Section: Anaesthesia

Original Research Article

PERIOPERATIVE COMPLICATIONS FOLLOWING DIFFERENT TYPES OF ANAESTHESIA IN CHILDREN AGED 1–5 YEARS: A CROSS-SECTIONAL OBSERVATIONAL STUDY

Misbah Asghar[1], Amjad Ali[2], Khawar Aziz Siddiqui[3], Abid Hussain[4], Ahmed Khan[5], Eiman Elyas[6]

[1]*Consultant Anaesthesia and Pain Physician, Alkhidmat Razi Hospital Satellite Town Rawalpindi Pakistan.*
[2]*Professor Anaesthesia, Bolan Medical College Quetta Pakistan.*
[3]*Consultant Anaesthesia, Mediclinic Airport Road Hospital Abu Dhabi, United Arab Emirates.*
[4]*Specialist Anesthesia, Royal Commission Health Services Program / Royal Commission Hospital Jubail, Saudi Arabia.*
[5]*Associate Professor Anesthesia and Intensive Care, Liaquat Institute of Medical and Health Sciences Thatta Pakistan.*
[6]*Anaesthesia Technologist, Sheikh Shakhbout Medical City (SSMC) Abu Dhabi, UAE.*

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Corresponding Author:
Dr. Misbah Asghar,
Consultant Anaesthesia and Pain Physician, Alkhidmat Razi Hospital Satellite Town Rawalpindi Pakistan.
Email: docmisba@yahoo.com

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ABSTRACT

Background: Children are prone to perioperative risks due to anatomical and physiological variation in their airways, respiratory function, and physiologic reserve, with respiratory adverse events being the most prevalent. The risk is a combination of multiple factors, such as those related to the patient, surgery, and anesthesia, including the mode of anesthesia administration. Many of the existing risk prediction models are developed for affluent nations and do not work in the case of developing nations, especially Pakistan. **Objective:** To evaluate the frequency and pattern of peri-operative complications amongst children between 1 and 5 years of age under different types of anesthesia at a tertiary care hospital. **Study design:** A quantitative cross-sectional observational study. **Duration and place of study:** This study was conducted at Alkhidmat Razi Hospital Satellite Town Rawalpindi from August 2025 to August 2026.

Materials and Methods: This study was carried out at our hospital after getting ethical approval. In total, 120 children aged between 1-5 years who were undergoing either elective or emergency surgical procedures were selected by consecutive non-probability sampling techniques after obtaining consent. Data related to demographics, types of anesthesia used, intraoperative and postoperative complications were collected by using a structured, pre-tested data collection form. Data were analyzed using SPSS version 27.0, and descriptive statistics were reported as frequencies and percentages.

Results: In total, 120 children participated in this study, where 60.0% were male and 88.3% belonged to ASA I-II. General anesthesia was the most common (70.0%) technique, along with general with caudal anesthesia as the second one (19.2%). Most of the procedures were elective (68.3%). Intraoperative complications included hypothermia (12.5%) and hypoxemia (9.2%) whereas no cases of cardiac arrest were detected. Postoperatively, the most common complication was the occurrence of nausea and vomiting (53.3%) and hypoxemia (15.8%).

Conclusion: Post-operative nausea and vomiting were the most common peri-operative complications, followed by hypoxemia, which occurred more postoperatively than intraoperatively. The most commonly used anesthetic method was general anesthesia.

Keywords: Pediatric Anesthesia, Perioperative Complications, Postoperative Nausea and Vomiting (PONV), Hypoxemia, Caudal Anesthesia.

INTRODUCTION

There are substantial differences between children and adults regarding the anatomy of their airways, cardiovascular reserve, respiratory physiology, pharmacokinetics of anesthetic drugs, and thermoregulation.[1] The presence of narrow airways, decreased functional residual capacity, high oxygen consumption, and limited physiological reserve makes children highly susceptible to complications during induction, manipulation of airways, and emergence.[2] The practice of safe pediatric anesthesia involves continuous monitoring, comprehensive preoperative assessment, and rapid interventions.[3]

Respiratory adverse events that include bronchospasm, laryngospasm, oxygen desaturation, and airway obstruction constitute the majority of complications associated with pediatric anesthesia.[4] The risk factors for these events are age, respiratory infection, airway anatomy, type of anesthesia, and experience of the practitioner.[5] The incidence of serious cardiovascular events like cardiac arrest is rare but still one of the major causes of anesthesia-associated deaths.[6] With the introduction of continuous monitoring and simulation training, serious adverse events have significantly decreased in frequency over the past few decades.[7]

Perioperative complications are multivariable in nature and are determined by interactions between patient-specific, surgical, and anesthesia-related factors.[8] Patient factors that increase the probability of perioperative complications include younger age, congenital problems with airways and heart, previous upper respiratory tract infection, malnutrition, chronic lung conditions, and higher ASA physical status.[9] Emergency surgery, airway or thoracic procedures, as well as prolonged surgical time, contribute to this list of surgical factors.[10] Anesthetic technique may impact perioperative care through effects on airway manipulation, anesthetic level, opioid use, postoperative analgesia, and recovery.[11]

A variety of predictive models, such as the COLDS score and machine learning models, are available for predicting risks in children.[12] These tools can help in early identification of children at increased risk. However, these tools were derived mostly in high-income countries and may not be generalizable to LMIC settings with distinct population, resource, and perioperative environments.

There is still a lack of literature available for anesthesia related complications in young children in Pakistan.[13] It is essential to have local literature available so that we can find out the frequency and pattern of complications. This is especially true for tertiary care hospitals where both elective and emergency pediatric surgeries are performed with limited resources. Therefore, this study was performed to evaluate the frequency and pattern of peri-operative complications amongst children between 1 and 5 years of age under different types of anesthesia at a tertiary care hospital.

MATERIALS AND METHODS

This was a quantitative cross-sectional observational study performed at the Pediatric Surgical Ward and Post-Anesthesia Care Unit (PACU) of a tertiary care hospital. Prior to conducting the study, approval from the Ethical Review Committee was obtained. Participants were selected using a consecutive non-probability sampling method to attain the sample size of 120 children.

Inclusion Criteria: This study included children aged 1-5 years having ASA physical status I-IV that underwent elective or emergency surgery with general anesthesia, caudal anesthesia, general anesthesia with caudal anesthesia, sedation or other forms of anesthesia.

Exclusion Criteria: Children who had incomplete perioperative record, those discharged within 24 hours of the surgical procedure, and those whose parents/guardians declined to participate in the study were excluded from participating in the study.

Informed consent was obtained from the parents or guardians of the subjects who met the eligibility criteria. They were told about the purpose, objectives, benefits and voluntary nature of the study. They were assured that their refusal or decision to withdraw from the study would not have an effect on the quality of care received by the child.

Data was collected through a structured and pre-tested data collection tool designed specifically for this study. Data was collected prospectively from anesthesia records and PACU monitoring charts during the perioperative period. The demographic and clinical parameters were age, sex, ASA physical status, emergency or elective surgery, and nature of surgery. The type of anesthesia was recorded, categorized as combined general and caudal anesthesia, general anesthesia, caudal anesthesia alone, sedation, or other techniques.

The outcome variable of interest was the occurrence of perioperative complications associated with anesthesia. Intraoperative complications involved the following: bradycardia, tachycardia, bronchospasm, hypoxemia, laryngospasm, cardiac arrest, hyperthermia, and hypothermia. On the other hand, postoperative complications were similar to the intraoperative ones, but postoperative nausea and vomiting (PONV) was added. Intraoperative complications were gathered from anesthesia records and continuous monitoring documents, while postoperative complications were collected in the PACU.

The data were assessed for consistency and completeness prior to analysis with IBM SPSS Statistics software version 27.0. Descriptive statistics were employed to summarize the demographic information, anesthetic techniques, and

perioperative complications, with categorical variables expressed as numbers and percentages.

RESULTS

There were a total of 120 children enrolled in this study. All children were aged between 1 to 5 years. The study population was predominantly male (60.0%) and low-risk, with 88.3% of children classified as ASA I-II. Most procedures were elective (68.3%), and general anesthesia was the principal technique used (70.0%). Table number 1 shows the baseline characteristics of the study population.

Table 1: Distribution of Study Subjects according to Maternal Demographics, & mode of delivery (N =196)

Characteristics	n	%
Gender		
• **Male**	72	60.0
• **Female**	48	40.0
ASA Physical Status		
• **I to II**	106	88.3
• **III to IV**	14	11.7
Anesthesia Technique		
• **Caudal alone**	6	5.0
• **General anesthesia**	84	70.0
• **Sedation**	4	3.3
• **General + Caudal**	23	19.2
• **Other**	3	2.5
Type of Surgery		
• **Emergency**	38	31.7
• **Elective**	82	68.3

Hypothermia (12.5%) and hypoxemia (9.2%) were the most common intraoperative complications, followed by bronchospasm (5.8%). Cardiovascular events were uncommon, and no cardiac arrest was recorded. Table number 2 shows the frequency of intraoperative anesthesia-related complications.

Table 2

Complications	n	%
Hypoxemia	11	9.2
Cardiac arrest	0	0.0
Laryngospasm	3	2.5
Tachycardia	5	4.2
Hypothermia	15	12.5
Bradycardia	5	4.2
Hyperthermia	5	4.2
Bronchospasm	7	5.8

Postoperative nausea and vomiting was the most common postoperative complication, occurring in more than half of the pediatric patients (53.3%). Table number 3 shows the frequency of postoperative anesthesia-related complications.

Table 3

Complications	n	%
Hypoxemia	19	15.8
Cardiac arrest	0	0.0
Laryngospasm	3	2.5
Tachycardia	2	1.7
Hypothermia	10	8.3
Bradycardia	3	2.5
Hyperthermia	3	2.5
Bronchospasm	3	2.5
Postoperative nausea and vomiting (PONV)	64	53.3

DISCUSSION

This study reported the frequency and pattern of intraoperative and postoperative complications in 120 children aged 1-5 years undergoing either elective or emergency surgeries under various forms of anesthesia at a tertiary care hospital. Most of the children were males (60.0%), ASA I-II (88.3%), and had elective surgeries (68.3%). General anesthesia was the most common form of anesthesia (70.0%) used, whereas general anesthesia with caudal was the second most common (19.2%). Postoperative nausea and vomiting (PONV), hypoxemia, and temperature disturbances were the most frequent complications, while cardiovascular complications were uncommon and no cardiac arrest occurred.

Respiratory complications have been repeatedly documented to be the most frequently occurring complications in pediatric anesthesia.[14] In the current study, hypoxemia occurred in 9.2% of patients intraoperatively and 15.8% after operation, while bronchospasm and laryngospasm occurred less often. In the APRICOT study, severe critical events occurred in 5.2% of patients, 3.1% of them being respiratory, and more commonly in patients younger than 6 years old.[15] Rates in our study were higher, but the APRICOT trial included only severe events necessitating immediate treatment, while in our study, all the documented events were taken into consideration, thus the comparison is not appropriate. Perioperative respiratory adverse events occurred in 15% of patients in a large cohort of Australian children, which is similar to our rate of postoperative hypoxemia.[16] The increase in the occurrence of hypoxemia from intraoperative to postoperative period is also consistent with a prospective study from Ethiopia, where desaturation was the most common respiratory complication, and postoperative period was the most critical period for these complications.[17]

PONV was the most common postoperative complication, experienced by 53.3% of all pediatric patients in the study group. This value falls within the 33-82% range that is typical for children exposed to general anesthesia. According to consensus guidelines, risk assessment and prophylaxis of multimodal type should be considered.[18] However, prophylaxis was not taken into account in our study, and therefore the consistency of prophylaxis could not be analyzed. Severe cardiovascular complications were extremely rare.[19] Neither cardiac arrest nor even bradycardia occurred in more than 5% of all patients, which confirms their rarity. The dominance of low-risk (ASA I-II) and elective surgeries certainly had its share in this outcome.

For the majority of children, the general anesthetic was applied either alone or combined with caudal blockade. However, caudal blockade as a single technique, sedation, or any other technique were used for just a few children. The caudal block in combination with general anesthesia is frequently used for infra-umbilical surgery in children and one randomized trial has reported a lesser incidence of pain, better hemodynamic stability, and less consumption of drugs when the caudal block is combined with general anesthesia.[20] No conclusions can be made on the basis of our study regarding safety due to lack of comparison among complications.

Several limitations of this study can be mentioned. First, the study involved only one center, used non-probability sampling and a relatively small number of participants, thus decreasing its generalizability. The caudal alone, sedation, and other techniques group consisted of few participants each. Complications were not standardized, and the postoperative monitoring was restricted to the period of stay in PACU. Further research involving more centers and a bigger number of participants is needed.

CONCLUSION

This study involves children who are 1-5 years old undergoing surgery in a tertiary care hospital. Post-operative nausea and vomiting were the most common peri-operative complications, followed by hypoxemia, which occurred more postoperatively than intraoperatively. The most commonly used anesthetic method was general anesthesia.

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Conflict in the interest

The authors had no conflict related to the interest in the execution of this study.

Permission

Prior to initiating the study, approval from the ethical committee was obtained to ensure adherence to ethical standards and guidelines.

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