ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCE

DEPARTMENT OF ANESTHESIOLOGY, CRITICAL CARE AND PAIN MEDICINE

Incidence and Factors Associated with Postoperative Vomiting in Pediatric Elective Surgical Patients at Minilik II Comprehensive Referral Hospital and Tikur Ambessa Specialized Hospital, Addis Ababa, Ethiopia, 2024/2025 G.C.

Research Proposal to be submitted to the Department of Anesthesiology in Partial Fulfillment of the Requirement for Specialty Program in Anesthesiology.

Principal Investigator –Dr. Abenzer Amha, final year ACCPM resident

Advisors – Primary advisor: Dr. Amria Shamil (Consultant anesthesiologist)

Secondary advisor: Dr. Semira Endris (Consultant Anesthesiologist)

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LIST OF ACRONYMS AND ABBREVIATIONS

AAU Addis Ababa University

AOR Adjusted odd ratio

ASA American Society of Anesthesiologists

BMI Body Mass Index

CI Confidence Interval

DC Data collector

GA General Anesthesia

GC Gregorian calendar

MAC Minimum Alveolar Concentration

MIICRH Minilik II Comprehensive Referral Hospital

OR Odd ratio

PACU Post-Anesthesia care unit

PONV Postoperative Nausea and Vomiting

POV Post-operative vomiting

TASH Tikur Anbesa Specialized Hospital

TIVA Total intravenous anesthesia

ABSTRACT

Background: Postoperative vomiting (POV) is one of the most common complications observed in pediatric anesthesia. The incidence in pediatrics is estimated to be between 33% and 82%. Children have twice the risk of experiencing postoperative vomiting compared to adults. Risk factors for postoperative vomiting can be divided into three categories: those related to the surgery, anesthesia, or patient.

Objective: The objective of this study was to assess the incidence and factors associated with POV among pediatrics patients undergoing elective surgeries at Minilik ll Comprehensive Referral Hospital and Tikur Anbesa Specialized Hospital, Addis Ababa, Ethiopia from December 2024 to March 2025

Methods: A multi-center, institution-based cross-sectional study was conducted to assess the incidence and factors associated with POV in pediatric patients undergoing elective surgeries. A final sample size of 185 was determined using a single population proportion formula, adjusted for finite population and non-response. Data were collected via structured questionnaires and analyzed using SPSS version 27, with statistical significance set at $p < 0.05$.

Result: The study reported a 23% incidence of postoperative vomiting among pediatric patients undergoing elective surgery. Most vomiting episodes (83.3%) occurred within the first 6 hours postoperatively, while 16.7% occurred between 7 and 24 hours. Multivariate logistic regression analysis identified several significant risk factors for POV:

- ✓ **ASA class II–III** (AOR = 3.9, 95% CI: 2.14–11.65) compared to ASA I
- ✓ **Presence of chronic medical conditions** (AOR = 6.1, 95% CI: 2.82–44.85)
- ✓ **Lack of premedication for POV** (AOR = 3.9, 95% CI: 1.24–12.41)
- ✓ **Duration of surgery greater than 60 minutes** (AOR = 13.6, 95% CI: 7.14–36.43)
- ✓ **Intraoperative complications** (AOR = 10.7, 95% CI: 2.28–50.46, $p = 0.003$) compared to those with no complications.

Conclusion and Recommendation: Based on the findings of this study, it is recommended to provide antiemetic prophylaxis for high-risk cases. Furthermore, it is advised to have institution specific protocols for the prevention and management of POV.

1. Introduction

1.1. Background

Postoperative vomiting refers to any occurrence of vomiting within the first 24 hours after surgery. Vomiting is defined as the involuntary, forceful ejection of stomach contents through the mouth. It can be classified as early (<6 hour) and late (6 to 24 hour)(1).

Postoperative vomiting is one of the most common complications observed in pediatric anesthesia. The prevalence of POV in children is notably high, with rates reported between 30% in the general surgical population and up to 80% in pediatric patients who are considered high-risk(2). Children have twice the risk of experiencing postoperative nausea and vomiting compared to adults.(1, 3)

Although not life-threatening by itself, POV can be uncomfortable for patients and result in increased dissatisfaction among patients and their families; They also have the potential to impede recovery from surgery(1, 4). These patients suffer from adverse psychological, metabolic, and surgical events, such as wound dehiscence. Increased costs of institution arise from delayed discharges or unplanned hospital admissions, with 2% of these cases attributable to postoperative vomiting(1). Risk factors for POV can be divided into three categories:

1. **Related to the surgery**: Ophthalmic surgeries, ENT, laparoscopic intra-abdominal surgeries and surgeries lasting longer than 30 minutes.
2. **Related to the anesthesia**: use of volatile anesthetics; administration of anticholinesterases like neostigmine, and long-acting opioids.
3. **The patient:** age 3 years and older, previous history of POV or motion sickness, family history of POV; and post pubertal female (3, 4).

There are different scoring systems for predicting POV in pediatrics. The two widely used scoring systems in children are the Postoperative Vomiting in Children (POVOC) Score and the Vomiting in the Postoperative Period (VPOP) Score (1, 5) . Due to the widespread occurrence of the condition and its impact on morbidity and rising healthcare costs, it is crucial to explore various preventive and therapeutic approaches.

1.2. Statement of the problem

Postoperative vomiting is frequent and troubling complications following surgery, particularly observed in pediatric patients. Although advancements in anesthetic techniques and antiemetic treatments have been made, POV remains a major concern, leading to extended hospital stays, increased healthcare costs, and significant discomfort for children.

The incidence of POV in pediatric populations is not fully understood and varies widely, ranging from 30% to 80%. This variability is due to several factors, including diverse study populations, differences in surgical procedures, variability in anesthetic practices, age, and individual patient factors.

The current lack of detailed understanding regarding the incidence and associated risk factors hinders healthcare providers' ability to effectively anticipate, prevent, and manage POV in children. Additionally, much of the existing research is based on adult populations, which may not account for unique pediatric factors such as differences in physiology, surgical procedures, and emotional responses.

This study aims to explore the incidence of POV in pediatric patients and identify the primary factors related to its occurrence. By addressing these gaps, the research seeks to provide valuable insights that could enhance the prediction, prevention, and management of POV in children, ultimately improving patient outcomes and reducing the burden on healthcare systems.

1.3. Significance of study

Studying the incidence and factors associated with postoperative vomiting in pediatric patients is crucial for several reasons:

i. POV can be distressing and uncomfortable for children, which in severe cases can lead to complications. Understanding the incidence and factors that contribute to POV helps in developing strategies to minimize these symptoms, improving overall patient comfort and safety.

ii. Anesthesia management plays a significant role in POV. By researching the specific factors that contribute to POV in children, anesthesiologists can use anesthetic techniques and medications to reduce the risk of nausea and vomiting.

iii. Managing POV can lead to additional healthcare costs, including extended hospital stays and additional medications. By identifying risk factors and implementing preventive measures, hospitals can reduce these costs and improve efficiency.

iv. Effective prevention and management of POV can lead to greater satisfaction among families, who are concerned about their child's well-being and recovery. Positive experiences can also improve trust in healthcare providers and the overall perception of the care provided.

2. Literature Review

2.1 Introduction

Postoperative vomiting is a common complication affecting both adults and children after surgery and anesthesia. It negatively impacts the well-being of patients and reduces satisfaction levels, particularly among children and their parents. POV also increases resource utilization, including prolonged recovery times and unplanned hospital admissions (2) . The incidence of POV in children is notably high, ranging from 33.2% to 82%, influenced by individual risk factors. POV encompasses vomiting or retching that typically begins in the post-anesthesia care unit (PACU) and can persist for up to 24 hours post-surgery, with symptoms occasionally lasting up to 7 days (3).

Children experience postoperative vomiting at about twice the rate of adults, with higher rates observed in school-aged children, increasing with age until puberty (6). Assessing nausea in children is difficult because they often struggle to express the nature and severity of their discomfort (7).

Preventive strategies for reducing POV in children emphasize addressing baseline risk factors, such as opting for total IV anesthesia (TIVA) over inhaled anesthetics. Prophylactic treatments are then administered to those at moderate to high risk for POV (8, 9).

2.2 Incidence of Postoperative vomiting among pediatrics

In the mid-19th century, the incidence of postoperative vomiting was significantly high, reaching up to 60% due to the use of older anesthetic agents such as Ether and Cyclopropane. However, with advancements in anesthetic techniques, the introduction of newer antiemetic agents, and the shift to short-acting anesthetic drugs, this incidence has been reduced to approximately 30% (10).

A variety of studies have examined the incidence of POV in different pediatric population. For instance, a prospective observational study conducted at Gondar University Hospital in Gondar, Ethiopia, involving 187 children undergoing ophthalmic procedures under general anesthesia, found that the incidence of POV was 19.9%. The highest occurrence was noted in the immediate postoperative period (0–2 hours), compared to the early and late periods (11).

A cross-sectional study at the Medical University Hospital of Graz in Austria, involving 626 children and adolescents, found PONV rates of 21.9% on the day of surgery, with a significant reduction to 3.8% on the first postoperative day and 3.6% on the second day (2).

A prospective study conducted at the University Hospital of Tours, focusing on the pediatric digestive and plastic surgery departments, found a lower incidence of PONV at 9.4%, with 7.1% of patients experiencing vomiting within the first 24 hours. This reduced rate could be due to the uniformity and limited range of surgeries performed in this group, implying that the type of surgery significantly influences the risk of POV (12). In contrast, a study conducted at Fujita Health University in Japan on 46 pediatric patients undergoing cleft-related surgery found a relatively higher PONV incidence of 21.7%, further illustrating how specific surgical procedures can impact the likelihood of postoperative nausea and vomiting (13).

These studies highlight the variability in the incidence of POV depending on factors like the type of surgery, and the postoperative period, with the highest incidence occurring on the early postoperative days. This emphasizes the need for tailored strategies in preventing and managing POV.

2.3 Risk factors associated with pediatric Postoperative Vomiting

Although several risk scores have been developed for adults, their application in pediatric patients is limited. This is because many established adult risk scores are either challenging to assess in children or not suitable for their specific needs (9). The development of POV in pediatric patients is influenced by a range of risk factors, which include patient-related factors, anesthesia-related factors, and surgical factors.

2.3.1. Patient factors

Several patient specific factors influence the likelihood of developing postoperative vomiting in children. These include age, sex, a personal or family history of POV or motion sickness, and general health condition.

A prospective survey conducted over 22 months in Germany, across two university hospitals, a community children's hospital, and an outpatient surgical center, found that the risk of postoperative vomiting increases with age. Toddlers were found to be less prone to POV compared to school-aged children and adolescents. The risk begins to rise significantly around

the age of three and continues to increase as children get older. This trend continues until puberty, where POV reaches its peak (5) .

A personal or family history is another important factor. Children with a family history of POV or motion sickness are at a greater risk of experiencing POV themselves. Genetic predisposition is thought to play a role, with certain inherited traits influencing an individual's likelihood of developing POV (5).

Although, in a previous study from the Royal Children's Hospital in Parkville, Victoria, found no significant difference in the incidence of POV between genders in children (14), It plays a role particularly in adolescents. This increased susceptibility in females is believed to be linked to hormonal changes during puberty. A research by Eberhart and colleagues in Germany identified gender as the eleventh most significant predictor of POV in a backward regression analysis, with female patients, particularly adolescent girls, showing greater susceptibility to POV. This finding aligns with observations in adults and may be attributed to the inclusion of older female participants in the study (5).

These studies underscore the complexity of POV risk factors, highlighting the influence of age, family history, and gender on the likelihood of experiencing POV.

2.3.2. Surgical factors

Surgical factors are key contributors to the risk of POV in pediatric patients. The likelihood of POV can be affected by the type of surgery, the length of the procedure, and the techniques used during surgery.

The duration of surgery is a significant factor influencing POV risk. Longer surgical procedures are associated with a higher incidence of POV due to prolonged exposure to anesthetic agents and increased physiological stress. Several studies have demonstrated that surgical procedures lasting more than 30 minutes have a higher likelihood of inducing PONV in pediatric patients. A study involving 17,638 consecutive ambulatory surgical patients at The Toronto Hospital, Western Division, found a direct correlation between the duration of anesthesia and the incidence of POV. The frequency of POV rose from 2.8% in patients with surgeries lasting 30 minutes or less to 27.7% in those with surgeries lasting between 151 and 180 min (15).

In the same study the incidence of POV varied widely depending on the type of surgery. The highest incidence was observed in patients undergoing ENT or dental surgery, at 14.3%. This was followed by orthopedic surgery at 7.6% and plastic surgery at 7.4%. Urologic, gynecologic, neurologic, or general surgery had incidences ranging from 4% to 5.2%. The lowest rates of POV were seen in those undergoing ophthalmologic procedures and chronic pain blocks, with incidences of 2.7% and 0.696%, respectively (15).

Additionally, invasive surgical techniques and procedures that involve significant manipulation of organs, such as gastrointestinal or abdominal surgeries, are more likely to trigger vomiting due to direct stimulation of the vagus nerve, which regulates the emetic response. Minimally invasive surgeries, by contrast, tend to have a lower incidence of POV.

2.3.3. Anesthetic factors

Anesthetic factors play a crucial role in the development of postoperative vomiting in pediatric patients. The type of anesthetic agents used, the mode of anesthesia, and the use of adjunct medications significantly influence the incidence of POV in children.

Inhalational anesthetics are strongly associated with a higher risk of POV in pediatric patients. Volatile anesthetics, such as sevoflurane and isoflurane, have been shown to increase postoperative vomiting incidence due to their emetogenic properties. POV occur at a baseline rate of approximately 20% following inhalational anesthesia. In a randomized control trial involving 1,118 children identified inhalational agents as a primary contributor to postoperative vomiting, whereas propofol demonstrated a potential protective effect against POV (16). Propofol appears to possess antiemetic properties, even at low doses, making it a useful option in reducing the risk of POV (17).

Opioids, commonly used for intraoperative and postoperative pain management, are another anesthetic-related factor that increases POV risk. Opioids are known to exacerbate PONV by stimulating opioid receptors in the gastrointestinal tract and the CTZ. In a study involving 50 children aged 4 to 16 years, classified as ASA class I–II, participants were randomized to receive either rectal diclofenac at 1 mg/kg or intravenous morphine at 0.05 mg/kg during the perioperative period. Both groups were well-matched in terms of age, weight, sex, type of surgery, and duration of anesthesia and surgery. The results revealed a significantly higher

incidence of vomiting in the morphine group compared to the diclofenac group. Within the first 24 hours, 12% of children in the diclofenac group experienced postoperative nausea and vomiting. In contrast, 72% of children in the morphine group experienced POV (18).

A similar study conducted by Stephen J. Mather and Jane M. Peutrell explored postoperative analgesic consumption and POV following general anesthesia for tonsillectomy. The study compared the effects of paracetamol premedication, paracetamol combined with an NSAID, and intravenous morphine for postoperative analgesia. The findings indicated that POV was significantly lower in the two groups that did not receive intraoperative morphine (19). Both studies underscore the association between intraoperative morphine use and increased POV, highlighting the benefits of alternative analgesic options such as NSAIDs and paracetamol in reducing the incidence of postoperative vomiting.

2.4 Prevention strategies for PONV in pediatrics

2.4.1 Non pharmacologic antiemetic strategies

Anesthetists can mitigate risk factors and lower the incidence of POV through several antiemetic strategies. These include avoiding volatile anesthetics in favor of TIVA, opting for regional anesthesia or a combination of general and regional anesthesia to minimize opioid use, employing multimodal pain management, and ensuring adequate hydration (20).

A prospective, randomized, double-blind trial conducted in the USA investigated the impact of perioperative fluid administration on POV. One hundred children undergoing strabismus repair were randomly assigned to receive 10 ml/kg/hr (control group) or 30 ml/kg/hr (superhydration group) of lactated Ringer's solution during surgery. Postoperatively, over the first 24 hours, the study assessed POV, thirst, pain, and fever. In the control group, 54% experienced vomiting, whereas only 22% in the superhydration group experienced these symptoms (21).

Prolonged postoperative fasting has traditionally been used to reduce the risk of POV, but evidence now suggests that it may not be necessary in many pediatric patients. In fact, early reintroduction of clear liquids and light foods may reduce dehydration, improve comfort, and potentially lower the risk of POV. In a study conducted in Germany with 147 children scheduled for elective outpatient surgery, participants were divided into two groups: 69 children were assigned to the fasting group, and 78 to the liberal group. In the fasting group, children were

prohibited from eating or drinking for the first 6 hours after extubation, while those in the liberal group were given a drink and a snack as soon as they were awake enough and requested for it. The study found no statistically significant difference in the incidence of vomiting between the two groups. Vomiting occurred in 15% of the liberal group and 22% of the fasting group (22).

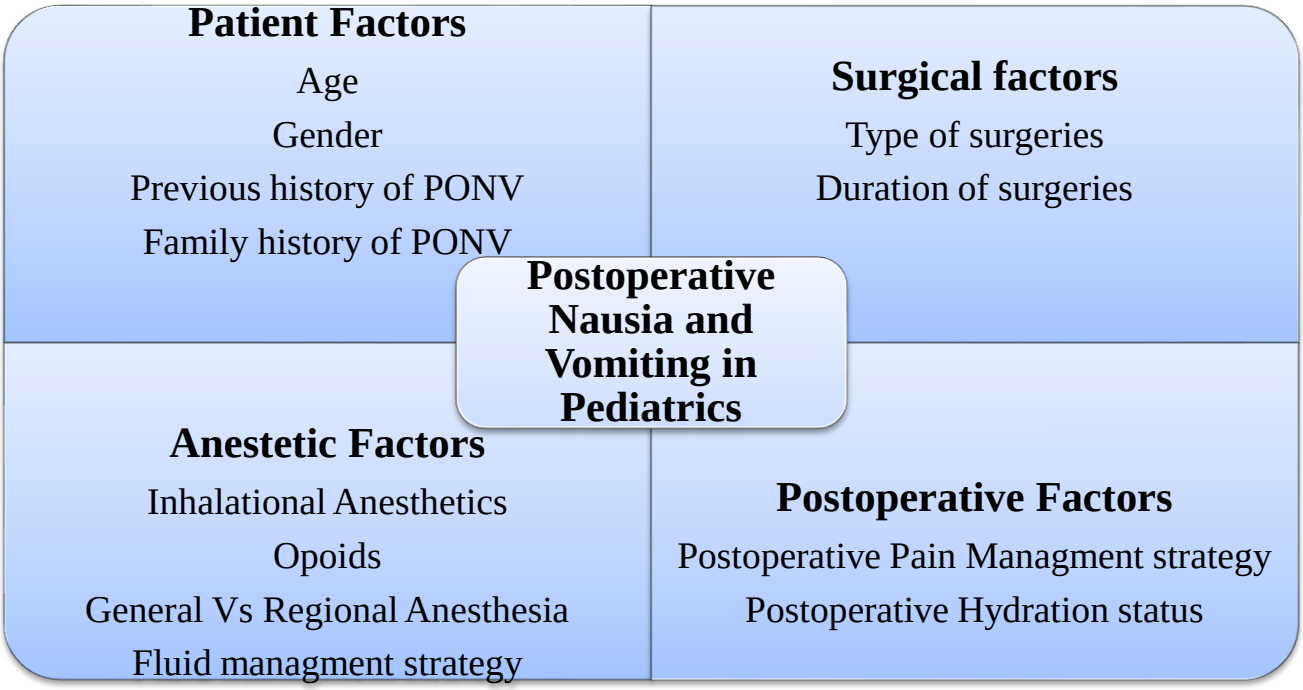
2.4.2 Pharmacologic antiemetic strategies

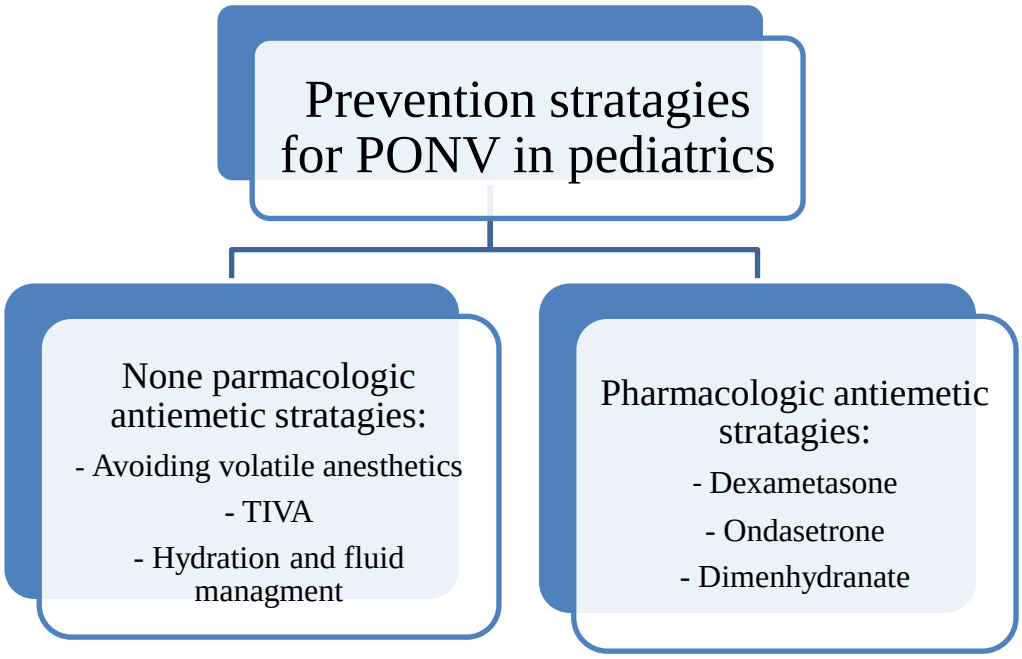
Postoperative vomiting remains a significant concern in pediatric anesthesia, contributing to discomfort, delayed recovery, and increased healthcare costs. Due to the complexity of POV pathophysiology, effective prevention often involves pharmacologic interventions. Multiple antiemetic agents have been studied for their efficacy in reducing the incidence of POV in children.

A retrospective study at Boston Children's Hospital, involving 160 patients with an average age of 5.6 years undergoing ASD repair, found no significant difference in POV rates between those who received intraoperative antiemetics (37.5%) and those who did not (36.2%) (23). On a contrary, a multicenter, double-blind study conducted at 28 sites across the USA examined the effectiveness of ondansetron in preventing POV. The study included 670 patients randomly assigned to receive either ondansetron or a placebo. Results showed a significantly lower POV incidence in the ondansetron group (11%) compared to the placebo group (28%), highlighting the efficacy of prophylactic antiemetic treatment in reducing POV risk (24).

Dexamethasone is commonly used drug to prevent POV in children. A randomized placebo-controlled trial involving 215 children, aged 2 to 17, was conducted at a major public teaching hospital in Switzerland from February 2005 to December 2007. The children were randomly assigned to one of four groups: a placebo/saline group and three dexamethasone groups receiving doses of 0.05 mg/kg, 0.15 mg/kg, or 0.5 mg/kg. Twenty-four hours after surgery, 24 of the 54 children in the placebo group experienced at least one episode of POV, leading to a 44% incidence rate. In comparison, 20 of the 53 children receiving dexamethasone at 0.05 mg/kg experienced POV 38%, while 13 of the 54 children in the 0.15 mg/kg group (24%) and 6 of the 52 children in the 0.5 mg/kg group (12%) reported POV(25).

2.5. Conceptual framework





3. Objectives

3.1. General objective

To assess the Incidence and factors associated with POV among pediatrics patients undergoing elective surgeries at Minilik ll Comprehensive Referral Hospital and Addis Ababa University, Tikur Anbesa Specialized Hospital from December 2024 to March 2025.

3.2. Specific objectives

- ✓ To assess the **incidence** of post-operative vomiting among pediatric patients undergoing elective surgeries at Minilik II Comprehensive Referral Hospital and Addis Ababa University, Tikur Anbesa Specialized Hospital from December 2024 to March 2025
- ✓ To identify the **factors** associated with post-operative vomiting among pediatric patients undergoing elective surgeries at Minilik II Comprehensive Referral Hospital and Addis Ababa University, Tikur Anbesa Specialized Hospital from December 2024 to March 2025

4. Methodology

4.1. Study area and period

The study took place from December 2024 to March 2025 at Tikur Anbessa Specialized Hospital and Minilik II Comprehensive Referral Hospital in Addis Ababa, Ethiopia. As the capital and largest city, Addis Ababa has an estimated population of nearly 6 million people in 2024. Tikur Anbessa is the largest referral hospital in the country, featuring 700 beds and offering specialized clinical services not available in other public or private facilities. It also serves as the main teaching hospital for various disciplines, where medical students and residents provide patient care.

Minilik II Referral Hospital, founded in 1909 and named after Emperor Menelik II, is among the oldest hospitals in Ethiopia. This tertiary care facility features more than 600 beds and offers specialized services in several areas, including ophthalmology, orthopedics, pediatric surgery, nephrology, and neurology. Managed by the Addis Ababa City Administration, Minilik II caters to approximately 10,000 patients each day and has around 2,300 staff members.

4.2. Study design

A multi-centered cross sectional study design was employed.

4.3. Source population

All pediatric surgical patients scheduled for elective surgery at Tikur Anbessa Specialized Hospital and Minilik II Comprehensive Referral Hospital in Addis Ababa, Ethiopia.

4.4. Study population

All selected pediatric surgical patients undergoing elective surgery at Tikur Anbessa Specialized Hospital and Minilik II Comprehensive Referral Hospital, between December 2024 and March 2025 and meet the inclusion criteria.

4.5. Eligibility criteria

4.5.1. Inclusion criteria

Inclusion criteria for the research consisted of all pediatric elective surgical patients up to 18 years of age at Tikur Anbessa Specialized Hospital and Minilik II Comprehensive Referral Hospital, whose parents or legal guardians have provided consent.

4.5.2. Exclusion criteria

- ✓ Patients undergoing non-elective surgeries
- ✓ Patients older than 18 years
- ✓ Patients whose parents or legal guardians do not provide informed consent for participation in the study.

4.6. Sample size determination

A single population proportion formula was used to calculate the sample size. Based on previous global studies, the incidence of PONV in pediatric patients ranged from 30% to 80%. To provide a more representative estimate, the mid-range value of 55% was selected for the calculation.

N= $\frac{(Z_{\alpha/2})^2 \times P(1-P)}{(d)^2}$ is used to estimate the sample size

Where N: is maximum sample size

Zα/2: is standard score value for 95% confidence level which is equal to 1.96

P: is expected prevalence of population

d : is the margin of error (±5% of the true value, **d = 0.05**)

$N = \frac{(1.96)^2 \times 0.55 \times (1-0.55)}{(0.05)^2} = 380$

The correction formula was applied because the number of patients operated was less than 10,000. According to recorded data, the total number of elective pediatric patients operated on under general anesthesia annually at both Tikur Anbessa Specialized Hospital and Minilik II

Comprehensive Referral Hospital, was 1,200. On average, these two institutions handled 100 elective pediatric surgical patients per month, amounting to 300 patients over a three-month period.

The adjusted sample size for a finite population:

$$N_{adj} = \frac{no}{1 + \frac{no - 1}{N}}$$

Where:

$\mathbf{n_0}$ = initial sample size calculated using the single population proportion formula (in this case, 380),

N = the total population size (the finite population) over the study period, which is 300

$\mathbf{N_{adj}}$ = the adjusted sample size for the finite population

$$N_{adj} = \frac{380}{1 + \frac{380 - 1}{300}} = 168,$$

By adding contingency 10% non-response rate, the total sample size will be 185.

4.7. Sampling technique

A total population sampling method was used to select participants for the study in order to maximize data accuracy, eliminate selection bias, and improve representativeness. This approach also ensured that all available cases were captured and that no small variables were overlooked.

4.8. Variables

4.8.1. Dependent variable

The outcome variable for this study was: Incidence of Postoperative vomiting in pediatrics.

4.8.2. Independent variable

- ✓ **Patient related factors:** Age, Gender, Medical history, previous history of POV, motion sickness, American Society of Anesthesiologists (ASA) functional status.
- ✓ **Surgery related factors:** Type of surgery (e.g. Ophthalmic, ENT, abdominal, orthopedic), Duration of surgery.
- ✓ **Anesthesia related factors:** Mode of anesthesia, type of induction and maintenance agents used, use of opioids, premedication for antiemetic, intraoperative fluid management.
- ✓ **Postoperative Factors**: use of postoperative antiemetic, time of initiation of oral intake.

4.9. Operational Definitions

Postoperative vomiting: refers to the forceful expulsion of stomach contents through the mouth that occurs within the first 24 after surgery.

Pediatric Patients: Children aged 0 to 18 years (WHO definition).

Elective Surgery: A procedure scheduled in advance at the convenience of the patient or physician, performed for medical conditions that are not urgent or life-threatening but still require surgical intervention.

Incidence of POV: The proportion of pediatric elective surgery patients who experience POV within a specific time period postoperatively.

Factors Associated with POV: Patient, surgical, anesthesia, and postoperative variables that may influence the likelihood of experiencing POV.

Antiemetic: Medications given to prevent or manage nausea and vomiting during and after surgery.

Duration of Surgery: The total time taken for the surgical procedure, from the initial incision to the final closure.

Early Oral Intake: Resumption of oral feeding after surgery within the first 4 to 6 hours postoperatively.

Early post-operative period: it begins when the patient arrives at the post-anesthesia care unit and lasts for six hours after the operation.

Late post-operative period: it refers to the time starting six hours after the patient arrives in the post-anesthesia care unit and continuing until 24 hours after the surgery.

4.10. Data collection procedures and data collectors

Data for this study was gathered using a pre-tested questionnaire. The questionnaire covered several key areas, including: socio-demographic information, clinical variables, potential risk factors, intraoperative and postoperative characteristics. For children who are old enough and able to communicate, data was collected through direct interviews. For children too young to respond, an interview was conducted with their parents or guardians.

To ensure high-quality data collection, anesthesia residents, nurse anesthetists, and PACU nurses was involved as data collectors. They received proper training and orientation on the study's objectives and the use of the questionnaire. Additionally, a pretest was conducted to refine the questionnaire and ensure that the data collectors were fully prepared for the process. This helped to maintain consistency and reliability in the data collection process across all participants.

4.11. Data processing and analysis

Data collected through questionnaires was entered into **SPSS version 27** for analysis. Prior to conducting statistical analysis, the data was thoroughly cleaned by checking for missing values, outliers, and inconsistencies. Any discrepancies were resolved by cross-referencing with the original data sources to ensure accuracy.

To generate valuable results from this study, both **descriptive statistics** and **logistic regression analysis** was applied. The data were first manually checked for completeness and clarity, then coded, entered, and cleaned using SPSS.

Descriptive statistics was used to summarize the socio-demographic, intraoperative and postoperative characteristics of the pediatric patients. Categorical variables were presented as frequencies and percentages.

Bivariate analysis was conducted to examine the relationship between each independent variable (e.g., age, gender, type of surgery) and the outcome variable (POV). Variables with a **p-value of ≤ 0.25** in the bivariate analysis were included in the **multivariate analysis**.

The multivariate analysis involved applying **logistic regression** to identify independent factors associated with POV, while controlling for potential confounders. The strength of association between variables and the outcome were measured using **odds ratios (ORs)** with **95% confidence intervals**. A **p-value of < 0.05** was considered statistically significant.

4.12. Data quality assurance

The completeness and consistence of the research was supervised by the principal investigator during the data collection process.

4.13. Ethical consideration

Before data collection begins, ethical approval was secured from the Ethical Review Committee of Addis Ababa University, College of Public Health. Verbal informed consent was obtained from all participants prior to their involvement in the study. The information collected was used solely for the purposes of this research, and strict confidentiality was maintained for all participants.

4.14. Dissemination plan

The research findings will be submitted to the College of Health Sciences, School of Medicine, Department of Anesthesia, Critical Care, and Pain Medicine, as well as to all anesthesia professionals and residents. Furthermore, the results will be deposited in the AAU Library's institutional repository and submitted to various academic journals for publication and broader dissemination.

5. Result

5.1 Socio-demographic characteristics of the study participants

The study involved 185 pediatric participants. The largest age group was children aged 1–3 years, accounting for 34.6% (n=64), followed by those aged 4–6 years at 27.0% (n=50), and 7–12 years at 21.6% (n=40). Infants aged 1–12 months comprised 6.5% (n=12), while neonates (<1 month) represented the smallest group at 1.6% (n=3). Adolescents made up 8.6% (n=16) of the total. In terms of gender, males were more prevalent, comprising of 58.9% (n=109), whereas females accounted for 41.1% (n=76). Participants were almost evenly distributed between the two hospitals: Tikur Anbessa Specialized Hospital (TASH) with 51.9% (n=96) and Menelik II Comprehensive Specialized Hospital (MIICRH) with 48.1% (n=89)

Table 1 Socio-demographic characteristic of study participants

Variable	Frequency	Percent
Age in years		
< 1 month	3	1.6
1-12 months	12	6.5
1-3 years	64	34.6
4-6 years	50	27.0
7- 12 years	40	21.6
12-18 years	16	8.6
Sex of the participants		
Female	76	41.1
Male	109	58.9
Hospitals		
TASH	96	51.9
MIICRH	89	48.1

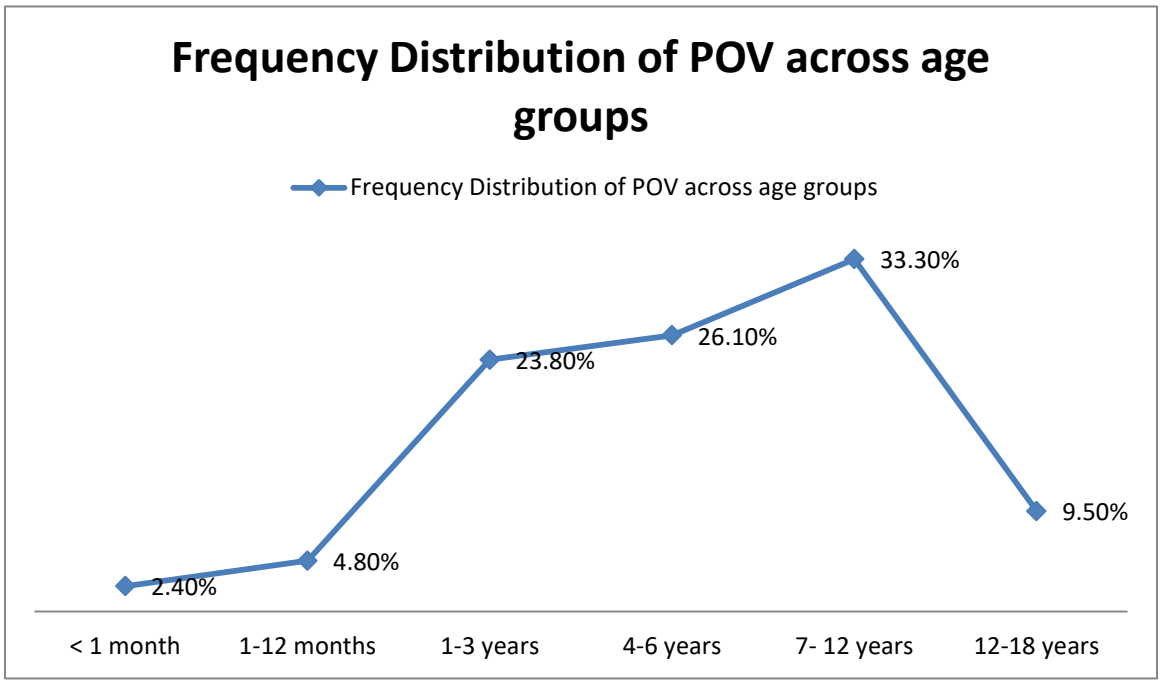


Chart 1 Frequency Distribution of POV across age groups

5.2 Medical History and Patient characteristics of the study participants

The majority of patients (76.2%) were classified as ASA I, while 16.8% were ASA II, and 7% were ASA III. Only 22.7% had history of previous surgery and out of these only 2.7% had previously experienced postoperative vomiting. A small proportion (7.6%) reported a history of motion sickness.

Regarding medication use, 96.8% of patients had not received opioids in the 24 hours before surgery. Among the six patients who did receive opioids, all were adolescent orthopedic patients with fractures. Morphine was more commonly administered (66.7%) than tramadol (33.3%) in this group.

Among the 13% of patients with chronic medical conditions, congenital heart disease was the most common, representing 41.7%, followed by chronic hypertension at 12.5%. Other conditions such as epilepsy, osteochondroma, and retinoblastoma were each reported in ≤8.3%.

Table 2 Medical History and Patient characteristics of study participants

Variable	Frequency	Percent
ASA classification		
ASA I	141	76.2
ASA II	31	16.8
ASA III	13	7
History of previous surgery		
Yes	42	22.7
No	143	77.3
Experience POV previously		
Yes	5	2.7
No	180	97.3
Patient ever experienced motion sickness		
Yes	14	7.6
No	171	92.4
The patients receive opioids within the last 24 hours before surgery		
Yes	6	3.2
No	179	96.8
Type of Opioid the patient took		
Morphine	4	66.7
Tramadol	2	33.3
Have chronic medical condition		
Yes	24	13
No	161	87
Type of chronic medical condition		
CHD	10	41.7
CKD	2	8.3
Epilepsy	2	8.3
Osteochondroma	2	8.3

Autism	1	4.2
PSGN	2	8.3
Chronic hypertension	3	12.5
Retinoblastoma	1	4.2

5.3 Intraoperative related characteristics of the study participants

The majority of participants (58.9%) received premedication for POV, with dexamethasone being the only medication used. General anesthesia was the predominant type, with ETT in 43.2% of cases and LMA in 34.1%. Additional combinations with regional/neuroaxial techniques were used less frequently, while regional anesthesia alone was employed in 8.6% of patients.

Regarding induction agents (n=169), the most commonly used combination was Propofol, ketamine, and fentanyl (43.8%), followed by Propofol and fentanyl (38.5%). Maintenance anesthesia was most often achieved with isoflurane alone (49.7%), while other agents such as halothane and propofol were used either alone or in combination. In terms of surgical duration, 50.8% of procedures lasted under 60 minutes, and 49.2% lasted >60min. Most patients (74.1%) received intraoperative fluids at rates greater than 10 ml/kg/hr, while 25.9% received ≤10 ml/kg/hr.

For analgesia, fentanyl alone was the most frequently used agent (52.4%), followed by a combination of fentanyl and PCM at 22.7%, and PCM alone at 15.7%. Multimodal regimens involving combinations of fentanyl, morphine, and PCM were less common. Intraoperative complications occurred in 10.3% of participants, while the remaining 89.7% had uneventful procedures.

Table 3 Intraoperative characteristic of study participants

Variable	**Frequency**	**Percent**
The patient premedicated for POV		
Yes	109	58.9
No	76	41.1
Types of medication (n=109)		

Dexamethasone	109	100
Type of Anesthesia		
General Anesthesia with ETT	80	43.2
General Anesthesia with ETT, Regional/Neuraxial Anesthesia	12	6.5
General Anesthesia with LMA	63	34.1
General Anesthesia with LMA, Regional/Neuraxial Anesthesia	14	7.6
Regional/Neuraxial Anesthesia	16	8.6
Induction agent (n=169)		
Propofol and Fentanyl	65	38.5
Propofol, Fentanyl and Dexmedetomidine	10	5.9
Propofol and ketamine	15	8.9
Propofol, ketamine and Fentanyl	74	43.8
Propofol, ketamine, Midazolam, Fentanyl	2	1.2
Propofol, Midazolam, Fentanyl	3	1.8
Maintenance anesthesia (n=169)		
Both Isoflurane and ketamine	2	1.2
Both Isoflurane and Propofol	24	14.2
Halothane	50	29.6
Halothane and Ketamine	2	1.2
Halothane and Propofol	3	1.8
Isoflurane	84	49.7
Isoflurane, Propofol and Ketamine	2	1.2
TIVA with Propofol	2	1.2
Duration of Surgery minute		
<60	94	50.8
>60	91	49.2
Intraoperative amount fluid ml/kg/hr		
≤10	137	74.1
>10	48	25.9
Intraoperative analgesia used		

Fentanyl	97	52.4
Fentanyl, Morphine and PCM	2	1.1
Fentanyl, PCM	42	22.7
Morphine	1	.5
Morphine, PCM	7	3.8
Morphine, PCM and Fentanyl	7	3.8
PCM	29	15.7
There any complication during surgery		
Yes	19	10.3
No	166	89.7

The **Chart 2** Distribution of Surgeries among Study Participants below illustrates the distribution of different types of surgeries among the study participants. Ophthalmologic surgeries were the most common, accounting for 60 cases (32.1%), followed by urological surgeries with 45 cases (24.1%). Orthopedic surgeries represented 28 cases (15.0%), while gastrointestinal (GI) surgeries accounted for 19 cases (10.2%). Cardiothoracic surgeries were reported in 17 participants (9.1%). Less common procedures included ENT (ear, nose, and throat) surgeries with 7 cases (3.7%), plastic/maxillofacial surgeries with 5 cases (2.7%), and other types of surgeries with 4 cases (2.1%). Overall, ophthalmologic and urological procedures were the most prevalent among the participants.

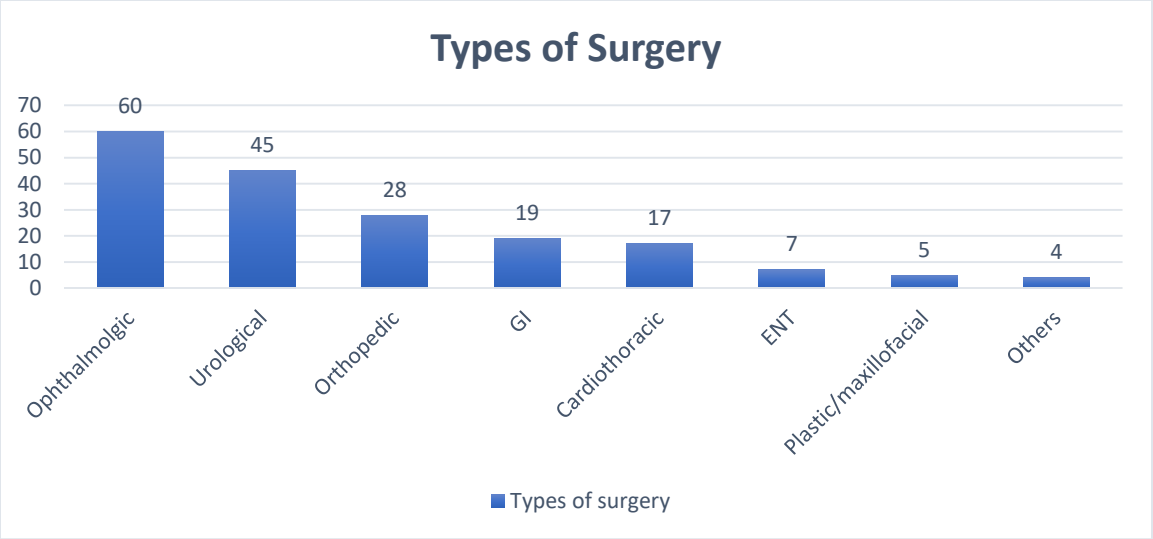


Chart 2 Distribution of Surgeries among Study Participants

5.4 Postoperative related characteristics of study participants

The study found that the incidence of postoperative vomiting among pediatric elective surgical patients was 23%, as illustrated in **Chart 3** Incidence of Postoperative Vomiting. The majority (69%) experienced two or fewer episodes and 31% experienced more than two. Most episodes of vomiting (83.3%) occurred within the first 6 hours after surgery, while 16.7% occurred between 7 to 24 hours. Despite the occurrence of POV, only 2.2% of patients received antiemetic medication, with the vast majority (97.8%) not given any. Among the few who were treated, Dexamethasone and Ondansetron were used equally. In terms of recovery, the time it took for children to resume eating or drinking varied: 4.3% did so within 2 hours, 36.2% within 2 to 4 hours, 35.1% within 4 to 6 hours, and 24.3% after more than 6 hours.

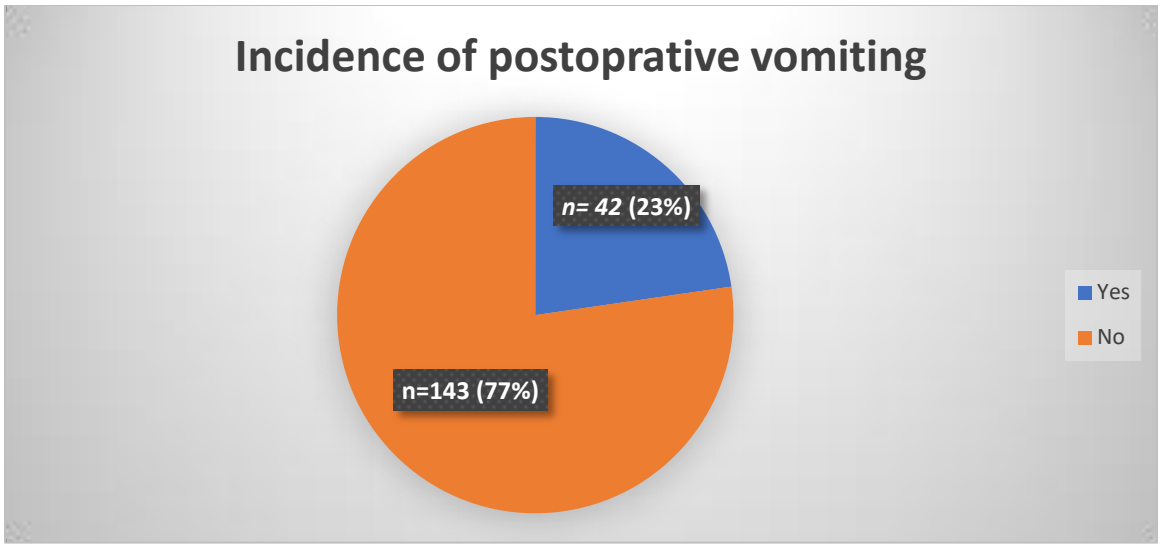


Chart 3 Incidence of Postoperative Vomiting

Table 4 Postoperative related characteristics of participants

Variable	Frequency	Percent
Episodes of vomiting (n=42)		
≤2	29	69
>2	13	31
Time of postop vomiting (n=42)		
0-6hours	35	83.3
7-24 hours	7	16.7
Medication given for postoperatively		
Yes	4	2.2
No	181	97.8
Types of medication (n=4)		
Dexamethasone	2	50
Ondansetron	2	50
Time of the child able to start eating drinking after surgery in hr		

<2	8	4.3
2-4	67	36.2
4-6	65	35.1
>6	45	24.3

5.6 Regression analysis of the determinant factors of postoperative vomiting in pediatric surgical patients

A logistic regression analysis was conducted to identify factors associated with POV among pediatric elective surgical patients at Minilik II Comprehensive Referral Hospital and Tikur Ambessa Specialized Hospital. In the bivariate analysis, several variables showed significant associations with POV, including female sex, higher ASA classification (II and III), experience of motion sickness,presence of chronic medical conditions, intraoperative complications, lack of premedication for POV, duration of surgery greater than 60min.

In the multivariate logistic regression analysis, several factors remained significantly associated with POV:

- **ASA class II–III** was significantly associated with a 3.9-fold increase in the odds of developing POV compared to ASA class I patients (AOR = 3.9, 95% CI: 2.14–11.65, p = 0.043).
- **Presence of chronic medical conditions** was associated with a 6.1-fold increase in the odds of POV (AOR = 6.1, 95% CI: 2.82–44.85, p = 0.048).
- **Lack of premedication for POV** significantly increased the odds of POV by nearly four times (AOR = 3.9, 95% CI: 1.24–12.41, p = 0.020).
- **Duration of surgery greater than 60 minutes** was strongly associated with increased risk, showing 13.6 times higher odds of POV compared to surgeries less than 60 minutes (AOR = 13.6, 95% CI: 7.14–36.43, p = 0.001).
- **Intraoperative complications** were also an independent risk factor, increasing the odds of POV by approximately 10.7 times (AOR = 10.7, 95% CI: 2.28–50.46, p = 0.003).

Although female sex and history of motion sickness were significant in the bivariate analysis, they were not statistically significant in the multivariate model.

Table 5 Bivariate and Multivariate Logistic Regression Analysis of Factors Associated with Postoperative Vomiting Among Pediatric Elective Surgical Patients at MIICRH and TASH

Variable	POV		p-value	COR with 95%CI	P-value	AOR with 95%CI
	Yes	No				
Sex						
Female	28	48	0.000	3.9(1.91, 8.21)	0.103	2.7(0.82, 8.98)
Male	14	95	1		1	
ASA class						
ASA I	24	117	1		1	
ASAII-III	18	26	0.001	3.4(1.60, 7.11)	0.043	3.9(2.14, 11.65)
Experience motion sickness						
Yes	6	8	0.001	3.7(1.75, 7.89)	0.067	4.3(0.90, 20.88)
No	36	135	1		1	
Chronic medical condition						
Yes	12	12	0.001	4.5(1.79, 10.67)	0.048	**6.1(2.82, 44.85)**
No	30	131	1		1	
Premedicated for POV						
Yes	17	92	1		1	
no	25	51	0.007	2.7(1.31, 5.37)	0.020	**3.9(1.24, 12.41)**
Duration of surgery in minute						
<60	5	89	1		1	
>60	37	54	0.000	12.2(4.52, 32.93)	0.001	**13.6(7.14, 36.43)**
Complication during surgery						
Yes	12	7	0.000	7.8(2.82, 21.39)	0.003	**10.7(2.28, 50.46)**
no	30	136	1		1	

6. Discussion

This study found that the incidence of postoperative vomiting among pediatric elective surgical patients was 23%, the majority 69% experienced two or fewer episodes and 31% experienced more than two. Most episodes of vomiting (83.3%) occurred within the first 6 hours after surgery, while 16.7% occurred between 7 to 24 hours.

The incidence reported in this study is higher compared to other studies. For instance, a study conducted at Gondar University Hospital in Ethiopia, which involved 187 children undergoing ophthalmic procedures, reported a POV incidence of 19.9% (11). The higher incidence observed in the present study may be attributed to the lower use of antiemetic prophylaxis, which only 58.9% of patients received it, compared to 89.2% in the Gondar study. Additionally, the duration of surgery was longer in the present study, with nearly half (49.2%) of the procedures lasting more than 60 minutes, whereas only 15.4% exceeded 30 minutes in the Gondar study. Similarly, a study conducted at the University Hospital of Tours, focusing on pediatric digestive and plastic surgery departments, found a lower incidence of 9.4%. This reduced rate could be due to the uniformity of surgeries performed in that group (12). On the other hand, a similar study conducted at the Medical University Hospital of Graz in Austria reported a comparable incidence rate of 21.9%.

Previous studies have identified a variety of determinant factors for POV in pediatric surgical patients, including: patient, anesthesia, and surgical related factors. In the present study, among the patient-related factors, ASA class II-III showed a strong association with POV **(AOR=3.9, 95% CI: 2.14, 11.65)**. This indicates that children classified as ASA class II-III were 3.9 times more likely to experience postoperative vomiting compared to those classified as ASA I. However, this finding contrasts with a study conducted at the Medical University Hospital of Graz in Austria, which found no significant association between ASA classification and POV (2).

Premedication has been shown to have a strong protective effect against postoperative vomiting (POV). Patients who did not receive premedication were 3.9 times more likely to experience POV compared to those who received it **(AOR = 3.9, 95% CI: 1.24–12.41).** Similar findings have been reported in multiple studies conducted globally (24, 25), further supporting this result.

These findings reinforce the idea that antiemetic premedication in children significantly reduces the risk of POV.

The duration of surgery is a significant factor influencing the risk of POV. Longer procedures are associated with a higher incidence of POV, likely due to extended exposure to anesthetic agents and increased physiological stress. This study also found that children undergoing surgeries lasting more than 60 minutes were 13.6 times more likely to develop POV compared to those with procedures under 60 minutes **(AOR = 13.6, 95% CI: 7.14–36.43).** Similarly, a study conducted at Toronto Hospital involving 17,638 participants demonstrated a direct correlation between the duration of anesthesia and the incidence of POV(15).

7. Strength and limitation of the study

7.1 Strength of the study

- ✓ **Multicenter Study**: The inclusion of two major referral hospitals enhances the study's validity by exposing to a broader range of pediatric surgeries. The study assesses the impact of POV across more than six types of surgeries and includes a diverse patient demographic, ranging from neonates to adolescents.
- ✓ This study evaluates a wide range of clinically relevant variables, offering a comprehensive assessment of POV risk factors.
- ✓ The significant risk factors identified (**ASA III classification, absence of premedication, and surgery duration longer than 60 minutes)** are consistent with findings in existing literature, further supporting the study's credibility.
- ✓ Although the pediatric population is known to be at high risk for POV, it remains one of the most understudied groups. This study helps to address that important gap in research.

7.2 Limitation of the study

- ✓ Although the study has a multicenter design, both hospitals are located in Addis Ababa, which limits the generalizability of the findings to settings with different surgical or anesthesia protocols. Additionally, it restricts representation of populations from other regions of Ethiopia with varying socioeconomic backgrounds.
- ✓ The total number of participants in the study (185) is adequate for addressing the main research questions. However, certain subgroups such as: patients classified as ASA III, those with a history of POV, and those undergoing ENT or maxillofacial surgery were underrepresented. The uneven distribution across different surgical procedures and the small sample sizes within these subgroups limit the ability to draw reliable conclusions.This is reflected in the wide confidence intervals observed for certain variables in the study.
- ✓ This study did not include long-term follow-up to assess delayed POV occurring after 24 hours.
- ✓ This study included only pediatric patients undergoing elective surgeries and excluded those undergoing emergency surgical procedures.

8 Conclusion and Recommendation

8.1 Conclusion

This study found that the incidence of POV among pediatric patients undergoing elective surgeries was relatively high at 23%, with the majority of episodes occurring within the first 6 hours after surgery. Key risk factors significantly associated with POV included **ASA class III status, absence of premedication, and surgery duration longer than 60 minutes**. These findings align with existing literature, reinforcing their clinical relevance. The study highlights the importance of identifying and effectively managing these risk factors in pediatric surgical patients. Implementing standardized premedication protocols may help reduce the incidence of POV. Future research involving larger, more diverse populations and longer follow-up periods is recommended to validate and build upon these results.

8.2 Recommendations for Future Research

- ✓ Based on the findings of this study, it is recommended to administer antiemetic prophylaxis for high-risk cases, such as those with ASA class III status or surgeries lasting more than 60 minutes. Additionally, it is advisable to develop and implement institution-based protocols for POV prophylaxis and management.
- ✓ Larger multicenter cohorts across diverse institutions and regions are needed, as larger sample sizes will help reach more reliable conclusions. Small sample sizes in variables can make statistical analysis unstable, potentially leading to misleading results.
- ✓ Incorporating long term follow up to assess delayed PONV is important, as it provides insight into its incidence and impact, and ideally supports the development of a proper, protocolized management approach.
- ✓ Encourage the documentation of POV as part of the preanesthetic evaluation and as an element of postoperative follow-up in pediatric patients.

DECLARATION OF THE PRINCIPAL INVESTIGATOR

The undersigned agrees to accept responsibility for the scientific ethical and technical conduct of the research project and for provision of required progress reports as per terms and conditions of the Department and College, in effect at the time of grant is forwarded as the result of this application. Name of the student:

_____ Date. _____

Signature _____ APPROVAL OF THE FIRST ADVISOR Name of the first advisor: _____ Date.

_____ Signature _____

APPROVAL OF THE SECOND ADVISOR Name of the second advisor: _____ Date. _____ Signature _____

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Annex 1: Subject information sheet

Addis Ababa University, School of medicine, Department of Anesthesiology critical care and pain medicine

Subject information sheet

Hello, my name is ----------, I am here in behalf of Dr. Abenzer Amha a student in Addis Ababa University School of medicine department of anesthesiology of critical care and pain medicine. He is conducting a research on "Incidence and Factors Associated with Postoperative Vomiting in Pediatric Elective Surgical Patients at Minilik II Comprehensive Referral Hospital and Tikur Ambessa Specialized Hospital, Addis Ababa, Ethiopia, 2024/2025 G.C". He has received permission from Addis Ababa University School of medicine and Tikur Anbessa Specialized Hospital officials to conduct the study.

You are being asked to participate in this study because you are scheduled for elective surgery at Tikur Anbessa or Minilik II Comprehensive Specialized Hospital. Your participation is completely voluntary. You can decide not to take part in the study, and if you do choose to participate, you may stop at any time without providing a reason, and there will be no negative consequences.

While there are no direct benefits to you from taking part in this study, the information collected may help future policymakers, health program developers, and researchers to focus on important issues and create better treatment options.

Any information you provide will be kept confidential. We will use code numbers instead of names to protect your privacy, and the data will be securely stored. Only the study team will have access to the uncoded data, and it will be used exclusively for this study.

Your participation is crucial to the success of this research. If you have any questions or need more information, you can use the provided contact details to get in touch with us.

Name: Dr. Abenzer Amha Tel- +251-921237807 Email- tegegneworkabenzer@gmail.com

Annex 2: Questionnaire

Questionnaire ID-

Date of data collection:

Addis Ababa University College of Health Sciences

Department of Anesthesiology, Critical care and Pain medicine

Section I: Socio-demographic

1. **Age** (in completed years): _____
2. **Sex**:
   - A. Male
   - B. Female
3. **Hospital**:

   A. Tikur Ambessa Specialized Hospital

   B. Minilik II Comprehensive Referral Hospital

Section II: Medical History

1. **ASA Classification: _____**
2. **Has the patient had previous surgery?**

   A. Yes

   B. No
3. **If Yes to question 2, did the patient experience POV previously?**

   A. Yes

   B. No
4. **Has the patient <u>EVER</u> experienced motion sickness?**

   A. Yes

B. No

5. **Did the patient receive opioids within the last 24 hours before surgery?**

   A. Yes (Specify type: _____

   B. No

6. **Does the patient have any other medical conditions?**

   A. Yes

   B. No

7. **If Yes to question 6, what medical conditions?**

   A. Diabetes Mellitus

   B. Hypertension

   C. Heart Failure

   D. Asthma

   E. Other (Specify: _____

Section III: Intraoperative Characteristics

1. **Was the patient premedicated for POV?**

   A. Yes

   B. No

2. **If Yes to question 1, what type of medication was given? _____**

3. **Type of Anesthesia: (circle all that apply)**

   A. General Anesthesia (GA) with LMA

   B. General Anesthesia (GA) with ETT

C. Regional/Neuraxial Anesthesia

4. Induction agent used: (check all that apply)

A. Propofol C. Ketamine

B. Fentanyl D. Other (Specify)

5. Anesthesia maintained with

A. Inhalational Anesthesia (specify agent):_____

B. TIVA (specify agent used):_____

C. Both inhalational and IV Anesthetics (specify agent):_____

6. Type of Surgery: Please write the specific type of surgery

A. Abdominal Surgery

B. Gynecological

C. Urological

D. Cardiothoracic Surgery

E. Ophthalmologic

F. Orthopedic

G. Other

7. Duration of Surgery:

A. Less than 60 min

B. Greater than 60 min

8. Total amount of fluid given intra-operatively (in ml/kg/hr)

A. Less than 10 ml/kg/hr B. Greater than 10ml/kg/hr

9. **Intraoperative analgesia (Specify drug): _____**

10. **Where there any complication during surgery?**

    A. Yes

    B. No

Section III: Postoperative Characteristics

1. **Did the patient experience postoperative vomiting (POV)?**

    A. Yes

    B. No.

2. **If Yes to question 1:**

    2.1. How many episodes of **VOMITING** did the child have? (Specify):

    _____

    2.2. When did the post op vomiting occur?

    A. 0-6 hours after surgery B. 7 to 24 hours after surgery

3. **Was any medication given to treat Vomiting Postoperatively?**

    A. Yes

    B. No

4. **If yes to Question number 3, type of medication given:**

    _____

5. **At what time was the child able to start eating or drinking after surgery?**

    A. Less than 2 hours after surgery

    B. 2-4 hours after surgery

    C. 4-6 hours after surgery

    D. More than 6 hours after surgery