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Comparison of the Effectiveness of Palonosetron and Dexamethasone to Prevent Postoperative Nausea and Vomiting in Patients Undergoing Uncomplicated Laparoscopic Cholecystectomy

Samra Ahmad[1*], Sheikh Ziarat Ali[1], Yashal Syed[1], Mehtab Tipu Chuadhary[1], Aqsa Iram[1] and Fizzah Haq[2]

[1]Department of Anesthesia, Fatima Jinnah Medical University, Sir Ganga Ram Hospital, Lahore, Pakistan
[2]Department of Innovation and Technology, INTI International University, Malaysia

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***Corresponding Author:**
Samra Ahmad
Department of Anesthesia, Fatima Jinnah Medical University, Sir Ganga Ram Hospital, Lahore, Pakistan
dr.samra.ahmad@gmail.com

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ABSTRACT

Postoperative nausea and vomiting (PONV), particularly in patients having laparoscopic cholecystectomy, continues to be a prevalent and distressing consequence after surgical operations. It leads to higher hospital stays and resource utilization, as well as patient dissatisfaction. PONV occurrences have been linked to a range of patient-specific, anesthesia- and surgery-related risk factors. **Objectives:** To determine the effectiveness of palonosetron compared to dexamethasone in preventing PONV in patients undergoing a laparoscopic cholecystectomy operation (uncomplicated). **Methods:** It was a quasi-experimental study that was conducted in the Department of Anesthesiology, Sir Ganga Ram Hospital, Lahore. The inclusion and exclusion criteria were met, and after that, 108 candidates were included and categorized into 2 groups. In patients of group A, 54 patients received 0.075mg Palonosetron (diluted in 5cc distilled water) intravenously in a single dose. In patients of group B, another 54 patients received 8mg dexamethasone intravenously. **Results:** Most of the patients included were female (66.7%), and the mean age of patients was 52.82 ± 8.80 years. When compared, the efficacy of both the drugs for PONV using the chi-square test (significant p-value>0.005) showed that only 20 cases (37.0%) of the group palonosetron suffered from PONV. While 42 patients (77.8%) of the dexamethasone group suffered from PONV (p-value<0.001). This showed that Palonosetron is clearly a superior drug in terms of efficacy as compared to dexamethasone. **Conclusions:** This study concluded that palonosetron is more effective than dexamethasone in preventing PONV in patients undergoing uncomplicated laparoscopic cholecystectomy.

INTRODUCTION

In laparoscopic surgeries, nausea and vomiting are the most frequently occurring postoperative complications after pain. Its consequences are delayed recovery, prolonged hospital stay, i.e., in the Post Anesthesia Care Units, pulmonary aspiration, wound dehiscence, electrolyte imbalance, dehydration, greater perception of pain, and esophageal rupture [1]. It has an incidence of 30% in all postoperative surgical cases, with the exception of high-risk cases in which it rises to 80% [2]. The female gender, nonsmoking, obesity, and use of post-op opioids are common risk factors. Extended surgical duration is a significant contributing factor to postoperative nausea and vomiting (PONV) risk [3]. Laparoscopic surgeries like laparoscopic cholecystectomy require carbon dioxide insufflation, which causes distension of the peritoneum and dilates the intestinal loops. This distension triggers the gut wall's mechanoreceptors, leading to a surge in serotonin production. This elicits the chemoreceptor

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trigger zone (CTZ) in the medulla, which receives vagal afferents from various parts of the body and produces emesis. The incidence of PONV ranges from 40% to 75% in laparoscopic surgeries without any antiemetic prophylaxis [4]. Drugs used to treat PONV include 5-Hydroxytryptamine antagonists such as ondansetron, Anticholinergics such as scopolamine, Histamine antagonists such as Dimenhydrinate, meclizine, etc. Dopamine antagonists such as Domperidone, metoclopramide, etc. Neurokinin antagonists like Aprepitant and corticosteroids such as dexamethasone [5]. Khan et al. affirmed that Dexamethasone is an effective antiemetic when used during anesthesia induction. Its mode of action is unfamiliar, but it is most likely to be the central blocking of the production of prostaglandins and result in the reduction of serotonin turnover in the central nervous system. It causes the stimulation of glucocorticoid receptors in the medulla and suppresses the synthesis of prostaglandins. It also prevents the emission of endogenous opioids [6]. Dexamethasone is very cheap [7]. It is a corticosteroid that has long-acting properties, and its half-life is 36-72 h [8]. Palonosetron is a 5-HT3 receptor antagonist that has the highest receptor-binding affinity. It lasts half-life of 40h, and its slow excretion by the body eliminates PONV to a range of 48h [9]. Srivastava and colleagues in 2016 concluded that the combination of these two antiemetics doesn't significantly decrease PONV incidence in laparoscopic surgeries as compared to drugs alone (24.4% vs. 22.2%) [10]. A study done by Kim et al. included only female patients, while we will study drug efficacy in both genders. Similarly, there are a few studies done on the comparison of these two drugs alone [9].

In Pakistan, there are few comparative studies to assess the effectiveness of various antiemetic drugs to prevent postoperative nausea and vomiting (PONV), especially in laparoscopic cholecystectomy patients. The available literature presents contradicting results, and there has been a lack of local studies comparing palonosetron to dexamethasone. Postoperative nausea and vomiting is a frequent and uncomfortable problem that happens after laparoscopic surgeries, and it results in delayed recovery and high cost of health care. Nevertheless, it is still unclear which prophylactic drug is the best agent in preventing its occurrence in clinical practice. This study aimed to compare the efficacy of Palonosetron and Dexamethasone to prevent PONV, as very few studies are available in Pakistan, and due to conflicts in the conclusions of the literature reviews mentioned above.

METHODS

This quasi-experimental study was conducted in the Department of Anesthesia, Sir Ganga Ram Hospital, Lahore, over a period of one year (November 2022 to November 2025) following synopsis approval (20-MS-Anesthesia/IRB). 108 patients were included, with 54 patients in each group, based on clinician allocation. The sample size was calculated assuming an expected PONV incidence of 27.2% in the palonosetron group versus 56.1% in the dexamethasone group, with 95% confidence, 80% power, and a 20% anticipated dropout rate [2]. After taking the written informed consent, the patients aged 40–70 years, with ASA physical status I–II and BMI <35 kg/m^2, were included. Patients were excluded if they had a history of nausea, vomiting, or motion sickness, were pregnant or lactating, had a BMI >35 kg/m^2, ASA III–IV, allergy to study drugs, prior use of medications affecting PONV, immunocompromised status, complicated cholecystitis, nasogastric tubes, or refused to participate. Baseline assessment included age, gender, and BMI, and patients were kept nil per OS for 8 hours before surgery. Study drugs were administered one hour before induction of anesthesia, with the palonosetron group receiving 0.075 mg intravenously diluted in 5 mL distilled water, and the dexamethasone group receiving 8 mg intravenously. Standard intraoperative monitoring included ECG, noninvasive blood pressure, nasopharyngeal temperature, and pulse oximetry, with Ringer's lactate infusion initiated upon arrival to the operating room. Premedication consisted of midazolam 0.2 mg/kg IV, followed by induction with nalbuphine 0.1 mg/kg and propofol 2 mg/kg. Atracurium (0.5mg/kg) was used to attain neuromuscular blockade and an endotracheal tube was inserted into the patient with the correct endotracheal tube. Controlled ventilation of 1.2% MAC isoflurane in 50% oxygen and 50% nitrous oxide was used, and end-tidal CO2 followed. Acetaminophen 15mg/kg was used as intraoperative analgesia, and neostigmine 0.04mg/kg and glycopyrrolate 10 µg/kg were used to reverse residual paralysis. The analgesia was postoperative IV paracetamol 1 g in 6h and ketorolac 30 mg in 6h IV as required. The main finding of the given research was the development of PONV during the first 6 hours of the surgical procedure. PONV was used to be characterized as an incidence of nausea, retching (involuntary vomiting), or vomiting (emergence of gastric contents). Complete response was defined as the absence of PONV without the need to use rescue antiemetic treatment. IV administration of metoclopramide 10mg was also administered as a rescue antiemetic. The intensity of PONV in the first 6 hours postoperatively was measured using a PONV scoring system in which a score of 1-4 was considered clinically important concerning PONV, and a score of 0 represented no PONV [11]. Structured forms were used to gather data. SPSS version 26.0 has been applied to analyze the data, where quantitative variables are in the form of mean and standard deviation, and qualitative variables are in the form of frequency and

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percentage. Chi-square test/Fisher Exact Test of categorical variables and t-test of continuous variables, using the assistance of Mann-Whitney U test (non-normally distributed data with the help of Shapiro wilk test), were used to compare the palonosetron versus dexamethasone group with a p-value of 0.005 as the significant value.

RESULTS

The average age of patients was 52.82 ± 8.81 years, and the mean BMI was 32.42 ± 2.97 kg/m2, which indicates a middle-aged cohort with moderately high body mass. Most of the respondents were women (66.7 percent), and males made up 33.3 percent of the sample population. Physical status: 72.2 percent of the patients were of the type ASA I, and 27.8 percent were of the type ASA II, which indicates that the majority of the participants were generally healthy with mild systemic disease, which was a smaller percentage (Table 1).

Table 1: Clinical and Demographics of Patients

Variables	Category	n (%)	Mean ± SD
Age	Years	108	52.82 ± 8.81
BMI (kg/m^2)	–	108	32.42 ± 2.97
Gender	Female	72	66.7
	Male	36	33.3
ASA Score	I	78 (71.2%)	–
	II	30 (2.8%)	–

A significantly lower rate of PONV was observed in the palonosetron group (37.0%) relative to the dexamethasone group (77.8%) (p<0.001), demonstrating superior prophylactic efficacy. The need for rescue antiemetic therapy was also markedly lower in the palonosetron group across all postoperative intervals, with only 14.8% requiring intervention in the first 1–2 hours and none in the 3–6-hour periods. In contrast, dexamethasone-treated patients had a higher and more prolonged need for rescue therapy, with 59.3% at 1–2 hours, 61.1% at 3–4 hours, and 14.8% at 5–6 hours (all p<0.005). These results indicate that palonosetron is more effective than dexamethasone in preventing early PONV and reducing reliance on rescue antiemetics following laparoscopic cholecystectomy (Table 2).

Table 2: Comparison of PONV and Need for Rescue Antiemetic in Study Groups

Parameter	Palonosetron (n=54)	Dexamethasone (n = 54)	p-value
Incidence of PONV			
Yes	20 (37.0%)	42 (77.8%)	<0.001*
No	34 (63.0%)	12 (22.2%)	
Need for Rescue Antiemetic			
1-2 h	8 (14.8%)	32 (59.3%)	<0.001*
3-4 h	0 (0.0%)	33 (61.1%)	<0.001*
5-6 h	0 (0.0%)	8 (14.8%)	0.003*

*Independent sample t-test

The mean PONV scores were consistently lower in the palonosetron group compared with the dexamethasone group across all postoperative intervals. At 1–2 hours, the palonosetron group had a mean score of 0.43 ± 0.63 versus 1.33 ± 1.20 in the dexamethasone group (p<0.001). At 3–4 hours, palonosetron-treated patients had no PONV (0.00 ± 0.00), and the dexamethasone group had a mean score of 0.74 ± 0.78 (p<0.001). On the same note, the palonosetron group showed no PONV at 5-6 hours (0.00 ± 0.00) as opposed to the dexamethasone group that had a mean of 0.26 + 0.71 (p<0.001). Such results suggest that palonosetron gives much better control of postoperative nausea and vomiting at any given time interval after laparoscopic cholecystectomy, which is more effective in prophylaxis than dexamethasone (Table 3).

Table 3: Comparison of Mean PONV Scores Between Study Groups

Time Interval	Group	Mean ± SD	p-value
1–2 Hours	Palonosetron	0.43 ± 0.63	<0.001*
	Dexamethasone	1.33 ± 1.20	
3–4 Hours	Palonosetron	0.00 ± 0.00	<0.001*
	Dexamethasone	0.74 ± 0.78	
5–6 Hours	Palonosetron	0.00 ± 0.00	<0.001*
	Dexamethasone	0.26 ± 0.71	

*Independent sample t-test

DISCUSSION

The present study was done on the comparison of the efficacy of palonosetron and dexamethasone in preventing postoperative PONV in patients who have already undergone laparoscopic cholecystectomy without any complications. Palonosetron is a selective 5-HT3 receptor antagonist that has demonstrated favorable propensity in inhibiting nausea and vomiting by means of central effects and peripheral effects, and the half-life is lengthy, approximated to 40 hours [12-14]. Conversely, dexamethasone, a corticosteroid, an anti-inflammatory and antiemetic agent, is a common PONV prophylaxis agent [14, 15]. The mean age of the participants in this study was 52.82280 years, with the majority being female (66.7%), which is similar to other past surveys like Chatterjee *et al.* where the mean age was 43.5711.74 years and females made up the majority. PONV was observed to be very low in the palonosetron group (37%) as compared to the dexamethasone group (77.8%). In the case of Chatterjee *et al.* it was 27.2% in the palonosetron group and 56.14% in the dexamethasone group [2]. On the same note, rescue antiemetics were also necessary to a much lower degree in the palonosetron group, with only 8 patients (14.8%) requiring treatment in the first 1–2 hours postoperatively and no patients requiring intervention

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from 3–6 hours, whereas dexamethasone-treated patients showed a higher and more prolonged requirement. Previous studies have also demonstrated that combination therapy of palonosetron with dexamethasone (PD) can further reduce PONV rates compared to either drug alone. As an example, a study has indicated that PD was found to reduce PONV both in the initial 24-48 hours of the postoperative period and decrease the use of rescue antiemetics in comparison to dexamethasone [16]. Although our research was not an evaluation of combination therapy, these findings suggest it might be feasible to employ this strategy in high-risk countries of PONV. In line with our observation, Gupta et al. observed that palonosetron was more potent than other 5-HT3 antagonists in managing PONV, with a response rate of 90 percent in all patients [17]. Other studies comparing palonosetron with granisetron demonstrated similar efficacy in preventing early PONV but showed superior prevention of late-onset nausea (2–48 hours) with palonosetron, likely due to its longer half-life and faster onset of action [18]. Dexamethasone is not as effective as palonosetron, but has been demonstrated to be as effective as ondansetron in PONV reduction in some surgery procedures, including pediatric strabismus repair, indicating it can be used as an alternative when palonosetron is not available [19]. Nevertheless, randomized trials comparing palonosetron with other such combinations like ondansetron plus dexamethasone or metoclopramide plus dexamethasone have continued to demonstrate palonosetron as a single agent to be a better PONV control and rescue antiemetic agent [20, 21]. In general, current results support the high-level of effectiveness of palonosetron over dexamethasone in the effectiveness of prophylaxis of PONV in patients after laparoscopic cholecystectomy. Palonosetron should be viewed as the agent of first choice due to its increased length of action, lower rates of PONV, and lower rates of antiemetic rescue use, but combination treatment should be used in high-risk situations where an agent alone might not be effective.

The quasi-experimental design applied in the research was not completely randomized and this can create selection bias. It was also a single-center study with a small sample size, which decreases the generalizability. Besides, short-term results (within the initial 6 hours after the operation) were evaluated. Randomized controlled trials using larger multi-center samples should be used in future research to enhance reliability. Long-term results should also be evaluated and combination therapy of antiemetics should be tested to improve the prevention of PONV.

CONCLUSIONS

To sum up, this thesis offers profound information in regard to the efficiency of Palonosetron and Dexamethasone in the prevention of PONV among patients who undergo uncomplicated Laparoscopic Cholecystectomy. The evidence provided herein lends credence to the fact that Palonosetron is by far better than Dexamethasone in lowering the occurrence of PONV. The clinical implications of these findings are immense because an effective PONV prophylaxis will result in better patient outcomes, a higher degree of satisfaction, and a decrease in healthcare expenditure. Hopefully, this research will also add to the existing literature in the area of anesthesia and perioperative care, which will eventually enable healthcare providers to make informed decisions when choosing the most relevant antiemetic regimen when employing uncomplicated Laparoscopic Cholecystectomy in patients.

Authors' Contribution

Conceptualization: SA, SZA, YS
Methodology: SA, SZA, YS, AI
Formal analysis: SZA, YS
Writing and Drafting: MTC, FH
Review and Editing: SA, SZA, YS, MTC, AI

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

All the authors declare no conflict of interest.

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