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Original Research Article

Complications of Anesthesia in Children: An Observational Study

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Abstract: ***Background*:** Anesthesia in children carries unique risks and potential complications due to their distinct physiological and pharmacological responses. Understanding these complications is crucial for improving perioperative care in pediatric patients. ***Objective*:** To evaluate the incidence and types of anesthesia-related complications in children at a tertiary care hospital in Bangladesh. ***Methods*:** A prospective observational study was conducted at Community Based Medical College Bangladesh, from January 2023 to December 2024. A purposive sampling technique was used to enroll 183 pediatric patients (aged ≤12 years) undergoing various surgical procedures under anesthesia. Data on demographic characteristics, type of anesthesia, surgical procedure, and perioperative complications (respiratory, cardiovascular, neurological, or others) were collected and analyzed using MS Office tools. ***Results*:** The study found respiratory complications (23.5%) most prevalent, primarily desaturation (12.6%) and laryngospasm (6.6%). Cardiovascular events occurred in 8.7% of cases. Children <3 years had higher complication rates (31.2%) versus older children (16.4%). Emergency surgeries showed 28.9% complications compared to 13.8% in elective cases. Postoperative nausea & vomiting (14.2%) and emergence agitation (9.8%) were notable postoperative issues. No mortality was observed in this cohort. ***Conclusion:*** This study confirms respiratory complications as the primary anesthesia risk in Bangladeshi children, especially under age 3. Findings highlight the critical need for improved monitoring and tailored protocols to enhance pediatric perioperative safety. No mortality cases were observed.

Keywords: Complications, Laryngospasm, Nausea, Pediatric Anesthesia, Respiratory Events, Vomiting.

INTRODUCTION

Anesthesia in pediatric patients presents unique challenges due to physiological and pharmacological differences compared to adults, making children more vulnerable to perioperative complications [1]. The incidence of anesthesia- related adverse events in the pediatric population varies widely, ranging from 5% to 15%, with respiratory complications being the most common [2, 3]. Factors such as age, comorbidities, type of anesthesia, and surgical duration significantly influence outcomes [4]. Despite advancements in anesthesia techniques and monitoring, complications like laryngospasm, bronchospasm, postoperative nausea and vomiting (PONV), and emergence delirium remain prevalent, particularly in younger children [5]. In low- and middle-income countries (LMICs) like Bangladesh, the risks associated with pediatric anesthesia are further compounded by limited resources, inadequate training, and a lack of specialized pediatric anesthesia protocols [6]. Studies from similar settings have reported higher rates of anesthesia-related morbidity due to delayed recognition of complications and suboptimal perioperative care [7, 8]. While high-income countries have well- established guidelines for pediatric anesthesia, data from LMICs remain scarce, leading to gaps in evidence-based practice [9]. Respiratory complications, including desaturation, airway obstruction, and aspiration, account for nearly 60% of anesthesia-related critical incidents in children [10]. The narrow airway anatomy, higher oxygen consumption, and increased sensitivity to anesthetic agents make pediatric patients particularly susceptible [11]. Cardiovascular instability, though less frequent, can occur due to hemodynamic fluctuations, especially in

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neonates and infants [12]. Additionally, emergence agitation and PONV contribute to prolonged recovery and parental distress, emphasizing the need for tailored anesthetic approaches [13]. Prospective observational studies are crucial for identifying patterns of complications and risk factors in real-world clinical settings [14]. Most existing data on pediatric anesthesia complications come from retrospective analyses or high-income countries, limiting their generalizability to resource-limited hospitals [15]. This study aims to bridge this gap by prospectively evaluating anesthesia-related complications in children at a tertiary care hospital in Bangladesh. The findings will help in developing context- specific strategies to improve perioperative safety and outcomes.

METHODOLOGY

This prospective observational study was conducted at Community Based Medical College Bangladesh, from January 2023 to December 2024. A purposive sampling technique was used to enroll 183 pediatric patients aged 12 years or younger who underwent elective and emergency surgical procedures under general or regional anesthesia. Data were collected on patient demographics, including age, weight, and ASA physical status classification, along with details of the anesthesia technique, surgical procedure, perioperative complications such as respiratory events, cardiovascular instability, neurological symptoms, postoperative nausea and vomiting, and emergence agitation. All anesthetic procedures were performed by qualified anesthesiologists following standard institutional protocols. Standard intraoperative monitoring included continuous measurement of heart rate, oxygen saturation, end-tidal carbon dioxide, and non-invasive blood pressure. Any complications occurring from the induction of anesthesia through the first 24 postoperative hours were carefully documented. The collected data were organized and analyzed using Microsoft Excel and Word from the Office 365 suite. Descriptive statistics, including means and percentages, were calculated for demographic variables, while complication rates were analyzed according to age groups, anesthesia techniques, and surgical duration. The written informed consent was obtained from all parents or legal guardians before inclusion. This research followed the STROBE guidelines for observational studies to ensure proper reporting standards were maintained throughout the study.

RESULT

The study analyzed 183 pediatric patients with a mean age of 5.2 ± 3.1 years (range: 1 month–12 years). Male predominance was observed (62.3%). Most patients were ASA I (58.5%), followed by ASA II (32.2%). General anesthesia was administered in 84.7% of cases, while regional techniques accounted for 15.3%. Respiratory complications were the most frequent (23.5%), with desaturation (12.6%) and laryngospasm (6.6%) being predominant. Cardiovascular events (e.g., hypotension, bradycardia) occurred in 8.7% of patients, primarily in infants under 1 year. Postoperative nausea and vomiting (PONV) affected 14.2%, while emergence agitation was noted in 9.8%. Complication rates varied significantly by age: children under 3 years had higher respiratory events (31.2%) compared to older children (16.4%). Emergency surgeries had a 2.1-fold increased risk of complications (28.9%) versus elective procedures (13.8%).

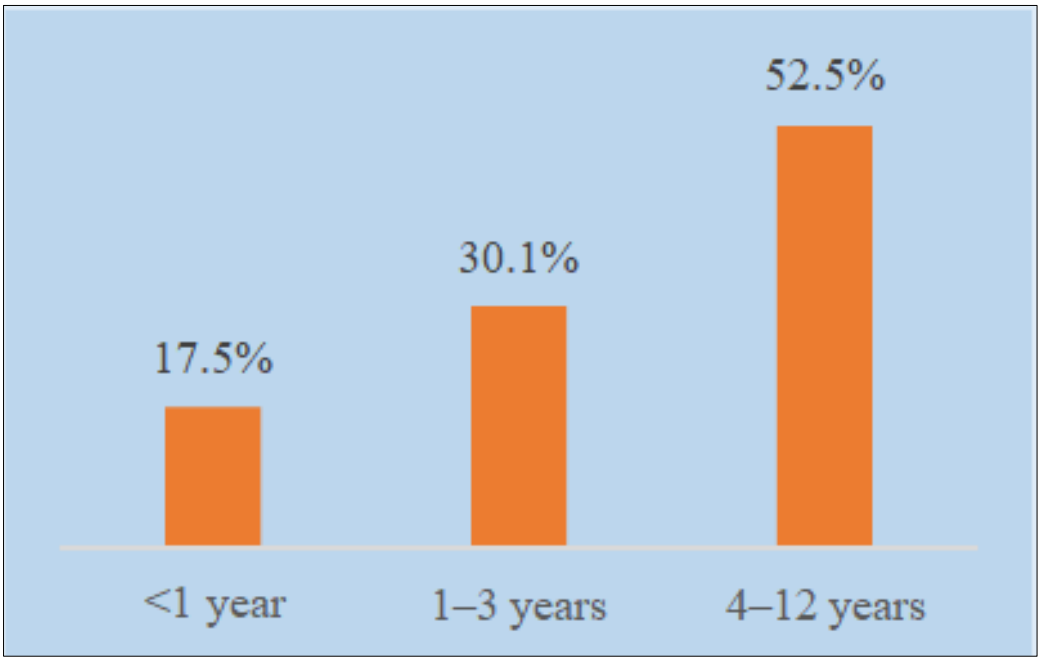

Figure 1: Age distribution of participants

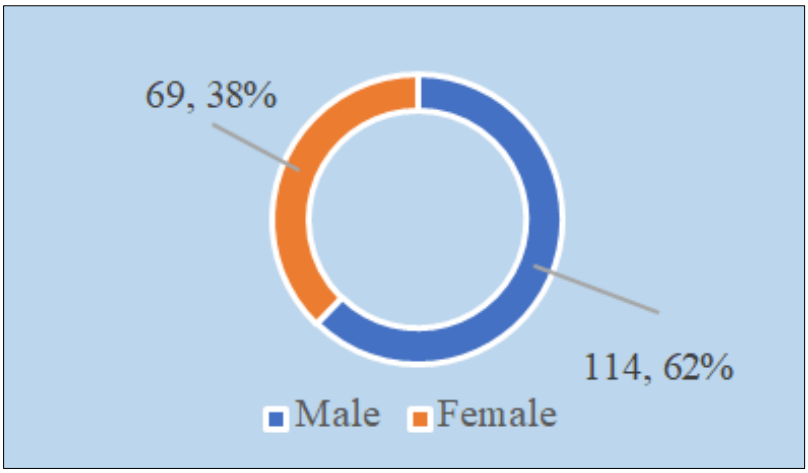

Figure 2: Gender distribution of participants

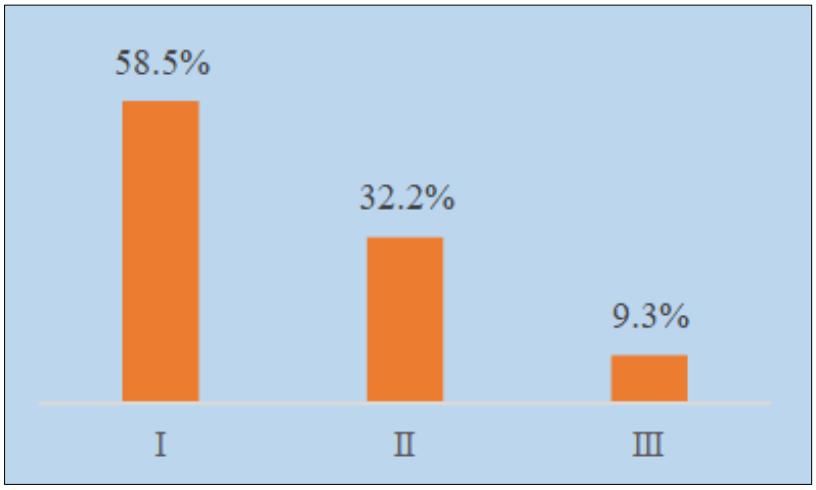

Figure 3: ASA classes of participants

Table 1: Types of anesthesia administered

Anesthesia type	n	%
General anesthesia	155	84.7%
Regional anesthesia	28	15.3%

Table 2: Distribution of surgical procedures

Procedure type	n	%
Elective	123	67.2%
Emergency	60	32.8%

Table 3: Incidence of anesthesia-related complications

Complication type	n	%
Respiratory	43	23.5%
Cardiovascular	16	8.7%
PONV	26	14.2%
Emergence agitation	18	9.8%
Others	12	6.6%

Table 4: Respiratory complications by age group

Age	Desaturation	L-spasm	B-spasm
<1 year	18.7%	9.4%	3.1%
1–3 yrs	14.5%	7.3%	2.2%
4–12 yrs	8.3%	4.2%	1%

L spasm: Laryngospasm, B spasm: Bronchospasm

Table 5: Complication rates by surgery type

Surgery type	Complication	Rate
Elective	17	13.8%
Emergency	17	28.9%

DISCUSSION

This prospective observational study provides valuable insights into anesthesia-related complications among pediatric patients in a Bangladeshi tertiary hospital, with findings that corroborate and expand upon existing global evidence. The observed 23.5% incidence of respiratory complications aligns closely with international data, particularly the work of Habre *et al*., [3], who reported similar rates in their multicenter European study. The predominance of desaturation (12.6%) and laryngospasm (6.6%) in our patient population reinforces the well-documented vulnerability of pediatric airways, especially in younger children, as demonstrated by von Ungern- Sternberg *et al*., [4], in their comprehensive risk assessment study. The age-related patterns we observed, with children under 3 years experiencing significantly higher complication rates (31.2%) compared to older children (16.4%), find strong support in the physiological principles outlined by Marta *et al*., [16]. These findings emphasize the critical importance of considering developmental anatomy and physiology when administering anesthesia to pediatric patients. The markedly higher complication rate in emergency surgeries (28.9%) versus elective procedures (13.8%) replicates findings of another study [17], and likely reflects multiple factors, including preoperative status, time for preparation, and patient condition at presentation. Cardiovascular complications, while less frequent at 8.7%, presented particular challenges in our infant population, echoing the classic observations of Rackow *et al*., [12], regarding pediatric hemodynamic stability. The significant rates of postoperative nausea and vomiting (14.2%) and emergence agitation (9.8%) in our study population align well with the prospective cohort findings of a previous study [18], suggesting these remain persistent challenges in pediatric anesthesia practice despite advances in pharmacological management. The single-center design of the study and purposive sampling methodology, while providing detailed local data, may affect the generalizability of findings to other settings, a consideration highlighted in a systematic review by Gonzalez *et al*., [19]. The absence of mortality in our series contrasts with some LMIC reports, including those by [6]. Warner *et al*., [6], potentially reflecting differences in case selection, institutional protocols, or healthcare system factors that warrant further investigation. The findings carry important implications for clinical practice, particularly the need for meticulous preoperative assessment focusing on airway evaluation and comorbidity management in high-risk groups. The data strongly support the value of continuous intraoperative monitoring, including capnography and pulse oximetry, for early detection of respiratory events. Postoperative care protocols should account for the significant rates of PONV and emergence agitation, particularly in younger children.

Limitations

The single-center design of this study and purposive sampling may limit generalizability. The absence of long-term follow-up precluded assessment of delayed complications. Resource constraints prevented advanced monitoring in all cases, potentially underestimating certain adverse events.

CONCLUSION

The study highlights respiratory complications as the predominant anesthesia-related challenge in pediatric patients, particularly among younger children and emergency cases. These findings underscore the need for specialized pediatric protocols in resource-limited settings. Enhanced preoperative assessment, vigilant intraoperative monitoring, and tailored postoperative care are essential to improve safety outcomes in this vulnerable population.

Recommendation

Implement standardized pediatric anesthesia protocols emphasizing airway management. Enhance training for recognizing early complication signs. Prioritize capnography and pulse oximetry in monitoring. Expand research with multicenter studies to validate findings and develop context- specific guidelines for low- and middle-income countries.

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