Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v6i1.1531
*Biol. Clin. Sci. Res. J., Volume 6(1), **2025**: 1531*
Original Research Article

Comparison of Prophylactic Gabapentin, Dexamethasone, and Ondansetron in Terms of Incidence of Postoperative Nausea and Vomiting in Patients Undergoing Tonsillectomy Under General Anesthesia

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(Received, 29th November 2024, Revised 12th January 2025, Published 31st January 2025)

Abstract: *Postoperative nausea and vomiting (PONV) is a common complication following tonsillectomy under general anaesthesia, leading to delayed recovery, prolonged hospital stays, and increased healthcare costs.* ***Objective:*** *This study aimed to compare the efficacy of gabapentin, dexamethasone, and ondansetron in preventing PONV in patients undergoing tonsillectomy.* ***Methods:*** *A randomised controlled trial was conducted at Mayo Hospital Lahore, involving 210 patients aged 12–40 years, with ASA status I–II, scheduled for tonsillectomy under general anaesthesia. Patients were randomly assigned to one of three groups: Group G (gabapentin 300 mg orally 1 hour before surgery), Group D (dexamethasone 8 mg IV at induction), and Group O (ondansetron 4 mg IV at induction). PONV was assessed using the PONV scoring system at 0 hours, 30 minutes, and 2 hours after extubation. Rescue antiemetics (metoclopramide 0.2 mg/kg IV) were administered if the PONV score was 2 or more.* ***Results:*** *The incidence of PONV was significantly lower in Group O (12.9%) compared to Group D (22.9%) and Group G (32.9%) (P = 0.01). Stratified analyses revealed that female gender, younger age (≤ 26 years), lower weight (<60 kg), and ASA status 1 were associated with higher PONV incidence. No significant difference was observed in PONV incidence concerning surgery duration (P > 0.05).* ***Conclusion:*** *Ondansetron had the lowest incidence of PONV compared to dexamethasone and gabapentin in patients undergoing tonsillectomy under general anaesthesia. Stratified data suggest that patients with female gender, younger age, and lower weight may benefit from more aggressive PONV prophylaxis.*

Keywords: Postoperative Nausea and Vomiting, Gabapentin, Dexamethasone, Ondansetron, Tonsillectomy, General Anaesthesia

[***How to Cite:*** Zamurd., Afzal, F., Hassan, A., Hasnat, M. Comparison of prophylactic gabapentin, dexamethasone, and ondansetron in terms of incidence of postoperative nausea and vomiting in patients undergoing tonsillectomy under general anaesthesia. *Biol. Clin. Sci. Res. J.*, **2025;** 6(1): 114-117. doi: https://doi.org/10.54112/bcsrj.v6i1.1531]

Introduction

Postoperative nausea and vomiting (PONV) is a common and distressing complication following general anaesthesia, especially in patients undergoing tonsillectomy. PONV causes discomfort and delays recovery, prolongs hospital stays, and may lead to additional healthcare costs. Tonsillectomy, a frequently performed surgical procedure, is mainly associated with a high incidence of PONV due to factors like the use of general anaesthesia, opioids, and manipulation of the oropharyngeal region during surgery (1).

The incidence of PONV in the general population varies, with reports indicating that 30% to 50% of patients experience some degree of postoperative nausea or vomiting following tonsillectomy (2). Various factors, including patient demographics, anaesthesia techniques, surgical procedures, and the medications used during and after the operation, play a role in the development of PONV. For instance, age, sex, obesity, and a history of motion sickness or PONV are all known to influence the likelihood of its occurrence (1, 3). Given the significant burden of PONV on patient recovery, effective prophylactic measures are crucial in reducing its incidence. Several pharmacological agents have been proposed to prevent PONV, with gabapentin, dexamethasone, and ondansetron commonly studied and utilised. Gabapentin, a medication primarily used for neuropathic pain and seizures, has shown promising results in preventing postoperative pain and PONV by its action on the central nervous system (4). Dexamethasone, a corticosteroid, has anti-inflammatory properties and has been found to reduce the incidence of PONV by inhibiting the release of inflammatory mediators (5). Ondansetron, a selective serotonin receptor antagonist, is widely used as a first-line treatment for PONV, with substantial evidence supporting its efficacy in preventing nausea and vomiting after surgery (6).

Despite the widespread use of these agents individually, limited data are available comparing their efficacy in preventing PONV in tonsillectomy patients under general anaesthesia. Studies have demonstrated varying success rates, with some suggesting that combination therapy may be more effective than single-drug prophylaxis (7). Additionally, the cost-effectiveness and safety profiles of these medications in the context of tonsillectomy remain insufficiently explored in the Pakistani healthcare setting, where surgical practices, anaesthesia protocols, and pharmacological interventions may differ from Western counterparts (8). In the Pakistani population, the prevalence of PONV following tonsillectomy and the availability of cost-effective prophylactic treatments remain underreported. Given the significant burden of PONV on recovery times and patient satisfaction, it is imperative to conduct a comparative study that evaluates the effectiveness of gabapentin, dexamethasone, and ondansetron in preventing PONV in this context. Such a study would provide crucial insights into optimising postoperative care for tonsillectomy patients, potentially reducing the burden on healthcare resources and improving patient outcomes.

This study aims to fill the gap in the current literature by directly comparing the efficacy of gabapentin, dexamethasone, and ondansetron in preventing postoperative nausea and vomiting in tonsillectomy patients undergoing general anaesthesia. By focusing on the Pakistani population, this research will provide valuable data specific to local practices and resources, offering practical recommendations for clinicians in managing PONV effectively. The results of this study could influence clinical practice by identifying the most effective and cost-efficient prophylactic treatment, improving patient recovery, and potentially reducing hospital costs associated with PONV.

Methodology

The study was a randomised controlled trial (RCT) conducted at the ENT operation theatre, Anesthesia Unit 2, Mayo Hospital Lahore, over six months following the approval of the study synopsis. After obtaining

informed consent, 210 patients were enrolled in the study. Patients were randomly assigned to one of three groups using a lottery method: Group G (gabapentin), Group D (dexamethasone), and Group O (ondansetron). Each group consisted of 70 patients.

The study included patients aged between 12 and 40, of ASA status I or II, who were scheduled to undergo tonsillectomy under general anaesthesia. Exclusion criteria included patients with a history of motion sickness, those on chronic steroid therapy, those experiencing vomiting within 24 hours before surgery, those with known allergies to the study drugs, patients with opioid dependence, and diabetics with fasting blood sugar levels greater than 126 mg/dl.

In the gabapentin group (Group G), patients received 300 mg of oral gabapentin one hour before surgery. In the dexamethasone group (Group D), patients received an intravenous (IV) dose of 8 mg of dexamethasone at the time of induction. In the ondansetron group (Group O), patients were administered 4 mg of IV ondansetron at the time of induction. All patients were kept nil per os (NPO) for six hours before surgery.

On the day of surgery, patients were premedicated with an IV dose of 8 mg of dexamethasone and 4 mg of ondansetron as per their assigned group. All patients received injections of nalbuphine at a dose of 0.1 mg/kg IV for analgesia. Anaesthesia induction was achieved with 2-3 mg/kg of IV propofol, adjusted as necessary for loss of verbal response. After confirming bag-mask ventilation, muscle relaxation was facilitated with 0.5 mg/kg of IV atracurium, followed by ventilation with 100% oxygen and isoflurane (MAC 1.2). Endotracheal intubation was performed after 3 minutes, and tube placement was confirmed by auscultation and end-tidal CO2 monitoring.

After the surgery, patients were extubated following the anaesthesia reversal with 0.03-0.07 mg/kg of neostigmine and 0.01-0.02 mg/kg of atropine. Postoperative nausea and vomiting (PONV) were monitored at 0 hours, 30 minutes, and 2 hours after extubation using the PONV scoring system. The PONV Impact Scale is a validated tool used to assess postoperative nausea and vomiting severity. It scores patients from 0 to 4, with 0 indicating no symptoms and 4 representing multiple vomiting episodes. A score of 2 or more typically warrants rescue antiemetic therapy. This scale standardizes PONV assessment, ensuring effective management and improving patient outcomes in clinical settings. Any patient with a PONV score of 2 or more was treated with 0.2 mg/kg IV metoclopramide as a rescue antiemetic.

Data was collected using a pre-designed proforma that recorded patient demographics, ASA status, weight, gender, and the PONV score at the specified intervals. The data were analysed using SPSS version 26. Quantitative variables, such as age, weight, and duration of surgery, were expressed as mean and standard deviation. In contrast, qualitative variables, including gender, ASA status, and PONV incidence, were presented as frequency and percentage. The chi-square test was used to compare the incidence of PONV between the three groups, and a p-value of ≤ 0.05 was considered statistically significant. Stratification of data by age, gender, ASA status, weight, and surgery duration was also performed to account for potential effect modifiers.

Results

The study comprised a total of 210 patients, with 70 patients in each of the three intervention groups: Ondansetron (Group O), Dexamethasone (Group D), and Gabapentin (Group G). The mean age across all groups was comparable: Group O (26.82 ± 7.62 years), Group D (26.84 ± 7.79 years), and Group G (26.27 ± 8.14 years). Age ranges from 12 to 40 years were observed in all groups. The gender distribution was predominantly male, with 62.9% in Group O, 65.7% in Group D, and 64.3% in Group G. The mean weight in Group O was 57.31 ± 8.38 kg, Group D was 55.28 ± 7.85 kg, and Group G was 55.68 ± 8.58 kilograms. The patients had a similar range of weight (40–75 kg) across the groups. The mean duration of surgery was approximately 71 minutes across all groups, with a duration range of 60-90 minutes.

The PONV incidence varied significantly across the groups. Group O (Ondansetron) had the lowest incidence of PONV at 12.9%, followed by Group D (Dexamethasone) at 22.9%, and Group G (Gabapentin) with the highest incidence at 32.9%. This difference in the incidence of PONV was statistically significant (P = 0.01). Table 1

Further analysis was performed by stratifying the data based on ASA status, gender, age, weight, and surgery duration to identify factors that may influence the incidence of PONV. The results revealed significant findings in several subgroups.

A higher incidence of PONV was observed in ASA Status 1 and 2 patients in Group G (Gabapentin), with statistically significant results (P = 0.02 for ASA 1 and P = 0.01 for ASA 2). Stratification by gender showed that female patients had a significantly higher incidence of PONV, particularly in Group G, where 63.6% of females experienced PONV (P = 0.04).Younger patients (≤ 26 years) had a higher incidence of PONV, with significant results for Group G, where 54.2% of patients ≤ 26 years experienced PONV (P = 0.04).A significant difference was found in patients weighing less than 60 kg, where 71.4% of the patients in Group G experienced PONV (P = 0.001).The stratification by surgery duration showed no significant difference in PONV incidence between the groups, with P-values of 0.08 and 0.1 for the 60-75 minutes and >75-90 minutes categories, respectively. Table 2.

Table 1: Demographic Characteristics and PONV Incidence Among Study Groups

Parameter	Group O (n=70)	Group D (n=70)	Group G (n=70)	Total (n=210)
Age (Mean ± SD)	26.82 ± 7.62	26.84 ± 7.79	26.27 ± 8.14	-
Age Range	12-40 years	12-40 years	12-40 years	12-40 years
Gender				
Male (%)	44 (62.9%)	46 (65.7%)	45 (64.3%)	135 (64.3%)
Female (%)	26 (37.1%)	24 (34.3%)	25 (35.7%)	75 (35.7%)
Weight (Mean ± SD)	57.31 ± 8.38	55.28 ± 7.85	55.68 ± 8.58	-
Weight Range	40-75 kg	40-75 kg	40-75 kg	40-75 kg
Surgery Duration (Mean ± SD)	70.85 ± 9.62	71.17 ± 9.58	69.95 ± 9.39	-
Surgery Duration Range	60-90 minutes	60-90 minutes	60-90 minutes	60-90 minutes
ASA Status				
ASA 1 (%)	47 (67.1%)	52 (74.3%)	47 (67.1%)	146 (69.5%)
ASA 2 (%)	23 (32.9%)	18 (25.7%)	23 (32.9%)	64 (30.5%)
PONV Incidence				
Yes (%)	9 (12.9%)	16 (22.9%)	23 (32.9%)	48 (22.9%)
No (%)	61 (87.1%)	54 (77.1%)	47 (67.1%)	162 (77.1%)
P Value	0.01			

Table 2: Data Stratification concerning ASA Status, Gender, Age, Weight, and Surgery Duration

Stratification Parameter	Group O PONV Yes (%)	Group D PONV Yes (%)	Group G PONV Yes (%)	P Value (Overall)
ASA Status				
ASA 1 PONV Yes (%)	8 (24.2%)	8 (24.2%)	17 (51.5%)	0.02
ASA 1 PONV No (%)	39 (34.5%)	44 (38.9%)	30 (26.5%)	
ASA 2 PONV Yes (%)	1 (6.7%)	8 (53.3%)	6 (40%)	0.01
ASA 2 PONV No (%)	22 (44.9%)	10 (20.4%)	17 (34.7%)	
Gender				
Male PONV Yes (%)	8 (21.6%)	13 (35.1%)	16 (43.2%)	0.18
Female PONV Yes (%)	1 (9.1%)	3 (27.3%)	7 (63.6%)	0.04
Age Group				
≤ 26 years PONV Yes (%)	4 (16.7%)	7 (29.2%)	13 (54.2%)	0.04
>26-40 years PONV Yes (%)	5 (20.8%)	9 (37.5%)	10 (41.7%)	0.29
Weight				
<60 kg PONV Yes (%)	1 (4.8%)	5 (23.8%)	15 (71.4%)	0.001
45-70 kg PONV Yes (%)	8 (29.6%)	11 (40.7%)	8 (29.6%)	0.53
Surgery Duration				
60-75 minutes PONV Yes (%)	8 (22.2%)	10 (27.8%)	18 (50%)	0.08
>75-90 minutes PONV Yes (%)	1 (8.3%)	6 (50%)	5 (41.7%)	0.1

Discussion

The results of this study highlight the varying effectiveness of three prophylactic agents—Ondansetron, Dexamethasone, and Gabapentin—in preventing postoperative nausea and vomiting (PONV) in patients undergoing tonsillectomy under general anaesthesia. Among the three groups, Ondansetron (Group O) showed the lowest incidence of PONV (12.9%), followed by Dexamethasone (Group D) at 22.9% and Gabapentin (Group G) at 32.9%. This difference was statistically significant (P = 0.01), indicating that Ondansetron may be the most effective agent for PONV prevention in this patient cohort. These findings are consistent with several previous studies that have investigated the efficacy of Ondansetron in preventing PONV, demonstrating its established role as a first-line antiemetic (9-11).

The results from Group D, which received Dexamethasone, align with existing literature suggesting corticosteroids effectively reduce PONV. A study by Kang et al. (12) demonstrated that Dexamethasone significantly reduces the incidence of PONV after tonsillectomy, supporting the present study's findings. While Dexamethasone was less effective than Ondansetron in our research, it still showed a notable reduction in the incidence of PONV compared to Gabapentin. This suggests that Dexamethasone could be a viable alternative, especially considering its anti-inflammatory properties, which may contribute to its antiemetic effect (13, 14).

Gabapentin (Group G) demonstrated the highest incidence of PONV, with 32.9% of patients experiencing nausea or vomiting postoperatively. This finding is somewhat unexpected, as Gabapentin has been shown to have a role in reducing PONV by its action on the central nervous system and the modulation of pain pathways (15). However, the high incidence in our study may reflect the specific patient characteristics, such as younger age and lower weight, which were more prevalent in Group G. Moreover, the findings suggest that Gabapentin's effectiveness may be less than that of Ondansetron and Dexamethasone in this population, particularly in patients with ASA status 1 and 2, who are generally considered low-risk for PONV (16).

Stratified analyses revealed interesting trends in specific subgroups. For instance, the higher incidence of PONV in females (63.6%) in Group G compared to males (43.2%) supports previous studies that indicate gender as a significant risk factor for PONV (17). Similarly, younger patients (≤ 26 years) in Group G had a significantly higher incidence of PONV (54.2%), which is in agreement with findings by Mutia et al. (17) and suggests that younger patients may have an increased susceptibility to PONV regardless of the prophylactic agent used.

The subgroup analysis of weight revealed a strong association between lower body weight and a higher incidence of PONV in Group G (71.4% in patients weighing less than 60 kg). This is consistent with earlier studies that have identified low body weight as a significant risk factor for PONV (18, 19). In contrast, there was no significant difference in PONV incidence based on surgery duration, which is contrary to some previous research that suggested longer surgeries could increase the risk of PONV (1, 20).

A similar trend was observed in the analysis of ASA status, with higher PONV incidence in ASA 1 and ASA 2 patients in Group G. This highlights that Gabapentin may be less effective in patients with low-risk profiles for PONV. The findings also suggest that ASA status, gender, and body weight may be more influential than the duration of surgery when predicting the likelihood of PONV.

In summary, while Ondansetron appears to be the most effective agent for preventing PONV in tonsillectomy patients, Dexamethasone provides a reasonable alternative, particularly in settings where cost and availability are considerations. Gabapentin, although effective in some studies, demonstrated higher rates of PONV in our cohort, suggesting that it may not be as reliable as Ondansetron and Dexamethasone for PONV prophylaxis in this patient population.

Conclusion

Ondansetron had the lowest incidence of PONV compared to dexamethasone and gabapentin in patients undergoing tonsillectomy under general anaesthesia. Stratified data suggest that patients with female gender, younger age, and lower weight may benefit from more aggressive PONV prophylaxis.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-MMC-02834-24)

Consent for publication

Approved

Funding

Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

***Z** (PGR**), FA** (HOD)*
Manuscript drafting, Study Design, Conception of Study, Development of Research Methodology Design
AH** (Resident), **MH (HO)
Review of Literature, Data entry, Data analysis, and drafting article, Study Design, manuscript review, critical input.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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