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Original Research Article

Evaluation of granisetron as an antiemetic in patients undergoing abdominal hysterectomy under spinal anaesthesia

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ABSTRACT

Background: PONV most common complications related to surgery and anaesthesia despite major advances in spinal, epidural and combined spinal-epidural anesthesia techniques IONV are still present in a significant number of patients. Ondansetron, used for controlling PONV induced by chemotherapy or radiation. Recently 5HT3 receptor antagonist granisetron has more potent, selective and longer acting activity than ondansetron. Granisetron is more active for control of PONV in cisplatin induced vomiting than ondansetron. It also reduces PONV in strabismus repair, tonsillectomy, and general surgeries, it has less side effects as compared to ondansetron. Objective of the study was to study efficacy and safety of granisetron and compare it with ondansetron for prevention of IONV and PONV.
Methods: 80 ASA grade I and II women undergoing abdominal hysterectomy under spinal anaesthesia were studied. Patients in group A received injection granisetron 2 mg and group B injection ondansetron 4 mg,10 minutes prior to induction of spinal anaesthesia. Main outcome measures were occurrence of nausea, retching or vomiting in intraoperative and postoperative period at 6, 12, 18 and 24 hours' post-surgery. The response of patient to therapy and side effects were evaluated in both groups. The results were analyzed by 'z' test ($p<0.5$) considered significant.
Results: Demographic characteristics of both groups were comparable patients in granisetron (80%) had more complete response as compared to ondansetron (47.5%). Adverse effects were lower in granisetron group.
Conclusions: Granisetron 2 Mg has better efficacy and safety profile than ondansetron 4 Mg.

Keywords: Granisetron, IONV, Ondansetron, PONV

INTRODUCTION

Postoperative nausea and vomiting (PONV) remains one of the most common complications related to surgery and anaesthesia. Referred to as the "big little problem", its complications range from minor patient discomfort to gastric aspiration.[1] PONV are common sequelae of general as well as regional anaesthesia and a leading cause of delayed procedure.[2]

An overall estimate of PONV is approximately 20-30% of all adult surgical patients. There is higher incidence of nausea and vomiting after surgery in female adults as compared to male adults. The incidence of PONV after day care and laparoscopic surgeries varies from 36-82% during immediate postoperative recovery and can be as high as 73% in certain gynaecological procedures.[3]

This is very frequent in gynaecological surgery leading to recommendation of routine prophylactic administration of antiemetics. PONV can be unpleasant and disturbing to the patient and make surgery difficult.[4] Furthermore, this can complicate postoperative care in several ways like aspiration of vomitus, electrolyte disturbance dehydration, delay of nutrition, fluid intake, oral drug therapy, and wound dehiscence.[5] The risk factors such as a residual pneumoperitoneum, use of nitrous oxide, opioids, obesity in females, 20-40 years of age, one-week premenstrual phase all contribute to these episodes. History of PONV and motion sickness are additional risk

factors.[6] The anesthesia related factors associated with emesis included premedication, inhalational agents, opioids, postoperative pain, patient mobilization, hemodynamic instability and initiation of oral intake.[7] These symptoms are distressing and uncomfortable for the parturient and may interfere with the surgical procedure. Patients who experience these symptoms consume more resources and require additional health care professional time than do those in whom these complications are avoided.[8]

Despite major advances in spinal, epidural and combined spinal-epidural anesthesia techniques, intraoperative nausea and vomiting (IONV) are still present in a significant number of patients. These symptoms can be distressing and uncomfortable for patients and may have a negative impact on their overall birthing experience.[9] Persistence of nausea and vomiting in the postoperative period especially in a patient, who is fasting, can result in dehydration, electrolyte imbalance and delayed discharge from hospital. Persistent retching and vomiting can cause tension in suture lines, venous hypertension, bleeding under skin flaps and increased risk of pulmonary aspiration of vomitus, if airway reflexes are depressed from the residual effects of anaesthetic and analgesic drug. It affects the patients in more ways than one and the consequences could be physical, metabolic, psychological[1] or economic.[10]

Many drugs have of far been tried to prevent or alleviate this problem. The antiemetics that are currently being widely used for treatment in our country are prochlorperazine, metochlopramide and promethazine. But these drugs have varying effectiveness and their use is limited because of delayed recovery, sedation and sometimes distressing side effect of extrapyramidal symptoms.[1,6] The introduction of $5HT_3$ receptor antagonist in 1990s was heralded as a major advance in the treatment of PONV because of the absence of adverse effects that were observed with commonly used traditional antiemetics.[11]

Ondansetron, a $5\text{-}HT_3$ receptor antagonist is an established drug for controlling nausea and vomiting induced by chemotherapy or radiation.[12] Ondansetron has also been reported to be effective in preventing IONV and PONV.[13,14]Recently introduced another 5HT3 receptor antagonist granisetron has more potent and longer acting activity against cisplatin induced emesis than ondansetron.

Recent study demonstrated that granisetron reduces the incidence and severity of vomiting following strabismus repair and tonsillectomy.[15] Recently, granisetron has been found to have a prophylactic antiemetic effect on PONV in patients undergoing surgery under general anesthesia.[16] It would be therefore, worthwhile to study the efficacy and safety of granisetron and compare it with ondensetron for prevention of IONV and PONV in patients undergoing abdominal hysterectomy under spinal anaesthesia.[17]

METHODS

This was a prospective, randomized, open-labeled study carried out in a tertiary care hospital. The protocol of the study was approved by the Institutional Ethics Committee. Total 80 women were enrolled in the study. The following were the inclusion and exclusion criteria for the enrolment of the patient in the study.

Inclusion criteria

- Women undergoing abdominal hysterectomy under spinal anaesthesia
- Patients belonging to 30-45 years of age group.
- Patients designated ASA grade I or grade II

Exclusion criteria

- Patients suffering from severe medical illnesses (ASA grade III and IV patients)
- Patients with history of allergic reaction to any of the drugs used in this study.
- Patients with history of PONV, motion sickness, hyperemesis gravidarum or pre-eclampsia.
- Patients who had received antiemetics, 24 hours prior to surger

Sample size was calculated by using a two-sided test for two population proportions considering 5% level of significance and 90% power of test.[18]

$$\textbf{Sample size (n)} = \frac{\{Z_{1-\frac{\alpha}{2}}\sqrt{[2P(1-P)]} + Z_{1-\beta}\sqrt{[P_1(1-P_1 + P_2(1-P_2)]}\}^2}{(P_1 - P_2)^2}$$

P_1= Proportions of patients who do not have PONV receiving granisetron and P_2 = proportions of patients who do not have PONV receiving ondansetron

Where $P = \frac{(P_1 - P_2)}{2}$

Where n=minimum sample size to be calculated.

Z1-α/2 =1.96 (for 5 % level of significance and 90 % power test) and Z1-β/2= 90% (power of test).

The sample size was found to be 36. Yet we took 40 as sample size for each group as it is minimal sample size for study. Subjects were divided into two groups. Total 80 patients were enrolled for the study. An informed and written consent was obtained from all the patients enrolled in the study.

Pre-operative evaluation

Preoperative visit was conducted on the day before surgery. Detailed present and past medical and surgical

history was taken. General and systemic examinations were done. Basic laboratory investigations like haemoglobin, total and differential leukocyte count, urine analysis, blood sugar, blood urea nitrogen, serum electrolytes, chest x-ray and electrocardiogram were done in all the patients.

Pre-operative order

Patients were advised to remain nil by mouth after 10 pm the day before surgery.

Randomization

The patients were randomized into two groups as 'Granisetron group' and 'Ondansetron group' by using computer generated random numbers.

Procedure

When the patient was brought to the operation theatre, her pulse rate, respiratory rate and blood pressure were recorded. Injection Atropine 0.01 mg/kg intramuscularly was administered to all patient's half an hour prior to induction of S.A. An i.v. access with 18 gauge i.v. cannula was obtained. Total 80 patients were randomly allocated into two groups, Group A and Group B (40 patients in each group), by computer generated random numbers.

Group A: Patients in group A received inj granisetron 2 mg, as a single dose given slowly i.v. over 5 minutes, 10 minutes prior to induction of S.A.

Group B: Patients in group B received inj ondansetron 4 mg, as a single dose given slowly i.v. over 5 minutes, 10 minutes prior to induction of S.A. Time of drug administration and vital parameters like pulse rate, respiratory rate and blood pressure were noted and recorded.

Each patient received 20 ml/kg of Ringer lactate solution as a preloading infusion before administration of S.A to prevent intraoperative hypotension. All patients received oxygen via a face mask at a flow rate of 3 litres/min since induction of S.A. S.A was administered in a left lateral decubitus position using 25 gauge Quinke spinal needle at L_3 -L_4 interspace.

All patients received 1.7 - 2.2 ml of 0.5% hyperbaric bupivacaine subarachnoid injection. The level of analgesia was assessed by pin-prick and all patients had analgesia (sensory block) up to T_5 – T_6 level. Aortocaval compression was avoided by placing a single folded blanket beneath the right buttock for left uterine displacement.

Intraoperative pulse rate, respiratory rate and blood pressure were monitored. Blood pressure was maintained with i.v. fluid and/or with i.v. ephedrine.

Assessment

Patients were interviewed for occurrence of any nausea, retching or vomiting in the immediate postoperative period at 6, 12, 18 and 24 hours' post-surgery. The primary efficacy variable was emesis (the number of emetic episodes).

An emetic episode was defined as a single vomit or retch or combination of vomiting and/or retch occurring within a minute of each other. The nausea and/or vomiting during 0-6 hours is referred to as early PONV and during 6-24hours as late PONV.[19]

The response of the patient to prophylactic antiemetic therapy was divided into three groups as follows.[20]

- Complete response: no nausea and vomiting during 24 hours period with no need of rescue anti emetic medication.
- Major response: one episode of vomiting in 24-hour study period irrespective of nausea.
- Treatment failure: two or more emetic episodes or the need to administer rescue antiemetic during study period.

Inj metoclopramide 10mg was given as a rescue antiemetic. The rescue antiemetic could be administered at any time upon physician's determination, patient's request, after encountering more than three emetic episodes or nausea lasting for at least 15 minutes.

The secondary efficacy variable was nausea. Nausea was assessed subjectively by using a verbal intensity score.[21]

0 - No nausea; 1 - Mild nausea; 2 - Moderate nausea and 3 - Severe nausea. Adverse effects/reactions, if any, to the drugs used in the study were noted and recorded.

Statistical analysis[18]

The results of data were analyzed by using 'Z' test for testing difference between proportions and 'Z' test for testing difference between means. The 'p-value' of <0.05 was considered statistically significant.

RESULTS

A total of 80 patients were included in the study, of which 40 patients were allocated to granisetron group (2 mg) and 40 patients to ondansetron. Group (4 mg). All the patients from both the groups completed the study and were considered for the analysis of data.

Table 1 shows that the as regards the baseline maternal characteristics the differences in the means of age, weight, parity, duration of surgery and no of patients using bupivacaine as anaesthetic and diclofenac as analgesic agents were not significant ($p>0.05$).

Table 2 shows that the frequency of total IONV was 13% in granisetron group and 15% in ondansetron group. The difference between the two groups for nausea, emesis and total IONV was not statistically significant (p>0.05) (Figure 1).

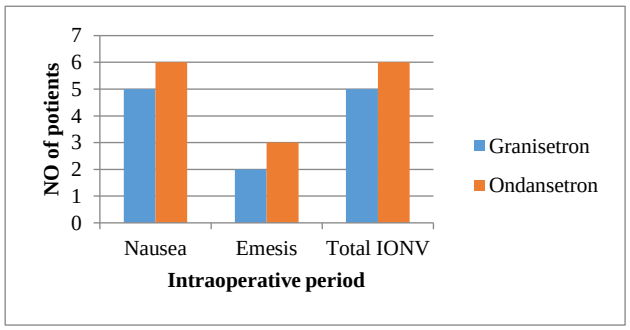
Table 1: Baseline maternal characteristics.

Parameters	Granisetron group A (n = 40)	Ondansetron group B (n = 40)	p value
Age (in Yrs)	24±2.36	25±1.56	>0.05
Weight (in Kg)	56±2.86	55±3.83	>0.05
Parity	1±0.93	1.1±0.74	>0.05
Duration of surgery (in mins)	48±1.96	46±2.56	>0.05
Anaesthetics used (bupivacaine) (0.5 % hyperbaric)	40	40	>0.05
Analgesics used (diclofenac sodium) (75 mg i.m.)	15	17	>0.05

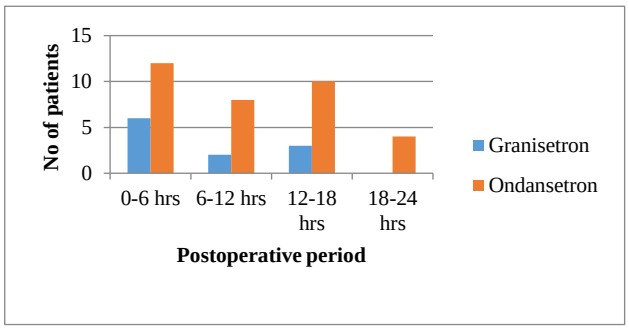
Figures indicate mean ± SD, Kg: kilograms, Mins: minutes

Table 2: Frequency of nausea and emesis (vomiting and/or retching) during intraoperative period.

Intraoperative Period	Granisetron Group A (n=40)	Ondansetron Group B (n=40)	p value
Nausea	5 (13%)	6 (15%)	>0.05
Emesis	2 (5%)	3 (7%)	>0.05
Total IONV	5 (13%)	6 (15%)	>0.05



Figures 1: IONV.



Figures 2: Nausea.

Table 3: Frequency of nausea during postoperative period.

	Number of patients who experienced nausea		
Postoperative Period	Granisetron Group A (n=40)	Ondansetron Group B (n=40)	p value
0-6hours	6 (15%)	12 (30%)	>0.05
6-12hours	2 (5%)	8 (20%)	<0.05
12-18hours	3 (7.5%)	10 (25%)	<0.05
18-24 hours	0	4 (10%)	<0.05

Table 3 shows that when the frequency of nausea during 6-12hours, 12-18 hours and 18-24 hours postoperatively was compared, it was observed that the frequency of nausea in granisetron group was less than that in ondansetron group at all time frames, and the difference between the two groups was statistically significant (<0.05) (Figure 2).

Table 4 shows that when frequency of emesis in two groups at 0-6 hours, 6-12 hours, 12-18 and 18-24 hours postoperatively was compared, it was seen that incidence of emesis was less in granisetron group and the difference between the two groups was significant statistically (<0.05) (Figure 3).

Table 4: Frequency of emesis (vomiting and/or retching) during postoperative period.

Postoperative Period	Number of patients who had emesis		p value
	Granisetron Group A (n=40)	Ondansetron Group B (n=40)	
0-6hour	4 (10%)	8 (20%)	>0.05
6-12hours	1 (2.5%)	7 (17.5%)	<0.05
12-18hours	2 (.5%)	9 (22.5%)	<0.05
18-24 hours	0 (0)	4 (10%)	<0.05

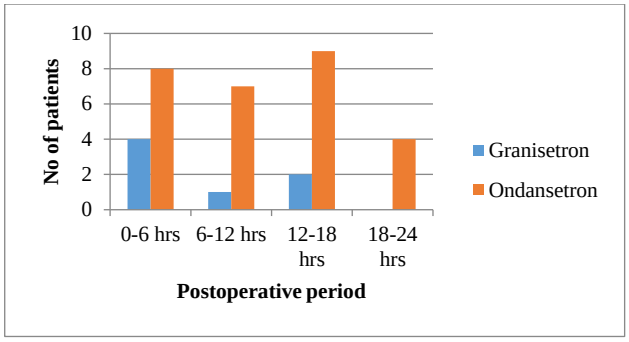


Figure 3: Emesis.

Table 5: Frequency of nausea and/or emesis during postoperative period (PONV).

Postoperative Period	Number of patients who had nausea and/or emesis		
	Granisetron Group A (n=40)	Ondansetron Group B (n=40)	p value
Early PONV (0-6hours)	7 (17.5%)	14 (35%)	>0.05
Late PONV (6-24 hours)	3 (7.5%)	10 (25%)	<0.05
Total PONV (0-24 hours)	8 (20%)	21 (52%)	<0.05

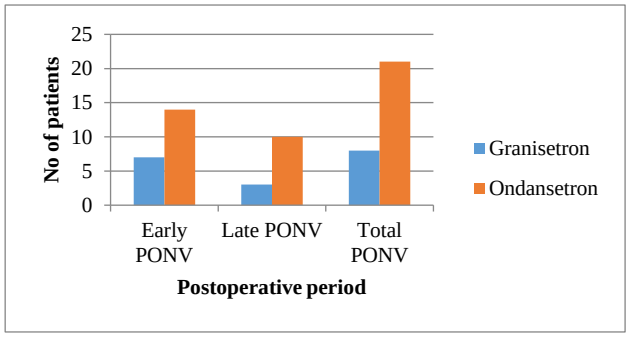


Figure 4: PONV.

Table 6: Response to prophylactic antiemetic therapy.

Response	Granisetron n=40	Ondansetron n=40	p Value
Complete response	32 (80%)	19 (47.5%)	P<0.05
Major response	7 (17.5%)	14 (35%)	p>0.05
Treatment failure	1 (2.5%)	7 (17.5%)	P<0.05

Table 5 shows that the frequency of nausea and/or emesis during early (0-6hrs) postoperative period was compared the difference between two groups was not statistically significant (p>0.05). However, during late (6-24 hours) postoperative period, the frequency of nausea and/or emesis was less in granisetron group as compared to ondansetron group and the difference between two groups was statistically significant (<0.05). The frequency of nausea and/or emesis during total (0-24 hours) postoperative period was less in granisetron group. The difference between two groups was statistically significant (p< 0.05) (Figure 4).

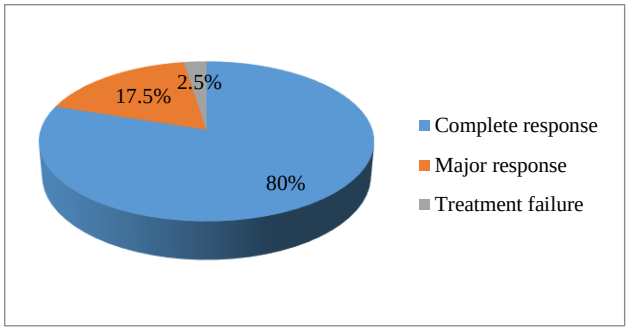


Figure 5: Granisetron.

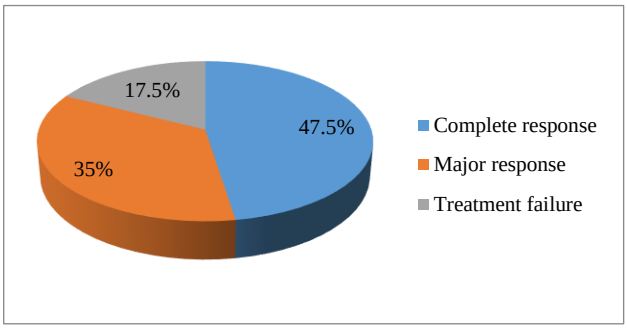


Figure 6: Ondansetron.

Table 7 shows that the number of mild as well as moderate nausea episodes were higher in ondansetron group as compared to granisetron group. The difference

in total number of nausea episodes (both mild as well as moderate) between two groups was statistically significant (p<0.05).

Table 8 shows that during all observation periods, frequency of headache the difference between two groups was statistically significant (p<0.05). The difference in the frequency of constipation and dizziness between granisetron and ondansetron group was not significant statistically (p<0.05). The difference in total frequency of adverse effects between two groups was significant statistically (p<0.05).

Table 7: Nausea grades during study period.

Period	Nausea Grade	Number of episodes of nausea		p value
		Granisetron group	Ondansetron group	
Intraoperative	Mild	4	5	>0.05
	Moderate	1	1	>0.05
	Severe	0	0	-
Postoperative	Mild	9	22	<0.05
	Moderate	2	12	<0.05
	Severe	0	0	-
Total	Mild	13	23	<0.05
	Moderate	3	13	<0.05
	Severe	0	0	-

Mild: Grade 1, Moderate: Grade 2, Severe: Grade 3

Table 8: Safety profile.

Adverse effects	Granisetron group (n= 40)	Ondansetron group (n= 40)	p value
Headache	3 (7.5%)	10 (25%)	<0.05
Constipation	2 (5%)	4 (10%)	>0.05
Dizziness	2 (5%)	4 (10%)	>0.05
Total	7 (17.5%)	18 (45%)	<0.05

DISCUSSION

PONV are the most commonly encountered symptoms after anaesthesia and surgery. This is very frequent in gynaecological surgery leading to recommendation of routine prophylactic administration of antiemetics.[7,22]

In the present prospective, randomized, open-labelled study, the efficacy and safety of granisetron was compared with that of ondansetron for the prevention of IONV and PONV in patients undergoing abdominal hysterectomy under S.A. Granisetron 2 mg dose was selected as our study dose because it has been shown to be as effective as higher doses in preventing and treating PONV and is not associated with any significant side effects. The same dose was used in studies conducted by Bhattacharya et al Chidambaram et al.[17,23] The dose of ondansetron 4 mg was selected, as it is the standard dose routinely used for prevention of PONV and the same dose was used in the previous studies.[17,23,24]

Efficacy

To the best of our knowledge, this is the first study comparing granisetron against ondansetron regarding evaluation of frequency of IONV. Balki et al reported that granisetron 1 mg i.v. was not more effective than 1ml of normal saline (NS) in preventing post-delivery IONV, with frequency of IONV 20.4% in granisetron group and 17% in NS group.[25] The frequency of IONV in granisetron group in present study is lower compared to the study conducted by Balki et al.[25]

Pan PH et al58showed that ondansetron 4 mg IV was more effective in reducing the frequency of intraoperative nausea than metoclopramide 10 mg i.v. and 10 ml of NS i.v. However, ondansetron was not more effective in reducing the incidence of intraoperative vomiting than metoclopramide and NS in cesarean section patients given epidural anesthesia. The frequency of IONV was 24% and 13% in ondansetron group respectively which is higher than findings in present study.

These findings are like study conducted by Ommid et al wherein granisetron and ondansetron were evaluated for prevention of PONV in female patients undergoing laparoscopic cholecystectomy.[3] It has been reported that granisetron was more effective than ondansetron in reducing the incidence of PONV during 6-24 hours' study interval and not during 0-6 hours study period (Table 5, Figure 4). However, findings of early PONV (0-6 hrs) of present study are in variance with studies

conducted by Wadaskar et al and Bhattacharya et al, wherein granisetron is more effective in reducing incidence of PONV during 0-6 hours study interval was shown.[17,24] This difference between present study and their studies could be because, nausea is a subjective phenomenon and many factors determine the occurrence of PONV and these include preoperative medications, anaesthetic and analgesics used, type of regional anaesthesia (epidural or spinal) and operative technique.

Chidambaram et al reported that complete response rate was more in granisetron group (86%) than ondansetron group (75%) ($p<0.05$).[23] This result is in accordance with our study (Table 6, Figure 5 and 6). However, results of study conducted by Mantovani et al are in variance with present study wherein 72% patients in granisetron group and 73.3% patients in ondansetron achieved complete response ($p>0.05$).[20] In the present study the cumulative nausea grade was lower in granisetron as compared to ondansetron showing statistically significant difference ($p<0.05$) (Table 7). Thus, in the present study, we found that granisetron is more efficacious than ondansetron in preventing PONV in patients undergoing abdominal hysterectomy under S.A.

Safety

In the present study, incidence of headache was significantly lower in granisetron as compared to ondansetron group ($p<0.05$) (Table 8]. This finding is similar to study conducted by Chidambaram et al.[23] However, present study finding is in variance with study conducted by Dua et al which reported that incidence of headache did not differ significantly in granisetron and ondansetron group in patients undergoing modified radical mastectomy.[27]

Two groups did not differ significantly about incidence of dizziness and constipation ($p> 0.05$) (Table 8). These findings are similar to study conducted by Dua et al.[27] The results of the present study demonstrate that administration of granisetron 2 mg is more efficacious and safe as compared to ondansetron 4 mg for prevention of PONV in women undergoing abdominal hysterectomy under S.A. The issuses of economy and surrogate variables like expenses incurred towards treating established PONV and sequel of PONV and these can be considered as the limitations of present study.

CONCLUSION

The present prospective, randomized, open-labelled study was aimed to study and compare the efficacy and safety of granisetron and ondansetron for prevention of IONV and PONV in patients undergoing abdominal hysterectomy under S.A. Total 80 patients were randomly allocated into two groups, Group A and Group B (40 patients in each group). Group A received granisetron 2 mg and Group B received ondansetron 4 mg, i.v 10 minutes before induction of S.A. Patients were interviewed for occurrence of any nausea, retching or vomiting intraoperatively and in the immediate postoperative period, at 6, 12, 18 and 24 hours' post-surgery.

In this study, significantly higher percentage of patients in granisetron group (80%) had complete response (i.e. not a single emetic episode during study period irrespective of nausea) to prophylactic antiemetic therapy as compared to ondansetron group (47.5%). The incidence of PONV was significantly less in granisetron group when compared with ondansetron group (20% versus 52%). The incidence of adverse drug effects was lower in granisetron group as compared to ondansetron group and this difference was statistically significant. ($p<0.05$)

Thus, it is fair to conclude from this study that granisetron 2 mg has better efficacy than ondansetron 4 mg about to prevention of PONV in patients undergoing abdominal hysterectomy under S.A. As far as safety is concerned granisetron is superior to ondansetron.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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