Comparison of the Efficacy of Palonosetron and Ondansetron in the Prevention of Postoperative Nausea and Vomiting in Patients Undergoing Tympanoplasty

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Abstract: Postoperative nausea and vomiting (PONV) is a frequent and distressing complication following general anaesthesia, particularly in tympanoplasty due to vestibular stimulation and prolonged surgical duration. Effective prophylaxis is essential to improve patient comfort, reduce complications, and enhance postoperative recovery. Palonosetron, a second-generation 5-HT3 receptor antagonist, has a longer half-life and higher receptor affinity than Ondansetron, potentially offering superior protection against PONV.

Methods: This comparative observational study included 84 ASA I–II patients aged 18–50 years undergoing elective tympanoplasty under general anaesthesia. Patients were randomized into two groups: Group A received intravenous Ondansetron (0.08 mg/kg), while Group B received intravenous Palonosetron (1 mcg/kg) before induction. Hemodynamic parameters, incidence of PONV, rescue antiemetic requirement, and adverse effects were recorded over 48 postoperative hours. Statistical analysis was performed using SPSS version 20.

Results: Palonosetron demonstrated significantly lower incidence of PONV, delayed need for rescue antiemetics, and reduced total rescue antiemetic requirement compared to Ondansetron. Hemodynamic parameters remained comparable between groups, indicating similar cardiovascular stability. Adverse effects were minimal and comparable in both groups.

Conclusion:- Palonosetron proved more effective than Ondansetron in preventing both early and delayed PONV following tympanoplasty, with prolonged antiemetic efficacy and excellent safety profile. Its superior pharmacological properties make it a preferable choice for PONV prophylaxis in high-risk surgical populations.

Keywords: Postoperative nausea and vomiting, Palonosetron, Ondansetron, Tympanoplasty, General anaesthesia

I. Introduction

Postoperative nausea and vomiting (PONV) remains one of the most common and distressing complications following anaesthesia and surgery, significantly affecting patient comfort, recovery, and overall satisfaction. Despite advances in anaesthetic techniques and pharmacological prophylaxis, the incidence of PONV continues to range between 20% and 30% in the general surgical population and may rise to as high as 70–80% in high-risk individuals [1,2]. The persistence of PONV as a clinical challenge underscores the importance of identifying effective preventive strategies and optimizing antiemetic therapy. PONV is not merely an unpleasant postoperative symptom but is associated with several adverse outcomes. These include delayed recovery, prolonged hospital stay, increased healthcare costs, and complications such as dehydration, electrolyte imbalance, wound dehiscence, increased intracranial pressure, and pulmonary aspiration [3,4]. In certain surgical populations, particularly those undergoing middle ear, laparoscopic, gynecological, or ophthalmic procedures, PONV may compromise surgical outcomes and delay discharge from post-anesthesia care units (PACU) [5]. Consequently, the prevention and management of PONV have become integral components of perioperative care. Given the multifactorial etiology of PONV, a multimodal approach to its prevention is recommended. This includes minimizing the use of emetogenic anesthetic agents, employing regional anesthesia when feasible, ensuring adequate hydration, and administering prophylactic antiemetics [6]. Over the years, various classes of antiemetic drugs have been utilized, including anticholinergics, antihistamines, dopamine antagonists, corticosteroids, and neurokinin-1 receptor antagonists. However, the introduction of selective serotonin 5-HT3 receptor antagonists has revolutionized the management of PONV due to their superior efficacy and favorable side-effect profile [7]. Ondansetron acts by selectively blocking 5-HT3 receptors both centrally in the CTZ and peripherally in the gastrointestinal tract, thereby inhibiting the emetic response [8]. It has a relatively short elimination half-life of approximately 3–6 hours, which may limit its duration of action in the postoperative period [9]. Despite its effectiveness, breakthrough PONV can occur, particularly in high-risk patients or in prolonged surgeries. Palonosetron, a second-generation selective 5-HT3 receptor antagonist, offers several pharmacological advantages over first-generation agents such as Ondansetron. It exhibits substantially higher receptor

binding affinity, unique allosteric receptor interactions, receptor internalization properties, and a markedly prolonged elimination half-life of approximately 40 hours[10]. These characteristics provide extended antiemetic protection, particularly against delayed postoperative nausea and vomiting.

Comparative clinical studies have shown that Palonosetron may be superior to Ondansetron in reducing both early and delayed PONV, especially among high-risk surgical populations. study aims to compare Palonosetron and Ondansetron with respect to incidence of PONV, time to rescue antiemetic administration, total antiemetic requirement, and adverse effects in patients undergoing elective surgery under general anaesthesia.

Materials and Methods

This prospective comparative observational study was conducted in department of anaesthesiology at Chirayu medical college and hospital to evaluate and compare the efficacy of Palonosetron and Ondansetron in preventing postoperative nausea and vomiting (PONV) in patients undergoing tympanoplasty under general anaesthesia from August 2024 to February 2026 and a total of 30 patients operated for tympanoplasty were included in the study.The patients were divided in to two groups Group A (n15) who received Ondansetron and Group B (n15) who received Palanosetron.

Inclusion Criteria

The inclusion criteria considered for this study include Patients undergoing tympanoplasty under general anaesthesia with ASA Grade I, II aged between 18 to 50 years with BMI<= 30.

Exclusion Criteria

- Patients receiving diuretics or antiarrhythmic drugs.
- Patients with prolonged QT interval syndrome, lactating women, history of motion sickness.
- Patients known to have hypersensitivity to one of the used drugs.
- Patients with history of gastro-esophageal reflux.

Anesthetic Technique

- After securing intravenous access with an 18G cannula, standard ASA monitoring including ECG, NIBP, pulse oximetry, and capnography was initiated. After ensuring that the patient is vitally stable general anaesthesia will be administered. Inj Glycopyrrolate 10 mcg/kg, Inj Midazolam (0.07 – 0.15 mg/kg), Inj Fentanyl 2-15 mcg/kg,Inj Propofol 1-1.5 mg/kg was administered. Anaesthesia was maintained as per institutional protocol. At the end of surgery, neuromuscular blockade was reversed using neostigmine and glycopyrrolate, followed by extubation after ensuring adequate recovery.

Drug Administration

- Group A:-Patients in Group A received Injection Ondansetron 0.8 mg/kg (upto maximum 8mg)
- Group B:- Patients in Group B received Injection Palonosetron 1 mcg/kg (upto maximum 75mcg)

Intraoperative Monitoring

Hemodynamic parameters including heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, oxygen saturation, and end-tidal carbon dioxide were recorded at baseline, post antiemetic administration, post induction, and at regular intervals of 10, 20, 30, and 60 minutes intraoperatively.

Postoperative Monitoring

Patients were monitored for PONV and related symptoms immediately after extubation and subsequently at 2, 6, 12, 24, and 48 hours postoperatively. Nausea severity was evaluated using the Motion Sickness Severity Scale (MSSS).

MSSS Assessment Scale

The MSSS is a 7-point validated scoring system ranging from 0 (no symptoms) to 6 (vomiting). Scores ≥2 were considered clinically significant and indicated the need for rescue antiemetic administration. Time to first rescue dose and total number of rescue doses were recorded.

Results

The distribution of MSSS scores among study subjects showed significant differences between Group A and Group B at most time intervals. Immediately post-extubation and at 2, 6, and 12 hours, Group A had significantly higher scores compared to Group B ($p<0.001$), indicating more symptoms in Group A. At 48 hours, the difference remained statistically significant ($p=0.003$). However, at 24 hours, the difference between the groups was not statistically significant ($p=0.232$). Overall, Group B demonstrated consistently lower MSSS scores, suggesting better clinical outcomes compared to Group A.

Variable	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value
Post-extubation	0.79 ± 0.56	0.00 ± 0.00	**<0.001***
2 hr	1.02 ± 0.81	0.31 ± 0.56	**<0.001***
6 hr	1.74 ± 1.52	0.26 ± 0.45	**<0.001***
12 hr	1.15 ± 1.28	0.02 ± 0.15	**<0.001***
24 hr	0.45 ± 0.67	0.29 ± 0.60	0.232
48 hr	0.29 ± 0.60	0.00 ± 0.00	**0.003***

Table 1:- Distribution of MSSS Score in study subject in Group A and Group B

The distribution of rescue dose timing among study subjects showed a significant difference between Group A and Group B. In Group B, the majority of participants (95.2%, n=14) did not require any rescue dose, compared to only 40.5% (n=6) in Group A. In Group A, a substantial proportion required rescue doses at 6 hours (38.1%, n=5) and 12 hours (14.3%, n=2), whereas such requirements were minimal in Group B. The difference between the groups was statistically highly significant ($p<0.001$) using the chi-square test, indicating better outcomes in Group B regarding rescue dose requirement.

	Group A	Group B	p-value
0	6(40.5%)	14(97.6%)	
1	0(0%)	1(2.4%)	**<0.001***
2	1(4.8%)	0(0%)	
6	6(38.1%)	0(0%)	
12	2(14.3%)	0(0%)	
24	0(0%)	0(0%)	
Total	15(100%)	15(100%)	

Table 2:- Distribution of Rescue dose time in study subject in Group A and Group B

The distribution of the number of doses among study subjects showed a significant difference between Group A and Group B. In Group B, the majority of participants (97.6%, n=14) did not require any doses, compared to 43.9% (n=6) in Group A. Most participants in Group A required one dose (54.7%, n=8), while only 2.4% (n=1) in Group B required a single dose. A small proportion in Group A (2.4%, n=1) required two doses, whereas none in Group B did. The difference was statistically highly significant ($p<0.001$), indicating better outcomes in Group B.

	Group A	**Group B**	**p-value**
0	6(43.9%)	14(97.6%)	**<0.001***
1	8(54.7%)	1(2.4%)	
2	1(2.4%)	0(0%)	
Total	15(100%)	15(100%)	

Table 3:- Distribution of number of doses in study subject in Group A and Group B

DISCUSSION

The present study was conducted to compare the efficacy of Palonosetron and Ondansetron in the prevention of postoperative nausea and vomiting (PONV) among patients undergoing middle tympanoplasty under general anaesthesia. PONV remains one of the most common and distressing postoperative complications, particularly in tympanoplasty, where vestibular stimulation significantly increases the incidence. Effective prophylaxis is essential not only to improve patient comfort and satisfaction but also to reduce postoperative complications, delayed recovery, and healthcare burden. Ondansetron, a first-generation 5-HT3 receptor antagonist, has been widely used for PONV prevention; however, its relatively shorter half-life may limit prolonged protection. Palonosetron, a second-generation 5-HT3 receptor antagonist, offers pharmacological advantages including stronger receptor affinity, prolonged half-life, and extended duration of antiemetic action. These properties suggest superior efficacy, particularly in preventing delayed PONV.

The distribution of Motion Sickness Severity Scale (MSSS) scores among study subjects in the present study revealed statistically significant differences between Group A and Group B at most postoperative intervals, clearly demonstrating the superior antiemetic efficacy of Palonosetron over Ondansetron. Group A showed significantly higher MSSS scores immediately after extubation and at 2, 6, and 12 hours postoperatively ($p<0.001$), indicating a greater severity of postoperative nausea and vomiting (PONV). At 48 hours, the difference remained statistically significant ($p=0.003$), suggesting that Palonosetron provided more sustained protection against delayed PONV, whereas the difference at 24 hours was not statistically significant ($p=0.232$). The consistently lower MSSS scores in Group B reflect better postoperative symptom control, reduced patient discomfort, and improved recovery outcomes.[11]

Palonosetron provides superior control of postoperative nausea severity due to its prolonged half-life and higher receptor binding affinity[12].

The distribution of rescue antiemetic dose timing among study subjects in the present study demonstrated a statistically highly significant difference between Group A and Group B, highlighting the superior prolonged antiemetic efficacy of Palonosetron compared to Ondansetron. In Group B, the overwhelming majority of patients (95.2%, n=14) did not require any rescue antiemetic dose, whereas only 40.5% (n=6) in Group A remained rescue-free. A considerable proportion of patients in Group A required rescue antiemetics at 6 hours (38.1%, n=6) and 12 hours (14.3%, n=2), indicating a higher incidence of breakthrough PONV and shorter duration of prophylactic effectiveness. The highly significant difference ($p<0.001$) observed between the two groups confirms that Palonosetron provided superior sustained protection against both early and delayed postoperative nausea and vomiting[13].

The distribution of the total number of rescue antiemetic doses required among study subjects in the present study demonstrated a statistically highly significant difference between Group A and Group B, further emphasizing the superior efficacy of Palonosetron over Ondansetron in preventing postoperative nausea and vomiting (PONV). In Group B, nearly all participants (97.6%, n=14) did not require any rescue antiemetic dose, whereas only 43.9% (n=6) of patients in Group A remained symptom-free without additional medication. The majority of patients in Group A required one rescue dose (54.7%, n=8), while only a single patient (2.4%, n=1) in Group B required one dose. Additionally, a small proportion of Group A participants (2.4%, n=1) required two rescue doses, whereas none in Group B required more than

one dose. The highly significant difference ($p<0.001$) clearly indicates that Palonosetron provided more effective and sustained prophylaxis, significantly reducing the need for postoperative rescue medication[14].

The present study clearly demonstrated that Palonosetron is significantly more effective than Ondansetron in the prevention of postoperative nausea and vomiting (PONV) among patients undergoing tympanoplasty under general anaesthesia. Palonosetron consistently showed superior outcomes by significantly reducing MSSS scores, delaying or eliminating the need for rescue antiemetic therapy, and minimizing the total number of rescue doses required during the postoperative period. Its prolonged half-life, stronger receptor affinity, and sustained pharmacological action contributed to enhanced control of both early and delayed PONV. Therefore, Palonosetron may be considered a superior first-line prophylactic antiemetic agent for high-risk surgical procedures such as tympanoplasty, where effective prevention of PONV is crucial for optimizing perioperative outcomes and patient satisfaction.

Limitations

1. The present study had certain limitations that should be considered while interpreting the findings. Being a single-center study, the generalizability of the results to broader populations and different clinical settings may be limited.
2. It did not evaluate combination antiemetic regimens or compare other newer antiemetic agents.

Conclusion

The present study comprehensively evaluated and compared the efficacy and safety of Palonosetron and Ondansetron for the prevention of postoperative nausea and vomiting (PONV) in patients undergoing tympanoplasty under general anaesthesia, a population recognized to be at particularly high risk for PONV due to vestibular stimulation and perioperative anesthetic factors. The findings clearly demonstrated that Palonosetron was superior to Ondansetron in providing more effective and prolonged prophylaxis against both early and delayed postoperative nausea and vomiting. Therefore, Palonosetron may be recommended as a preferred first-line agent for PONV prophylaxis in middle ear surgeries and similar procedures requiring extended postoperative antiemetic coverage. Future multicentric studies with larger populations are warranted to further validate these findings and optimize perioperative antiemetic protocols.

Conflict of Interest

There was no conflict of interest.

References

1. Gan TJ. Selective serotonin 5-HT3 receptor antagonists for postoperative nausea and vomiting: are they all the same? CNS Drugs. 2005;19(3):225-38. doi: 10.2165/00023210-200519030-00004. PMID: 15740177.
2. Apfel CC, Läärä E, Koivuranta M, Greim CA, Roewer N. A simplified risk score for predicting postoperative nausea and vomiting: conclusions from cross-validations between two centers. Anesthesiology. 1999 Sep;91(3):693-700. doi: 10.1097/00000542-199909000-00022. PMID: 10485781.
3. Kovac AL. Prevention and treatment of postoperative nausea and vomiting. Drugs. 2000 Feb;59(2):213-43. doi: 10.2165/00003495-200059020-00005. PMID: 10730546.
4. Darkow T, Gora-Harper ML, Goulson DT, Record KE. Impact of antiemetic selection on postoperative nausea and vomiting and patient satisfaction. Pharmacotherapy. 2001 May;21(5):540-8. doi: 10.1592/phco.21.6.540.34543. PMID: 11349743.
5. Ryu J-H, Jeon Y-T, Min B, Hwang J-Y, Sohn H-M (2018) Effects of palonosetron for prophylaxis of postoperative nausea and vomiting in high-risk patients undergoing total knee arthroplasty: A prospective, randomized, double-blind, placebo-controlled study. PLoS ONE 13(5): e0196388.
6. Gan TJ, Diemunsch P, Habib AS, Kovac A, Kranke P, Meyer TA, Watcha M, Chung F, Angus S, Apfel CC, Bergese SD, Candiotti KA, Chan MT, Davis PJ, Hooper VD, Lagoo-Deenadayalan S, Myles P, Nezat G, Philip BK, Tramèr MR; Society for Ambulatory Anesthesia. Consensus guidelines for the management of postoperative nausea and vomiting. Anesth Analg. 2014 Jan;118(1):85-113. doi: 10.1213/ANE.0000000000000002.

7. Loewen PS, Marra CA, Zed PJ. 5-HT3 receptor antagonists vs traditional agents for the prophylaxis of postoperative nausea and vomiting. Can J Anaesth. 2000 Oct;47(10):1008-18. doi: 10.1007/BF03024875. PMID: 11032279.
8. Roila F, Del Favero A. Ondansetron clinical pharmacokinetics. Clin Pharmacokinet. 1995 Aug;29(2):95-109. doi: 10.2165/00003088-199529020-00004. PMID: 7586904.
9. Tang, D. and Malone, D.. A network meta-analysis on the efficacy of serotonin type 3 receptor antagonists used in adults during the first 24 hours for postoperative nausea and vomiting . Clinical therapeutics. 2012.
10. Gupta K, Singh I, Gupta PK, et al. Palonosetron, Ondansetron, and Granisetron for antiemetic prophylaxis of postoperative nausea and vomiting: A comparative evaluation. Anesth Essays Res. 2014;8(2):197-201.
11. Sharma S, Khanna S, Das J, Mehta Y, Handa KK. A randomized study to compare palonosetron with ondansetron for prevention of postoperative nausea and vomiting following middle ear surgeries. J Anaesthesiol Clin Pharmacol. 2019 Apr-Jun;35(2):182-187. doi: 10.4103/joacp.JOACP_196_17.
12. Singh PM,Borle A,Gouda D,Trikha A,Sinha A.Efficacy of palonosetron in postoperative nausea and vomiting prophylaxis: a systemic review and metaanalysis.J Clin anesth.2016:34:459-82
13. Gupta K, Singh I, Gupta PK, et al. Palonosetron, Ondansetron, and Granisetron for antiemetic prophylaxis of postoperative nausea and vomiting: A comparative evaluation. Anesth Essays Res. 2014;8(2):197-201.
14. Seshamani M,Varghese BT, D'souza N.Comparative study of Palonosetron and Ondansetron for prevention of postoperative nausea and vomiting.Indian J Clin anesth.2018;5(2):235-40