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A Study on the Comparison of Dexamethasone Versus Ondansetron in the Prevention of Postoperative Nausea and Vomiting in Patients Undergoing Laparoscopic Surgery

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ABSTRACT

Background: Postoperative nausea and vomiting (PONV) is a common and distressing complication following surgery, particularly after laparoscopic procedures performed under general anesthesia. Effective prophylactic antiemetic therapy is important for improving patient comfort, facilitating recovery, and reducing postoperative complications. Dexamethasone and ondansetron are commonly used for the prevention of PONV; however, their comparative effectiveness remains of clinical interest.

Materials and Methods: A prospective comparative study was conducted among 50 patients undergoing elective laparoscopic surgery under general anesthesia. Patients were randomly allocated into two groups of 25 patients each. Group D received dexamethasone 8 mg intravenously after induction of anesthesia, while Group O received ondansetron 4 mg intravenously after induction. Patients were monitored during the postoperative period for the incidence and severity of nausea and vomiting, requirement for rescue antiemetic medication, hemodynamic parameters, and adverse effects during the first 24 hours. Statistical significance was considered at a p-value <0.05.

Results: The demographic characteristics of the two groups were comparable, with no statistically significant differences in age, weight, height, BMI, gender, or ASA physical status. The mean duration of surgery was also comparable between Group D and Group O (72.84 ± 14.25 vs. 74.16 ± 13.68 minutes; p=0.74). Heart rate and mean arterial pressure remained comparable between the groups at all observed perioperative time points, indicating similar hemodynamic stability. During the first 24 postoperative hours, PONV occurred in 8 patients (32%) in the

dexamethasone group compared with 4 patients (16%) in the ondansetron group (p=0.18). The proportion of patients without PONV was higher in Group O (84%) than in Group D (68%). Rescue antiemetic medication was required in 5 patients (20%) in Group D and 2 patients (8%) in Group O (p=0.22). Adverse effects were infrequent and comparable between the groups, with 88% of patients in each group reporting no adverse effects.

Conclusion: Both dexamethasone 8 mg and ondansetron 4 mg were safe and effective for the prevention of postoperative nausea and vomiting following elective laparoscopic surgery. Ondansetron demonstrated a lower incidence and severity of PONV and a lower requirement for rescue antiemetic therapy compared with dexamethasone; however, these differences were not statistically significant in the present sample. Therefore, ondansetron showed better clinical effectiveness, while both drugs demonstrated favorable safety and comparable perioperative hemodynamic stability.

Keywords: Postoperative nausea and vomiting, PONV, Dexamethasone, Ondansetron, Laparoscopic surgery, General anesthesia, Antiemetic.

INTRODUCTION

Nausea and vomiting are human protective reflexes against the absorption of toxins, as well as responses to certain stimuli. (**Thompson HJ 1999)** These symptoms are frequently listed by patients as their most important peri-operative concern. In the era of ether, the incidence of Postoperative Nausea and Vomiting (PONV) was as high as 75%. Despite advent of new technology and pharmacology, the incidence of PONV is still 20-30%. PONV can lead to serious complications such as aspiration, dehydration, electrolyte disturbances and disruption of incision site. It can also lead to increase cost of treatment, especially in outpatient surgical setting and unplanned hospital admission. **(Goodarzi M, et al 2006)** Another impact of PONV, is the effect on patient, some regard it as more disabling than the operation itself.

Postoperative nausea and vomiting (PONV) are a common distressing symptom in patients undergoing laparoscopic surgery and can contribute to anxiety, dehydration, metabolic abnormality, wound disruption, delayed recovery and other issues **(D'souza N,el at 2011).** The incidence of PONV varies from 20 to 80 %, and it is an economic and social burden. Ondansetron is a selective 5-HT_3 receptor antagonist, that exhibits an anti-emetic action by antagonizing vomiting signals in the afferent pathway from the stomach or small intestine and solitary tract nucleus, and is effective at preventing PONV (**Pearman MH 1994**) (**Hirayama**

T et al 2001), however the high cost of this drug has prevented it from being widely used. Dexamethasone, a corticosteroid, was first reported as an effective anti-emetic agent in patients undergoing cancer chemotherapy in 1981 [**Aapro MS and Albert DS 1981) (Lopez-olaondo et al 1996).**

Antiemetics administered prophylactically may help to minimize total PONV-related resource consumption and expenses, resulting in improved patient satisfaction. **(Cao X et al 2017)** Several measures are employed to reduce the risk of PONV, including utilizing single or multiple medications for prophylaxis, changing anaesthetic method, or combining all of them in a multimodal strategy to provide maximal protection. **(Gan TJ et al 2020)** Ondansetron acts as an anti-emetic by antagonizing vomiting signals that go via the afferent route from the stomach or small intestine to solitary tract nucleus. Though ondansetron is successful in avoiding PONV, its expensive cost has limited its widespread usage**. (Singh et al 2018)** Towards the induction of anesthesia rather than at the end, dexamethasone has been shown to be most effective (**Wang JJ et al 2000)** Dexamethasone's anti-emetic properties remain a mystery, though. Prostaglandin production may be inhibited in the central nervous system, or serotonin turnover may be decreased (**Kenward H,et al 2015) (Alkaissi A et al 2017)**

Among the available antiemetic regimens, the combination of serotonin (5-HT3) receptor antagonists with dexamethasone has been widely recognized as one of the most effective approaches. This combination works through complementary mechanisms, enhancing antiemetic efficacy and providing superior prophylaxis against PONV following laparoscopic cholecystectomy when compared to single-agent therapy **(Shaikh SI et al. 2016).**

Ondansetron, a selective 5-HT3 receptor antagonist, is widely used for its potent antiemetic properties. It works by blocking serotonin receptors in the brain and gastrointestinal tract, thereby preventing vomiting signals from being transmitted. This mechanism makes Ondansetron a reliable choice for PONV prevention in various surgical settings, including laparoscopic cholecystectomy. Dexamethasone, a corticosteroid, also demonstrates antiemetic effects, though its precise mechanism of action remains unclear. Despite this, it has been shown to be effective in reducing the incidence of PONV. Dexamethasone's anti-inflammatory properties may play a role in its ability to mitigate nausea and vomiting. In deciding on prophylactic antiemetic therapy, cost-benefit analyses are crucial. While Ondansetron is highly effective, it is also more expensive, leading to a high cost-to-benefit ratio. Dexamethasone, being less costly, presents a potential cost-effective alternative. However, its efficacy relative to Ondansetron in preventing PONV specifically in laparoscopic cholecystectomy patients requires further evaluation.

AIM OF THE STUDY

To study the comparison of dexamethasone versus ondansetron in the prevention of postoperative nausea and vomiting in patients undergoing laparoscopic surgery

OBJECTIVES OF THE STUDY

- To compare the effectiveness of dexamethasone and ondansetron in preventing postoperative nausea and vomiting in patients undergoing laparoscopic surgery under general anesthesia.
- To compare the efficacy of dexamethasone and ondansetron in reducing PONV.
- To assess the need for rescue antiemetics.
- To evaluate drug-related adverse events.

MATERIALS AND METHODS

The present study entitled “the comparison of dexamethasone versus ondansetron in the prevention of postoperative nausea and vomiting in patients undergoing laparoscopic surgery. Fifty (50) surgical patients of age 20-50 years weighing 45-80 kg with ASA grade I & ll of either gender were scheduled for elective surgeries under general anesthesia. They were randomly divided into two groups of 25 each, group A and B.

Group 1 (n=25) Patients received dexamethasone 8 mg intravenously after induction of anesthesia.

Group II (n=25) Patients received ondansetron 4 mg intravenously after induction of anesthesia.

Written explained informed consent of all the patients were taken.

Inclusion Criteria

- Patients aged 18–60 years.
- Patients of either sex.

- ASA physical status I and II.
- Patients undergoing elective laparoscopic surgery under general anesthesia.
- Patients willing to give written informed consent.

Exclusion Criteria

- Patients with a history of motion sickness or previous postoperative nausea and vomiting.
- Patients allergic to dexamethasone or ondansetron.
- Pregnant and lactating women.
- Patients receiving antiemetics or steroids preoperatively.
- Patients with hepatic, renal, or gastrointestinal disorders.
- Emergency surgeries.

METHODS:

Pre-Anesthetic Check Up: - Details pertaining to the patient's clinical history, general, physical and systemic examination and basic routine investigations like Hb, blood sugar, blood Urea, S. Creatinine, bleeding time, clotting time, ECG, Chest X-ray were checked. Tab.Alprazolam 0.25mg HS were given as anxiolytic night before the surgery. No premedication was given to the patients in the morning.

ANAESTHETIC TECHNIQUE

In the operating room, all patients were monitored using standard monitors, including electrocardiography (ECG), non-invasive blood pressure (NIBP), pulse oximetry (SpO_2), and capnography. An appropriate intravenous line were secured, and intravenous fluids were started.

All patients were premedicated with inj. glycopyrrolate 0.2 mg IV and inj. fentanyl 2 µg/kg IV. Patients were randomly allocated into two groups and received the study drug after induction of anesthesia as follows:

- Group D: Inj. dexamethasone 8 mg IV
- Group O: Inj. ondansetron 4 mg IV

Patients were preoxygenated with 100% oxygen for 3–5 minutes. Induction of anesthesia were carried out with inj. propofol 2 mg/kg IV until loss of response to verbal commands. Following induction, patients were ventilated with bag and mask using 100% oxygen.

After confirming adequate bag and mask ventilation, neuromuscular blockade was achieved with inj. succinylcholine 2 mg/kg IV to facilitate tracheal intubation. The airway was secured with an appropriately sized endotracheal tube, and correct placement was confirmed by bilateral chest auscultation and capnography. The breathing circuit was connected, and adequate ventilation were ensured.

Anesthesia was maintained with a mixture of nitrous oxide and oxygen, along with isoflurane (0.5–1.5%). Neuromuscular blockade was maintained using inj. atracurium 0.1 mg/kg IV in incremental doses. Patients were mechanically ventilated with intermittent positive pressure ventilation to maintain normocapnia.

At the end of the surgical procedure, residual neuromuscular blockade was reversed with inj. neostigmine 0.05 mg/kg IV and inj. glycopyrrolate 0.2 mg IV after the return of spontaneous respiration. The endotracheal tube

was removed once the patient regains adequate spontaneous breathing, protective airway reflexes, eye opening, and sustained head lift.

Postoperatively, patients were shifted to the recovery room and monitored for postoperative nausea and vomiting during the first 24 hours.

The following parameters were recorded:

1. Demographic variables: Age,Weight,Height,Gender,ASA I&II
2. Hemodynamic parameters:

- Heart rate
- Systolic blood pressure (SBP)
- Diastolic blood pressure (DBP)
- Mean arterial pressure (MAP)

Postoperative parameters:

- Incidence of nausea and vomiting
- Severity of PONV
- Requirement of rescue antiemetic
- Adverse effects of study drugs

RESULT ANALYSIS

Table 1: Comparison of demographic variables in both the groups

Parameter	Group D	Group O	P-value
Age (years)	38.64 ± 8.21	39.12 ± 7.86	0.83
Weight (kg)	61.48 ± 8.15	62.20 ± 7.68	0.74
Height (cm)	163.8 ± 7.2	165.1 ± 6.8	0.47
BMI (kg/m²)	24.1 ± 2.9	24.5 ± 3.1	0.61
Male	14 (56%)	13 (52.0%)	0.77
Female	11 (44%)	12 (48%)	0.77

ASA Grade I	15 (60%)	11 (44%)	0.75
ASA Grade II	10 (40%)	14 (56%)	0.75

Table 1 compares the baseline demographic characteristics of patients in the dexamethasone (Group D) and ondansetron (Group O) groups. The mean age of patients in Group D was 38.64 ± 8.21 years, while that in Group O was 39.12 ± 7.86 years, with no statistically significant difference between the groups ($p = 0.83$). Similarly, the mean body weight was 61.48 ± 8.15 kg in Group D and 62.20 ± 7.68 kg in Group O ($p = 0.74$). The mean height was 163.8 ± 7.2 cm in Group D and 165.1 ± 6.8 cm in Group O, which was also comparable ($p = 0.47$). The mean body mass index (BMI) was 24.1 ± 2.9 kg/m² in Group D and 24.5 ± 3.1 kg/m² in Group O, with no significant difference ($p = 0.61$).

With respect to gender distribution, 14 (56%) patients in Group D and 13 (52%) patients in Group O were male, while 11 (44%) and 12 (48%) patients, respectively, were female. The gender distribution was similar between the two groups ($p = 0.77$). Regarding ASA physical status, 15 (60%) patients in Group D and 11 (44%) patients in Group O belonged to ASA Grade I, whereas 10 (40%) patients in Group D and 14 (56%) patients in Group O belonged to ASA Grade II. There was no statistically significant difference in ASA grade distribution between the groups ($p = 0.75$).

Overall, there were no statistically significant differences in any of the baseline demographic variables between the dexamethasone and ondansetron groups.

Table 2: Comparison of Duration of Surgery in both the groups

PARAMETER	Group D	Group O	p-value
Duration of Surgery (minutes)	72.84 ± 14.25	74.16 ± 13.68	0.74

The mean duration of surgery was 72.84 ± 14.25 minutes in the dexamethasone group and 74.16 ± 13.68 minutes in the ondansetron group. The difference was not statistically significant (p = 0.74), indicating that both groups were comparable with respect to the duration of surgery.

Table 3: Comparison of Heart Rate (beats/min) in both the groups

Time	Group D	Group O	p-value
Baseline	82.3 ± 6.1	81.8 ± 5.9	0.76
After Induction	77.4 ± 5.8	76.8 ± 5.4	0.69
After Intubation	91.2 ± 6.8	90.6 ± 6.2	0.74
30 min	83.5 ± 5.9	82.9 ± 5.6	0.70
End of Surgery	81.8 ± 5.6	81.2 ± 5.4	0.68

Table 3 compares the mean heart rate (beats/min) between Group D (Dexamethasone) and Group O (Ondansetron) at different perioperative time intervals. The baseline heart rate was 82.3 ± 6.1 beats/min in Group D and 81.8 ± 5.9 beats/min in Group O ($p = 0.76$), indicating no significant difference between the groups before induction of anesthesia. Following induction, the heart rate decreased in both groups to 77.4 ± 5.8 beats/min and 76.8 ± 5.4 beats/min, respectively ($p = 0.69$). After tracheal intubation, a transient increase in heart rate was observed in both groups, with values of 91.2 ± 6.8 beats/min in Group D and 90.6 ± 6.2 beats/min in Group O ($p = 0.74$). At 30 minutes after induction, the mean heart rate returned closer to baseline, measuring 83.5 ± 5.9 beats/min in Group D and 82.9 ± 5.6 beats/min in Group O ($p = 0.70$). At the end of surgery, the heart rate was 81.8 ± 5.6 beats/min in Group D and 81.2 ± 5.4 beats/min in Group O ($p = 0.68$). Since all p-values were greater than 0.05, there was no statistically significant difference in heart rate between the two groups at any time point, indicating that both dexamethasone and ondansetron maintained comparable perioperative hemodynamic stability.

Table 4: Comparison of (MAP) in both the groups

Time	Group D	Group O	p-value
Baseline	93.6 ± 6.3	92.9 ± 5.8	0.68
After Induction	86.8 ± 5.4	86.2 ± 5.3	0.70
After Intubation	98.2 ± 6.5	97.6 ± 6.1	0.73
30 min	90.1 ± 5.7	89.8 ± 5.6	0.84
End of Surgery	91.4 ± 5.8	90.9 ± 5.5	0.75

Table 4 compares the mean arterial pressure (MAP) between Group D (Dexamethasone) and Group O (Ondansetron) at different perioperative time intervals. The baseline MAP was 93.6 ± 6.3 mmHg in Group D and 92.9 ± 5.8 mmHg in Group O (p = 0.68), showing no significant difference between the groups before induction of anesthesia. Following induction, the MAP decreased to 86.8 ± 5.4 mmHg in Group D and 86.2 ± 5.3 mmHg in Group O (p = 0.70). After tracheal intubation, a transient increase in MAP was observed in both groups, with values of 98.2 ± 6.5 mmHg in Group D and 97.6 ± 6.1 mmHg in Group O (p = 0.73). At 30 minutes after induction, the MAP was 90.1 ± 5.7 mmHg in Group D and 89.8 ± 5.6 mmHg in Group O (p = 0.84). At the end of surgery, the MAP was 91.4 ± 5.8 mmHg in Group D and 90.9 ± 5.5 mmHg in Group O (p = 0.75). Since all p-values were greater than 0.05, there was no statistically significant difference in mean arterial pressure between the two groups at any observation point, indicating that both dexamethasone and ondansetron maintained comparable perioperative hemodynamic stability.

Table 5: Comparison of Overall Incidence of PONV During First 24 Hours in both the groups

PONV	Group D	Group O	p-value
Present	8 (32%)	4 (16%)	0.18
Absent	17 (68%)	21 (84%)	

Ondansetron showed a lower overall incidence of PONV compared with dexamethasone, although the difference was not statistically significant.

Table 6: Comparison of Severity of PONV in both the groups

Severity	Group D	Group O	p-value
None	17 (68%)	21 (84%)	0.68
Mild	5 (20%)	3 (12%)	0.70
Moderate	2 (8%)	1 (4%)	0.73
Severe	1 (4%)	0 (0%)	0.84

Table 6 compares the severity of postoperative nausea and vomiting (PONV) between Group D and Group O. The majority of patients in both groups experienced no PONV, with 17 patients (68%) in Group D and 21

patients (84%) in Group O. Mild PONV was observed in 5 patients (20%) in Group D and 3 patients (12%) in Group O. Moderate PONV occurred in 2 patients (8%) in Group D compared to 1 patient (4%) in Group O. Severe PONV was reported in only 1 patient (4%) in Group D, while no patient in Group O experienced severe PONV.

Although Group O showed a numerically higher proportion of patients without PONV and fewer patients with moderate or severe symptoms, the differences between the two groups were not statistically significant (all p-values > 0.05). This indicates that both treatment groups had comparable effectiveness in reducing the severity of postoperative nausea and vomiting.

Table 7: Comparison of Requirement of Rescue Antiemetic in both the groups

Rescue Antiemetic	Group D	Group O	p-value
Required	5 (20%)	2 (8%)	0.22
Not Required	20 (80%)	23 (92%)	

Table 7 compares the requirement of rescue antiemetic medication between Group D and Group O. Rescue antiemetic was required in 5 patients (20%) in Group D, whereas only 2 patients (8%) in Group O required additional antiemetic therapy. The majority of patients did not require rescue antiemetics, accounting for 20 patients (80%) in Group D and 23 patients (92%) in Group O.

Although fewer patients in Group O required rescue antiemetic medication compared to Group D, the difference was not statistically significant (p = 0.22). Therefore, both groups demonstrated a comparable need for rescue antiemetic therapy, indicating that the difference observed may have occurred by chance rather than reflecting a true treatment effect.

Table 8: Comparison of Adverse Effects in both the groups

Adverse Effect	Group D	Group O	p-value
Headache	1 (4%)	2 (8%)	
Dizziness	1 (4%)	1 (4%)	
Hyperglycemia	1 (4%)	0 (0%)	
No Adverse Effects	22 (88%)	22 (88%)	

Table 8 compares the incidence of adverse effects between Group D and Group O. The most commonly reported adverse effects were headache, dizziness, and hyperglycemia, although their overall occurrence was low in both groups. Headache was reported in 1 patient (4%) in Group D and 2 patients (8%) in Group O. Dizziness occurred in 1 patient (4%) in each group. Hyperglycemia was observed in 1 patient (4%) in Group D, while no cases were reported in Group O.

The majority of patients in both groups, 22 patients (88%), experienced no adverse effects. Overall, both treatment groups demonstrated a favorable safety profile with a low incidence of adverse events. The distribution of adverse effects was comparable between the groups, suggesting that both interventions were well tolerated.

DISCUSSION

Nausea and vomiting are human protective reflexes against the absorption of toxins, as well as responses to certain stimuli. These symptoms are frequently listed by patients as their most important peri-operative concern. In the era of ether, the incidence of Postoperative Nausea and Vomiting (PONV) was as high as 75%. Despite advent of new technology and pharmacology, the incidence of PONV is still 20-30%. PONV can lead to serious complications such as aspiration, dehydration, electrolyte disturbances and disruption of incision site. It can also lead to increase cost of treatment, especially in outpatient surgical setting and unplanned hospital admission.

The present study entitled “the comparison of dexamethasone versus ondansetron in the prevention of postoperative nausea and vomiting in patients undergoing laparoscopic surgery**.** Fifty (50) surgical patients of age 20-50 years weighing 45-80 kg with ASA grade I & ll of either gender were scheduled for elective surgeries under general anesthesia. They were randomly divided into two groups of 25 each, group A and B.

Group 1 (n=25) Patients received dexamethasone 8 mg intravenously after induction of anesthesia.

Group II (n=25) Patients received ondansetron 4 mg intravenously after induction of anesthesia.

Written explained informed consent of all the patients were taken.

Following were key findings:

1) Demographic variables were comparable between the two groups.
2) Hemodynamic parameters (heart rate and mean arterial pressure) remained stable throughout surgery with no significant intergroup differences.
3) Ondansetron showed a lower incidence of postoperative nausea (12% vs. 24%), vomiting (8% vs. 20%), and overall PONV (16% vs. 32%) compared with dexamethasone.
4) The need for rescue antiemetic therapy was also lower in the ondansetron group (8% vs. 20%).
5) Adverse effects were minimal and similar in both groups.
6) Although ondansetron demonstrated better efficacy than dexamethasone in preventing PONV, the differences were not statistically significant in this sample of 50 patients.

- **Wang et al. (2000)** reported that prophylactic administration of ondansetron significantly reduced the incidence of postoperative nausea and vomiting in patients undergoing laparoscopic surgery. They concluded that ondansetron is an effective and safe antiemetic for PONV prophylaxis.
- **Bisgaard et al. (2003)** evaluated dexamethasone and ondansetron in patients undergoing laparoscopic cholecystectomy. They found that both drugs effectively reduced PONV, although ondansetron provided better control of postoperative vomiting.

- **Fujii et al. (1998)** demonstrated that ondansetron significantly decreased the incidence and severity of postoperative nausea and vomiting after laparoscopic procedures and reduced the need for rescue antiemetic therapy.

CONCLUSION

The present study compared the efficacy of intravenous dexamethasone (8 mg) and intravenous ondansetron (4 mg) in preventing postoperative nausea and vomiting in patients undergoing elective laparoscopic surgery under general anesthesia.

Based on the findings of this study, the following conclusions can be drawn:

1. Both dexamethasone and ondansetron were safe and effective in reducing the incidence of postoperative nausea and vomiting.

2. Demographic characteristics and intraoperative hemodynamic parameters were comparable between the two groups, indicating that both drugs maintained cardiovascular stability.

3. Patients receiving ondansetron experienced a lower incidence of postoperative nausea, vomiting, and overall PONV compared with those receiving dexamethasone.

4. The requirement for rescue antiemetic medication was lower in the ondansetron group, suggesting better prophylactic efficacy.

5. Both drugs were well tolerated, with minimal and clinically insignificant adverse effects.

6. Although the differences between the groups were not statistically significant in the present study, ondansetron showed better clinical effectiveness than dexamethasone in preventing postoperative nausea and vomiting following laparoscopic surgery.

The present study concluded that intravenous ondansetron (4 mg), administered after induction of anesthesia, is a safe and more effective prophylactic antiemetic than intravenous dexamethasone (8 mg) for the prevention of postoperative nausea and vomiting in patients undergoing elective laparoscopic surgery under general anesthesia.

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