Original Article

DOI: 10.17354/ijss/2016/167

Randomized Controlled Study to Compare the Efficacy of Intravenous Palonosetron and Intravenous Ondansetron in Preventing Post-operative Nausea and Vomiting in Laparoscopic Surgeries

K Sureshkumar[1], A Sivashanmugam[2], N Giri Murugan[3], Suneeth P Lazarus[4], M Nithish Mukunthan[2]

[1]Associate Professor, Department of Anaesthesiology, Sri Manakula Vinayagar Medical College and Hospital, Puducherry, India, [2]Post-graduate, Department of Anaesthesiology, Sri Manakula Vinayagar Medical College and Hospital, Puducherry, India, [3]Senior Resident, Department of Anaesthesiology, Sri Manakula Vinayagar Medical College and Hospital, Puducherry, India, [4]Professor, Department of Anaesthesiology, Sri Manakula Vinayagar Medical College and Hospital, Puducherry, India

Abstract

Introduction: Post-operative nausea and vomiting (PONV) are two of the most common and unpleasant side effects following anesthesia and surgery resulting in complications such as dehydration, gastric aspiration, and wound dehiscence. Laparoscopic surgery is minimally invasive with faster recovery, shorter hospital stay but PONV remains a major cause for morbidity.

Purpose: The purpose of the study was to compare the efficacy of intravenous (IV) palonosetron and IV ondansetron in preventing PONV in laparoscopic surgeries.

Materials and Methods: This randomized, double-blinded, controlled study was conducted in the Department of Anaesthesiology, SMVMCH, Puducherry, India. 100 adult patients were divided into two groups of 50 each, randomized to receive 0.075 mg of palonosetron and 4 mg of ondansetron before induction. The occurrence of nausea, vomiting and severity of nausea according to a visual analog scale (VAS: 0 - No nausea; 10 - Worst nausea) were observed immediately after the end of surgery at 0-2 h, 2-6 h, 6-12 h, and 12-24 h post-surgery. Injection metoclopramide (10 mg IV) was used as a rescue antiemetic when one episode of PONV occurred or at VAS >5 and the patient requested for treatment. Details of any adverse events and their overall satisfaction were recorded.

Results: The two groups were comparable regarding age, gender, weight, and category of surgery. The incidence of post-operative nausea and overall PONV were lower in Group P than Group O, which was statistically significant ($P < 0.05$). The requirement of rescue medication was lower in Group P but statistically not significant. Adverse events in both groups were statistically non-significant. Patient satisfaction was better with Group P though statistically not significant.

Conclusion: Palonosetron 0.075 mg IV produced a lower incidence of PONV compared with ondansetron 4 mg IV in patients undergoing laparoscopic surgeries in the first 24 h with better patient satisfaction.

Key words: Adverse events, Nausea, Ondansetron, Palonosetron, Patient satisfaction, Rescue medication, Vomiting

INTRODUCTION

Post-operative nausea and vomiting (PONV) are two of the most common and unpleasant side effects following anesthesia and surgery.[1] Patients not only rank the absence of PONV as being important[2] but also rank it more important than an earlier discharge from an ambulatory surgical unit.[3] PONV can be very distressing to the patient, sometimes more than the surgery itself, and it can result in several complications such as dehydration, gastric aspiration, and wound dehiscence.[4-6]

The overall incidence of PONV after general anesthesia in outpatients has been reported to be 37% although several factors including age, sex, history of PONV, and opiate administration influence the risk.[7] Even patients with zero

Access this article online

www.ijss-sn.com

Month of Submission : 01-2016
Month of Peer Review : 02-2016
Month of Acceptance : 03-2016
Month of Publishing : 03-2016

Corresponding Author: Dr. A Sivashanmugam, Department of Anaesthesiology, Sri Manakula Vinayagar Medical College and Hospital, Puducherry, India. Phone: +91-9944999771. E-mail: shanmugam.siva1986@gmail.com

known risk factors carry a 10% risk of PONV. This risk increases dramatically to 61% and 79%, respectively, when 3 or 4 risk factors exist (female gender, non-smoker, history of motion sickness, post-operative opioid use, and history of PONV).[8]

Laparoscopic surgery provides tremendous benefits to patients including faster recovery, shorter hospital stay, and prompt return to normal activities. Despite the minimally invasive nature of laparoscopy, high incidence of PONV remains a major cause for morbidity.[9]

Post-operative nausea and/or vomiting can be defined as nausea and/or vomiting within 24 h of surgery.[10,11] Nausea and vomiting are associated with decreased quality of life and patient satisfaction.[12,13]

Factors that reportedly affect the incidence of PONV include female sex, non-smoker, history of PONV, motion sickness, lengthy surgical duration, inhalational anesthetics, nitrous oxide, intra-operative and post-operative use of opioids. In addition, severe anxiety before surgery, the type of surgery, intra-operative fluid therapy, and increased duration of anesthesia also affect the incidence of PONV.[14] Female gender, motion sickness, history of PONV, non-smoker, and post-operative use of opioids are known to be the most predictive factors among all the factors.[15]

The 5-hydroxytryptamine-3 (5-HT3) receptor antagonists are popular drugs for PONV prophylaxis because of their similar efficacy to droperidol or dexamethasone and their favorable side-effect profile.[16] Ondansetron was the first commercially available 5-HT3 receptor antagonist. Thereafter, granisetron, dolasetron, tropisetron, ramosetron, and palonosetron were introduced. Many studies have confirmed that this class of antiemetics exhibited better prophylactic efficacies compared with the older traditional drugs including droperidol, perphenazine, or metoclopramide.[17-19]

Palonosetron is a new, potent, selective 5-HT3 receptor antagonist with a strong receptor binding affinity and a long elimination half-life and, therefore, a long duration of efficacy.[20,21] Palonosetron is a pharmacologically distinct 5-HT3 RA with a greater binding affinity and longer half-life than older agents in this class.[22] Binding isotherms, equilibrium diagnostic tests, and kinetic diagnostic tests show that palonosetron is an allosteric antagonist with positive cooperativity, unlike ondansetron and granisetron. Differential effects on [^{3}H]-ligand binding indicate that palonosetron interacts at different or additional sites on the 5-HT3 receptor compared with the binding profiles of granisetron or ondansetron. Unlike these agents, palonosetron also elicits 5-HT3 receptor internalization and promotes extended inhibition of receptor activity.[23] The aim of the study is to compare the efficacy of intravenous (IV) palonosetron and IV ondansetron in preventing PONV in patients undergoing laparoscopic surgeries.

MATERIALS AND METHODS

This is a randomized controlled clinical study comparing the efficacy of a single pre-induction dose of palonosetron (0.075 mg) in Group P and ondansetron (4 mg) in Group O as per Good Clinical Practice Guidelines by WHO and Ethics. The sample size was calculated on the basis of the primary outcome measure. It was estimated that 49 subjects would be required per group to detect 2/3rd reduction in the frequency of PONV from the control treatment (from 40% to 15%) with 80% power and 10% probability of type one error. Hence, in the present study, 50 patients per group were selected. Totally, 100 adults belonging to the age group of 18-60 years of both sexes scheduled for elective laparoscopic surgeries were divided into two groups, Group P (palonosetron) and Group O (ondansetron) of 50 people each. Patients included were American Society of Anesthesiologists I-II with patients aged 18-60 years, non-smoker, no history of motion sickness or previous PONV, and elective laparoscopic surgery. Patients excluded were pregnancy and lactation, administration of an antiemetic medication, antipsychotic medications or steroids within 24 h before surgery, the presence of a cardiovascular or respiratory disease, obesity (body mass index >35 kg/m^2), renal or hepatic dysfunction, history of allergy to either of the drugs. Double-blinded randomization was followed with 1:1 ratio on the basis of computer-generated random numbered list, and allocation was concealed by serially numbered sealed envelopes. 100 adult patients were randomly allocated into two groups: Group P (palonosetron) and Group O (ondansetron) of 50 each. In the pre-anesthetic room, IV access was secured, and baseline parameters were observed and recorded such as heart rate, mean arterial pressure, and oxygen saturation. All patients in Group P received 0.075 mg of palonosetron and Group O received 4 mg of ondansetron before induction. Drugs were given by another anesthesiologist not involved in this study. After premedication with injection glycopyrrolate 0.004 mg kg^{-1}, injection midazolam 0.05 mg kg^{-1}, injection fentanyl 2 μg kg^{-1}, and after adequate pre-oxygenation, anesthesia was induced by injection propofol 2 mg kg^{-1} followed by injection atracurium 0.5 mg kg^{-1} to facilitate laryngoscopy and intubation. Anesthesia was maintained with 70% nitrous oxide in oxygen and 0.5-2% sevoflurane. At the completion of surgery, patients received injection neostigmine 0.05 mgkg^{-1} and glycopyrrolate 0.004 mg kg^{-1}, for reversal of neuromuscular blockade and extubated.

Then, patients were observed for the baseline parameters in the recovery room for 1 h. The occurrence of nausea and vomiting and the severity of nausea according to a visual analog scale (VAS; 0, no nausea; 10, worst nausea) were observed immediately after the end of surgery at 0-2 h, 2-6 h, 6-12 h, and 12-24 h post-surgery. Nausea is defined as a subjectively unpleasant sensation associated with awareness of the urge to vomit, whereas an episode of vomiting is defined as vomiting (forceful expulsion of gastric contents from the mouth) or retching (labored spasmodic, rhythmic contractions of the respiratory muscles without expulsion of gastric contents). Injection Metoclopramide (10 mg IV) was used as a rescue antiemetic when one episode of PONV occurred or at VAS >5 and the patient requested for treatment. If metoclopramide treatment was ineffective, ondansetron 4 mg IV was administered. A complete response was defined as the absence of PONV and no use of rescue antiemetic. Details of any adverse effects including a headache, dizziness, and constipation were recorded. Patients were also asked to rate their overall satisfaction on a three-point scale (satisfied, neutral, and unsatisfied) 24 h after surgery completion. The data were entered and analyzed using statistical software using Epi Info 3.4.3 version and SPSS version 20. *Z*-test for the difference between the means was used to analyze age and weight of study participants. Chi-square test was applied to study gender wise distribution, category of surgery, to compare the frequency of PONV, overall nausea and vomiting, requirement of rescue medication, adverse events (headache and dizziness), and patient satisfaction. Fisher's exact test was used to compare the incidence of constipation in the study participants. The level of significance was fixed at 0.05.

RESULTS

A total of 100 patients were included in this study. The two groups were similar regarding age, weight, and gender as in Table 1. In our study (Table 2), mean age in ondansetron group is 31.50 ± 9.945 years; and in palonosetron group, it is 34.32 ± 10.750 years and suggesting that both the groups have similar age characteristics and are statistically not significant ($P = 0.176$). In our study (Table 3), mean weight in ondansetron group is 57.68 ± 7.435, and in palonosetron group, it is 56.68 ± 5.648 and suggesting that both the groups have comparable demographic characteristics and are statistically not significant ($P = 0.451$). In this study, (Table 4) 34% were males and 66% were females in group ondansetron and 30% were males and 70% were females in group palonosetron, suggesting that both the groups have comparable demographic characteristics. When we compared the following surgeries in both the groups, namely, abdominal, abdominal/gynecological, diagnostic, diagnostic/gynecological, and gynecological (Table 5), we found that they were not statistically significant ($P = 0.692$). In our study (Table 6-10), the incidence of post-operative nausea was lower in palonosetron group compared to ondansetron group. This was found to be statistically significant in first 2 h ($P = 0.046$) (Table 6) and overall 24 h ($P = 0.001$) (Tables 11-15). In our study, the incidence of post-operative vomiting was lower in palonosetron group compared to ondansetron group, but they were not statistically significant. In our study (Table 16), the

Table 1: Participants demographic data in both groups

Characteristics	Mean±SD (*n*=50)		*P* value
	Group O	Group P	
Age	31.5±9.945	34.32±10.750	0.176
Weight	57.68±7.435	56.68±5.648	0.451
Gender			
Female	33	35	0.668
Male	17	15	

SD: Standard deviation, Group P: Palonosetron, Group O: Ondansetron

Table 2: Age distribution of study participants in both groups

Age (years)	Mean±SD	*P* value
Group O (*n*=50)	31.50±9.945	0.176
Group P (*n*=50)	34.32±10.750	

SD: Standard deviation, Group P: Palonosetron, Group O: Ondansetron

Table 3: Mean weight of study participants in both groups

Weight (kg)	Mean±SD	*P* value
Group O (*n*=50)	57.68±7.435	0.451
Group P (*n*=50)	56.68±5.648	

SD: Standard deviation, Group P: Palonosetron, Group O: Ondansetron

Table 4: Gender wise distribution of study participants in both groups

Sex	Group O	Group P	Total
Female	33	35	68
Male	17	15	32
Total	50	50	100

Group P: Palonosetron, Group O: Ondansetron

Table 5: Category of surgery in both groups

Surgery	Group O	Group P	Total	*P* value
Abdominal	32	34	66	
Abdominal/gynecological	0	1	1	
Diagnostic	9	5	14	0.692
Diagnostic/gynecological	0	1	1	
Gynecological	9	9	18	
Total	50	50	100	

Table 6: Comparison of frequency of post-operative nausea episodes in patients administered with palonosetron and ondansetron at 0-2 h

Time and Occurence	Group O	Group P	Total	*P* value
0-2 h				
No	36	44	80	0.046
Yes	14	6	20	
Total	50	50	100	

Group P: Palonosetron, Group O: Ondansetron

Table 7: Comparison of frequency of post-operative nausea episodes in patients administered with palonosetron and ondansetron at 2-6 h

Time and Occurence	Group O	Group P	Total	*P* value
2-6 h				
No	39	45	84	0.102
Yes	11	5	16	
Total	50	50	100	

Group P: Palonosetron, Group O: Ondansetron

Table 8: Comparison of frequency of post-operative nausea episodes in patients administered with palonosetron and ondansetron at 6-12 h

Time and Occurence	Group O	Group P	Total	*P* value
6-12 h				
No	33	40	73	0.115
Yes	17	10	27	
Total	50	50	100	

Group P: Palonosetron, Group O: Ondansetron

Table 9: Comparison of frequency of post-operative nausea episodes in patients administered with palonosetron and ondansetron at 12-24 h

Time and Occurence	Group O	Group P	Total	*P* value
12-24 h				
No	34	42	76	0.061
Yes	16	8	24	
Total	50	50	100	

Group P: Palonosetron, Group O: Ondansetron

Table 10: Comparison of frequency of post-operative nausea episodes in patients administered with palonosetron and ondansetron at 0-24 h

Time and Occurence	Group O	Group P	Total	*P* value*
0-24 h				
No	15	32	47	0.001
Yes	35	18	53	
Total	50	50	100	

**P*<0.05 (significant), Group P: Palonosetron, Group O: Ondansetron

Table 11: Comparison of frequency of post-operative vomiting episodes in patients administered with palonosetron and ondansetron 0-2 h

Time and Occurence	Group O	Group P	Total	*P* value
0-2 h				
No	45	48	93	0.436
Yes	5	2	7	
Total	50	50	100	

Group P: Palonosetron, Group O: Ondansetron

Table 12: Comparison of frequency of post-operative vomiting episodes in patients administered with palonosetron and ondansetron 2-6 h

Time and Occurence	Group O	Group P	Total	*P* value
2-6 h				
No	45	47	92	0.715
Yes	5	3	8	
Total	50	50	100	

Group P: Palonosetron, Group O: Ondansetron

Table 13: Comparison of frequency of post-operative vomiting episodes in patients administered with palonosetron and ondansetron 6-12 h

Time and Occurence	Group O	Group P	Total	*P* value
6-12 h				
No	42	44	86	0.564
Yes	8	6	14	
Total	50	50	100	

Group P: Palonosetron, Group O: Ondansetron

incidence of PONV was lower in palonosetron group compared to ondansetron group. This was found to be statistically significant in first 2 h ($P = 0.046$) and overall 24 h ($P = 0.003$). In our study, (Tables 17, 18) 9 patients from ondansetron group and 6 patients from palonosetron group required rescue medication. This was statistically not significant. In this study, (Tables 19,20) we have compared 3 adverse events between the two groups, namely, headache, dizziness, and constipation. The headache was found in 12% of ondansetron group and 8% of palonosetron group. Dizziness was found in 12% of ondansetron group and 12% of palonosetron group. Constipation was found in 6% of ondansetron group and 8% of palonosetron group. They were not statistically significant. In this study, (Table 21) 50% patients from ondansetron group and 68% patients from palonosetron group were satisfied with the prophylactic drug administered. 38% from ondansetron group and 22% from palonosetron group had a neutral response. 12% from ondansetron group and 10% from palonosetron group were unsatisfied. Despite the above result, patient satisfaction was statistically not significant.

Table 14: Comparison of frequency of post-operative vomiting episodes in patients administered with palonosetron and ondansetron 12-24 h

Time and Occurence	Group O	Group P	Total	*P* value
12-24 h				
No	43	45	88	0.538
Yes	7	5	12	
Total	50	50	100	

Group P: Palonosetron, Group O: Ondansetron

Table 15: Comparison of frequency of post-operative vomiting episodes in patients administered with palonosetron and ondansetron 0-24 h

Time and Occurence	Group O	Group P	Total	*P* value
0-24 h				
No	32	36	68	0.391
Yes	18	14	32	
Total	50	50	100	

Group P: Palonosetron, Group O: Ondansetron

Table 16: Comparison of frequency of overall PONV episodes in patients administered with palonosetron and ondansetron

Time and Occurence	Group O	Group P	Total	*P* value*
0-24 h				
No	15	30	45	0.003
Yes	35	20	55	
Total	50	50	100	

*$P<0.05$ (significant), PONV: Post-operative nausea and vomiting, Group P: Palonosetron, Group O: Ondansetron

Table 17: Requirement of rescue medication in both groups

Rescue medication	Frequency	Percentage
Group O		
No	41	82.0
Yes	9	18.0
Total	50	100.0
Group P		
No	44	88.0
Yes	6	12.0
Total	50	100.0

Group P: Palonosetron, Group O: Ondansetron

Table 18: Comparison of rescue medication in both groups

Rescue medication	Group O	Group P	Total	*P* value
Rescue medication				
Yes	9	6	15	0.401
No	41	44	85	
Total	50	50	100	

Group P: Palonosetron, Group O: Ondansetron

Table 19: Adverse events in both groups

Adverse events	*n* (%)	
	Group O	Group P
Headache	6 (12.0)	4 (8.0)
Dizziness	6 (12.0)	6 (12.0)
Constipation	3 (6.0)	4 (8.0)

Group P: Palonosetron, Group O: Ondansetron

Table 20: Comparison of adverse events in patients administered with palonosetron and ondansetron

Adverse events	Group O	Group P	Total	*P* value
Headache				
Yes	6	4	10	0.505
No	44	46	90	
Total	50	50	100	
Dizziness				
Yes	6	6	12	0.100
No	44	44	88	
Total	50	50	100	
Constipation				
Yes	3	4	7	0.100
No	47	46	93	
Total	50	50	100	

Group P: Palonosetron, Group O: Ondansetron

Table 21: Comparison of patient satisfaction in patients undergoing surgery who received palonosetron and ondansetron before anesthesia

Patient satisfaction	*n*=50 (%)		Total *n*=100	*P* value
	Group O	Group P		
Satisfied	25 (50)	34 (68)	59	0.165
Neutral	19 (38)	11 (22)	30	
Unsatisfied	6 (12)	5 (10)	11	

Group P: Palonosetron, Group O: Ondansetron

DISCUSSION

PONV is a complication that causes discomfort and dissatisfaction in patients who undergo surgery.[24] Post-operative period is associated with the variable incidence of nausea and vomiting depending on the duration of surgery, the type of anesthetic agents used (dose, inhalational drugs, and opioids), smoking habit etc.[25] 5-HT3 receptor stimulation is the primary event in the initiation of vomiting reflex.[26] These receptors are situated on the nerve terminal of the vagus nerve in the periphery and centrally on the chemoreceptor trigger zone (CTZ) of the area postrema.[24] Anesthetic agents initiate the vomiting reflex by stimulating the central 5-HT3 receptors on the CTZ and also by releasing serotonin from the enterochromaffin cells of the small intestine and subsequent stimulation of 5-HT3 receptors on vagus nerve afferent fibers.[24] The use of prophylactic antiemetics is intended to prevent episodes

of vomiting, eliminate or lessen the severity of nausea, and minimize or remove the need for PONV rescue medications.[27] 5-HT3 RAs are generally safe at the usual doses used to prevent or treat PONV, with no dose-related sedation or extrapyramidal reactions and no significant effects on vital signs.[28] Ondansetron is a selective 5-HT3 (serotonin) receptor antagonist used for prevention of PONV. It is given in 4 mg and 8 mg doses, but it has been shown in various studies that 4 mg is the optimal dose as increasing the dose to 8 mg does not confer any additional beneficial effect.[29-31] Palonosetron is a second generation serotonin 5-HT3 receptor antagonist. Unlike other antagonists, it has unique structural, pharmacological, clinical characteristics. Other antagonists directly compete with serotonin, but palonosetron has an indirect effect by its allosteric binding with 5-HT3 receptors.[22] Furthermore, it suppresses the response induced by substance P has negative cooperativity with neurokinin-1 receptors by cross-talk and creates an antiemetic effect.[23] These explain strong receptor-affinity of palonosetron and its long plasma half-life. Kovac *et al*.[32] demonstrated that palonosetron 75 μg is the more effective dose for the prevention of PONV after major gynecological and laparoscopic surgery than 25 μg and 50 μg.[32] We did not include a control group receiving placebo in our study. Aspinall and Goodman[33] have suggested that if active drugs are available, placebo-controlled trials may be unethical because PONV are very much distressing after laparoscopic surgery.[33] Bhattacharjee *et al*.[34] have reported that prophylactic therapy with palonosetron is more effective than granisetron in the prevention of PONV after laparoscopic cholecystectomy in the 24-48 h post-operative period, though not in the first 24 h. Kim *et al*.[35] concluded in his study that ramosetron 0.3 mg IV and ondansetron 8 mg IV were equally effective in decreasing the incidence of PONV and severity of nausea in high-risk female patients during the first 24 h after surgery. Although there were no significant differences between ramosetron and ondansetron in decreasing the incidence of PONV, severity of nausea, need for additional rescue antiemetics, or patient satisfaction rate, ramosetron appears to be a more effective antiemetic agent because it requires less additional rescue antiemetics after surgery. Candiotti *et al*.[36] reported that palonosetron and ondansetron did not show differences in the primary efficacy endpoint of complete control during the 72 h after study drug administration. There was a trend toward less emesis in the 0-72 h period favoring palonosetron. In our study, we compared the efficacy of palonosetron and ondansetron in the prevention of PONV in laparoscopic surgeries over a period of 24-h. In the study by Gupta *et al*.,[37] the incidence of PONV was maximal during the first 4 h and was more in the patients of ondansetron group as compared to patients of palonosetron and granisetron group. In our study, the incidence of post-operative nausea was compared over 0-2 h, 2-6 h, 6-12 h, 12-24 h, and 0-24 h. The incidence was 14 in ondansetron group and 6 in palonosetron group in 0-2 h which was statistically significant ($P = 0.046$). Similarly, the incidence was 35 in ondansetron group and 18 in palonosetron group in 0-24 h which was statistically significant ($P = 0.001$). In our study, post-operative vomiting was compared over 0-2 h, 2-6 h, 6-12 h, 12-24 h, and 0-24 h. The incidence was 18 in ondansetron group and 14 in palonosetron group over 0-24 h. Though the incidence was lower in palonosetron group than ondansetron group, they were not statistically significant ($P = 0.391$). In our study, overall PONV was compared between the two groups in 0-2 h, 2-6 h, 6-12 h, 12-24 h, and 0-24 h. The incidence of overall PONV was 14 in ondansetron group and 6 in palonosetron group in 0-2 h. Similarly, the incidence of overall PONV was 35 in ondansetron group and 20 in palonosetron group. This was statistically significant in first 2 h ($P = 0.046$) and 0-24 h ($P = 0.003$). Adverse effects with single IV dose of the study drugs were not serious, and there were no significant differences in the incidence of the headache, dizziness, and constipation between the groups. Concerns have raised over the QTc interval prolonging the effect of ondansetron and the risk of ventricular tachycardia. However, there was no QTc interval prolongation or other electrocardiography abnormalities in this study. Thus, both palonosetron and ondansetron are devoid of clinically important adverse effects when used in this manner. In our study, 3 adverse events were compared, namely, headache, dizziness, and constipation. Of these, the incidence of the headache was more in ondansetron group; dizziness was similar between the two groups, and constipation was more in palonosetron group. This was statistically not significant. In our study, rescue medication was required in 12% of palonosetron group and 18% of ondansetron group. This holds for the first 24-h period following surgery. It remains to be explored if the same is true for the next 24-h.

CONCLUSION

Palonosetron 0.075 mg IV produced a lower incidence of PONV compared with ondansetron 4 mg IV in patients undergoing laparoscopic surgeries in the first 24 h with better patient satisfaction.

REFERENCES

1. Gan TJ. Postoperative nausea and vomiting – Can it be eliminated? JAMA 2002;287:1233-6.
2. Gold BS, Kitz DS, Lecky JH, Neuhaus JM. Unanticipated admission to the hospital following ambulatory surgery. JAMA 1989;262:3008-10.
3. Philip BK. Patients' assessment of ambulatory anesthesia and surgery. J Clin Anesth 1992;4:355-8.
4. Bano F, Zafar S, Aftab S, Haider S. Dexamethasone plus ondansetron for

prevention of postoperative nausea and vomiting in patients undergoing laparoscopic cholecystectomy: A comparison with dexamethasone alone. J Coll Physicians Surg Pak 2008;18:265-9.
5. Ashfaque M. Prevention of postoperative nausea and vomiting: A review of causative factors and management. Med Channel 1998;4:43-52.
6. Goodarzi M, Matar MM, Shafa M, Townsend JE, Gonzalez I. A prospective randomized blinded study of the effect of intravenous fluid therapy on postoperative nausea and vomiting in children undergoing strabismus surgery. Paediatr Anaesth 2006;16:49-53.
7. Apfel CC, Philip BK, Cakmakkaya OS, Shilling A, Shi YY, Leslie JB, *et al*. Who is at risk for postdischarge nausea and vomiting after ambulatory surgery? Anesthesiology 2012;117:475-86.
8. Roberts SM, Bezinover DS, Janicki PK. Reappraisal of the role of dolasetron in prevention and treatment of nausea and vomiting associated with surgery or chemotherapy. Cancer Manag Res 2012;4:67-73.
9. Gupta P, Khanna J, Mitramustafi AK, Bhartia VK. Role of pre-operative dexamethasone as prophylaxis for postoperative nausea and vomiting in laparoscopic surgery. J Minim Access Surg 2006;2:12-5.
10. Habib AS, Chen YT, Taguchi A, Hu XH, Gan TJ. Postoperative nausea and vomiting following inpatient surgeries in a teaching hospital: A retrospective database analysis. Curr Med Res Opin 2006;22:1093-9.
11. Sarin P, Urman RD, Ohno-Machado L. An improved model for predicting postoperative nausea and vomiting in ambulatory surgery patients using physician-modifiable risk factors. J Am Med Inform Assoc 2012;19:995-1002.
12. Ballatori E, Roila F, Ruggeri B, Betti M, Sarti S, Soru G, *et al.* The impact of chemotherapy-induced nausea and vomiting on health-related quality of life. Support Care Cancer 2007;15:179-85.
13. Osoba D, Zee B, Warr D, Latreille J, Kaizer L, Pater J. Effect of postchemotherapy nausea and vomiting on health-related quality of life. The Quality of Life and Symptom Control Committees of the National Cancer Institute of Canada Clinical Trials Group. Support Care Cancer 1997;5:307-13.
14. Gan TJ. Risk factors for postoperative nausea and vomiting. Anesth Analg 2006;102:1884-98.
15. 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;91:693-700.
16. Muchatuta NA, Paech MJ. Management of postoperative nausea and vomiting: Focus on palonosetron. Ther Clin Risk Manag 2009;5:21-34.
17. Kovac AL. Prevention and treatment of postoperative nausea and vomiting. Drugs 2000;59:213-43.
18. Chatterjee S, Rudra A, Sengupta S. Current concepts in the management of postoperative nausea and vomiting. Anesthesiol Res Pract 2011;2011:748031.
19. Alon E, Himmelseher S. Ondansetron in the treatment of postoperative vomiting: A randomized, double-blind comparison with droperidol and metoclopramide. Anesth Analg 1992;75:561-5.
20. Wong EH, Clark R, Leung E, Loury D, Bonhaus DW, Jakeman L, *et al.* The interaction of RS 25259-197, a potent and selective antagonist, with 5-HT3 receptors, *in vitro*. Br J Pharmacol 1995;114:851-9.
21. Stoltz R, Cyong JC, Shah A, Parisi S. Pharmacokinetic and safety evaluation of palonosetron, a 5-hydroxytryptamine-3 receptor antagonist, in U.S. and Japanese healthy subjects. J Clin Pharmacol 2004;44:520-31.
22. Rojas C, Stathis M, Thomas AG, Massuda EB, Alt J, Zhang J, *et al.* Palonosetron exhibits unique molecular interactions with the 5-HT3 receptor. Anesth Analg 2008;107:469-78.
23. Rojas C, Thomas AG, Alt J, Stathis M, Zhang J, Rubenstein EB, *et al*. Palonosetron triggers 5-HT(3) receptor internalization and causes prolonged inhibition of receptor function. Eur J Pharmacol 2010;626:193-9.
24. Watcha MF, White PF. Postoperative nausea and vomiting. Its etiology, treatment, and prevention. Anesthesiology 1992;77:162-84.
25. Lerman J. Surgical and patient factors involved in postoperative nausea and vomiting. Br J Anaesth 1992;69 7 Suppl 1:24S-32.
26. Bunce KT, Tyers MB. The role of 5-HT in postoperative nausea and vomiting. Br J Anaesth 1992;69 7 Suppl 1:60S-62.
27. Gan TJ, Diemunsch P, Habib AS, Kovac A, Kranke P, Meyer TA, *et al.* Consensus guidelines for the management of postoperative nausea and vomiting. Anesth Analg 2014;118:85-113.
28. Kovac AL. Benefits and risks of newer treatments for chemotherapy-induced and postoperative nausea and vomiting. Drug Saf 2003;26:227-59.
29. Elhakim M, Nafie M, Mahmoud K, Atef A. Dexamethasone 8 mg in combination with ondansetron 4 mg appears to be the optimal dose for the prevention of nausea and vomiting after laparoscopic cholecystectomy. Can J Anaesth 2002;49:922-6.
30. Leksowski K, Peryga P, Szyca R. Ondansetron, metroclopramide, dexamethasone and their combinations compared for the prevention of postoperative nausea and vomiting in patients undergoing laparoscopic cholecystectomy: A prospective randomized study. Surg Endosc 2006;20:878-82.
31. McKenzie R, Kovac A, O'Connor T, Duncalf D, Angel J, Gratz I, *et al.* Comparison of ondansetron versus placebo to prevent postoperative nausea and vomiting in women undergoing ambulatory gynecologic surgery. Anesthesiology 1993;78:21-8.
32. Kovac AL, Eberhart L, Kotarski J, Clerici G, Apfel C; Palonosetron - 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. Anesth Analg 2008;107:439-44.
33. Aspinall RL, Goodman NW. Denial of effective treatment and poor quality of clinical information in placebo controlled trials of ondansetron for postoperative nausea and vomiting: A review of published trials. BMJ 1995;311:844-6.
34. Bhattacharjee DP, Dawn S, Nayak S, Roy PR, Acharya A, Dey R. A comparative study between palonosetron and granisetron to prevent postoperative nausea and vomiting after laparoscopic cholecystectomy. J Anaesth Clin Pharmacol 2010;26:480-3.
35. Kim SI, Kim SC, Baek YH, Ok SY, Kim SH. Comparison of ramosetron with ondansetron for prevention of postoperative nausea and vomiting in patients undergoing gynaecological surgery. Br J Anaesth 2009;103:549-53.
36. Candiotti KA, Ahmed SR, Cox D, Gan TJ. Palonosetron versus ondansetron as rescue medication for postoperative nausea and vomiting: A randomized, multicenter, open-label study. BMC Pharmacol Toxicol 2014;15:45.
37. Gupta K, Singh I, Gupta PK, Chauhan H, Jain M, Rastogi B. Palonosetron, ondansetron, and granisetron for antiemetic prophylaxis of postoperative nausea and vomiting - A comparative evaluation. Anesth Essays Res 2014;8:197-201.

How to cite this article: Sureshkumar K, Sivashanmugam A, Murugan NG, Lazarus SP, Mukunthan MN. Randomized Controlled Study to Compare the Efficacy of Intravenous Palonosetron and Intravenous Ondansetron in Preventing Post-operative Nausea and Vomiting in Laparoscopic Surgeries. Int J Sci Stud 2016;3(12):288-294.

Source of Support: Nil, **Conflict of Interest:** None declared.