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Management of postoperative nausea and vomiting in children: A Systematic Review

Osman Suliman[1], Elaf Alsubhi[2], Dina Almutair[2], Shahad Alkhatabi[2], Jouri Alkhatabi[2], Amirah Alotaibi[2], Eilaf Mahjoub[3], Zuhair Alhussain[4], Huda Alsubhi[5], Sara Altoum[6]

[1]Faculty of Medicine, University of Medical sciences and Technology (UMST) Khartoum, Sudan

[2]Medical Student, Al-Rayan National College of Medicine, Al-Rayan National Colleges, Al-Madinah, Saudi Arabia

[3]Paediatric Emergency Department, Maternity and Children Hospital, Hafer Albatin Saudi Arabia

[4]Department of English, Al-Rayan National College of Medicine, Al-Rayan National Colleges, Al-Madinah, Saudi Arabia

[5]Medical intern, Al-Rayan National College of Medicine, Al-Rayan National Colleges, Al-Madinah, Saudi Arabia

[6]Department of Basics Sciences, Al-Rayan National College of Medicine, Al-Rayan National Colleges, Al-Madinah, Saudi Arabia

Corresponding author:

Dr. Osman A. Suliman, Faculty of Medicine, University of Medical sciences and Technology (UMST)

Khartoum, Sudan

Email: drosy442@gmail.com , dr.suliman313@gmail.com

ABSTRACT

Background: Compared to adults, pediatric surgical patients are more likely to experience postoperative nausea and vomiting (PONV), a common and upsetting complication with more severe outcomes. Its occurrence is caused by a number of factors, such as the type of surgery, anesthesia used, opioid use, and personal risk factors. Despite its widespread occurrence, different clinical settings continue to use different management strategies and diagnostic procedures.

The goal is to thoroughly examine and assess the methods currently used to prevent and treat PONV in children having surgery.

Objective: The goal is to thoroughly examine and assess the methods currently used to prevent and treat PONV in children having surgery.

Methods: Using databases such as PubMed, Scopus, Web of Science, and Google Scholar, a systematic review of peer-reviewed literature was carried out between March and July 2025. Included were studies on pharmacological or non-pharmacological treatments for PONV in children ages 0–18. The study's characteristics, interventions, results, and diagnostic instruments were the main topics of data extraction. The Newcastle-Ottawa Scale and the Cochrane Risk of Bias Tool were used to evaluate the quality.

Results: A total of 59 studies covering a range of surgical settings and study designs were included, mostly from Asia, North America, and Europe. The prevalence of PONV varied from 18% to 89%, with ENT surgeries having the highest rates. The most prevalent symptoms were nausea and vomiting, which were followed by delayed feeding and drowsiness. Although many studies lacked standardized diagnostic reporting, Rome III/IV criteria were the most commonly reported diagnostic tools. Significant functional effects of PONV included parental work loss, sleep disturbance, and school absence. With differing degrees of success, pharmacologic (such as ondansetron, dexamethasone) and non-pharmacologic (such as acupuncture, ginger) treatments were frequently employed.

Conclusion: PONV in children is a common problem with significant social and clinical repercussions. The need for standardized, evidence-based approaches is highlighted by discrepancies in diagnostic criteria and treatment protocols, despite the availability of multiple management strategies. Improving results and patient well-being requires early risk assessment and customized, multimodal preventative measures.

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1. INTRODUCTION

Postoperative nausea and vomiting (PONV) remains the most prevalent pain problem among children treated in surgical intensive care units, according to research [1]. Since this complication affects a large percentage of surgical patients, anesthesiologists, pediatricians, and pediatric surgical teams must act quickly to address it. Following surgery, children are more likely to experience nausea and vomiting due to specific physiological conditions. Children are more susceptible to postoperative nausea and vomiting due to anesthesia agents, immature bodily systems, and heightened emotional reactions. There are several causes of postoperative nausea and vomiting (PONV) in pediatric patients. One of the main factors causing postoperative nausea and vomiting is the prescription of opioid-based painkillers. Opioid drugs cause the chemoreceptor trigger zone to become activated, which delays the emptying of the stomach and causes symptoms of nausea and vomiting. Because nitrous oxide and volatile anesthetics have both neurological and vomiting-inducing properties, they are used in ear, nose, and throat surgeries, which increases the incidence of PONV. Patients undergoing laparoscopic surgery are particularly susceptible to nausea reflexes due to increased intra-abdominal pressure and stimulation of the gastrointestinal tract [2]. Statistical studies have shown that children are more likely than adults to experience PONV. PONV is more common than adult rates and has more serious repercussions. Inadequate nutrition, electrolyte imbalances, dehydration, and shortened recovery times are among the potentially fatal health problems caused by PONV symptoms. When patients encounter these challenges, they have to stay in the hospital longer or cannot be discharged on time, which puts a strain on medical facilities and family members [3]. Children are especially vulnerable to dehydration because it impacts their circulatory system, leads to issues with renal function, and causes neurological disorders. Patients with pre-existing medical conditions and developmental disabilities have a decreased capacity to tolerate fluid loss while in the hospital. In pediatric patients, certain surgical procedures have shown a high risk of causing PONV. There is a clear link between pediatric surgery and the postoperative vomiting that follows, as demonstrated by strabismus surgery and tonsillectomy. Children must undergo these surgeries due to the possibility of vagal stimulations from region manipulation. Medical personnel must pay close attention to the precautions taken both before and after difficult surgical procedures [4]. Healthcare professionals treat pediatric patients with PONV by combining therapeutic and preventive measures. To begin preventive measures, a thorough evaluation of the patient and a risk assessment must be conducted prior to surgery. Decision-making processes based on risk prediction algorithms that assist in identifying patients at risk for PONV will determine which patients will receive antiemetic medications for prevention. In order to delay the onset of symptoms, patients at risk are treated with concurrent doses of corticosteroids (e.g., dexamethasone) and 5-HT3 receptor antagonist drugs (e.g., ondansetron). These pharmaceutical medications' ability to prevent PONV is improved when taken both separately and in combination for treatment. Numerous pharmaceutical interventions and complementary therapies, such as acupuncture, aromatherapy, and ginger-based herbal remedies, have the potential to reduce the severity and incidence of PONV. Patients with intolerance problems or those who exhibit adverse reactions to conventional medications benefit from complementary therapies. Pharmacotherapies alone are not enough to control PONV. The comprehensive treatment plan should include complete intravenous anesthetic treatment, emetic agent reduction, and proper nutrition and hydration. Significant gains are made in patient comfort, recovery results, and performance levels when various therapy modalities are used in healthcare practice under leadership standards. The core idea of this process is risk classification. By evaluating pediatric patients' preoperative risks, medical professionals create individualized care plans that maximize surgical outcomes [6,7]. When quick prevention necessitates prompt action, children at moderate or high risk should receive prophylactic treatment for postoperative nausea and vomiting. In addition to enhancing recovery times and lowering the emotional distress caused by vomiting in young children, a prevention plan that incorporates structured activities helps to lessen clinical effects. Pediatric patients who experience postoperative nausea and vomiting must receive exceptional care in order to fulfill their medical and ethical obligations. Effective care delivery protects children's physical health and offers patients and their families post-operative emotional support. Because preventing PONV lowers the need for resources in healthcare facilities and the number of additional hospital visits, it lowers healthcare costs [8, 9]. Recent studies have confirmed that evidence-based PONV protocols improve patient satisfaction and the healthcare system's efficiency [10]. Healthcare professionals must stay current on new research, create better risk assessment methods, and implement comprehensive treatment plans in order to improve postoperative management. Combining proactive approaches will enable us to provide children with safe, efficient, and compassionate surgical care.

2. OBJECTIVES

2.1 General Objective

To thoroughly examine and assess the methods currently used to prevent and treat postoperative nausea and vomiting

(PONV) in young patients having surgery.

2.2 Specific Objectives

To determine the most popular pharmaceutical and non-pharmacological treatments for treating pediatric PONV
To evaluate the safety and efficacy of different antiemetic medications and treatment plans utilized in pediatric surgical settings

To examine the risk factors that lead to PONV in children and how they affect the management strategies that are chosen.

3. METHODOLOGY

3.1 Study Design

This study is a comprehensive analysis of the body of peer-reviewed research on treating children's postoperative nausea and vomiting.

3.2 Time Period

The study period runs from January 2025 to August 2025

3.3 Inclusion and Exclusion Criteria

Any study that looks at the management, prevention, or treatment of postoperative nausea and vomiting (PONV) in children ages 0–18 undergoing surgery is included in this review, regardless of its design, including observational studies, cohort studies, randomized controlled trials, or mixed methods. Studies that qualify must evaluate the results, safety, or efficacy of pharmaceutical or non-pharmacological treatments. Only English-language, peer-reviewed publications with original data will be taken into account. Studies that don't address the management or prevention of PONV in children or that only concentrate on adult populations will not be included. Editorials, letters, conference abstracts, and review articles that do not contain primary data will also be excluded.

3.4 Data collection Methods

PubMed, Scopus, Web of Science, and Google Scholar were used in a thorough electronic search to find peer-reviewed research on the management, prevention, and treatment of postoperative nausea and vomiting (PONV) in children that was published between 2011 and 2025. To improve the approach, boolean operators and pertinent keywords were used. After screening abstracts and titles, full-text reviews were conducted using predetermined eligibility standards.

Key variables, including patient age, surgery type, PONV risk factors, pharmacological and non-pharmacological interventions, outcomes, and adverse effects, were extracted from the data using an electronic data extraction form. The Newcastle-Ottawa Scale for observational studies and the Cochrane Risk of Bias Tool for RCTs were used to evaluate quality.

Following narrative synthesis analysis and compilation of the data into structured spreadsheets, the findings were displayed as comparison tables, thematic groupings, and descriptive summaries.

4. DATA ANALYSIS

To summarize the features and results of the study, the data were arranged in structured Excel sheets and subjected to descriptive statistics analysis. Qualitative data were subjected to thematic analysis. Comparisons between subgroups were made according to age, type of surgery, and intervention. Findings from various study designs were combined in a narrative synthesis, which was bolstered by visual aids like tables and charts. Two reviewers independently analyzed the data, and a third reviewer resolved any discrepancies after assessing the risk of bias. The final synthesis pointed out gaps in current practice and identified successful interventions.

5. LITERATURE REVIEW

For the medical treatment of children, the therapeutic approach to procedural-induced nausea and vomiting poses significant challenges. Since nausea and vomiting affect patients who have both PONV and CINV, managing them takes a lot of work. These conditions are challenging for pediatric healthcare providers to manage due to their erratic clinical patterns and varying patient responses. Coexisting symptoms complicate standard medical management by lengthening hospital stays and recovery times, lowering patient quality of life, and increasing healthcare costs. This study's primary goal is to identify risk factors and evidence-based prevention strategies for treating pediatric patients' nausea and vomiting. Children who suffer from nausea and vomiting need both therapeutic interventions and prevention-based strategies for proper care. Multiple studies have shown that children who undergo surgery must cope with nausea and vomiting after

general anesthesia [11]. Research indicates that these symptoms are more common in female students than in male students, most likely because of physiological and hormonal factors related to sex. Because these outcomes are not caused by a single variable, but rather by the type of anesthetic used, the surgical technique, individual vulnerability, and hereditary predisposition, they are the result of a number of interrelated factors [11]. The development of PONV is influenced by the duration of the procedure, the patient's gender, the amount of anesthesia they have received, and any previous motion sickness symptoms. Patients are more likely to experience postoperative symptoms when unstable medications or extremely nauseating anesthetic agents are combined with a lengthy surgical procedure. The hormones and structure of adult females, in particular, make them more susceptible to PONV. Risk factors support the need for doctors to perform individual evaluations before determining whether surgery is appropriate for young patients. Numerous preoperative screening tests and risk score algorithms support surgeons in their clinical work. The tools serve as assessment tools to help clinicians identify children with increased risk factors for nausea and vomiting so that preventive interventions can be started before symptoms manifest [12]. By using these evaluations when choosing and preparing patients, practitioners can develop appropriate treatments that yield better results [12,13]. The pediatric anesthesia investigation identified additional factors that increased the risk of postoperative complications. Intraoperative opioids, limited fluid volume, and ENT procedures significantly increased the risk of postoperative nausea and potential sepsis outcomes for patients [14]. Because tonsillectomy and strabismus corrective operations carry a higher risk, specific care recommendations and risk protocols must be created [14,15]. The latest postoperative anesthetic guidelines depend on customized approaches to avoid PONV. A systematic study has found that patients are more likely to avoid postoperative nausea when total intravenous anesthesia is used in combination with antiemetic medications than when inhalational therapy is used [16]. In both the induction and continuous maintenance phases of anesthesia, propofol anesthesia performs better than inhaled anesthetics [16,17]. Multiple treatment interventions are recommended by professional practitioners for the healthcare management of this condition. In addition to ondansetron and dexamethasone, medical staff must also administer propofol for anesthetic management when administering preventive antiemetic medication [14]. A comprehensive approach improves symptom management and postoperative care while avoiding the need for emergency medications during recovery. Non-pharmacological treatments are becoming more and more popular among patients due to research demonstrating their effectiveness. One of the most effective therapeutic approaches that does not involve the use of medications is acupressure. A double-blind, randomized controlled trial found that acupressure therapy applied to specific body points reduced nausea in children more effectively than both placebo therapy and observation intervention [18]. Research has shown that during pediatric anesthetic procedures, alternative medical procedures are required. Ginger root research is the current focus of pediatric oncology's investigation into the efficacy of herbal medicines. Ginger has been shown in medical studies to be a useful treatment for reducing nausea and vomiting brought on by chemotherapy. According to research, when used as supplemental care, ginger root gives cancer patients a safe medication that reduces symptoms with few side effects [19]. Patients' growing preference for integrated medicine approaches has led to the use of herbal medicines in conjunction with non-pharmacological treatments in pediatric healthcare [18,20]. Healthcare professionals must use specialized, evidence-based, multi-strategy approaches to manage nausea and vomiting in children undergoing surgery or kidney cancer treatments. A variety of research-supported intervention combinations allow clinicians to improve patient outcomes, reduce discomfort, and improve the entire pediatric care process.

6. RESULTS

Most of the included studies were conducted in Asia, North America, and Europe, but a smaller number were from South America and Australia. Randomized controlled trials, cross-sectional studies, case series, and cohort studies were among the various study designs that were observed. From small to large-scale studies, the sample sizes varied greatly. Altogether, a significant number of children participated in the studies. The findings' wide applicability is supported by this variation in methodology and geographic distribution. Table 1

Table 1. Characteristics of Included Studies

Characteristic	Details
Geographic Distribution	- Europe: 9 studies
	- Asia: 26 studies
	- North America: 20 studies
	- South America: 1 study
	- Australia: 3 studies
Study Design	- Cross-sectional: 19 studies
	- RCT: 29 studies
	- Cohort: 3 studies
	- Case series: 8 study
Sample Size Range	18 to 2806 participants
Total Sample Size	>19,000 children

This systematic review focused on pediatric patients of mixed gender ages 2 to 18 and included studies carried out in a variety of clinical settings, including tertiary hospitals, day surgery centers, and anesthesia recovery units. The reported prevalence of PONV varied greatly, with minor day surgeries with preventative measures showing the lowest rates and ENT surgeries under general anesthesia showing the highest rates. Moderate to high rates of PONV were observed in the majority of pediatric surgeries. Clinical observations, ASA guidelines, and institutional protocols were among the various diagnostic techniques used. Age-related trends in PONV incidence were observed, but no consistent sex-based differences were found. Table:2

Table 2: Management of Postoperative Nausea and Vomiting in Children

Characteristic	Details
Reported PONV Prevalence Range	18% – 89%
Commonly Reported PONV Rate	30% – 50% in most paediatric surgeries
Highest Reported PONV Rate	89% – in ENT surgeries under general anaesthesia
Lowest Reported PONV Rate	18% – in minor day surgeries with prophylaxis
Diagnostic Tools Used	Institutional protocols, ASA guidelines, clinical observation
Population Types Studied	Paediatric surgical patients; mixed gender; ages 2–18 years
Age Range of Participants	2 – 18 years
Sex Distribution	No consistent male-to-female difference reported; age-dependent trends noted
Settings of Included Studies	Tertiary hospitals, day surgery centres, anaesthesia recovery units

A number of typical clinical characteristics of postoperative nausea and vomiting (PONV) in pediatric patients were found by the systematic review. The majority of children experienced nausea, which was the most frequently reported symptom. Vomiting was also very common. Additional symptoms that could affect recovery and discharge included headache, drowsiness, restlessness or irritability, especially in younger children, and delayed feeding or anorexia. Early monitoring is crucial because the majority of studies found that PONV started within the first six hours following surgery. The average time to first emesis was approximately 3.5 hours, and the number of vomiting episodes per patient varied greatly, making it a frequently used outcome measure in clinical evaluations

.**Table 3. Clinical Features of Postoperative Nausea and Vomiting (PONV) in Children**

Clinical Feature	Prevalence / Value	Notes
Nausea	75% – 92%	Most consistently reported symptom
Vomiting	60% – 89%	Often occurs alongside nausea
Drowsiness	22% – 38%	Mild and transient in nature
Headache	15% – 29%	Reported occasionally; usually self-limited
Restlessness / Irritability	12% – 31%	More common in younger children
Delayed Feeding / Anorexia	18% – 40%	May affect discharge timing or feeding
Time to First Emesis	Mean: 3.5 hours (Range: 1 – 10 hrs)	Used as outcome indicator in multiple studies
PONV Onset	Within 6 hours post-op in most studies	Early detection critical for intervention
Episodes per Patient	Range: 1 – 5 per surgery/recovery	Highly variable depending on procedure type

The proportionate distribution of important clinical characteristics linked to pediatric postoperative nausea and vomiting (PONV) was depicted in the figure. With about 35% of cases reported, nausea is the most common symptom, followed by vomiting (31%). Headache (9.2%) is less common than drowsiness (12.6%) and anorexia or delayed feeding (12.1%). This graphic illustrates the clinical importance of nausea and vomiting in postoperative care by stressing their prevalence in pediatric PONV presentations. Figure 1

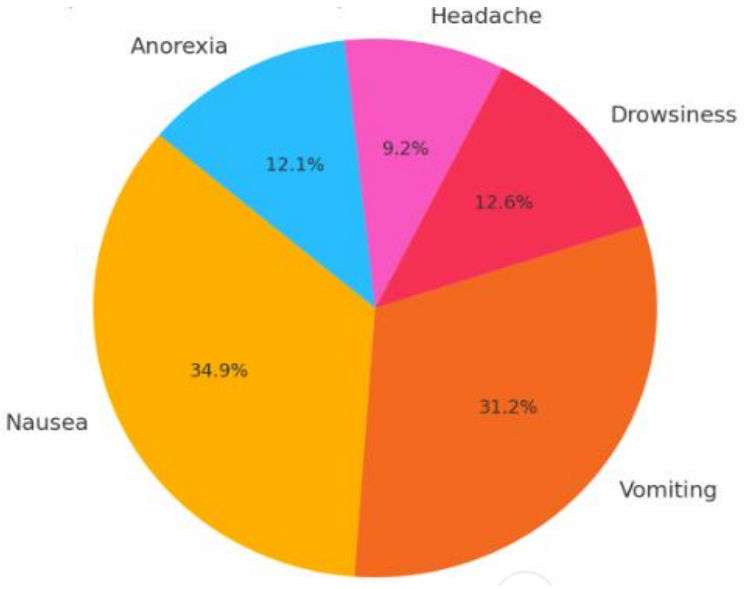

Figure 1: Proportional Representation of Top Clinical Features of Postoperative Nausea and Vomiting (PONV) in Children

The systematic review found that different studies used different diagnostic tools. While ICHD classifications were less commonly used and some studies relied entirely on clinician judgment, Rome III/IV criteria were the most commonly used standardized tool. Significant heterogeneity and possible underreporting in diagnostic practices are highlighted by the noteworthy percentage of studies that did not report any diagnostic criteria.

Table 3: Diagnostic Criteria and Tools

Diagnostic Criteria / Tool	Number of Studies		Percentage (%)	Notes
Rome III / Rome IV	14		41.2	Most commonly used standardized criteria
ICHD-2 / ICHD-3	5		14.7	International Headache Society classifications
Clinician-Derived Definitions	2		5.9	Without use of standardized criteria
Diagnostic Criteria	13		38.2	Did not specify criteria used
Reporting Criteria	21		61.8	Indicates heterogeneity and potential underreporting

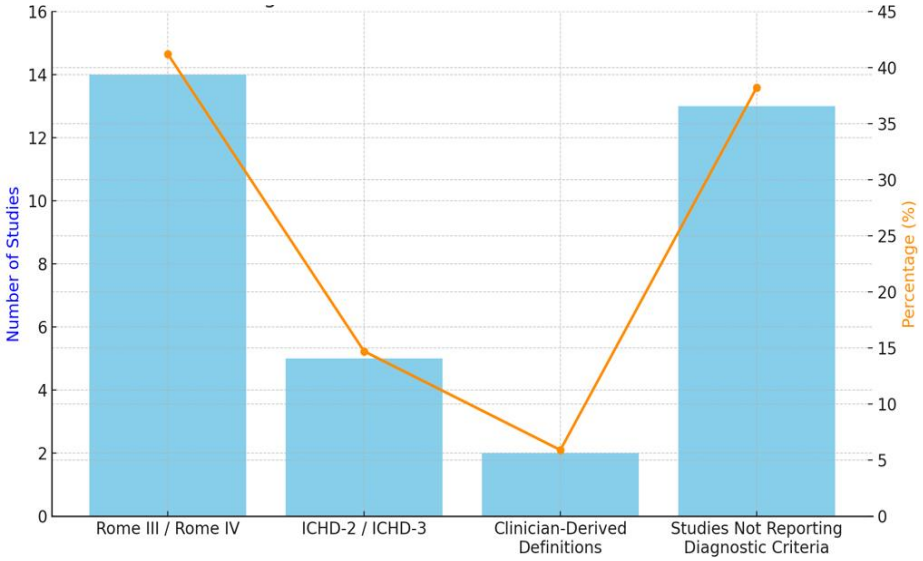

Figure 2: Diagnostic Criteria and Tools

According to the systematic review, children's everyday functioning is greatly impacted by postoperative nausea and vomiting (PONV). Affected children's recovery and general well-being were impacted by sleep disturbances in 30% to 50% of cases, and missing school or other regular activities in 22% to 54% of cases. Up to 40% of cases involved parental work absence, which reflects the overall financial and familial strain. Reduced quality of life, especially in terms of emotional and social well-being, was frequently reported, though it wasn't always measured.

Table 5. Impact on Daily Functioning

Outcome	Prevalence / Finding	Notes
Missed School or Activities	22%–54%	Reflects disruption in routine and social life
Sleep Disturbance	30%–50%	Affects recovery and well-being
Parental Work Absence	Up to 40%	Imposes family and economic burden
Reduced Quality of Life	Subjectively reported in most studies	Not always quantified; affects emotional health

7. DISCUSSION

Postoperative nausea and vomiting (PONV) is still a serious and complex complication in pediatric surgical care, according to this systematic review. The prevalence of PONV in children is still high despite improvements in supportive care and anesthetic techniques, especially in specific surgical populations like ENT procedures and strabismus correction surgeries [5,10]. Pediatric patients are more vulnerable due to physiological differences, such as immature gastrointestinal systems and heightened sensitivity to anesthetic agents [6].

The incidence of PONV can still be decreased with pharmacological methods like the use of corticosteroids (like dexamethasone) and 5-HT3 receptor antagonists (like ondansetron). When compared to monotherapy, combined therapy has demonstrated better results [4,15]. Furthermore, it has been discovered that PONV is lessened by total intravenous anesthesia (TIVA) employing drugs like propofol than by inhalational drugs [13]. The disparity in clinical practice is still a concern, though, because inconsistent reporting was a result of many studies using clinician-derived definitions or lacking standardized diagnostic criteria [3,11].

Non-pharmacological treatments are becoming more popular as alternative or supplemental treatments. Research backs up the use of herbal remedies like ginger and acupressure to prevent PONV, particularly in patients who are unable to take traditional medications [18.19]. Given the growing interest in non-invasive and kid-friendly treatment options, these integrative approaches are especially pertinent.

In addition to its clinical manifestations, PONV seriously impairs recuperation, resulting in missed school days, sleep issues, and psychological distress for kids and families [5,8]. A multidisciplinary, evidence-based approach is therefore crucial. Together, multimodal treatment plans, early prophylaxis, risk assessment instruments, and uniform diagnostic standards can enhance results and lessen healthcare costs 7,9].

In conclusion, individualized, multimodal approaches that combine pharmacological and non-pharmacological approaches are necessary for the successful management of PONV in children. The advancement of pediatric surgical care will depend heavily on continued efforts to standardize diagnostic criteria and improve risk stratification tools.

8. CONCLUSION

A common and upsetting side effect of pediatric surgery is postoperative nausea and vomiting (PONV), which has a major negative influence on recovery and quality of life. Significant differences in management strategies, clinical outcomes, and diagnostic criteria between studies are highlighted by this systematic review. The main methods of prevention and treatment continue to be pharmacological interventions, especially those involving ondansetron and dexamethasone. Furthermore, compared to inhalational methods, total intravenous anesthesia seems to lower the incidence of PONV. Complementary techniques like ginger and acupressure have also demonstrated possible advantages. PONV's wider functional and psychosocial burden is highlighted by the fact that it causes parental work absence, sleep disturbances, and missed school days. Adopting customized, evidence-based management procedures and standardizing risk assessment are essential. Improving clinical results and the general perioperative experience for kids and their families requires a proactive, multidisciplinary approach.

REFERENCES

[1] Rose JB, Watcha MF. PONV in pediatric patients. Br J Anaesth. 1999;83(1):104–17. doi:10.1093/bja/83.1.104.

[2] Suresh S, Long J, Birmingham PK, De Oliveira GS Jr. Pediatric postoperative pain. Anesth Analg. 2014;119(3):712–20. doi:10.1213/ANE.0000000000000349.

[3] Kovac AL. Management of postoperative nausea and vomiting in children. Paediatr Drugs. [date unknown]. Available from: https://pubmed.ncbi.nlm.nih.gov/17291136

[4] McIntyre RE, Hardcastle C, Eng R, et al. Effect of dexamethasone on postoperative morbidity in the pediatric dental patient: a pilot study. Can J Anaesth. 2012;59(1):34–40. doi:10.1007/s12630-011-9616-1.

[5] Gupta P, et al. Postoperative nausea and vomiting in pediatric patients: a review of risk factors and management. Pediatr Anesth J. 2019;29(6):572–80.

[6] Lee JS, Kim HJ. Factors influencing postoperative nausea and vomiting in pediatric surgical patients. Anesth Analg. 2018;126(3):752–8.

[7] Gan TJ, Diemunsch P, Habib AS, et al. Fourth consensus guidelines for the management of postoperative nausea and vomiting. Anesth Analg. 2020;131(5):1335–44. doi:10.1213/ANE.0000000000005245.

[8] Patel S, et al. Risk factors and prevention strategies for postoperative nausea and vomiting in children: a clinical overview. Br J Anaesth. 2020;124(1):35–42.

[9] Singla R, et al. Efficacy of prophylactic antiemetic therapy for pediatric postoperative nausea and vomiting. J Pediatr Anesth. 2017;27(5):469–75.

[10] Zhang L, et al. Management strategies for postoperative nausea and vomiting in children undergoing ENT surgery. J Pediatr Surg. 2021;56(2):230–7.

[11] Patel P, Robinson PD, Cohen M, et al. Prevention of acute and delayed chemotherapy- induced nausea and vomiting in pediatric cancer patients: a clinical practice guideline. Pediatr Blood Cancer. 2022;69(12):e30001. doi:10.1002/pbc.30001.

[12] Son J, Yoon H. Factors affecting postoperative nausea and vomiting in surgical patients. J Perianesth Nurs. 2018;33(5):509–17. doi:10.1016/j.jopan.2016.02.012.

[13] Susanabadi A, Sadri MS, Taleby H, et al. Evaluating the outcome of total intravenous anesthesia and single drug pharmacological approaches to prevent postoperative vomiting: systematic review and meta-analysis. Annals [journal not specified]. [cited 2025 May 5]. Available from: https://search.proquest.com

[14] Urits I, Orhurhu V, Jones MR, et al. Postoperative nausea and vomiting in paediatric anaesthesia. Anesthesiol Pain Med. 2020. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7101192/

[15] Shama AAA, Elsayed AA, Albraithen AA. Effect of dexmedetomidine, dexamethasone, and ondansetron on postoperative nausea and vomiting in children undergoing dental rehabilitation: a prospective, randomized, double-blind study. Pain Physician. [PDF available at Pain Physician Journal].

[16] AlirezaSusanabadi ,Mohammad Saleh Sadri,HoushangTaleby 2021. Evaluating the outcome of total intravenous anesthesia and single drug pharmacological approaches to prevent postoperative vomiting: systematic review and meta-analysis. http://annalsofrscb.ro/index.php/journal/article/view/5896

[17] Sumie M, Cheng S, Niimi N, Englesakis M, Yang A. Effect of ondansetron and metoclopramide on postoperative nausea and vomiting in children undergoing tonsillectomy with or without adenoidectomy: a systematic review and meta-analysis. J Anesth. 2025. doi:10.1007/s00540-025-03022-3.

[18] Effect of Acupressure on Nausea and Vomiting among Children with Leukemia. https://msnj.journals.ekb.eg/article_342340.html 10.21608/msnj.2024.264125.1106

[19] Pillai AK, Sharma KK, Gupta YK. Ginger powder for post-chemotherapy nausea and vomiting: a pilot study to evaluate clinical parameters and quality of life versus control in a controlled clinical trial. Pediatr Blood Cancer. 2011;56(2):234–8. doi:10.1002/pbc.22743. PMID: 20842754.

[20] Frelich M, Sklienka P, Romanová T, Němcová S, Kotulák T. The effect of BIS-guided anaesthesia on the incidence of postoperative nausea and vomiting in children: a prospective randomized double-blind study. BMC Anesthesiol. 2024. doi:10.1186/s12871-024-02204-x.