http://www.banglajol.info/index.php/JNINB

Original Article

DOI: https://doi.org/10.3329/jninb.v11i1.78981

Journal of National Institute of Neurosciences Bangladesh,
January 2025, Vol. 11, No. 1, pp. 52-57

ISSN (Online) 2518-6612
ISSN (Print) 2410-8030

Comparative Study on the Effectiveness of Palonosetron Versus Granisetron in Preventing Postoperative Nausea and Vomiting (PONV)

Md. Anwarul Mamun[1], Md. Aminul Hasnat[2], Tayeba Haque[3], Md. Rayhan Reza Rony[4], Rabiul Islam[5], Nur Mohammad Arif Sarker[6], Jamaddar Maniruzzaman Noor[7], Mohammad Aftab Rassel[8].

[1]Junior Consultant, Department of Neuro-Anaesthesiology, National Institute of Neurosciences and Hospital, Dhaka, Bangladesh; [2]Associate Professor, Department of Neuro-Anaesthesiology, National Institute of Neurosciences and Hospital, Dhaka, Bangladesh; [3]Senior Consultant, Department of Neuro-Anaesthesiology, National Institute of Neurosciences and Hospital, Dhaka, Bangladesh; [4]Senior Consultant, Department of Neuro-Anaesthesiology, National Institute of Neurosciences and Hospital, Dhaka, Bangladesh; [5]Junior Consultant, Department of Neuro-Anaesthesiology, National Institute of Neurosciences and Hospital, Dhaka, Bangladesh; [6]Junior Consultant, Department of Neuro-Anaesthesiology, National Institute of Neurosciences and Hospital, Dhaka, Bangladesh; [7]Junior Consultant, Department of Neuro-Anaesthesiology, National Institute of Neurosciences and Hospital, Dhaka, Bangladesh; [8]Assistant Professor, Department of Neuro intervention, National Institute of Neurosciences and Hospital, Dhaka, Bangladesh

Abstract

Background: Palonosetrone is a potent, single stereoisomeric 5-HT_3RA, with a structure based on a fused tricyclic ring system attached to a quinuclidine moiety - unique and different from first-generation 5-HT_3RA, therefore aim of our study was to find out betterment of palonosetrone as PONV management in comparison to granisetrone. **Objectives:** The purpose of the present study was to evaluate the effectiveness of Palonosetrone in comparison with Granisetrone in preventing Postoperative nausea and vomiting. **Methodology:** The patient with ASA grade I, II and age between (20-50) years undergoing surgery under general anaesthesia having no pathology or deformity causing vomiting were selected after their admission in Bangladesh Medical college and hospital from November 2019 to May 2020, Department of Anaesthesiology & ICU, Bangladesh Medical College & Hospital, Dhaka. The selected patients were divided in two groups. Both the group was given a prospective randomized trial were conducted on a total of 60 patients of ASA grade I and II and mallampati I & II of either sex between age group of 20 to 50 years, scheduled for general anaesthesia were selected at random. **Results:** The overall incidence of PONV was 26.67 % for group A and 63.33% for group B. The number of complete responders to drugs at 24 hr after the surgery was 22 (73.33 %) for palonosetrone and 11 (36.67%) for granisetrone representing statistical difference (P = 0.035). **Conclusion:** Palonosetrone is more effective in the prevention of PONV in patients undergoing elective surgerys under general anaesthesia as compared to granisetrone, especially in the 2-24 h period postoperatively. *[Journal of National Institute of Neurosciences Bangladesh, January 2025;11(1):52-57]*

Keywords: PONV; Palonosetrone; Granisetrone; VAS for nausea.

Introduction

Postoperative nausea and vomiting (PONV) are among the most common complications of general anaesthesia, affecting (30-40) % of patients, and up to 80% in high-risk populations. Post operative nausea and vomiting (PONV) are hazardous symptoms that commonly occur after surgery performed under general anaesthesia[1]. Vomiting can cause dehydration, disruption of surgical repair, electrolyte imbalance, other complications, including increased hospital costs and increase the perception of pain[2]. A number of pharmacological agents (butyrophenones, dopamine receptor antagonists, antihistamines) have been tried for prevention and treatment of PONV but adverse effects such as excessive sedation, hallucinations, hypertension, dry mouth, dysphoria and extra pyramidal symptoms have been noted[3]. 5-hydroxytryptamine type-3 ($5HT_3$) receptor antagonists are devoid of such side effects and highly effective in prevention and treatment of PONV.

Granisetrone is a highly selective & potent 5-HT_3 receptor antagonist[4]. It acts specifically at 5-HT_3 receptors on the vagal afferent nerves of the gut.

Correspondence: Dr. MD. Anwarul Mamun, Junior Consultant, Department of Neuro-Anaesthesiology, National Institute of Neurosciences and Hospital, Dhaka, Bangladesh; Email: zoinmamun.zm@gmail.com; Cell no: +8801714577944;
ORCID: https://orcid.org/0009-0001-7289-909X

Granisetron produces irreversible block of 5-HT_3 receptors and it may account for the long duration of this drug[5,6]. Palonosetron is a 5-HT_3 receptor antagonist used for preventing chemotherapy induced nausea and vomiting. This unique 5-HT_3 receptor antagonist has a greater binding affinity and longer half-life than older 5-HT_3 antagonists like ondansetron. Recent receptor binding studies suggest that palonosetron is further differentiated from other 5-HT_3 by interacting with 5-HT_3 receptors in an allosteric, positively cooperative manner at sites different from those that bind with ondansetron and granisetron[7].

We designed this randomized clinical study to assess and compare the antiemetic efficacy of granisetron and palonosetron to prevent PONV in patients undergoing Surgery under General Anaesthesia.

Methodology

Study Settings and Population: The patient with ASA grade I, II and age between (20-50) years undergoing surgery under general anaesthesia having no pathology or deformity causing vomiting were selected after their admission in Bangladesh Medical college and hospital from November 2019 to May 2020, Department of Anaesthesiology & ICU, Bangladesh Medical College & Hospital, Dhaka.

Study Procedure: Patients were randomly selected for the study from admitted patient scheduled to undergo elective surgical procedures under general anaesthesia at BMCH, Dhaka. The selected patients were divided into two groups. Both the group was given a prospective randomised trial were conducted on a total of 60 patients of ASA grade I and II and mallampati I & II of either sex between age group of 20 to 50 years, scheduled for general anaesthesia were selected at random.

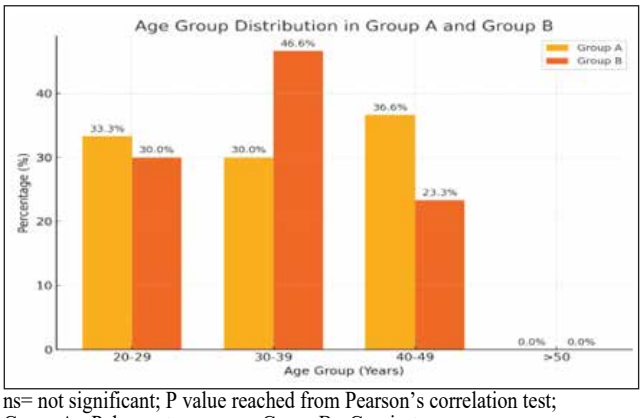
Statistical Analysis: Statistical analyze were carried out by using the Statistical Package for Social Sciences version 23.0 for Windows (SPSS Inc., Chicago, Illinois, USA). Appropriate statistical test was applied. P values <0.05 was considered as statistically significant.

Ethical implications: Ethical clearance were taken from the Institutional ethical body. The purpose and effects of the study was clearly explained to each of the subjects and the confidentiality was ensured. The study was done after taking proper informed written consent.

Results

The results of this study were to brought the true picture of patient's post-operative nausea and vomiting.

The majority of the patients were in the age range of 30-39 years in Group B and 40-49 years old in Group A. The mean age was found 36.0 ± 9.1 years in group A and 35.4 ± 7.8 years in group B. The difference was not statistically significant (p>0.05) between two groups. No statistical difference between mean ages of the groups (p>0.05) (Figure 1)



ns= not significant; P value reached from Pearson's correlation test;
Group A= Palonosetron group; Group B= Granisetrone group

Figure 1: Distribution of the study patients by age (n=60)

The majority of the patients mean weight were found 72.3 ± 14.1 kg in group A and 70.5 ± 13.8 kg in group B. No statistically significant difference was found when correlated (Table 1).

Table 1: Distribution of the study patients according to weight (n=60)

	Group A	Group B	P value
	Mean ± SD	Mean ± SD	
Weight (kg)	72.3 ± 14.1	70.5 ± 13.8	0.614^{ns}
Range (min-max)	45-105	45 -105	

ns= not significant; P value reached from Pearson's correlation test

The mean duration of anaesthesia was found 78.6 ± 25.1 minute in group A and 77.6 ± 22.9 minute in group B. The difference was not statistically significant (p>0.05) between two groups (Table 2).

Table 1: Distribution of the study patients according to weight (n=60)

	Group A	Group B	P value
	Mean ± SD	Mean ± SD	
Duration of anaesthesia (min)	78.6 ± 25.1	77.6 ± 22.9	0.91^{ns}
Range (min-max)	40-140	40-130	

ns= not significant; P value reached from Pearson's correlation test

After the end of surgery Group B experienced slightly more nausea, but they also experienced more vomiting, with a statistically significant P=0.035 (Table 3).

Table 1: Distribution of the study patients according to weight (n=60)

	Group A	Group B	P value
No PONV	22 (73.3%)	11 (36.6%)	
(0-2) hours			
Nausea	5 (16.6%)	6 (20%)	
Vomiting	1 (3.3%)	5 (16.6%)	
VAS	0.73 ± 1.43	0.83 ± 1.49	
(2-24) hours			
Nausea	1 (3.3%)	2 (6.6%)	
Vomiting	1 (3.3%)	6 (20%)	
VAS	0.27 ± 0.78	0.27 ± 0.78	0.03[s]
Total			
Nausea	**6 (20%)**	**8 (26.6%)**	
Vomiting	**2 (6.6%)**	**11 (36.6%)**	

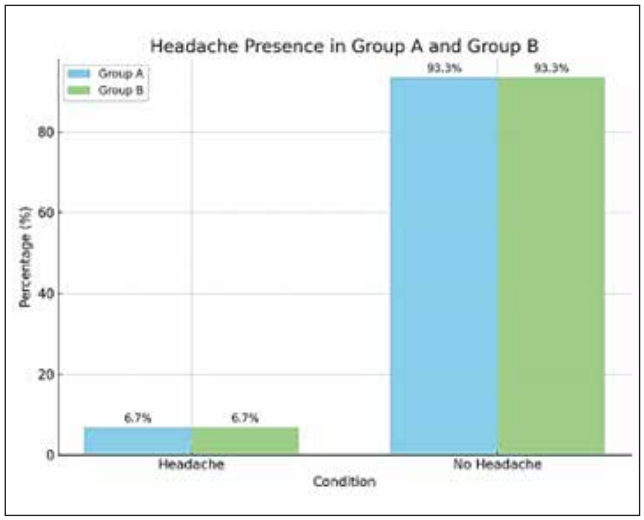
S= Significant, ns= not significant, P value reached from Chi-Square test, VAS value reached from t-test, Data are mean ± SD or number of patients (%). VAS: visual analogue scale. *VAS score for nausea (0: none, 10: the worst imaginable nausea).

Both Groups A and B used Ondensetron more frequently and Group B required more rescue medication. The difference between these two groups were statistically significant (Table 4).

Table 4: Rescue medication. (n=60)

	Group A	Group B	P value
No Rescue medicine	28 (46.6%)	19 (31.6%)	
Metoclopramide 10mg I.V.	0	3 (16.6%)	0.01[ns]
Ondensetron 4mg I.V.	2 (3.3%)	8 (13.3%)	

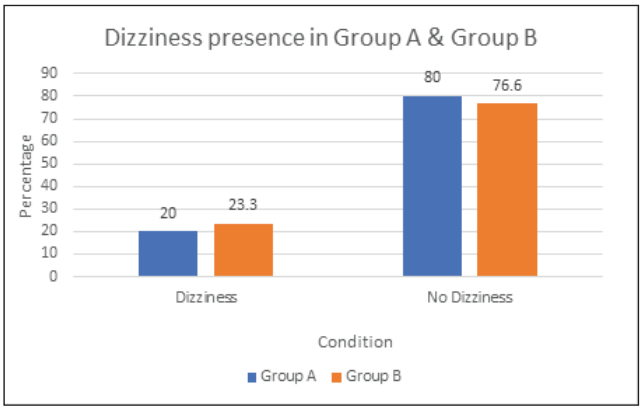
Headache was equal in both group 6.7% and statistically not significant. (Figure 2)



S= Significant, ns= not significant, P value reached from chi square test.

Figure 2: Headache in postoperative period (n=60)

Dizziness was more in Group B 23.3% but statistically it was not significant. (Figure 3)



ns= not significant, P value reached from chi square test.

Figure 3: Dizziness in postoperative period

Discussion

This prospective randomized clinical study was conducted in Department of Anaesthesiology & ICU, Bangladesh Medical College & Hospital, Dhaka from November 2019 to May 2020. Total of 60 patients fulfilling inclusion/exclusion criteria were studied to determine the effectiveness of pretreatment with Palonosetrone and Granisetrone.

In this study observed that the mean age was found 36.0 ± 9.1 years in group A and 35.4 ± 7.8 years in group B & was not statistically significant (p>0.05) between two groups. Similar observation was found Tong J. Gan, MB.[21] they showed the mean age in group Granisetrone was 34.3 ± 8.3 years and in group Promethazine was 33 ± 6.5 years. The difference was not statistically significant (p>0.05) between two groups.

In present study observed that the majority (53.3%) patients were female in group A and equal in group B & was not statistically significant (p>0.05) between two groups. Cho et al[23] showed the distribution of sex was 51 male and 45 female in Group P and 45 male and 51 female in Group PD & was not statistically significant (p>0.05) between two groups.

In this study observed that the mean weight was found 72.3 ± 14.1 kg in group A and 70.5 ± 13.8 kg in group B & was not statistically significant (p>0.05) between two groups. Gan et al[21] study reported similar observation they showed that the mean weight was found 79.5 ± 25.3 kg in group Granisetrone and 77.0 ± 19.6 kg in group Promethazine & was not statistically significant (p>0.05) between two groups. Jigisha Makwana.[22] also reported the mean weight in group Palonosetrone was 60.1+4.9 kg and in group

Granisetrone was 59.3 + 5.1 kg & was not statistically significant (p>0.05) between two groups. Cho et al[23] reported the mean body weight of group P was 66.5 ± 12.3 kg and group PD was 65.0±13.3 kg & was not statistically significant (p>0.05) between two groups.

In this study observed that the mean duration of operation was found 68 ± 23.47 minute in group A and 67.3 ± 23.3 minute in group B & was not statistically significant (p>0.05) between two groups. Cho et al[23] studied the mean duration of surgery was found 80.8 ± 47.8 minute for group P, 76.8 ± 40.1 minute in group PD & was not statistically significant (p>0.05) between two groups. Our observation was supported different studies, in study of Makwana et al[22] reported the mean duration of surgery was found 100.2 ± 34.1 minute in group palonosetrone and 99.4 ± 25.3 minute in group Granisetrone & was not statistically significant (p>0.05) between two groups. Gan et al[21] also reported that the mean duration of surgery was found 109.6 ± 54.2 minute in group granisetrone and 106.2 ± 62.5 minute in group palonosetrone & was not statistically significant (p>0.05) between two groups.

In this study observed that the mean duration of anaesthesia was found 78.6 ± 25.1 minute in group A and 77.6 ± 22.9 minute in group B & was not statistically significant (p>0.05) between two groups. Cho et al[23] reported the mean duration of anaesthesia in group P was 123.4 + 53.3 minute and in the group, PD was 118.4 + 49.6 minute were comparable and an insignificant 'p' value. Park et al[24] found the mean duration of anesthesia was found 117.1 ± 42 minute in group P and 123.1 ± 45.5 minute in group C & was not statistically significant (p>0.05) between two groups. Makwana et al[22] reported the duration of anesthesia in both groups was comparable with duration in palonosetrone group was 128.1 ± 47.5 hour and in granisetrone group was 123.5 ± 35.1 hour & was not statistically significant (p>0.05) between two groups.

In this study observed that almost two third 19(63.3%) patients was found ASA grade I in group A and 19(63.3%) in group B & was not statistically significant (p>0.05) between two groups. Park et al[24] observed that the ASA grade ratio was 39:2 in group P and 40:3 in group C & was not statistically significant (p>0.05) between two groups. Makwana et al[22] reported that the ASA grade ratio was 23:12 in group Palonosetrone and 24:11 in group Granisetrone & was not statistically significant (p>0.05) between two groups.

In this study observed at the end of surgery, patient with no post operative nausea and vomiting was found to be 22(36.6%) in group A and 11(18.3%) in group B. 0 to 2 hours nausea in group A was 5(8.3%) and group B was 6(10%), whereas vomiting was 1(1.6%) in group A and 5(8.3%) in group B. 2 to 24 hours nausea post operatively was 1(1.6%) in group A and 2(3.3%) in Group B & vomiting was 1(1.6%) in Group A and 6(10%) in Group B. VAS for Nausea in 0 to 2 hours mean and SD was 0.73 ± 1.43 for Group A and 0.8 ± 1.4 for Group B. VAS for Nausea in 2 to 24 hours was 0.2 ± 0.7 for Group A and 0.27±0.78 for Group B. There is statistically significant (p=0.035 s) difference in the patients in both the groups with relation to above factors. Cho et al[23] observed that in 0-6 hours after surgery in group P nausea was 60 (62.5%) and in group PD was 47 (49%). Vomiting was 10 (10.4%) for group P and 8 (8.3%) for group PD and p=0.042. 6 to 24 hours nausea was 62 (64.9%) for group P and 52 (54.2%) for group PD, vomiting was 11(11.5%) for group P and 11(11.5%) for group PD & p=0.142. Makwana et al[22] found in study that 0 to 6 hours nausea for Palonosetrone group was 2 out of 35 and 3 out of 35 for Granisetrone group & vomiting was 1 out of 35 for Palonosetrone group and 1 out of 35 for Granisetrone group & p=0.5 & 1 respectively. 6-24 hours postsurgical observation was nausea was 2 out of 35 for Palonosetrone group and 4 out of 35 for Granisetrone group & p=0.336, vomiting was 0 for palonosetrone group and 1 out of 35 for granisetrone group, overall p=0.311. Gan et al[21] found that nausea for first 2 hour granisetrone group was 17(37%) and promethazine group was 23(49%) & Vomiting incidence for 0-2 hours was 5(11%) for granisetrone group and 6(13%) for promethazine group (& p=0.17), 2-6 hours nausea in granisetrone group was 12 (26%) and promethazine group was 16(34%) & 2-6 hours vomiting in granisetrone group was 5 (11%) and promethazine group was 3(6%) (& p=0.041), 6-24 hours granisetrone group was 12(26%) and promethazine group was 12(26%), 6-24 hours granisetrone group was 2(4%) and promethazine group was 2(4%) (& p=0.024).

In this study 4 (13.3%) patients needed rescue medicine postoperatively in group A whereas group B needed more rescue medicine and that was 10(33.3%). There was statistically significant difference in the patients in both the groups with relation to above factors. Makwana et al[22] found to have rescue medicine given in 0-6 hours was 1 out of 35 for palonosetrone

group and 1 out of 35 for granisetrone group. For 6-24 hours duration postoperatively, the number was 0 for palonosetrone group and it was 1 out of 35 for granisetrone group. Gan et al[21] found that granisetrone group needed rescue medicine postoperatively 0-2 hours was 10(22%), 2-6 hours was 1(2%) and 6-24 hours was 0, whereas Promethazine group needed in 0-2 hours postoperatively was 17(37%), 2-6 hours was 3(7%) and 6-24 hours was 2(4%).

In this study 2(6.7%) patients had headache in postoperative period in group A and 2(6.7%) in group B. There was no statistically significant ($p>0.05$) between two groups. R. A. Johns study reported that the headache was found 13% in group Cyclizine and 15% in group Granisetrone & was not statistically significant ($p=0.79$) between two groups.

In this study 6(20%) patients had dizziness in postoperative period in group A and 7(23.3%) in group B. There is no statistically significant ($p>0.05$) between two groups. R. A. Johns study reported that the dizziness was found 40% in group Cyclizine and 32% in group Granisetrone & was statistically significant ($p=0.04$) between two groups.

Conclusion

Present study demonstrated that addition of palonosetrone to combat post operative nausea and vomiting results in markedly prolonged duration of antiemetic property with minimum unwanted effects. And palonosetrone have few requirements of rescue medication. So, it is concluded that palonosetrone can be used to prevent post operative nausea and vomiting. The limitation of our study was small sample size and short duration of study period.

Acknowledgements
None

Conflict of interest: Authors declared no conflict of interest.

Financial Disclosure
This research project was not funded by any organization.

Contribution to authors: Study Design & Protocol Preparation: Md. Anwarul Mamun, Md. Aminul Hasnat; Data Collection & Literature Review: Tayeba Haque, Md. Rayhan Reza Rony, Rabiul Islam; Statistical Analysis & Interpretation: Nur Mohammad Arif Sarker; Manuscript Drafting & Revision: Jamaddar Maniruzzaman Noor All authors reviewed and approved the final manuscript.

Data Availability
Data supporting the findings of this study are available from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate
Ethical approval was obtained from the Institutional Review Board of Bangladesh Medical College & Hospital. Written informed consent was obtained from all participants prior to inclusion in the study. All procedures were conducted in accordance with relevant ethical guidelines and regulations.

How to cite this article: Mamun MA, Hasnat MA, Haque T, Rony MRR, Islam R, Sarker NMA, Noor JM. Comparative Study on the Effectiveness of Palonosetron Versus Granisetron in Preventing Postoperative Nausea and Vomiting (PONV). Journal of National Institute of Neurosciences Bangladesh. 2025;11(1):52–57

ORCID:
MD. Anwarul Mamun: https://orcid.org/0009-0001-7289-909X
MD. Aminul Hasnat: https://orcid.org/0009-0001-3802-0600
Tayeba Haque: https://orcid.org/0009-0009-9559-0720
MD. Rayhan Reza Rony: https://orcid.org/0009-0003-0231-9808
Rabiul Islam: https://orcid.org/0009-0004-1383-2380
Nur Mohammad Arif Sarker: https://orcid.org/0009-0009-9217-3788
Jamaddar Maniruzzaman Noor: https://orcid.org/0009-0002-5922-866X
Mohammad Aftab Rassel: https://orcid.org/0000-0002-2444-9924

Article Info
Received on: 7 September 2024
Accepted on: 24 November 2024
Published on: 1 January 2025

References

1. 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 1;91(3):693-700.
2. Kumar SA, Prajnyananda D, Sachidananda D. A Comparative Study of Ondansetron versus Ondansetron with Dexamethasone in Prevention of Postoperative Nausea and Vomiting (PONV) in Patients Undergoing Modified Radical Mastectomy with Axillary Node Dissection Under General Anaesthesia.
3. Conway C. Textbook of Anaesthesia. Edited by Smith G.and Aitkenhead A. R. Published by Churchill Livingstone. Pp. 586; indexed; illustrated. British Journal of Anaesthesia. 2013;58(9):843.
4. Wennstrøm B. Neostigmine may cause postoperative nausea and vomiting. Acta anaesthesiologica scandinavica. 2002 Oct;46(9):1179-.
5. Fero KE, Jalota L, Hornuss C, Apfel CC. Pharmacologic management of postoperative nausea and vomiting. Expert opinion on pharmacotherapy. 2011 Oct 1;12(15):2283-96.
6. Tramer MR, Reynolds JM, Moore RA, McQuay HJ. Efficacy, dose-response, and safety of ondansetron in prevention of postoperative nausea and vomiting: a quantitative systematic review of randomized placebo-controlled trials. Database of Abstracts of Reviews of Effects (DARE): Quality-assessed Reviews

[Internet]. 1997.
7. Johns RA, Hanousek J, Montgomery JE. A comparison of cyclizine and granisetron alone and in combination for the prevention of postoperative nausea and vomiting. Anaesthesia. 2006 Nov;61(11):1053-7.
8. Sukhani R, Frey K. Multimodal analgesia approach to postoperative pain management in ambulatory surgery. Techniques in Regional Anesthesia and Pain Management. 1997 Apr 1;1(2):79-87.
9. Makwana J, Vadodariya D, Vadodariya B. Palonosetron and Granisetron for the Prevention of Postoperative Nausea and Vomiting after Laparoscopic Cholecystectomy: A Prospective Comparative Randomised Active Controlled Trial. JMSCR 2017;05(04):21034-39
10. George E, Hornuss C, Apfel CC. Neurokinin-1 and novel serotonin antagonists for postoperative and postdischarge nausea and vomiting. Current Opinion in Anesthesiology. 2010 Dec 1;23(6):714-21.
11. Kovac AL, Eberhart L, Kotarski J, Clerici G, Apfel C, Palonosetron 04-07 Study Group. A randomized, double-blind study to evaluate the efficacy and safety of three different doses of palonosetron versus placebo in preventing postoperative nausea and vomiting over a 72-hour period. Anesthesia & Analgesia. 2008 Aug 1;107(2):439-44.
12. Park SK, Cho EJ. A randomized, double-blind trial of palonosetron compared with ondansetron in preventing postoperative nausea and vomiting after gynaecological laparoscopic surgery. Journal of International Medical Research. 2011 Apr;39(2):399-407.
13. Park JW, Jun JW, Lim YH, Lee SS, Yoo BH, Kim KM, Yon JH, Hong KH. The comparative study to evaluate the effect of palonosetron monotherapy versus palonosetron with dexamethasone combination therapy for prevention of postoperative nausea and vomiting. Korean journal of anesthesiology. 2012 Oct;63(4):334.
14. Aitkenhead A, Thompson J, Rowbotham D, Moppett I. Smith & Aitkenhead's textbook of anaesthesia. 6th ed. 2013.p846
15. Clark-Snow R, Affronti ML, Rittenberg CN. Chemotherapy-induced nausea and vomiting (CINV) and adherence to antiemetic guidelines: results of a survey of oncology nurses. Supportive Care in Cancer. 2018 Feb; 26:557-64.
16. Cochran, W. G. (1977) Sampling Techniques, 3rd ed., Wiley, New York.
17. Sukhani R, Frey K. Multimodal analgesia approach to postoperative pain management in ambulatory surgery. Techniques in Regional Anesthesia and Pain Management. 1997 Apr 1;1(2):79-87.
18. Smith CA, Haas RE, Zepp JC, Klein M. Improving the quality of post-anesthesia care: An evidence-based initiative to decrease the incidence of postoperative nausea and vomiting in the post-anesthesia care unit. Perioperative Care and Operating Room Management. 2016 Sep 1; 4:12-6.
19. Gan TJ, Candiotti KA, Klein SM, Rodriguez Y, Nielsen KC, White WD, Habib AS. Double-blind comparison of granisetron, promethazine, or a combination of both for the prevention of postoperative nausea and vomiting in females undergoing outpatient laparoscopies. Canadian journal of anesthesia. 2009 Nov 1;56(11):829.
20. Cho E, Kim DH, Shin S, Kim SH, Oh YJ, Choi YS. Efficacy of palonosetron-dexamethasone combination versus palonosetron alone for preventing nausea and vomiting related to opioid-based analgesia: a prospective, randomized, double-blind trial. International Journal of Medical Sciences. 2018;15(10):961.
21. Gan TJ, Candiotti KA, Klein SM, Rodriguez Y, Nielsen KC, White WD, Habib AS. Double-blind comparison of granisetron, promethazine, or a combination of both for the prevention of postoperative nausea and vomiting in females undergoing outpatient laparoscopies. Canadian journal of anesthesia. 2009 Nov 1;56(11):829.
22. Makwana J, Vadodariya D, Vadodariya B. Palonosetron and Granisetron for the Prevention of Postoperative Nausea and Vomiting after Laparoscopic Cholecystectomy: A Prospective Comparative Randomised Active Controlled Trial.
23. Cho E, Kim DH, Shin S, Kim SH, Oh YJ, Choi YS. Efficacy of palonosetron-dexamethasone combination versus palonosetron alone for preventing nausea and vomiting related to opioid-based analgesia: a prospective, randomized, double-blind trial. International Journal of Medical Sciences. 2018;15(10):961.
24. Park JW, Jun JW, Lim YH, Lee SS, Yoo BH, Kim KM, Yon JH, Hong KH. The comparative study to evaluate the effect of palonosetron monotherapy versus palonosetron with dexamethasone combination therapy for prevention of postoperative nausea and vomiting. Korean journal of anesthesiology. 2012 Oct;63(4):334.