

Research Article

A Comparative Study of Dexamethasone and Local Anaesthetic Infiltration in the Management of Postoperative Nausea and Vomiting in Pediatric Tonsillectomy

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Abstract

Objective: To compare the effectiveness of intravenous dexamethasone and pre-incision local anesthetic infiltration in reducing postoperative nausea, vomiting, and pain among pediatric patients undergoing tonsillectomy. **Materials and Methods:** This quasi-experimental study was conducted at the Venkateshwara Institute of Medical Science, a tertiary care institute. Pediatric patients aged 4–13 years undergoing tonsillectomy under general anesthesia were enrolled in the study. Patients were divided into two groups: Group A: Received intravenous dexamethasone 0.5 mg/kg (maximum dose 16 mg). Group B: Received 24 ml of local anesthetic administered as pre-incision infiltration at the surgical site. **Results:** A total of 96 patients were enrolled in the study, with 48 patients in each group. In the post-anesthesia care unit (PACU), 6 patients (12.5%) in Group A experienced vomiting, whereas 1 patient (2.1%) in Group B experienced vomiting ($p = 0.0024$). After 24 hours, the incidence of postoperative nausea and vomiting (PONV) increased to 11 patients (22.9%) in Group A and 4 patients (8.3%) in Group B ($p = 0.023$). Similar trends were observed at 48 hours and on the 3rd, 4th, and 5th postoperative days. Group A showed higher consumption of postoperative analgesics both in the PACU and throughout the 1st to 5th postoperative days compared with

Group B. Patients in Group B were able to tolerate oral fluids earlier during their PACU stay compared to Group A ($p = 0.05$). **Conclusion:** Local anesthetic infiltration is an effective method for reducing postoperative nausea and vomiting, and it also provides better analgesic benefits in pediatric patients undergoing tonsillectomy under general anesthesia.

Keywords: Corticosteroids; Dexamethasone; Local anesthetic infiltration; Nausea; Pain; Postoperative; Vomiting.

Introduction

Tonsillectomy, with or without adenoidectomy, is one of the most frequently performed surgical procedures in children and is associated with a high incidence of postoperative vomiting, ranging from 40% to 73% [1–2]. Morbidity related to postoperative nausea and vomiting (PONV), postoperative pain, poor oral intake, dehydration, and fever continues to be a significant concern in children undergoing tonsillectomy in an ambulatory setting [2–3]. Delayed postoperative oral fluid intake and inadequate feeding due to nausea, vomiting, and pain may prolong hospital discharge and increase the risk of dehydration during the early or late postoperative period. Therefore, effective control of pain, nausea, and vomiting, along with early initiation of oral fluid intake, is extremely important in pediatric patients undergoing tonsillectomy [3].

Sutters et al. reported that 33% of children experienced moderate to severe nausea on the first postoperative evening, while 25% reported moderate to severe vomiting following the procedure [4]. Similarly, Splinter reported that each episode of vomiting prolongs hospital stay by approximately 13.2 minutes [5]. In pediatric patients, postoperative vomiting can cause considerable distress and anxiety and may lead to dehydration, metabolic disturbances, delayed discharge from the hospital, and unplanned hospital admissions [6]. The incidence of postoperative emesis is also reported to be higher in pediatric patients than in adults [7].

Anaesthesiologists and otolaryngologists have therefore been actively seeking effective methods to minimize these complications, particularly in day-care surgical programs [8]. Research has consistently demonstrated that children experience moderate to severe pain during home recovery after tonsillectomy and adenoidectomy, often lasting for more than seven days [9]. In one study, children reported that the passage of time and the use of medication contributed to relief from postoperative pain [10].

Various pharmacological interventions have been explored to reduce postoperative morbidity after tonsillectomy. Among these, dexamethasone and other corticosteroids have been used to minimize tissue injury, inflammation, and edema, thereby reducing postoperative pain, fever, and poor oral intake [2]. The antiemetic effects of dexamethasone have also been demonstrated in patients undergoing chemotherapy, gynecological procedures, laparoscopic surgeries, and cesarean sections [11]. Dexamethasone is widely used because it is inexpensive, can be administered as a single

intravenous dose, and has a long biological half-life of approximately 36–48 hours. In addition to its antiemetic effect, dexamethasone has anti-inflammatory properties that may reduce postoperative edema and improve oral intake following tonsillectomy. However, some studies have questioned its effectiveness as an antiemetic and its overall benefit in improving oral intake after tonsillectomy. These inconsistencies may be attributed to variations in dosage regimens and anesthetic techniques used across different studies [1].

The literature reports that the frequency of PONV after tonsillectomy ranges between 23% and 71% [12]. PONV is an unpleasant postoperative complication that may limit oral intake and predispose patients to dehydration, thereby increasing the risk of hospital readmission [13]. These outcomes often lead to dissatisfaction among surgeons, parents, and patients. Despite the high incidence of postoperative complications, standardized guidelines for postoperative management following tonsillectomy remain limited [14]. Consequently, ongoing surgical and anesthetic research aims to establish effective strategies for reducing postoperative nausea, vomiting, and pain after tonsillectomy [15].

Local anesthetic infiltration of the tonsillar bed has also been proposed as an effective method to reduce postoperative morbidity. Various local anesthetic agents in different concentrations and doses have been used for tonsillar infiltration to decrease postoperative pain and facilitate faster recovery [16]. Several studies have demonstrated favorable outcomes with this technique [17].

Corticosteroids such as intravenous dexamethasone are considered useful adjuncts in reducing PONV and

providing analgesia due to their anti-inflammatory properties. These effects may promote earlier resumption of oral intake and improved postoperative recovery [18]. Additionally, both dexamethasone and local anesthetic infiltration have the advantage of reducing postoperative opioid and analgesic requirements [19].

Based on the pharmacological properties of dexamethasone and the potential benefits of pre-incision local anesthetic infiltration, the present quasi-experimental study was designed to compare the effectiveness of intravenous dexamethasone and local anesthetic pre-incision infiltration in pediatric patients undergoing tonsillectomy under general anesthesia. The primary outcome of the study was the frequency of postoperative nausea and vomiting during the first five postoperative days, while the secondary outcome was the effectiveness of these interventions in reducing postoperative pain.

Methodology

This quasi-experimental study was conducted at the Venkateshwara Institute of Medical Science, a tertiary care institute, after obtaining approval from the Institutional Ethical Research Committee. A total of 96 pediatric patients were enrolled in the study, with 48 patients in each group, using a consecutive non-probability sampling technique. Written informed consent was obtained from the parents or guardians after explaining the study procedures and protocols in detail.

Inclusion Criteria

Children aged 4–13 years undergoing total or subtotal tonsillectomy with or without adenoidectomy under general anesthesia and classified as American Society of Anesthesiologists (ASA) physical status I or II were included in the study.

Exclusion Criteria

- A history of intake of antiemetics, steroids, antihistamines, or psychoactive drugs within 24 hours before surgery
- Suspected malignant neoplasm
- Acute pharyngeal infection
- History of diabetes mellitus, asthma, coagulation disorders, or hypersensitivity to the study drug.

Study Groups

The patients were divided into two groups:

Group A:

Patients received **intravenous dexamethasone 0.5 mg/kg** (maximum dose **16 mg**) before surgery.

Group B:

Patients received pre-incision local anesthetic infiltration consisting of a 24 ml solution prepared with 3 ml of 2% lidocaine plain, 3 ml of 2% lidocaine with epinephrine, and 3 ml of 0.5% bupivacaine, diluted with 0.9% normal saline.

Using a 25-gauge (3.5 cm) curved needle, infiltration was performed at the superior pole of the tonsil. The tonsil was grasped with tonsil-holding forceps and pulled medially. The needle was inserted laterally toward the superior pole and advanced within the plane between the tonsillar capsule and the tonsillar bed toward the inferior pole. After careful aspiration to avoid intravascular injection, the anesthetic mixture was infiltrated in a retrograde manner. The needle was slowly withdrawn along the same tract, with most of the solution delivered in the middle of the trajectory.

Anesthetic Technique

All patients were premedicated with intravenous midazolam (1 mg). General anesthesia was induced with intravenous propofol (2 mg/kg). Endotracheal intubation was performed following administration of intravenous atracurium (0.5 mg/kg) after ensuring adequate ventilation for 3–5 minutes. Anesthesia was maintained with 1.5%

isoflurane, along with 60% oxygen and 40% air. At the end of surgery, neuromuscular blockade was reversed using neostigmine and glycopyrrolate. All patients received intravenous paracetamol (15 mg/kg) as an adjuvant analgesic approximately 15 minutes before extubation, and awake extubation was performed.

Data Collection

Patient demographic characteristics, duration of surgery, amount of paracetamol administered, hemodynamic parameters, and oxygen saturation (SpO_2) were recorded.

Postoperative data collected included:

- Frequency of postoperative nausea and vomiting (PONV)
- Visual Analogue Scale (VAS) scores for pain
- Requirement of antiemetics and analgesics
- Retching was considered an indicator of nausea. Intravenous ondansetron (0.15 mg/kg) was administered if the patient experienced one or more episodes of vomiting. After discharge, patients were prescribed domperidone syrup (0.25 mg/kg) twice daily.
- Pain severity was assessed using a Visual Analogue Scale (VAS) ranging from 0 to 10, where 0 indicated no pain and 10 indicated maximum pain. Analgesia was administered when the VAS score reached ≥ 4 , in the form of intravenous paracetamol (15 mg/kg) in the hospital and paracetamol suspension (240 mg/ml) for home use.
- Parental satisfaction was assessed and categorized as satisfied, moderately satisfied, or unsatisfied. Post-discharge data were recorded using a pre-designed proforma, which parents were instructed to bring during follow-up visits.

Statistical Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS)

Table I: Demographic and Postoperative Hemodynamic Profile (n = 96)

version 28.0. Continuous variables were expressed as mean \pm standard deviation (Mean \pm SD), while categorical variables were presented as frequency and percentage. The Chi-square test and independent sample t-test were applied where appropriate. A p-value < 0.05 was considered statistically significant.

Results

A total of 96 patients were enrolled in the study, with 48 participants in each group. The demographic characteristics and hemodynamic profiles of the study participants are presented in Table I. In the post-anesthesia care unit (PACU), mean arterial pressure (MAP) and heart rate (HR) were comparable between the two groups. In the PACU, 6 patients (12.5%) in Group A experienced vomiting compared with 1 patient (2.1%) in Group B, and the difference was statistically significant ($p = 0.024$). After 24 hours, the frequency of postoperative nausea and vomiting (PONV) increased to 11 patients (22.9%) in Group A and 4 patients (8.3%) in Group B ($p = 0.023$). Similar trends were observed at 48 hours and on the 3rd postoperative day. Group A demonstrated higher postoperative analgesic consumption in the PACU and throughout the 1st to 5th postoperative days compared with Group B (Table II). The frequency of postoperative nausea and vomiting among study participants from the PACU to the third postoperative day is shown in Table III. Postoperative pain intensity was assessed using the Visual Analogue Scale (VAS). The comparison of pain scores between both groups is presented in Table IV, which shows that Group B had significantly lower pain scores compared with Group A during the postoperative period.

Characteristics	Group A (n=48)	Group B (n=48)	p-value
Gender			
Male	32	25	
Female	16	23	
Age (years)	5.6 ± 1.5	6.7 ± 1.9	0.002
Preoperative Hemodynamic Data			
Heart Rate (bpm)	96.4 ± 2.2	96.6 ± 2.3	0.664
Mean Arterial Pressure (mmHg)	64.4 ± 1.6	65.1 ± 2.03	0.064
Oxygen Saturation (%)	98.8 ± 0.9	99.1 ± 1.03	0.192
Pre-incision Hemodynamic Data			
Heart Rate (bpm)	94.08 ± 1.7	94.6 ± 2.1	0.186
Mean Arterial Pressure (mmHg)	63.5 ± 1.4	64.4 ± 1.9	0.01
Oxygen Saturation (%)	98.6 ± 0.9	98.7 ± 1.1	0.627
Post-incision Hemodynamic Data			
Heart Rate (bpm)	103.6 ± 1.5	103.7 ± 1.8	0.768
Mean Arterial Pressure (mmHg)	70.2 ± 2.09	70.8 ± 2.6	0.216
Oxygen Saturation (%)	99.1 ± 1.2	99.3 ± 1.3	0.435
Duration of Surgery (minutes)	31.6 ± 2.6	33.9 ± 2.9	0.000
PACU Hemodynamic Data			
Heart Rate (bpm)	95.9 ± 2.1	95.2 ± 2.4	0.132
Mean Arterial Pressure (mmHg)	63.9 ± 3.5	63.7 ± 3.2	0.771
Oxygen Saturation (%)	99.1 ± 1.1	99.2 ± 1.2	0.671

Table II: Postoperative Analgesic Consumption During the First Five Days (n = 96)

Duration	Group A (n=48)	Group B (n=48)	p-value
PACU	9 (18.8%)	1 (2.1%)	0.003
1st Day (24 hrs)	16 (33.3%)	18 (37.5%)	0.33
2nd Day (48 hrs)	24 (50%)	13 (27.1%)	0.009
3rd Day	22 (45.8%)	5 (10.4%)	0.00004
4th Day	14 (29.2%)	3 (6.3%)	0.409
5th Day	3 (6.3%)	0 (0.0%)	0.039

Table III: Frequency of Postoperative Nausea and Vomiting (PONV)

Frequency of PONV	Group A (n=48)	Group B (n=48)	p-value
PACU Duration (min)	89.8 ± 5.6	72.6 ± 7.1	0.0001
PACU	6 (12.5%)	1 (2.1%)	0.024
24 Hours	11 (22.9%)	4 (8.3%)	0.023
48 Hours	3 (6.3%)	0 (0%)	0.039

Frequency of PONV Group A (n=48) Group B (n=48) p-value

3rd Day	0 (0.0%)	1 (2.1%)	0.157
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PACU – Post-Anesthesia Care Unit

PONV – Postoperative Nausea and Vomiting

Table IV: Postoperative Pain Scores (Visual Analogue Scale)

Time	Group A (n=48)	Group B (n=48)	p-value
PACU	3.7 ± 1.1	2.6 ± 0.9	0.000
24 Hours	3.2 ± 1.1	2.4 ± 0.9	0.000

The duration of PACU stay was significantly shorter in Group B (72.6 ± 7.1 minutes) compared with Group A (89.8 ± 5.6 minutes) (p = 0.0001). Postoperative analgesic consumption was higher in Group A compared with Group B during the PACU stay and across the first five postoperative days. The difference was statistically significant during the PACU period, 2nd postoperative day, 3rd postoperative day, and 5th postoperative day (Table II). Postoperative pain intensity was assessed using the Visual Analogue Scale (VAS). Patients in Group B reported significantly lower pain scores compared with Group A during the PACU period and at 24 hours postoperatively (p < 0.001), as shown in Table IV. Overall, local anesthetic infiltration (Group B) demonstrated better outcomes in terms of lower incidence of PONV, reduced analgesic consumption, shorter PACU stay, and lower postoperative pain scores compared with intravenous dexamethasone (Group A).

Discussion

The present study demonstrated that local anesthetic infiltration significantly reduced postoperative nausea and vomiting (PONV) and provided

effective analgesia in pediatric patients undergoing tonsillectomy under general anesthesia. The findings of this study were compared with previously published literature, and although some results were consistent, certain observations differed from earlier studies.

Tonsillitis is a common condition among children, particularly those aged below 12–14 years, and tonsillectomy remains a frequently performed surgical procedure in this population. However, postoperative nausea, vomiting, and pain are common complications that may persist for several days after surgery. These complications can lead to behavioral disturbances, school absenteeism, and increased parental concern. Therefore, successful surgical outcomes depend not only on the operative procedure but also on adequate perioperative management aimed at reducing postoperative morbidity and promoting early recovery.

A study conducted by Samir S. Aouad et al. compared intravenous dexamethasone with intravenous methylprednisolone and concluded that both agents demonstrated comparable effectiveness in preventing PONV following tonsillectomy [1]. Evidence-based guidelines, such as the Paradise

criteria, recommended by the American Academy of Otolaryngology–Head and Neck Surgery Foundation, indicate that tonsillectomy should be considered when children experience seven or more episodes of sore throat in one year, five or more episodes annually for two consecutive years, or three or more episodes annually for three consecutive years, as reported by Reginald Baugh et al. [20]. These criteria highlight that a substantial proportion of pediatric patients may require tonsillectomy during childhood.

The findings of the present study revealed that pre-incision local anesthetic infiltration significantly reduced the frequency of PONV and provided superior postoperative analgesia compared with intravenous dexamethasone. This benefit was observed in the post-anesthesia care unit (PACU), at 24 hours, 48 hours, and during the 3rd, 4th, and 5th postoperative days. Furthermore, patients receiving local anesthetic infiltration required fewer additional analgesics during the postoperative period.

According to Christoph Messerer et al., several factors contribute to the risk of PONV, including intraoperative opioid administration, use of non-opioid analgesics such as diclofenac, and the type of surgical procedure performed [21]. These factors may influence the variability in postoperative outcomes reported in different studies. A study by Said Elhakim et al. demonstrated that preoperative intravenous dexamethasone (0.5 mg/kg) significantly reduced postoperative vomiting and pain in children undergoing electrocautery tonsillectomy, which aligns partially with the objectives of the present study [22]. Dexamethasone is often considered a cost-effective and

practical intervention for reducing PONV, particularly when administered as a single preoperative dose.

However, Martin Czarnetzki et al. reported a dose-dependent increase in post-tonsillectomy hemorrhage associated with dexamethasone administration. Their study evaluated three different doses of dexamethasone (0.05, 0.15, and 0.5 mg/kg) in a pediatric population and found a higher incidence of postoperative bleeding in patients receiving dexamethasone compared with those who did not receive the drug [23]. In contrast, a study by Jochen Schietroma et al. found no significant difference in the incidence of PONV following intravenous dexamethasone administration, which differs from the findings of the present study [24].

Similarly, Nadeem Ahmed et al. reported that dexamethasone effectively reduces postoperative pain during the first 24 hours after surgery, likely due to its anti-inflammatory and analgesic properties [25]. Local anesthetic infiltration of the tonsillar bed has been widely recognized as an effective strategy for postoperative pain control. In the present study, patients who received local anesthetic infiltration demonstrated lower postoperative pain scores, which may be attributed to the combined analgesic effect of lidocaine and bupivacaine, providing both rapid onset and prolonged analgesia. The use of a curved needle technique during infiltration also minimized the risk of deep tissue penetration and reduced potential complications such as taste disturbances, vocal cord paralysis, or osteomyelitis, as described in previous studies [26]. Despite these encouraging findings, the present study had certain limitations. The relatively small sample size may limit the generalizability of the

results. Additionally, the study design was quasi-experimental rather than randomized, which may introduce potential bias. Long-term postoperative outcomes and delayed complications were also not assessed.

Future research should involve large-scale randomized controlled trials to validate these findings. Further investigations may also explore the relationship between postoperative pain and PONV in pediatric tonsillectomy patients, as well as evaluate the combined use of local anesthetic infiltration with NSAIDs and paracetamol to enhance postoperative recovery.

Conclusion

Local anesthetic infiltration proved to be an effective technique for reducing postoperative nausea and vomiting (PONV) in pediatric patients undergoing tonsillectomy. In addition to its antiemetic effect, it also provided significant postoperative pain relief. Children who received local anesthetic infiltration experienced fewer episodes of nausea and vomiting and required fewer rescue antiemetics compared with those receiving intravenous dexamethasone. Furthermore, analgesic requirements were reduced during the immediate postoperative period. These findings highlight the dual benefit of local anesthetic infiltration in improving postoperative recovery, enhancing patient comfort, and facilitating early oral intake following pediatric tonsillectomy under general anesthesia.

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