SAS Journal of Surgery
Abbreviated Key Title: SAS J Surg
ISSN 2454-5104
Journal homepage: https://www.saspublishers.com

OPEN ACCESS

Anesthesiology

Perioperative Anesthetic Management in Children: A Retrospective Analysis

Dr. Shamim Ara Sultana[1]*, Dr. Rahnuma Tasnim[1], Dr. Mohammed Badrul Alam[1], Dr. Taj Uddin Ahmed[1], Dr. Mehedi Masud[1], Dr. Md. Shahadat Hossain[1], Dr. Hassnul Alam[1]

[1]Assistant Professor, Department of Anesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

DOI: https://doi.org/10.36347/sasjs.2025.v11i01.011 | **Received:** 02.12.2024 | **Accepted:** 08.01.2025 | **Published:** 15.01.2025

***Corresponding author:** Dr. Shamim Ara Sultana
Assistant Professor, Department of Anesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

Abstract **Original Research Article**

Background: Anesthetic management in paediatric patients is challenging due to physiological and developmental differences compared to adults. The perioperative process includes preoperative preparation, intraoperative techniques and postoperative care which requires meticulous attention to avoid complications and ensure optimal outcomes. This study aims to evaluate the perioperative management of anesthesia in children, focusing on risk factors, preferred methods and areas for practice improvement. *Methods*: A retrospective observational study was conducted at Department of Anesthesiology, Bangabandhu Sheikh Mujib Medical University (BSMMU) from July 2022 to June 2023. A total of 250 paediatric patients who underwent surgical procedures requiring anesthesia during the study period were included. Demographics characteristics, surgical details, anesthetic approaches, preoperative interventions, intraoperative techniques and postoperative outcomes were included. SPSS version 25 was used for statistical analysis. *Results*: Majority of the patients aged between 1–5 years (38%) with a predominance of males (59.6%). General anesthesia is most commonly used technique (72%) with oral midazolam as the preferred premedication (60.8% with 90% success rate). Airway management and blood loss were intraoperative challenges with nausea and vomiting (16.4%) and pain (12.8%) the most common postoperative complications. Pharmacological interventions and parents were effective in anxiety reduction and improved outcomes. *Conclusion*: Perioperative strategies tailored for paediatric patients significantly improve patient safety and minimize complications. More refinement of protocols would be needed in future studies to take care of perioperative patients further.

Keywords: Perioperative management, paediatric anesthesia, anxiety management, anesthesia complications.

INTRODUCTION

In paediatric anesthesia, perioperative period are important and it starts with preoperative preparation, intraoperative techniques and postoperative outcomes. Physiological, psychological and developmental differences of children make it impossible to rely on adult strategies in children and therefore require specialized strategy to ensure safety and efficacy of surgery in children. The importance of comprehensive planning and evidence based interventions emerges with common perioperative complications including hypoxia, hypotension and hemodynamic instability [1, 2].

Preoperative anesthesia in paediatric patients consists of metabolic stability, psychological readiness and fasting guidelines assessment. Optimized fasting protocols have been shown to decrease risk of hypoglycemia and ketoacidosis with similar hemodynamics observed [3, 4]. Another is preoperative anxiety that, commonly seen in children, can be a detriment to the perioperative experience. High efficacy for reducing anxiety and improving cooperation has been demonstrated with non pharmacological interventions including distraction techniques and parental presence and pharmacological agents such as oral midazolam [5, 6].

Intraoperative management aims to choose proper anesthetic procedures considering patient's age, weight and need in surgery. Sevoflurane induction by inhalation is still preferred over intravenous induction because it is very rapid and has a good safety profile for surgery on ENT and orthopedic patients. Meanwhile, as in complex cases, propofol is an ideal agent for intravenous use such as for neurosurgical and urological

procedures where hemodynamic stability is critical [7, 8]. Ketamine-based induction has proven particularly useful for trauma and high risk patients, permitting robust airway reflex preservation and cardiovascular stability [9].

Complications occurring postoperatively are things like nausea, vomiting, pain, etc. which are very common in paediatric patients. These issues and poor recovery outcomes have been demonstrated to be minimized when multimodal analgesia and antiemetic prophylaxis are used [10, 11]. Although perioperative protocols have advanced, standardized strategies remain poorly implemented in diverse populations and settings.

Objective

The objective of this study was to evaluate the perioperative anesthetic management practice in paediatric patients.

METHODOLOGY & MATERIALS

This retrospective observational study conducted at Department of Anesthesiology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Bangladesh from July 2022 to June 2023. A total 250 paediatric patients aged between 0–15 years who underwent surgical procedures requiring anesthesia during the study period are included in this study following the inclusion and exclusion criteria.

Inclusion Criteria

- Paediatric patients aged between 0–15 who underwent any surgical procedure that requires anesthesia.
- Complete and retrievable medical records for patients including anesthetic and surgical details.
- Surgery within the defined study period.
- Patients documented with perioperative evaluations including post operative outcomes.

Exclusion Criteria

- Patients with incomplete or missing medical records, especially for anesthetic and surgical details
- No preoperative anesthetic evaluation before the emergency surgery.
- Patients undergoing diagnostic procedures without anesthetics.
- Known refusal for postoperative follow up or lack of documentation.

Data collection: Medical records for paediatric patients of 0–15 years old were reviewed and data associated with demographics, surgical procedures, anesthetic techniques, pre-operative medications, interventions and post-operative complications were extracted. Inclusion criteria were implemented to ensure complete documentation of perioperative evaluations, intraoperative details and postoperative outcomes; complete or missing records and cases with insufficient or no anesthetic evaluation were excluded from this study.

Statistical analysis of data: The collected data was explored comprehensively using statistical analysis with SPSS version 25. Patient demographics, surgical and anesthetic details were summarized with descriptive statistics using means and standard deviations for continuous variables and frequencies and percentages for categorical data. A p-value of <0.05 was used to determine statistical significance.

RESULTS

Table 1: Patients Demographic Characteristics (n=250)

Characteristics		Number of patients	Percentage (%)
Age (year)	<1	30	12.00%
	1-5	95	38.00%
	5-10	72	28.80%
	10-15	53	21.20%
Gender	Male	149	59.60%
	Female	101	40.40%
Weight (kg)	<10	41	16.40%
	10-20	116	46.40%
	>20	93	37.20%
ASA physical status	1	147	58.80%
	2	80	32.00%
	>2	23	9.20%

The majority of patients (38%) were aged between 1–5 years, followed by those aged 5–10 years (28.8%) and 21.2% in 10-15 years age group. A smaller proportion of patients were under 1 year (12%). Male patients accounted for 59.6% and females 40.4% in this study. Regarding weight, 46.4% of the patients weighed between 10–20 kg, while 37.2% weighed over 20 kg, and 16.4% were under 10 kg. Most of the patients (58.8%) were classified as ASA physical status I, while 32% were

ASA physical status II, and 9.2% were ASA physical status >II.

Table 2: Preoperative medication and interventions (n=250)

Medication/Intervention	Number of Patients (%)	Effectiveness (% Success)
Midazolam (oral)	152(60.8%)	90%
Fentanyl (intranasal)	28 (11.2%)	82%
Diamorphine (oral or intranasal)	26 (10.4%)	76%
Distraction Techniques	21 (8.4%)	68%
Parental Presence During Induction	18 (7.2%)	71%
Cognitive-Behavioral Therapy	5 (2.0%0	65%

Table 2 shows how perioperative medications and non-pharmacological interventions reduce anxiety in paediatric patients. The most common premedication was oral midazolam, administered to 60.8% of patients with a 90% success rate. The success rates for intranasal fentanyl (11.2%) and oral/intranasal diamorphine (10.4%) were 82% and 76%, respectively. Distraction techniques were used in 8.4% of cases, resulting in a success rate of 68%, while parental presence during induction (7.2%) was effective in 71% of cases. Cognitive-behavioral therapy was used in 2% of patients and achieved 65% success rate.

Table 3: Surgical procedure and preferred anesthesia technique (n=250)

Surgical Category	Number of patients (%)	Preferred Anesthetic technique	Intraoperative challenges
General surgery	75 (30.0%)	Anesthesia with LMA	Hypotension during induction
Orthopedic surgery	52 (20.8%)	Regional (caudal block)+General	Blood loss management
Urologic	48 (19.2%)	Sedation	Fluid overload, blood loss, injury prevention
Neurosurgery	12 (4.8%)	General (ETT)	Airway stability, longer duration
ENT surgery	40 (16.0%)	General (LMA)	Risk of airway edema
Others	23 (9.2%)	Varies	Patient positioning, thermoregulation

Table 3 shows the surgical procedures and anesthetic approaches in paediatric patients. General surgery (30%) used general anesthesia with LMA, often complicated by hypotension during induction. Orthopedic surgery (20.8%) combined caudal block and general anesthesia, with blood loss challenges. Sedation was employed in 19.2% of urological cases, addressing fluid overload and blood loss. ENT surgeries (16%) used LMA, with airway oedema risks. Neurosurgeries (4.8%) required ETTs, while other surgical procedures (9.2%) faced unique challenges like positioning and thermoregulation.

Table 4: Anesthesia induction and maintenance (n=250)

Techniques	Number of patients (%)	Agent used	Surgical technique
Inhalational Induction (Sevoflurane)	180(72.0%)	Sevoflurane ± N2O	ENT, Orthopedic Surgery
IV Induction (Propofol)	53 (21.2%)	Propofol	Neurosurgery, Urology
Maintenance (Inhalational)	163 (65.2%)	Sevoflurane, Isoflurane	General, ENT Surgery
Maintenance (TIVA)	75 (30.0%)	Propofol + Remifentanil ± Adjuncts	Neurosurgery, Urology
Ketamine-Based Induction (IV)	18 (7.2%)	Ketamine	Trauma, high-risk patients

The anesthesia induction and maintenance techniques were recorded in this table. Sevoflurane, used for 72% of cases, was most commonly inhaled with the majority of inhalations for ENT and orthopedic surgeries. Propofol was used as an intravenous induction in 21.2% of patients, mainly neurosurgical and urological procedures. Total intravenous anesthesia (TIVA) was used in 30% and inhalational agents (65.2%) were predominantly used for maintenance of anesthesia. In high risk or trauma cases, 7.2% of patients preferred ketamine based induction.

Table 5: Postoperative complications (n=250)

Complications	Number of patients (%)
Postoperative Nausea and Vomiting (PONV)	41 (16.4%)
Pain (VAS > 4)	32 (12.8%)
Airway Complications	13 (5.2%)

Table 1 displays the postoperative complications observed in the study population. The most common complication was postoperative nausea and vomiting (PONV), present in 16.4% of patients. A score on Visual Analog Scale (VAS) of > 4 was reported in 12.8% of cases. Airway complications were less frequent (5.2%) and sometimes required additional intervention.

DISCUSSION

This study was designed to assess the perioperative anesthetic care of children for subjects of 250 from various surgical specialties through a retrospective analysis. This is important for providing insights into demographic characteristics, surgical procedures, anesthesia techniques, medication interventions and postoperative complications for this patient population.

Regarding demographic characteristics, the majority of paediatric patients (38%) were <5 years old, which is comparable to the findings from de Graaff *et al*., regarding the large spectrum of paediatric surgical procedures related to common childhood conditions that require surgical interventions [12]. Male patients are more predominant (59.6%) compared to female patients, a similar trend as observed in the study by Weiss et al. who reported that male children develop more surgical diseases [3].

In addition, ASA physical status was assessed in the study, and most patients (58.8%) were found to be ASA I (low risk surgical population). It is consistent with previous studies such as the work by Habre and von Ungern-Sternberg, which have shown that much of paediatric surgery involves children who are otherwise healthy [13, 14]. Despite this, a considerable number of patients had higher ASA scores suggesting the need for more careful anesthetic management in these children.

The most commonly used preoperative medication administered was oral midazolam (60.8%) with 90% success rate. These results are consistent with those of Kain, et al. who demonstrated that perioperative sedation with benzodiazepines significantly reduces anxiety and enhances cooperation in children undergoing surgery [11]. Less frequently other interventions like parental presence during induction, cognitive behavioural therapy were used, while it is supported by studies such as Manyande *et al*., which highlight the effectiveness of the psychological support in decreasing perioperative distress [15].

The type of surgery dictated which anesthetic technique was used. For the majority of cases, general anesthesia was preferred (30% of cases for general surgery and 16% for ENT surgery), with LMA use being common for airway management. This is consistent with the findings of Chidambaran *et al*., regarding the benefits of LMA in paediatric anesthesia, including safety and ease of use in younger children [16]. Caudal blocks were also applied frequently, as a regional anesthesia was generally used more often than the total IV anesthetic in the orthopedic cases, as was the case with decreasing the intraoperative analgesic requirement [17].

The induction of anesthesia in this study was primarily induced with sevoflurane (72%) according to current practice with sevoflurane's safety and rapid onset profile in paediatric patients [18]. In line with studies by Bijker *et al*., who reported that propofol is an ideal induction agent with stable hemodynamics in paediatric anesthesia, the use of propofol in more complex surgeries such as neurosurgery and urology IV induction is also in line [19]. High risk patients and trauma cases encouraged the use of ketamine based induction, which retains its effectiveness in management of the airway reflexes and maintaining cardiovascular stability [10].

Relatively common postoperative complication patterns included postoperative nausea and vomiting (PONV) (16.4%) and pain (12.8%). These results are consistent with those of Powell *et al*., who observed similar PONV incidence among paediatric patients undergoing surgery [7].

CONCLUSION

This study emphasizes the critical necessity of perioperative anesthetic management tailored to the demands of paediatric patients to promote patient safety and outcomes. Results indicate the efficacy of age appropriate techniques and emphasize the need to individualize to prevent risks such as airway complications and postoperative nausea. By adopting evidence based guidelines and by integrating psychological and pharmacological strategies, much more can be achieved to improve the perioperative experience in paediatric patients.

LIMITATIONS AND RECOMMENDATIONS

The findings of this study are limited by the use of retrospective data that may create selection and recall bias and a single center design that may limit generalizability of findings. These limitations should be addressed by future studies with multicenter analysis of larger, more diverse populations and prospective design.

REFERENCES

1. Weiss, M., Vutskits, L., Hansen, T. G., & Engelhardt, T. (2015). Safe anesthesia for every tot–the SAFETOTS initiative. *Current Opinion in Anesthesiology*, *28*(3), 302-307.
2. Dennhardt, N., Beck, C., Huber, D., Sander, B., Boehne, M., Boethig, D., ... & Sümpelmann, R. (2016). Optimized preoperative fasting times decrease ketone body concentration and stabilize mean arterial blood pressure during induction of anesthesia in children younger than 36 months: a prospective observational cohort study. *Pediatric Anesthesia*, *26*(8), 838-843.
3. Thomas, M., Morrison, C., Newton, R., & Schindler, E. (2018). Consensus statement on clear fluids fasting for elective pediatric general anesthesia. *Pediatric Anesthesia*, *28*(5), 411-414.
4. Force, A. T. (1999). Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: application to healthy patients undergoing elective procedures: a report by the American Society of Anesthesiologists Task Force on Preoperative Fasting. *Anesthesiology*, *90*, 896-905.
5. Nafiu, O. O., Maclean, S., Blum, J., Kheterpal, S., Cowan, A., & Tremper, K. K. (2010). High BMI in children as a risk factor for intraoperative hypotension. *European Journal of Anaesthesiology| EJA*, *27*(12), 1065-1068.
6. Owen, J., & John, R. (2012). Childhood obesity and the anaesthetist. *Continuing Education in Anaesthesia, Critical Care and Pain*, *12*(4), 169-175.
7. Powell, S., Kubba, H., O'Brien, C., & Tremlett, M. (2010). Paediatric obstructive sleep apnoea. *Bmj*, *340*.
8. Silvanus, M. T., Groeben, H., & Peters, J. (2004). Corticosteroids and inhaled salbutamol in patients with reversible airway obstruction markedly decrease the incidence of bronchospasm after tracheal intubation. *Anesthesiology*, *100*(5), 1052-1057.
9. American Society of Anesthesiologists. American Society of Anesthesiologists - Standards & Guidelines [Internet]. https://www. asahq.org/standards-and-guidelines. Accessed March 15, 2017.
10. Serafini, G., Ingelmo, P. M., Astuto, M., Baroncini, S., Borrometi, F., Bortone, L., ... & Zadra, N. (2014). Preoperative evaluation in infants and children: recommendations of the Italian Society of Pediatric and Neonatal Anesthesia and Intensive Care (SARNePI). *Minerva Anestesiol*, *80*(4), 461-469.
11. Kain, Z. N., Caldwell-Andrews, A. A., Mayes, L. C., Weinberg, M. E., Wang, S. M., MacLaren, J. E., & Blount, R. L. (2007). Family-centered preparation for surgery improves perioperative outcomes in children: a randomized controlled trial. *Anesthesiology*, *106*(1), 65-74.
12. De Graaff, J. C., Pasma, W., Van Buuren, S., Duijghuisen, J. J., Nafiu, O. O., Kheterpal, S., & Van Klei, W. A. (2016). Reference values for noninvasive blood pressure in children during anesthesia: a multicentered retrospective observational cohort study. *Anesthesiology*, *125*(5), 904-913.
13. Habre, W., Disma, N., Virag, K., Becke, K., Hansen, T. G., Jöhr, M., ... & Didier, A. (2017). Incidence of severe critical events in paediatric anaesthesia (APRICOT): a prospective multicentre observational study in 261 hospitals in Europe. *The Lancet Respiratory Medicine*, *5*(5), 412-425.
14. Von Ungern-Sternberg, B. S., & Habre, W. (2007). Pediatric anesthesia–potential risks and their assessment: part I. *Pediatric Anesthesia*, *17*(3).
15. Manyande, A., Cyna, A. M., Yip, P., Chooi, C., & Middleton, P. (2015). Non-pharmacological interventions for assisting the induction of anaesthesia in children. *Cochrane Database of Systematic Reviews*, (7).
16. Chidambaran, V., Costandi, A., & D'Mello, A. (2015). Propofol: a review of its role in pediatric anesthesia and sedation. *CNS drugs*, *29*(7), 543-563.
17. Wolf, A. R. (2012). Effects of regional analgesia on stress responses to pediatric surgery. *Pediatric Anesthesia*, *22*(1), 19-24.
18. Coté, C. J., Lerman, J., & Anderson, B. J. (2019). The practice of paediatric anesthesia. In A Practice of Anesthesia for Infants and Children 2019 Jan 1 (pp. 1-7). Elsevier.
19. Bijker, J. B., Van Klei, W. A., Kappen, T. H., Van Wolfswinkel, L., Moons, K. G., & Kalkman, C. J. (2007). Incidence of intraoperative hypotension as a function of the chosen definition: literature definitions applied to a retrospective cohort using automated data collection. *The Journal of the American Society of Anesthesiologists*, *107*(2), 213-220.