Original Research Article

COMPARISON OF DEXMEDETOMIDINE AND ONDANSETRON FOR PREVENTION OF POST OPERATIVE NAUSEA AND VOMITING IN LAPAROSCOPIC SURGERIES

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ABSTRACT

Background: Postoperative nausea and vomiting (PONV) remains a common complication following laparoscopic surgeries, adversely affecting patient satisfaction, recovery, and healthcare costs. While ondansetron is widely used for prophylaxis, dexmedetomidine—an α_2-adrenergic agonist with sedative, analgesic, and antiemetic properties—has emerged as a potential alternative. The objective is to compare the efficacy and safety of dexmedetomidine versus ondansetron in preventing PONV in patients undergoing elective laparoscopic surgery.

Materials and Methods: In this prospective, randomized, double-blind trial, 90 patients (ASA I–II) scheduled for laparoscopic procedures under general anesthesia were divided into two groups. Group I (n=45) received dexmedetomidine 1 µg/kg diluted in 100 mL normal saline over 10–15 minutes after intubation, while Group II (n=45) received ondansetron 4 mg intravenously. PONV incidence, severity, need for rescue antiemetics, hemodynamic parameters, sedation scores, and adverse events were recorded at 0, 4, and 12 hours postoperatively.

Results: At 0 hours, significantly more patients in the dexmedetomidine group were free from PONV symptoms compared to the ondansetron group (68.9% vs. 40%, p=0.034), with vomiting occurring in only 8.9% vs. 26.7%, respectively. Rescue antiemetic use was also lower in the dexmedetomidine group at 0 hours (15.6% vs. 40%, p=0.010). No significant differences were observed at 4 and 12 hours. Dexmedetomidine was associated with a lower heart rate during surgery but without significant hemodynamic instability. Sedation profiles were comparable, and adverse events were minimal in both groups.

Conclusion: Dexmedetomidine is more effective than ondansetron in preventing early postoperative nausea and vomiting following laparoscopic surgery and reduces the immediate need for rescue antiemetics, without causing excessive sedation or clinically significant hemodynamic compromise. It may be preferred in settings where early PONV control is crucial, though vigilant monitoring for bradycardia is advised.

Keywords: Dexmedetomidine, ondansetron, postoperative nausea and vomiting (PONV), sedation.

INTRODUCTION

Postoperative nausea and vomiting (PONV) are usually defined as any nausea, retching, or vomiting that occurs during the first 24 postoperative hour. PONV is one of the most common causes of patient dissatisfaction after anesthesia, with a reported incidence as high as 63% after laparoscopic

cholecystectomy. PONV may delay patient discharge from the post-anesthesia care unit (PACU) and increase unanticipated hospital admissions in outpatients. Therefore, prevention of PONV will improve patient satisfaction and decrease overall health care costs. One third of patients will have postoperative nausea, vomiting, or both. Patients often rate postoperative nausea and vomiting as worse than postoperative pain. Therefore prevention of postoperative nausea and vomiting improves satisfaction among patients who are likely to experience. Postoperative nausea and vomiting frequently delay discharge from postanesthesia care units, and they are the leading cause of unexpected hospital admission after planned ambulatory surgery. Nausea and vomiting are some of the most common complaints of patients after any anesthesia. Postoperative nausea and vomiting, may occur up to 24 hours after surgery, occurring in 60–70% of patients. This may be due to the effect of anesthetics on the vomiting control center in the medulla oblongata or because of a intraoperative hypoxia which subsequently causes nausea and vomiting.[1-4] Several risk factors have been identified for PONV. Factors such as female sex, previous history of PONV or history of motion sickness, non-smoking status, certain agents used in perioperative period (volatile anesthetics, N2O, opioids, ketamine, para sympathomimetic drugs (neostigmine>2.5mg), long duration of surgery, intra-abdominal surgery (gynecologic surgeries and Laprsocopic Surgeries) are among these risk factors. Postoperative nausea and vomiting can cause complications such as airway obstruction, aspiration pneumonia, and surgical wound opening. Postoperative vomiting causes dehydration, electrolyte abnormalities, hypotension, suture stretching, increased bleeding from skin flaps, and delayed discharge. This complication can increase the risk of pulmonary aspiration if the airway reflexes are reduced due to the residual effects of anesthetic drugs. In Earlier studies dexamethasone, dexmedetomidine, metoclopramide, ondansteron and their combinations have been used. PONV is more common in Laparoscopic surgeries because Carbon dioxide is commonly used to inflate the abdomen during laparoscopic surgery, creating a pneumoperitoneum. The insufflation of CO2 can irritate the diaphragm, leading to referred nausea and vomiting via the phrenic nerve. This irritation, combined with the increased pressure in the abdomen, can affect gastrointestinal motility and contribute to nausea and vomiting postoperatively.[5] Dexmedetomidine is a potent α2-adrenergic agonist with its broad-spectrum effects, which include anxiolytic, sedative, analgesic, anaesthetic-sparing, sympatholytic, and hemodynamic-stabilizing properties. The intra-operative use of dexmedetomidine as an anaesthetic adjuvant has led to significant reductions in the use of opioids and inhalation anaesthetics, reduction in the incidence of emergence agitation, a favourable recovery profile, and reduction of postoperative pain without adverse

hemodynamic effects, and hence it may decrease PONV. It can prevent postoperative nausea and vomiting, and numerous studies have shown the anti-nausea and vomiting effects of low-dose dexmedetomidine. Dexmedetomidine works by binding to alpha-2 adrenergic receptors in the central nervous system, particularly in the locus coeruleus. This decreases norepinephrine release, leading to sedative and analgesic effects. It offers a non-dopaminergic mechanism of action, which is beneficial, as many antiemetics (such as ondansetron) work by blocking serotonin receptors. Side effects of dexmedetomidine are hypotension, bradycardia, arrythmias, dry mouth, retching so to be used carefully in heart disease patient. Dexmedetomidine is primarily metabolized in the liver by the cytochrome P450 (CYP450) enzymes, particularly CYP2A6 and CYP2A9, CYP1A2. The metabolism involves N-glucuronidation and N-methylation, leading to the formation of metabolites that are mainly inactive. The metabolites are excreted through the urine. Dexmedetomidine, has a relatively short half-life around 2-3 hours. Dexmedetomidine loading dose is 1mcg/kg over 10 minutes and maintenance 0.2-0.7mcg/kg/hr I.V. for sedation and analgesia.[6-8]

Ondansetron is one of the medications most commonly used for empirical treatment of nausea and vomiting. It is very effective against radiation and chemotherapy induced vomiting but not effective in case of motion sickness. Serotonin is the key neurotransmitter in the gastrointestinal (GI) tract and binds to 5HT3 receptors in the GI tract and activates the vagal channels and vagal impulses in the CTZ, leading to nausea and vomiting. These receptors are the targets of 5HT3 receptors blocking drugs. Ondansetron, one of the most common 5HT3 blocker is available for the prevention and treatment of PONV in patients undergoing different type of surgeries. The serotonin 5-HT3 receptors are located on the nerve terminals of the vagus in the periphery, and centrally in the chemoreceptor trigger zone of the area postrema. The temporal relationship between the emetogenic action of emetogenic drugs and the release of serotonin suggest that release serotonin from the enterochromaffin cells of the small intestine by causing degenerative changes in the GI tract. The serotonin then stimulates the vagal and splanchnic nerve receptors that project to the medullary vomiting center, as well as the 5-HT3 receptors in the area postrema, thus initiating the vomiting reflex, causing nausea and vomiting Ondansetron is a substrate for human hepatic cytochrome P450 enzymes, including CYP1A2, CYP2D6 and CYP3A4. In humans, less than 10% of the dose is excreted unchanged in the urine. The major urinary metabolites are glucuronide conjugates (45%), sulphate conjugates (20%) and hydroxylation products (10%). The half-life of ondansetron after either an 8 mg oral dose or intravenous dose was approximately 3-4 hours and could be extended to 6-8 hours in the elderly.

Ondansetron given as 4mg I.V. 30 min before completion of surgery for PONV.[9-11]

The present study was conducted to compare of Dexmedetomidine and Ondansetron for prevention of Post Operative nausea and vomiting in laparoscopic surgeries.

MATERIALS AND METHODS

Study design: The present study will be conducted in a prospective, randomized, double blinded manner in the Department of Anaesthesiology and Critical Care, Pt. B.D. Sharma PGIMS, Rohtak after obtaining approval from institutional ethical committee and the written informed consent from patients. 90 patients of either sex, aged 18-60 years, belonging to American society of anaesthesiologists physical status 1and 2 scheduled for Laparoscopic surgery under general anaesthesia.

Exclusion Criteria

Following patients will be excluded from the study Patients with: -

1. Refusal to consent.
2. H/O of motion sickness.
3. Combined hepatic and renal disease
4. H/O of parkinsonism.
5. H/O of vertigo
6. On Chemotherapy
7. ASA grade 3or more
8. H/O of GERD
9. Any H/O of vomiting.

Sample Size: As per study by Bakri H.M. et al2. the true mean response rate of dexmedetomidine Q197% and the true mean response rate of control dexamethasone Q2 83%. The calculated Sample size of the study is 40 each group. However to counteract any dropout, 45 patients will be taken in each group.

Clinical Examination: All the patients will be examined during preoperative visit a day prior to surgery. Detailed clinical history will be taken. General physical examination as well as systemic examination will be done. Routine investigations like haemoglobin (Hb), bleeding time (BT) clotting time (CT) and urine examination will be carried out in all the patients. Other investigations will be carried out as per requirements of the particular surgery.

Preparation of the patient: The purpose and protocol of the study will be explained to the patients and informed written consent will be obtained for the same. Patient will be kept fasting for 6 hours prior to scheduled time of surgery. They will be premedicated with tablet alprazolam 0.25mg and tablet pantoprazole 40mg night before and in the morning 2 hours before surgery. Routine monitoring including heart rate, ECG, non-invasive blood pressure (NIBP), end tidal CO2 (EtCO2) and pulse oximetry (SpO2) will be established and baseline readings will be recorded. Randomization:

Patients will be randomly allocated to one of the two groups using computer generated sequence as follows

- Group I (n=45) Dexmedetomidine 1µgkg-1 in 100ml normal saline over 10-15 minutes will be given after intubation
- Group II (n=45) Ondansetrom 4mg will be given after intubation. Anaesthesia Technique: -

Standardized anaesthesia protocol was followed. In both the groups oral intubation was done in sniffing position using ETT tube. Peripheral intravenous line was secured with 18 gauze cannula. After preoxygenation with 100% oxygen for 3 minutes, anaesthesia was induced with glycopyrrolate 0.005mgkg-1, fentanyl 2µgkg-1 and Thiopentone 5mgkg -1. Increments of Thiopentone will be given till loss of consciousness. Ability to mask ventilate the patient was judged before giving neuromuscular blocking agent. Muscle relaxation will be achieved with atracurium 0.5mgkg-1. Patient was ventilated for 3 minutes via facemask given anaesthesia using 2% sevoflurane and 33% oxygen and 66% nitous oxide. For females 7.5 mm ID reinforced ETT was used and for males 8.0 mm ID will be used.

Anaesthesia was maintained with sevoflurane (MAC 1) in 66% of N2O and 33% of oxygen. Patient will be given either 1mcg/kg of Dexmedetomidine in 100ml N.S. over 10-15 minutes or 4 mg of ondansetron . At the end of surgery, neuromuscular blockade will be reversed with glycopyrrolate (0.01 mgkg-1) and neostigmine (0.05mgkg-1). After achieving adequate recovery, patients will be extubated and transferred to post anesthesia care unit. If there is any episopde of nausea and vomiting injection Dexamethasone 8mg was given as rescue antiemetic. Any serious adverse event was reported to ethical committee within 24 hours and report related to its relatedness to any intervention of the study was sent within 14 days for ethical committee review.

The following observations will be recorded

1. PONV Score at 0 hr , 4hr and at 12 hr 0- No Symptoms
- Mild Nausea
- Severe Nausea But No Vomiting
- Vomiting.
2. Hemodyanmic changes; changes in mean arterial blood pressure and pulse rate Intraoperative and in postoperative room
3. Ramsay sedation score
- Awake and anxious, agitated and restless
- Awake, cooperative, accepting, oriented, or tranquil
- Awake, responds only to commands
- Asleep, brisk response to light
- Asleep, sluggish response to light, glabella tap, or loud noise
- Asleep, no response to light, glabella tap, or loud noise
4. Use of rescue antiemetic [Dexamethasone 8mg].

Statistical methods: Post-operative nausea and vomiting after Laparoscopic surgeries was considered as primary outcome variables. Hemodyanmic changes during and after surgery, Ramsay sedation score and Complications

(hypotension, Bradycardia) were considered as Secondary outcome variables. Study group (EMSET Vs Dexmedetomidine) was considered as Primary explanatory variable. Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Non normally distributed quantitative variables were summarized by median and interquartile range (IQR). Data was also represented using appropriate diagrams like bar diagram, pie diagram. All Quantitative variables were checked for normal distribution within each category of explanatory variable by using visual inspection of histograms and normality Q-Q plots. Shapiro- wilk test was also conducted to assess normal distribution. Shapiro wilk test p value of >0.05 was considered as normal distribution. For normally distributed Quantitative parameters the mean values were compared between study groups using Independent sample t-test (2 groups). For non-normally distributed Quantitative parameters, Medians and Interquartile range (IQR) were compared between study groups using Mann Whitney u test (2 groups). Categorical outcomes were compared between study groups using Chi square test /Fisher's Exact test (If the overall sample size was < 20 or if the expected number in any one of the cells is < 5, Fisher's exact test was used.). P value < 0.05 was considered statistically significant. Data was analyzed by using SPSS software, V.22.

RESULTS

A total of 90 subjects were included in the final analysis.

Table 1: Descriptive analysis of study group in the study population (N=90)

Study Group	Frequency	Percentages
EMSET	45	50.00%
Dexmedetomidine	45	50.00%

Among the study population was evenly divided into two groups: EMSET (50.00%, 45 patients) and Dexmedetomidine (50.00%, 45 patients).

The mean age in the EMSET group was 38.2 ± 14.69 years, while in the Dexmedetomidine group, it was 38.44 ± 9.97 years. The difference in age between the two study groups was statistically not significant P-value (0.927).

In the EMSET group of 45 participants, 73.3% were female and 26.7% were male. In the Dexmedetomidine group, also with 45 participants, 68.9% were female and 31.1% were male. The Chi-square value was 0.216 with a P-value of 0.642, indicating no statistically significant difference in gender distribution between the two groups.

The mean weight in the EMSET group was 61.62 ± 11.52 kg, while in the Dexmedetomidine group, it was 62.49 ± 9.77 kg. The difference in weight between the two study groups was statistically not significant (P-value = 0.701). The mean height in the EMSET group was 162.91 ± 10.16 cm, while in the Dexmedetomidine group, it was 160.44 ± 6.99 cm. The difference in height between the two study groups was statistically not significant (P-value = 0.183).

In the EMSET group (N=45), the most common diagnosis was cholelithiasis (77.8%), followed by appendicitis (17.8%), ectopic pregnancy (2.2%), and right dermoid cyst (2.2%). In the Dexmedetomidine group (N=45), cholelithiasis (77.8%) was also the most frequent diagnosis, followed by appendicitis (20%), and bilateral inguinal hernia (2.2%).

In the EMSET group (N=45), the most common surgery performed was laparoscopic cholecystectomy (77.8%), followed by laparoscopic appendicectomy (17.8%), laparoscopic cystectomy (2.2%), and laparoscopic salpingectomy (2.2%). In the Dexmedetomidine group (N=45), laparoscopic cholecystectomy (77.8%) was also the most frequent procedure, followed by laparoscopic appendicectomy (20%) and TEP (totally extraperitoneal) repair (2.2%).

Table 2: Comparison of PONV score between study groups at different time periods (N=90)

PONV Score	Study Group		Chi square	P value
	EMSET (N=45)	Dexmedetomidine (N=45)		
at 0 Hour				
No Symptoms	18 (40%)	31 (68.9%)	8.699	0.034
Mild Nausea	9 (20%)	7 (15.6%)		
Severe nausea but no vomiting	6 (13.3%)	3 (6.7%)		
Vomiting	12 (26.7%)	4 (8.9%)		
at 4th Hour				
No Symptoms	29 (64.4%)	27 (60%)		
Mild Nausea	5 (11.1%)	11 (24.4%)	4.198	0.241
Severe Nausea But No Vomiting	7 (15.6%)	6 (13.3%)		
Vomiting	4 (8.9%)	1 (2.2%)		
12 Hr				
No Symptoms	35 (77.8%)	36 (80%)		
Mild Nausea	5 (11.1%)	2 (4.4%)	1.800	0.615
Severe Nausea But No Vomiting	3 (6.7%)	5 (11.1%)		
Vomiting	2 (4.4%)	2 (4.4%)		

At 0 Hours: No symptoms were observed in 40% of the EMSET group compared to 68.9% of the Dexmedetomidine group. Vomiting was more common in the EMSET group (26.7%) than in the Dexmedetomidine group (8.9%). The P-value of 0.034 indicates a statistically significant difference, suggesting that Dexmedetomidine was more effective in reducing immediate postoperative nausea and vomiting (PONV).

At 4 Hours: No significant difference in PONV symptoms was observed between the two groups (P-value = 0.241). The incidence of mild nausea was slightly higher in the Dexmedetomidine group (24.4%) than in the EMSET group (11.1%). However, vomiting remained lower in the Dexmedetomidine group (2.2%) compared to the EMSET group (8.9%).

At 12 Hours: The majority of patients in both groups reported no symptoms (77.8% in the EMSET group and 80% in the Dexmedetomidine group). The P-value of 0.615 indicates no statistically significant difference, meaning both drugs had comparable effects on PONV by 12 hours postoperatively.

Table 3: Comparison of use of rescue antiemetics between study group (N=90)

Use of rescue antiemetics	Study Group		Chi square	P value
	EMSET (N=45)	Dexmedetomidine (N=45)		
At 0 hour				
Yes	18 (40%)	7 (15.6%)	6.702	0.010
No	27 (60%)	38 (84.4%)		
At 4 Hours				
Yes	11 (24.4%)	7 (15.6%)	1.111	0.292
No	34 (75.6%)	38 (84.4%)		
At 12 Hours				
Yes	4 (8.9%)	7 (15.6%)	0.932	0.334
No	41 (91.1%)	38 (84.4%)		

At 0 Hours: In the EMSET group, 40% of patients required rescue antiemetics, while only 15.6% in the Dexmedetomidine group needed them. The Chi-square value (6.702) and P-value (0.010) indicate a statistically significant difference, suggesting that Dexmedetomidine was more effective in reducing the need for immediate postoperative antiemetics.

At 4 Hours: The need for rescue antiemetics decreased in both groups, with 24.4% in the EMSET group compared to 15.6% in the Dexmedetomidine group. However, the P- value (0.292) was not statistically significant, indicating no major difference between the two groups at this time point.

At 12 Hours: The need for rescue antiemetics was further reduced, with 8.9% in the EMSET group versus 15.6% in the Dexmedetomidine group. The P-value (0.334) shows no significant difference between the groups.

At Induction, the mean blood pressure (MBP) was 90.8 ± 8.8 mmHg in the EMSET group and 95.76 ± 14.11 mmHg in the Dexmedetomidine group, with a statistically significant P-value of 0.049 indicating higher MBP with Dexmedetomidine. At 5, 10, and 15 minutes, the MBP remained higher in the Dexmedetomidine group, but P-values of 0.061, 0.052, and 0.385 were not statistically significant. At 20, 45, and 60 minutes, the MBP values became similar, with P-values of 0.539, 0.986, and 0.426 showing no significant difference. In the Postoperative Room, MBP was also similar: 93.22 ± 9.18 mmHg in EMSET and 91.82 ± 9.73 mmHg in Dexmedetomidine, with a P-value of 0.484 indicating no significant difference.

At 5, 10, and 15 minutes after induction, the PR remained similar between the two groups, with P-values of 0.921, 0.929, and 0.397, respectively, suggesting no significant changes during this period. However, at 20 minutes, the PR was 77.64 ± 11.45 bpm in the EMSET group and 72.6 ± 10.77 bpm in the Dexmedetomidine group, yielding a P- value of 0.034. This indicates a significant reduction in PR for the Dexmedetomidine group. At both 45 and 60 minutes, the PR continued to be significantly lower in the Dexmedetomidine group, with P-values of 0.001 and 0.007, respectively. This suggests a notable bradycardic effect from Dexmedetomidine over time. In the postoperative room, the PR was 79.56 ± 9.45 bpm in the EMSET group and 75.38 ± 10.87 bpm in the Dexmedetomidine group, with a P-value of 0.055. This indicates a trend toward a lower PR in the Dexmedetomidine group, although it did not reach statistical significance.

Table 4: Comparison of Ramsay sedation score between study group at different time periods (N=90)

Ramsay Sedation Score	Study Group	
	Emset (N=45)	Dexmedetomidine (N=45)
At 0 Hour		
1	1 (2.2%)	0 (0%)
2	31 (68.9%)	30 (66.7%)
3	13 (28.9%)	15 (33.3%)
At 4 Hours		
1	1 (2.2%)	0 (0%)
2	40 (88.9%)	40 (88.9%)
3	4 (8.9%)	5 (11.1%)
At 12 hours		

	0 (0%)	0 (0%)
1	0 (0%)	0 (0%)
2	45 (100%)	45 (100%)
3	0 (0%)	0 (0%)

*No statistical test was applied- due to 0 subjects in the cells

At 0 hours: Most patients in both groups were at score 2. A few were lightly sedated (score 3), and one patient in the EMSET group was restless (score 1). At 4 hours: The majority of patients in both groups remained at score 2, with a few progressing to deeper sedation (score 3). At 12 hours: All patients in both groups had a score of 2, showing a consistent and stable level of sedation with both treatments. Both EMSET and Dexmedetomidine maintained a similar sedation profile over 12 hours, with most patients being calm and cooperative (RSS 2).

Table 5: Comparison of Complications between study group (N=90)

Complications	Study Group		Fisher exact P value
	EMSET (N=45)	Dexmedetomidine (N=45)	
Bradycardia			
Yes	1 (2.2%)	2 (4.4%)	1.000
No	44 (97.8%)	43 (95.6%)	
Hypotension			
Yes	0 (0%)	1 (2.2%)	*
No	45 (100%)	44 (97.8%)	

*No statistical test was applied- due to 0 subjects in the cells

There was no statistically significant difference between the two groups in terms of bradycardia occurrence.

DISCUSSION

Dosage of drugs in our study: In our study, we administered dexmedetomidine at a dose of 1 mcg/kg diluted in 100 ml of normal saline, infused over 10–15 minutes following intubation and prior to the surgical incision. This regimen effectively reduced the incidence of postoperative nausea and vomiting (PONV) in patients undergoing laparoscopic surgeries. The observed efficacy is consistent with findings from other studies that have evaluated dexmedetomidine for PONV prevention.

Ahmed Shama et al. conducted a randomized controlled trial involving 112 patients, divided into four groups: Group 1 received dexamethasone (0.15 mg/kg), Group 2 received ondansetron (0.05 mg/kg), Group 3 received dexmedetomidine (0.3 mcg/kg), and Group 4 served as the control group receiving normal saline. Their results demonstrated that dexmedetomidine significantly reduced PONV compared to the control group; however, the difference was not statistically significant when compared to the dexamethasone or ondansetron groups.

In Bakri et al.'s randomized controlled trial, 86 patients received either 1 μg/kg of Dexmedetomidine or 8 mg of Dexamethasone intravenously before skin incision. They observed a PONV incidence of 21% in the Dexmedetomidine group versus 28% in the Dexamethasone group, a difference that was not statistically significant (P = 0.6). However, the Dexmedetomidine group experienced significantly lower postoperative pain scores and delayed the first analgesic request, indicating superior analgesic properties.

Nandita Kad et al also compared 1mcg/kg of dexmedtomidine and 8 mg of dexamethasone for prevention of PONV in Laparoscopic Cholecystectomy, Dexamethasone group have more severe PONV at 6hr and also Dexmedetomidine group had less incidence of PONV at 12 and 24 hr. In this study one patient has episode of hypotension which was treated with mephentermine.

Kallio et al conducted a study to see the effects of dexmedetomidine on hemodynamic control mechanisms. Dexmedetomidine was administered to five healthy volunteers in a single intravenous dose of 12.5, 25, 50 and 75μg as a part of placebo-controlled study.

Dose dependent decrease in systolic and diastolic blood pressure was observed and heart rate was decreased.

Demographic: In our study, we included only ASA I and II patients, aligning with the standard practice of minimizing confounding comorbidities that could independently influence postoperative outcomes. The mean age, weight, and height of patients in both the EMSET and Dexmedetomidine groups were comparable, eliminating demographic bias as a confounding variable. Furthermore, a female predominance was observed in both groups, with 73.3% females in the EMSET group and 68.9% in the Dexmedetomidine group, consistent with the known higher incidence of PONV among female patients. Our demographic findings are in agreement with the large-scale study conducted by Sinclair et al., who prospectively evaluated 17,638 consecutive outpatients undergoing surgery to determine predictors of PONV. They found that females had approximately double the risk of experiencing PONV compared to males, a trend that has been consistently supported across numerous studies. This biological predisposition has been attributed to hormonal differences, particularly fluctuations in estrogen and progesterone levels, as well as differences in gastric

emptying and serotonin receptor activity. Regarding age, Sinclair et al.6 reported that age was not a significant predictor of PONV among patients younger than 50 years, which aligns with our study population where the mean age was around 38 years in both groups. They also noted a linear decrease in the frequency of PONV after age 50, likely due to changes in hormonal and receptor sensitivity with aging. Since most of our study participants were under 50, this could explain the relatively high baseline incidence of PONV, especially among the EMSET group. With respect to ASA classification, Sinclair et al. found that while ASA I and II patients exhibited higher rates of PONV compared to ASA III patients, ASA status was not found to be an independent risk factor. This observation is echoed in our study, which excluded higher-risk ASA III and IV patients, further standardizing the baseline health status across our sample. Therefore, any differences observed in PONV incidence between the EMSET and Dexmedetomidine groups can be attributed more confidently to the pharmacological action of the study drugs rather than underlying health disparities. Additional support for our demographic findings comes from Apfel et al., who developed the Apfel Simplified Risk Score, identifying female gender, nonsmoking status, history of motion sickness or PONV, and postoperative opioid use as the most reliable predictors of PONV. Notably, age and ASA status are not included in this scoring system, reinforcing the minimal impact these variables have, especially in low- risk populations like ours. Taken together, our findings are consistent with established literature, and they support the notion that female gender and younger age are important factors associated with increased PONV risk. However, our strict inclusion of ASA I and II patients with comparable demographic characteristics across both treatment groups allowed us to assess the true pharmacological efficacy of Dexmedetomidine versus EMSET without significant confounding.

PONV score: In our study, postoperative nausea and vomiting (PONV) was assessed at 0, 4, and 12 hours following laparoscopic surgery. At 0 hours, a significantly greater proportion of patients in the Dexmedetomidine group (68.9%) experienced no PONV symptoms, compared to 40% in the EMSET (Ondansetron) group, with a P-value of 0.034, indicating statistical significance. Additionally, vomiting was three times more common in the EMSET group (26.7%) compared to the Dexmedetomidine group (8.9%), clearly demonstrating the superior early antiemetic efficacy of Dexmedetomidine.

By 4 hours, while no statistically significant difference was observed between the two groups (P = 0.241), vomiting remained lower in the Dexmedetomidine group (2.2% vs. 8.9%), although the incidence of mild nausea was higher (24.4% vs. 11.1%). At 12 hours, both groups showed an excellent response, with 77.8% of EMSET patients and 80% of Dexmedetomidine patients free from PONV symptoms, and no significant difference (P = 0.615), indicating that both drugs had comparable long-term efficacy.

These findings are in agreement with the results of Bakri et al, who conducted a randomized controlled trial comparing Dexmedetomidine and Dexamethasone for PONV prophylaxis in laparoscopic cholecystectomy. In their study, only 21% of patients in the Dexmedetomidine group experienced PONV, compared to 28% in the Dexamethasone group, although the difference was not statistically significant. However, similar to our findings, Bakri et al. noted that Dexmedetomidine significantly improved early postoperative comfort, reduced analgesic consumption, and resulted in lower vomiting rates. The effectiveness of Dexmedetomidine in early PONV control is also supported by Gupta et al, who found a significant reduction in PONV episodes when Dexmedetomidine was used as a premedication, particularly in the first 2–4 hours after laparoscopic surgery. Similarly, Shukla et al, compared Dexmedetomidine with Ondansetron and reported that Dexmedetomidine was more effective in reducing both the incidence and severity of PONV, especially in the immediate postoperative period.

Furthermore, Gupta et al,9 demonstrated that when Dexmedetomidine was used as an intraoperative infusion, the requirement for rescue antiemetics was significantly reduced, and most patients remained asymptomatic in the early postoperative hours. Their findings emphasized that Dexmedetomidine's effectiveness may be time- dependent, with the most noticeable benefit seen during the first few hours post- surgery, which aligns precisely with our observation of a marked early benefit at 0 hours.

Taken together, these results suggest that Dexmedetomidine provides superior early- phase antiemetic efficacy, comparable late-phase results, and an added sedative and analgesic advantage, reinforcing its role in enhanced recovery protocols for laparoscopic surgeries. However, given the diminishing difference in PONV control by 12 hours, a combination of Dexmedetomidine with other agents (e.g., Ondansetron or Dexamethasone) may offer sustained prophylaxis across all phases.

Use of rescue Antiemetics: In our study, the requirement for rescue antiemetics in the immediate postoperative period was significantly lower in the Dexmedetomidine group compared to the EMSET (Ondansetron) group. At 0 hours, 40% of patients in the EMSET group required rescue antiemetics, whereas only 15.6% did so in the Dexmedetomidine group (P = 0.010), indicating a statistically and clinically significant benefit of Dexmedetomidine in controlling early postoperative nausea and vomiting (PONV). This early antiemetic effect supports the hypothesis that Dexmedetomidine provides superior prophylaxis against PONV in the immediate postoperative phase.

These findings are in alignment with those of Bakri et al,8 who observed a lower incidence of PONV and

significantly better postoperative pain and sedation control in patients receiving Dexmedetomidine compared to Dexamethasone during laparoscopic cholecystectomy. Their study noted improved patient comfort and reduced analgesic and antiemetic requirements in the Dexmedetomidine group, reinforcing its role as a multimodal agent that not only sedates but also helps prevent nausea, likely through opioid-sparing effects and central sympatholytic action.

At 4 hours postoperatively in our study, although the need for rescue antiemetics declined in both groups, the difference between EMSET (24.4%) and Dexmedetomidine (15.6%) was not statistically significant (P = 0.292). This attenuation of Dexmedetomidine's advantage over time may reflect its pharmacokinetics, as the peak antiemetic effect appears to be most prominent during the early recovery phase.

Interestingly, at 12 hours, the use of rescue antiemetics in the Dexmedetomidine group showed a slight increase to 15.6%, compared to 8.9% in the EMSET group, although this difference remained non-significant (P = 0.334). This could suggest a waning effect of Dexmedetomidine over time, potentially due to its relatively short duration of action, thereby highlighting the importance of timing in antiemetic prophylaxis.

Sedation Score: In our study, The sedation scores in our study remained comparable across both groups, with most patients having a Ramsay Sedation Score of 2, indicating they were calm and cooperative. Similar findings were reported by Goyal et al, where both Dexmedetomidine and Ondansetron maintained stable sedation profiles.

Complications: In our study, only a small number of bradycardia and hypotension cases were observed, with no statistically significant difference between the two groups one patient in emset group developed Bradycardia which relieved on its own and in Dexmedetomidine group 2patients developed bradycardia for that atropine 0.6mg i.v. used and 1 patient developed hypotension which was relieved by

Intravenous fluid therapy. So we need more studies to find out right dose of Dexmedetomidine at which it does not do any hemodynamic compromise.

CONCLUSION

We concluded that Dexmedetomidine is more effective than EMSET in the immediate postoperative period for preventing nausea and vomiting after laparoscopic surgeries. It also reduces the need for rescue antiemetics without causing excessive sedation or significant hemodynamic instability. While both drugs are safe and effective, Dexmedetomidine may be preferred in patients where early PONV control is critical. Nevertheless, vigilant monitoring is warranted due to its bradycardic effects.

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