporting. A critical incident reporting system is like storytelling. It meanstelling each other about rare events that happened and can be used to improve systems.[16]

Many countries have already established a national-level critical incident reporting system in anesthesiology, such as the UK, Switzerland, and USA.[6,17,18] Proper education regarding the cataloguing and collection of adverse event data should include the following components: the ability to identify a complication, understanding of the reporting systems, and the capability to provide inputs for improvements.[19] Inadequacy of non-technical skills at the individual level, communication barriers, and cultural barriers also increase the chance of adverse events. Improvement in human factor components of teamwork, communication, and situation awareness will help in reducing adverse events in anesthesia.[20] But even these software have limitations; hence, it is important to identify, report, and then analyze the adverse event for better quality improvement strategies in anesthesia.

CONCLUSION

With the development of new technologies and rising numbers of complex surgeries, reporting of the critical incidents and adverse events could play crucial role in quality improvement if the adverse event reporting is implemented using a centralized reporting system. Documentation, recording and analysis of such perioperative adverse events seen in anesthetic procedures can also aid in strategic planning to mitigate such adverse events.

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