Comparative Study Of Efficacy Of Palonosetron With Dexamethasone Versus Granisetron With Dexamethosone In Laproscopic Abdominal Surgeries For Control Of Post Operative Nausea And Vomiting

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Abstract: Background & Aim**:** This study was carried out to demonstrate the efficacy and compare a dose of Granisetron with Dexamethasone and Palonosetron with Dexamethasone for prophylaxis against postoperative nausea and vomiting. Aim is to study the effectiveness of palonosetron and granisetron with aims of evaluating the efficacy of palonosetron and granisetron with dexamethasone in prevention of postoperative nausea and vomiting and to study associated adverse effects. The study was carried out in Civil Hospital, Ahmedabad with prior permission of ethical committee of the hospital. Methodology: This study was designed to evaluate the efficacy and compare a dose of study drugs in 60 patients of either sex and age ranging from 18 to 60 years and physical status ASA risk I or II undergoing general anaesthesia for various laparoscopic surgical procedures. Patients were divided into 2 groups(n=30), assigned to receive granisetron 1mg plus dexamethasone 8mg i.v and palonosetron 0.075mg plus dexamethasone 8mg i.v. A standard general anaesthesia technique and post operative analgesia were used throughout our study. The groups were compared with regards to the incidence of complete response, mean PONV score, mean nausea VDS scores and requirement of rescue anti emetics drug at various intervals (0-6,6-24,24-72hrs). Differences in continuous variables (age and duration of anaesthesia) across two dosage groups were compared using analysis of variance (ANOVA) test which is a parametric statistical test. Differences in categorical variables (gender, presence of complete response, use of rescue anti-emetics) across two dosage groups were compared using chi square test. Differences in ordinal variables (PONV scores and 4-point verbal descriptive nausea scores) across two dosage groups were compared using non-parametric Kruskal Wallis one-way analysis of variance. Mann Whitney U test was used to conduct sub-group analyses for comparing PONV scores and 4-point verbal descriptive nausea scale scores between two given groups. McNemar's test was done to compare differences in rates of complete response in a given dosage group across different time periods of assessment. Results: Our study results shows clear superiority of palonosetron with dexamethasone as a prophylactic drug for the prevention of PONV than that of granisetron with dexamethasone. Conclusions: Due to its longer duration of action, a single dose of palonosetron with dexamethasone before induction is effective in preventing PONV for upto 72 hours and hence can be termed as a prophylactic drug for PDNV also. It's optimal and effective dose is 0.075mg i.v. with minimal side effects. [Patel K NJIRM 2016; 7(1):16-22]

Key Words: Dexamethasone, Granisetron, Laproscopic Surgeries, Palonosetron, Postoperative Nausea and Vomiting.

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Introduction: Postoperative nausea and vomiting (PONV) is the most common complication of surgery and anaesthesia,[1] leading to adverse consequences including patient dissatisfaction, unexpected hospital admission, increased cost of treatment, delayed recovery and return to work.[2] PONV is less commonly associated with more serious post-surgical complications such as wound dehiscence and surgical site bleeding.[3] The incidence of PONV can reach 80% in high-risk patients underlining the importance of prevention and control by anaesthesiologists.[4] Despite significant advances in the delivery of general anaesthesia, PONV continues to be a 'Big little problem' for surgical patients.[5] Many complex procedures are now a days carried out on 'day care' basis which make PONV a significant problem. Gynaecological, middle ear, laparoscopic, and ophthalmic surgery have more risk of PONV.

Anti-emetics are the main stay therapy for PONV. The main pharmacological classes of drugs used in the treatment are cholinergic-muscarinic, dopaminergic, histaminic or serotonergic($5HT_3$ antagonists). Besides this, dexamethasone is also considered very effective antiemetic in many situations. Combination of antiemetics as a multi modal therapy may sometimes be needed to control PONV successfully. The 5-hydroxytryptamine-3($5HT_3$) receptor antagonists are popular drugs for PONV prophylaxis because of their similar efficacy to droperidol or dexamethasone and their favourable side effect.

Initially, ondansetron with a half life of (3-4hours) was introduced. However, frequent dosing was required with it. Palonosetron is a new second generation, potent, selective $5HT_3$ receptor antagonist with a strong receptor binding affinity and a long elimination half life and therefore, a long duration of efficacy.[6,7] It has been recently approved for prophylaxis against PONV. Granisetron is a novel specific $5HT_3$ receptor antagonist and acts on the vagal afferent nerves of the gut. It produces irreversible block of the $5HT_3$ receptors which may account for the long duration of action of the drug. Our study is a comparative dose ranging study comparing the antiemetic properties and side effect profiles of granisetron 1 mg i.v with palonosetron 0.075 mg i.v.

Material and Methods: This study was carried out on 60 patients of either sex from the age group 18-60 years of ASA risk I and II undergoing general anaesthesia for various laparoscopic surgical procedures. Ethical clearance was obtained from the ethical committee of our institution. Patients were pre operatively assessed a day before surgery. Patients with history of motion sickness, past history of PONV, pregnancy, who were menstruating, those who had received any anaesthetic in last 24 hours and body mass index >35 were excluded from the study. Patient's physical and systemic examination was done. Vital parameters like pulse, blood pressure(BP), respiratory rate(RR) were checked and noted. Routine laboratory investigations like haemoglobin, random blood sugar, renal function test, s.bilirubin, x-rays and electrocardiogram(ECG) were advised and reports recorded. Written informed consent was taken after explaining patients about the procedure. Patients were not given any solid or liquid food after 10 pm on the previous night before operation. No pre-medication was given in the ward. Baseline pulse and BP were recorded in the pre operative room. Patients were divided into 2 groups classified as G+D(Granisetron 1 mg diluted in 5 ml saline plus 8 mg dexamethasone) and P+D(Palonosetron 0.075 mg diluted in 5 ml saline plus 8 mg dexamethasone). After taking patient on OT table, IV line was established. Monitoring in the form of ECG, pulse oximeter for SpO_2 and NIBP were applied. Pre medication was given in the form of glycopyrrolate 0.004 mg/kg, midazolam 0.02 mg/kg, fentanyl 2 µg/kg intravenously.

At this point, study drug was administered according to the group just before induction of anaesthesia. Patients were pre oxygenated with 100% O_2 for 3 min by facemask. General anesthesia was administered with thiopentone sodium 5-6mg/kg IV. Intubation was facilitated using succinyl choline 2mg/kg IV. Patients were intubated with appropriate size oral cuffed endotracheal tube. Bilateral air entry was checked and tube was fixed at appropriate distance. Nasogastric tube was inserted and stomach contents were suctioned. Anaesthesia was maintained with 50% O_2, 50% N_2O and isoflurane or sevoflurane using controlled ventilation on closed circuit. Vecuronium bromide 0.08 mg/kg or atracurium besylate 0.5 mg/kg IV was used as non depolarizing muscle relaxant.

Intra operative pulse, BP, SpO_2, ECG and $ETCO_2$ were monitored and documented. Diclofenac sodium 2mg/kg IV was given as an analgesic at the end of surgery. After completion of surgery, neuromuscular blockade was reversed with glycopyrrolate 0.008 mg/kg and neostigmine 0.05 mg/kg IV. Adequate oropharyngeal and endotracheal suctioning was done and patients were extubated followed by removal of nasogastric tube. Patients were monitored for emetic episodes, severity of nausea, requirement of rescue antiemetic and vital signs for 72 hrs (0-6,6-24,24-72hrs) post operatively which began when the patient responded to a vocal command after extubation. Ondansetron 4mg/kg IV was given as a "rescue" antiemetic for vomiting or persistent nausea, if 2 or more episodes occurred in 72 hours and the time of its administration was noted. Adverse events like rash, headache and diarrhoea within 72 hours of surgery were also assessed and noted. The duration of anaesthesia, duration of surgery and awakening time were also noted. Nausea was rated on a 4 point verbal descriptive scale. Nausea assessment was made post operatively over a period of 72 hrs(0-6,6-24,24-72hrs). The patients who scored the nausea as 0 over the specified time period were termed nausea free.

The efficacy of the study medication was assessed in terms of percentage of patients having complete response, mean PONV score, and mean nausea VDS score and requirement of rescue antiemetic. Differences in continuous variables (age and duration of anaesthesia) across the two dosage groups were compared using the analysis of variance (ANOVA) test which is a parametric statistical test. Differences in categorical variables (gender, presence of complete response, use of rescue anti-emetics) across the two dosage groups were compared using Chi square test. Differences in ordinal variables (PONV scores and 4-

point verbal descriptive nausea scale scores) across the two dosage groups were compared using non-parametric Kruskal-Wallis one-way analysis of variance. Mann Whitney U test was used to conduct sub-group analyses for comparing PONV scores and 4-point verbal descriptive nausea scores between two given groups. McNemar's test was done to compare differences in rates of complete response in a given dosage group across different time periods of assessment (0-6 hours versus 6-72 hours).

Results: The study was done to evaluate the effects of palonosetron with dexamethasone and a granisetron with dexamethasone on PONV. It included 60 patients of either sex undergoing laparoscopic surgeries. The following observation and results were noted.

Table 1: Age, Sex and Surgery Distribution

		G+D [n(%)]	P+D [n(%)]	Total [n(%)]
Age(in years) [mean(s.d)]		41.08 (12.56)	36.56 (13.2)	---
Males/Female		18(72)/ 12(28)	17(68)/ 13(32)	---
Surgery	Lap. Cholecystectomy	11 (18.3)	14 (23.3)	25 (41.6)
	Lap. Appendicectomy	10 (16.6)	13 (21.6)	23 (38.3)
	Diagnostic laparoscopy	9 (15)	3 (5)	12 (20)

Above table showed no difference in patient's age (F(df)=0.827(3,96), p=0.058) and gender [$\chi2$=4.33, p=0.228] across the two groups.

Table 2: PONV Score(0-6,6-24,24-72 HOURS)

	No. of Patients [n%]				
Time	Group	Score 0	Score 1	Score 2	Mean Rank
0-6 Hrs.	G+D	23(76)	5(16)	2(8)	52.46
	P+D	29(96)	1(4)	0(0)	42.36
6-24 Hrs.	G+D	22(72)	4(12)	4(16)	52.88
	P+D	29(96)	1(4)	0(0)	40.72
24-72 Hrs.	G+D	18(60)	5(16)	7(24)	54.96
	P+D	23(76)	5(16)	2(8)	45.52

Kruskalwalis test revealed a statistically significant difference in the ratings of the PONV Score assessed at 0-6 hours across all two groups[p=0.088]. Analysis of subjects in group P+D had significantly lower PONV Score when compared to group G+D[Mann Whitney U= 249, p=0.041]. Kruskalwalis test revealed a statistically significant difference in the ratings of PONV Score assessed at 6-24hours across all two groups[$\chi2$=8.09, p=0.044]. Analysis of subjects in group P+D had significantly lower PONV Score when compared to group G+D[Mann Whitney U= 235, p=0.019]. Kruskalwalis test revealed no statistically significant difference in the ratings of PONV Score assessed at 24-72 hours across the 2 groups[$\chi2$=2.64, p=0.45].

Table 3: 4 Point Verbal Descriptive Nausea Scale (0-6,6-24,24-72 Hours)

	No. of Patients					
Time	Group	Grade 0 n(%)	Grade 1 n(%)	Grade 2 n(%)	Grade 3 n(%)	Mean Rank
0-6 Hrs	G+D	23 (76)	0 (0)	5 (16)	2 (8)	52.46
	P+D	29 (96)	0 (0)	1 (4)	0 (0)	42.36
6-24 Hrs	G+D	22 (72)	0 (0)	2 (8)	6 (20)	53.48
	P+D	29 (96)	0 (0)	1 (4)	0 (0)	40.74
24-72 Hrs	G+D	15 (60)	2 (8)	4 (16)	4 (16)	55.84
	P+D	28 (92)	0 (0)	1 (4)	1 (4)	40.20

Kruskalwalis test revealed no statistically significant difference in the ratings of nausea scale assessed at 0-6 hours across 2 groups[$\chi2$=6.86, p=0.076]. Analysis of subjects in group P+D had significantly lower rating on the nausea scale when compared to group G+D[Mann Whitney U= 249, p=0.041]. Kruskalwalis test revealed a statistically significant difference in the ratings of the nausea scale assessed at 6-24 hours across the 2 groups[$\chi2$=8.02, p=0.046] however on subgroup analysis subjects in group P+D had significantly lower rating on the nausea scale when compared to group G+D[Mann Whitney U= 235, p=0.018]. Kruskalwalis test revealed a statistically significant difference in the ratings of the nausea scale assessed at 24-72 hours across the 2 groups[$\chi2$=7.87, p=0.049]. Analysis of subjects in group P+D had significantly lower rating on the nausea scale when compared to group G+D[Mann Whitney U= 214, p=0.011].

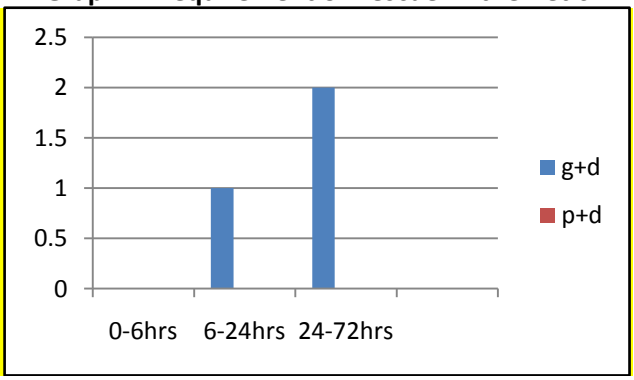
In table no 4, 0-6 hrs assessment, patients in group P+D had better rates of complete response and lower rates of nausea and vomiting assessed using PONV scores and

nausea VDS when compared to the rest of group G+D. These results were statistically significant ($p<0.05$). None of the patients in group P+D received rescue ant-emetics. While in 6-24 hours assessment, patients in group P+D had better rates of complete response and lower rates of nausea and vomiting assessed using PONV scores and nausea VDS when compared to the rest of group G+D. These results were statistically significant ($p<0.05$). None of the patients in group P+D received rescue anti-emetics.

Table 4: Comparison of Efficacy amongst 4 Groups

Time	Groups	Complete Response n(%)	Mean Rank of PONV score	Mean Rank of nausea VDS	Rescue Anti-emetic Given
0-6 Hrs	G+D	19(76)	52.46	52.46	0(0)
	P+D	24(96)	42.36	42.36	0(0)
6-24 Hrs	G+D	18(72)	52.88	53.48	1(16.7)
	P+D	24(96)	40.72	40.74	0(0)

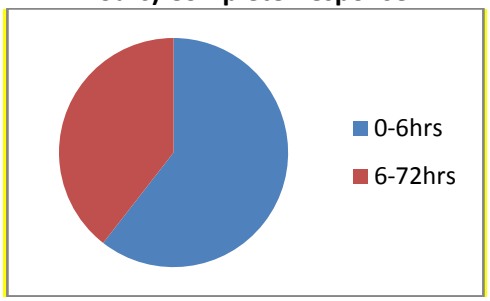
Graph 1: Requirement of Rescue Anti-emetic



The above graph depicts the rates of requirement of rescue antiemetic drug at three time points 0-6, 6-24 and 24-72hrs across the 2 groups. P+D group didn't require rescue antiemetic in postoperative period.

The below graph depicts results of McNemar's test done to demonstrate that complete response rates were not significantly different for early (0-6 hours) and late (6-72 hours) assessments in each of the 2 study groups. Similarly, there were no significant differences in rates of nausea, vomiting and rescue anti-emetic use at early (0-6 hours) and late (6-72 hours) assessments in each of 2 study groups. However, the rates of nausea and vomiting were lower in group P+D compared to group G+D.

Graph 2: Comparison of Early(0-6 hours) and Late(6-72 hours) Complete Response



Discussion: Postoperative nausea and vomiting is a common problem in the general patient population occurring in an estimated 35% of all patients. If high risk patients are considered as a separate group then as much as 70% of these patients will experience PONV. Clearly, this is a problem that is worth addressing and a great deal of time, money and effort is spent each year dealing with prevention and treatment of PONV. In addition to possible medical consequences of vomiting, ambulatory surgery centres are especially concerned with control of PONV in order to prevent extended post-operative stays or unplanned admissions and expense that accompanies them. However, there is a reason above and beyond the financial to approach this problem aggressively. Patient satisfaction with their ambulatory experience is closely tied with their ability to avoid nausea and vomiting after their surgery. In multiple surveys, patients list the avoidance of nausea and vomiting as their number one concern when faced with surgery and anaesthesia. In fact, this issue ranks ahead of such things as pain, death, myocardial infarction and stroke for patients. While this may reflect some degree of denial, it also demonstrates clearly just how important this issue has become today. So, even though aggressive prevention and management of PONV might incur some additional costs, it is worth doing to ensure patient satisfaction. PONV may lead to significant morbidity from dehydration, electrolyte imbalance and aspiration of vomiting. Surgical complications like wound dehiscence, bleeding beneath skin flaps and loss of vitreous fluid following intraocular surgery may follow severe PONV.

The aim of our study was to evaluate the efficacy of palonosetron and granisetron with dexamethasone as agents in prevention of post-operative nausea and vomiting using a single dose of granisetron with dexamethasone and palonosetron with dexamethasone and thus determining the optimal drug amongst these

two. The associated adverse effects were also studied for two groups. Our sample size of 60 cases was divided into two groups of 30 patients each. They received granisetron 1mg i.v plus 8mg dexamethasone(G+D), palonosetron 0.075mg i.v plus 8mg dexamethasone(P+D). The patients were of either sex from the age group 18-60 years. Patients with ASA risk category I & II, undergoing various laparoscopic surgical procedures under general anaesthesia were recruited. Lack of systematic randomization may have resulted in selection bias, this is an important limitation of our study however treatment groups were similar with regard to patient demographics(age, sex, weight), duration of anaesthesia, anaesthetic agents administered and analgesic used postoperatively. Therefore, difference in the incidence of PONV among groups can be attributed to the different doses of granisetron and palonosetron administered. Patients undergoing laparoscopic surgery, strabismus, ear surgery and gynaecological surgeries are known to have a higher incidence of PONV. Hence, we selected patients undergoing laparoscopic surgeries. 60% of patients in our study were posted for laparoscopic cholecystectomy, others being laparoscopic appendicectomy, laparoscopic hernia repair and diagnostic laparoscopies. The incidence of PONV after laparoscopic surgery is high (40-75%). Etiology of PONV after laparoscopic surgery is complex and dependent on a variety of factors including age, obesity, history of previous PONV, surgical procedure (effect of intraperitoneal CO_2 insufflated on residual stretching and irritation of peritoneum), anesthetic technique and post operative pain.[8] The dose of granisetron was fixed at 1mg i.v as Daiki Tsuji et al concluded that 1 mg granisetron is not inferior to 3 mg when both doses are combined with dexamethasone.[9] Similarly doses of palonosetron were ascertained as in the study of Candiotti K A et al in which patients receive one of three doses of IV palonosetron (0.025 mg, 0.050 mg or 0.075 mg) or placebo immediately prior to induction of anaesthesia and found 0.075mg to be the most effective.[10] We did not include a control group receiving placebo in our study because PONV are very much distressing after laparoscopic surgery.[11] A J Wilson and Candiotti K A administered study drug before induction of anaesthesia.[10,12] In our study, we administered drug before induction of anaesthesia as described previously. As appropriate timing of administration remains unclear, further studies are needed to elucidate this matter. It was an open label single blind study. The incidence of PONV was studied over a period of 72 hours after surgery and was divided into 3 timed points of (0-6), (6-24) and (24-72) hours. The efficacy of drug was assessed in terms of following 4 outcome variables - 1. Rates of complete response 2. Mean PONV scores 3. Mean nausea Verbal Descriptive Scale (VDS) scores 4. Requirement of rescue anti emetic.

The crucial findings in our results are that the rate of complete response at 0-6 hours was significantly higher in group P+D (96%), in comparison to that of group G+D (76%) [$\chi2=4.153$, $p=0.042$] and at 6-24 hours the rate of complete response was significantly higher in group P+D (96%) than group G+D(72%)[$\chi2=5.35$, $p=0.021$]. Similarly at 6-24 hours, the rate of nausea and vomiting was significantly lower in group P+D(0%) than that of group G+D (16%)[$\chi2=4.35$, $p=0.037$]. These two above findings were in accordance to those found in other studies.[4,13] However at 24-72 hours, there was no statistically significant difference in the rates of complete response and presence of nausea and vomiting across two groups. This is in accordance to the findings of Candiotti K A et al[10] who showed that a single 0.075 mg IV dose of palonosetron significantly increased the CR rate (no emetic episodes and no rescue medication) from 0 to 24 h, decreased nausea severity and patients experienced significantly less interference in their postoperative function due to PONV. There was a statistically significant difference in the ratings of PONV Score assessed at 0-6 hours across two groups[$\chi2=6.55$, $p=0.088$] on analysis subjects in group P+D had significantly lower PONV Score when compared to group G+D[Mann Whitney U= 249, $p=0.041$] and group P+D[Mann Whitney U=223, $p=0.010$]. There was also a statistically significant difference in the ratings of PONV Score assessed at 6-24 hours across two groups [$\chi2=8.09$, $p=0.044$]. On group analysis, subjects in group P+D had significantly lower PONV Score when compared to group G+D [Mann Whitney U= 235, $p=0.019$].

However, there was no statistically significant difference in the ratings of PONV Score assessed at 24-72 hours across two groups[$\chi2=2.64$, $p=0.45$] similar to the study of Candiotti K A et al.[10] This may be attributed mainly to a low general incidence of PONV in this period.[14] With respect to ratings of nausea scale, there was no statistically significant difference assessed at 0-6 hours across the two groups. However group analysis subjects in group P+D had significantly lower rating on the nausea scale when compared to group G+D [Mann Whitney U= 249, $p=0.041$]

There was a statistically significant difference in the ratings of the nausea scale assessed at 6-24 hours across 2 groups [$\chi 2$=8.02, p=0.046]. On group analysis, subjects in group P+D had significantly lower rating on the nausea scale when compared to group G+D[Mann Whitney U= 235, p=0.018].

A statistically significant difference was seen in the ratings of the nausea scale assessed at 24-72 hours across two groups[$\chi 2$=7.87, p=0.049]. On group analysis, subjects in group P+D had significantly lower rating on the nausea scale when compared to group G+D[Mann Whitney U= 214, p=0.011]. Since patients become increasingly ambulatory after surgery, additional time intervals of 0-6 and 6-72 hours were also evaluated to study the extent of emesis and nausea control during a time when patients had minimal ambulation(0-6 hours) and also a time interval when they were mobile(6-72hours).

Complete response rates were not significantly different for early(0-6 hours) and late(6-72 hours) assessments in each of the two study groups. Similarly, there were no significant differences in rates of nausea and vomiting and rescue anti-emetic use at early(0-6 hours) and late(6-72 hours) assessments in each of the 2 study groups.

There is a need to expand the definition of PONV from first 24 h after surgery to the first 72 hr with the interval from 24 to 72 hr defined as post discharge nausea and vomiting(PDNV).[15]

In our study, at 24-72 hours, group P+D had significantly lower rating on the nausea scale when compared to group G+D. Similarly, rates of nausea and vomiting were lower in group P+D in the 6-72 hours period and regarding the use of rescue anti emetics, there was no requirement of rescue medication in all the three time periods for group P+D. These valuable findings suggest that group P+D has potential to be used as prophylaxis not just for PONV but also for PDNV. Regarding the presence of adverse effects across 3 time points, there was no significant difference in the presence of complications(headache, diarrhoea, gastritis and rashes) across the 2 groups[$\chi 2$=0.86, p=0.83].

The exact reason for the difference in effectiveness between granisetron and palonosetron is not known but may be related to the half-lives (granistron 8-9 hours versus palonosetron 40 hours) and/or the binding affinities of 5-HT_3 receptor antagonists (palonosetron interacts with 5-HT_3receptors in an allosteric, positive cooperative manner at sites different from that bind with granisetron).

It also triggers functional effects that persist beyond its binding to the 5-HT3 receptor at the cell surface. Differences in binding and effects on receptor function may be relevant to the unique beneficial actions of palonosetron, clearly differentiating it from other 5-HT3-receptor antagonists.[16] On comparing the efficacy of our 2 drug groups across all the 4 pre defined outcome variables, we can conclude that patients in group P+D had better rates of complete response and lower rates of nausea and vomiting assessed using PONV scores and nausea VDS when compared to the rest of the groups at 0-6 and 6-24 hrs. Also there was no requirement of rescue anti emetic administration for patients in group P+D for the entire 0-72 hrs duration. Our study clearly shows the superiority of palonosetron plus dexamethasone as a prophylactic drug for the prevention of PONV than that of granisetron plus dexamethasone.

Conclusion: This study was designed to evaluate the efficacy and compare a dose of above mentioned two groups for prophylaxis against PONV comparing in regards to the incidence of “complete response”, mean PONV score, mean nausea VDS scores and requirement of rescue anti emetics drug at various intervals. Due to its longer duration of action, a single dose of palonosetron with dexamethasone before induction is effective in preventing PONV for upto 72 hours and hence can be termed as a prophylactic drug for PDNV also. Palonosetron’s optimal and effective dose is 0.075 mg i.v. which is highly effective in prophylaxis of PONV in comparison to granisetron 1 mg i.v. and has a minimal side effect.

References:

1. Watcha MF, White PF. Postoperative nausea and vomiting. Its etiology, treatment, and prevention. Anesthesiology 1992;77(1):162-84.
2. Muchatuta NA, Paech MJ. Management of postoperative nausea and vomiting: focus on palonosetron. Ther Clin Risk Manag 2009;5(1):21-34.
3. Gan TJ. Risk factors for postoperative nausea and vomiting. Anesth Analg 2006;102(6):1884-98.
4. Apfel CC, Laara 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(3):693-700.
5. Aapro MS. Palonosetron as an anti-emetic and anti-nausea agent in oncology. Ther Clin Risk Manag 2007;3(6):1009-1020.
6. 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(4):851-9.
7. 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(5):520-31.
8. Iitomi T, Toriumi S, Kondo A, Akazawa T, Nakahara T. Incidence of nausea and vomiting after cholecystectomy performed via laparotomy or laparoscopy. Masui 1995;44 (12):1627-31.
9. Tsuji D, Kim YI, Taku K, Nakagaki S, Ikematsu Y, Tsubota H, Maeda M et al. Comparative trial of two intravenous doses of granisetron (1 versus 3 mg) in the prevention of chemotherapy-induced acute emesis 2001: a double-blind, randomized, non-inferiority trial. Support Care Cancer 2012;20(5):1057-64.
10. Candiotti KA, Kovac AL, Melson TI, Clerici G, Joo Gan T. A randomized, double-blind study to evaluate the efficacy and safety of three different doses of palonosetron versus placebo for preventing postoperative nausea and vomiting. Anesth Analg 2008;107(2):445-51.
11. 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. Br J Anaesth 1995;311(7009):844-6.
12. Wilson AJ, Diemunsch P, Lindeque BG, Scheinin H, Helbo-Hansen HS, Kroeks MV et al. Single-dose i.v. granisetron in the prevention of postoperative nausea and vomiting. Br J Anaesth 1996;76(4):515-8.
13. Kovac AL, Eberhart L, Kotarski J, Clerici G, Apfel C. 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(2):439-44.
14. Wallenborn J, Kaisers U, Roewer N, Kranke P. Palonosetron in the prevention of postoperative nausea and vomiting (PONV): A quantitative systematic review : 1AP7-2. European Journal of Anaesthesiology 2010;27(47):24.
15. Lichtor JL, Glass PS . We're tired of waiting. Anesth Analg 2008;107(2):353-5.
16. Rojas C, Stathis M, Thomas AG, Massuda EB, Alt J, Zhang J et al. Palonosetron exhibits unique molecular interactions with 5-HT3 receptor. Anesth Analg 2008;107(2):469-78.

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