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Original Research Article

Effect of 4mg Dexamethasone for Prevention of Post-Operative Nausea and Vomiting in Laparoscopic Surgeries

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Abstract

Background: Laparoscopy was first introduced as a therapeutic alternative to laparotomy more than a century ago. Since then, the field of laparoscopic surgery has undergone enormous development and expansion, to the point where it is now the standard treatment for a wide range of surgical procedures, including cholecystectomy, appendicectomy, gynecologic surgeries, bariatric surgery, hernia repair and even complex oncologic operations. However, laparoscopic surgeries are associated with high incidence of postoperative nausea and vomiting (PONV) of 40%-80%. A number of drugs have been used for its prevention. Dexamethasone, a glucocorticoid, having an antiemetic effect along with anti-inflammatory and analgesic effect has been shown to reduce the incidence of PONV. However, the optimal dose for reducing PONV has not been clearly defined. In this study, we aim to study 4mg dose of dexamethasone on incidence of PONV in patients undergoing laparoscopic surgery.

Methods: A double blind randomized controlled study was performed on 70 patients posted for elective laparoscopic surgeries under general anesthesia to assess the efficacy of 4mg dose of dexamethasone in preventing PONV. Patients were randomly assigned into two groups: 4mg dexamethasone (1ml) and 1ml normal saline group. The incidence of nausea, vomiting and the need for anti-emetic were evaluated during first 24 postoperative hours.

Results: Patients who received IV dexamethasone 4mg had significant reduction of PONV ($P<0.01$) and the need for rescue anti emetic drugs was also lower in dexamethasone group compared to normal saline group.

Conclusion: Inj Dexamethasone 4mg given before induction of anesthesia effectively controls postoperative nausea and vomiting in laparoscopic surgeries.

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Introduction

Nausea and vomiting are the most common adverse events in the postoperative period with estimated incidence of 30% in general surgical population and as high as 80% in high risk population [1]. However, laparoscopic surgeries are associated with high incidence of postoperative nausea and vomiting (PONV) of 40%-80% [2].

Laparoscopic procedures, such as cholecystectomy, gynecologic surgery, and bariatric surgery, are strongly associated with increased PONV risk due to pneumoperitoneum, visceral manipulation, and the use of volatile anesthetics and opioids. This can be highly distressing and is associated with significant patient dissatisfaction. In addition, the occurrence of PONV is associated with a significantly longer stay in post anesthesia care unit(PACU), unanticipated hospital stay, delayed oral intake, increase need for rescue antiemetics and increased health care costs.[3]

Studies have revealed various factors for PONV such as age, female gender, previous history of PONV, type of surgical procedure, prolonged surgery, carbon dioxide retention, pneumoperitoneum, anesthesia techniques. Excessive vomiting may result in dehydration and electrolyte imbalances [2] but most dreaded complication is pulmonary aspiration of vomitus especially when airway reflexes are depressed due

to the residual effects of anesthetic drugs. Therefore, it is important to reduce the incidence of these adverse events in the most effective manner.

Various classes of drugs have been employed for prevention of PONV such as serotonin antagonists, anticholenergics, butyrophenones, benzamides, steroids, antihistamines [2].

Even though anti-emetic drugs reduced the incidences of nausea and vomiting, it has got its own undesirable side effects, metoclopramide is associated with impaired taste, smell, hot flushes and has rare association like dystonia reaction. Droperidol cause extra pyramidal symptom, dysphoria and induces tachycardia.5HT3 antagonist like ondansetron, granisetron, palonosetron are all effective in reducing postoperative nausea and vomiting with low incidence of side effects but high acquisition cost.

Dexamethasone, a synthetic corticosteroid with potent anti-inflammatory and immunosuppressive properties, has emerged as a key component in multimodal strategies for PONV prevention. When administered as a single low dose (typically 4–8 mg intravenously) at the time of anesthesia induction, dexamethasone has been shown to reduce the incidence and severity of nausea and vomiting in the early and late postoperative periods.

Perioperative intravenous (IV) administration of dexamethasone has also been shown to decrease pain scores, reduce postoperative opioid consumption, increase patient satisfaction, shorten hospital stays, expedite recovery and reduce healthcare costs [6].

Given its low cost, long duration of action, and favorable safety profile in single-dose use, dexamethasone is increasingly recommended as a first-line agent for PONV prophylaxis, particularly in combination with other antiemetic agents such as 5-HT3 antagonists or NK1 receptor antagonists [1].

However, optimal timing, dosage, and patient selection remain areas of ongoing research, especially in the context of minimally invasive surgeries like laparoscopy. In this study, we aim to study 4mg dose of dexamethasone on incidence of PONV in patients undergoing laparoscopic surgery.

Materials and Methods

Research Design: This is a double blind randomized controlled study for evaluation of efficacy of 4mg dose of dexamethasone in preventing PONV in patients undergoing elective laparoscopic surgeries under general anesthesia.

The study was conducted in our hospital in India and lasted for a duration of one year. The study was conducted after ethical approval and proper inclusion and exclusion criteria were considered. Written informed consent from each patient was taken before enrollment in the study. All patients were randomized into two groups as under:

Group D (n=35): Patients receiving IV Dexamethasone 4mg (1ml).

Group S (n=35): Patients receiving IV 1ml Normal saline.

Inclusion Criteria:

- Provide valid informed consent prior to study procedure.
- ASA : I –II
- Age >18yrs
- Patients undergoing laparoscopy surgery.

Exclusion Criteria:

- Pregnant and lactating women.
- History of hepatic, renal or cardiopulmonary abnormality

Procedure: Patients who fulfill the inclusion criteria was enrolled in the study. Routine pre-anesthetic check-up was done and demographic data, history, general physical examination, routine investigations and airway assessment was documented. Written informed consent was taken. Patients were randomized into 2 groups: Group D patients receiving IV Dexamethasone 4mg (1ml) or Group S patients receiving IV 1ml Normal saline

After checking the identity and consent, patients was shifted to operation room and dexamethasone 4mg (1ml) or 1ml normal saline was administered before induction of anesthesia.

The anesthesia techniques, anesthetic drugs and surgical techniques were standardized. Anesthesia was induced with propofol 1-2mg/kg IV, glycopyrrolate 0.2mg IV and fentanyl 1mcg/kg IV.

Endotracheal intubation was facilitated with vecuronium 0.1mg/kg IV. Anesthesia was maintained with 1.0-2.0% isoflurane in oxygen. Ventilation was controlled mechanical and adjusted to keep end-tidal CO2 partial pressure 30-40 mm hg. Preoperative fluid management was standardized.

At the end of the surgery residual neuromuscular blockade was antagonized with neostigmine 0.05mg/kg IV and glycopyrrolate 0.01mg/kg IV and the trachea was extubated. No antiemetic drug was given intraoperatively.

After surgery patients were observed for 1 hour and with stable vital signs patients were transferred to surgical ward. Inj diclofenac 75mg IV was given for postoperative analgesia.

All the post-operative cases will be followed up at 0,2,12 and 24 hours and PONV will be evaluated on five point ordinal scale:

0-none, 1-nausea, 2-retching, 3-vomiting, 4-severe vomiting (>3 episodes).

In patients who complained of vomiting Inj ondansetron 4mg IV was used as a rescue antiemetic.

Statistical Analysis: Data were entered in Excel and analysed using SPSS. Normality was assessed with the Shapiro-Wilk test. Continuous variables were expressed as mean ± SD and compared using Student t- test, while categorical variables were presented as frequencies or percentages and analysed using Fisher's exact test. A p-value < 0.01 was considered statistically significant.

Results

Table 1: Comparative evaluation of the baseline features.

Parameters	Group D Dexamethasone 4mg (n=35)	Group S Normal saline 1ml (n=35)	p-value
Age (years),mean SD	32.0 ± 9.0	30.6 ±8.8	0.52
Gender(Female/Male) (n)	29/6	28/7	1.00
ASA I/II (n)	22/13	25/10	0.61

There was no statistically significant difference in age distribution (p-value of 0.52), distribution of gender (p-value of 1.00) and physical status of ASA (p-value of 0.61) between groups.

Table 2: Comparison of various types of laparoscopic surgeries.

Laparoscopic surgery	Total number of cases (n)	Percentage (%)	Group D		Group S		p-value
			Number of cases (n)	Percentage (%)	Number of cases (n)	Percentage (%)	
Sterilization	29	41.4	16	45.7	13	37.1	0.89
Ovarian cystectomy	14	20	6	17.1	8	22.9	
Diagnostic laparoscopy	8	11.4	4	11.4	4	11.4	
Appendicectomy	19	27.1	9	25.7	10	28.6	

Sterilization was the most frequently performed procedure in both groups accounting for 41.4% of all cases, followed by appendicectomy (27.1%) and ovarian cystectomy (20%), while diagnostic laparoscopy was the least common (11.4%). There was no statistically significant difference in the distribution of surgical procedures between the two groups (p-value = 0.89), indicating that both groups were comparable with respect to the type of surgery performed.

Table 3: Comparison of duration of pneumoperitoneum.

Duration of pneumoperitoneum (hours)	Total number of cases	Percentage (%)	Group D		Group S		p- value
			Number of cases (n)	Percentage (%)	Number of cases (n)	Percentage (%)	
<30mins	31	44.3	17	48.9	14	40	0.63
31-60mins	39	55.7	18	51.4	21	60	

Nearly half of the patients in each group had a pneumoperitoneum duration of less than 30 minutes, 48.9% in group D and 40% in group S while the remaining patients had a duration of 31–60 minutes 51.4% in group D and 60% in group S. The difference in distribution of pneumoperitoneum duration between the dexamethasone and saline groups was not statistically significant with p-value of 0.63 making the parameter comparable.

Table 4: Incidence of PONV with duration of pneumoperitoneum.

Duration	Group D		Group S		p-value
	Number of cases (n)	Percentage (%)	Number of cases (n)	Percentage (%)	
<30mins	6	35.3	12	85.7	0.0094
31-60mins	10	55.6	21	100	0.00071

The incidence of postoperative nausea and vomiting in dexamethasone group was 35.3% and 55.6 % at less than 30mins and 31-60mins duration of pneumoperitoneum respectively whereas in normal saline group, it was 85.7% at less than 30mins and 100% at 31-60mins duration of pneumoperitoneum. This signifies lower PONV in the dexamethasone group compared with the saline group for both durations of pneumoperitoneum (<30 min and 31–60 min), with statistically

significant differences observed in each duration category ($p < 0.01$).

Table 5: Assessment of PONV at different hour's post-operative intervals.

Post-operative intervals (hrs)	Group D		Group S		p-value
	Number of cases (n)	Percentage (%)	Number of cases (n)	Percentage (%)	
0	13	37.1	27	77.1	0.0033
2	17	48.6	30	85.7	0.0019
12	9	25.7	23	65.7	0.0016
24	6	17.1	12	34.3	0.171

At 0hrs, 2hrs and 12 hrs postoperative period, the incidence of postoperative nausea and vomiting in dexamethasone group was 37.1%, 48.6% and 25.7% respectively whereas in saline group was 77.1%, 85.7% and 65.7% respectively showing lower incidence of PONV in the dexamethasone group compared with the saline group during the early postoperative period (0–12 hrs) with p-value of less than 0.01, while no statistically significant difference was observed at 24 h postoperatively.

Table 6: Need for rescue anti-emetic.

Need for rescue anti-emetic	Group D		Group S		p-value
	Number of cases (n)	Percentage (%)	Number of cases (n)	Percentage (%)	
	6	17.1	30	85.7	0.0001

The requirement for rescue anti-emetic therapy was significantly lower in the dexamethasone group compared with the saline group (17.1% vs 85.7%, $p = 0.0001$).

The lack of a statistically significant difference in PONV at 24 hours may be due to the administration of rescue antiemetic therapy in patients who experienced PONV earlier.

Table 7: Variation of post-operative blood glucose levels

Groups	Preop mean grbs	Postop mean grbs	Mean change
D	94.49 ± 6.24 mg/dl	105.83 ± 7.86 mg/dl	+11.34mg/dl
S	98.48 ± 8.00 mg/dl	104.18 ± 6.06 mg/dl	+5.70mg/dl

The mean preoperative random blood sugar (GRBS) levels were comparable between the two groups. In the dexamethasone group (Group D), the mean preoperative GRBS was 94.49 mg/dl, which increased to 105.83 mg/dl postoperatively, showing an average rise of 11.34 mg/dl.In the saline group (Group S), the mean preoperative GRBS was 98.48 mg/dl, which increased to 104.18 mg/dl postoperatively, with an average rise of 5.70 mg/dl. Although dexamethasone was associated with a greater postoperative increase in GRBS compared with saline, the rise was mild and clinically acceptable, with no reported adverse glycaemic events.

Discussion

Laparoscopic surgery is a minimally invasive surgical technique which has evolved into primary operative approach for abdominal and pelvic procedure. Compared to traditional open surgery, laparoscopic techniques offer numerous advantages such as smaller incisions resulting in reduced postoperative pain and improved cosmetic outcomes, faster recovery and shorter hospital stays, lower risk of surgical site infections and wound complications, earlier return to normal activities and work[13].Despite these benefits, laparoscopic surgery introduces unique physiological and technical challenges. The creation of pneumoperitoneum (insufflation of the abdomen with carbon dioxide) increases intra-abdominal pressure, which can affect cardiovascular and respiratory function and stimulate visceral afferent nerves that contribute to postoperative nausea and vomiting (PONV). Additionally, the Trendelenburg position often used in gynecologic and colorectal laparoscopy may exacerbate diaphragmatic irritation and emetogenic triggers. Dexamethasone is recommended first line agent in reducing the incidence of PONV [1]. The effect of different dosage of dexamethasone on reduction of PONV has been documented in numerous studies [3,4,9-12] .The current guidelines recommands use of 4mg, whilst permitting consideration of 8mg dose[17].Adult dosage studies have determined that minimum of 2.5mg intravenous dexamethasone is required for prevention of PONV after gynaecological surgery[18] and a minimum of 5mg after thyroidectomy[11].

In laparoscopic procedures, where the risk of PONV is inherently higher, dexamethasone has shown consistent benefit. Vivek et al. demonstrated that dexamethasone 8mg significantly reduced postoperative nausea and vomiting in patients undergoing laparoscopic cholecystectomy, reinforcing its role in minimally invasive surgery

[10]. Similarly, Wang et al. reported that even small doses of dexamethasone (5mg) significantly reduced PONV after laparoscopic cholecystectomy when compared with placebo [16].

Meta-analyses have further strengthened the evidence base. De Oliveira et al. concluded that dexamethasone 4mg to 5mg have similar effects in reduction of PONV across a wide range of surgical procedures as the 8mg to10mg dose when dexamethasone was used as a single drug or as a combination therapy supporting SAMBA guidelines for PONV which favours 4mg-5mg dose regime of systemic dexamethasone [4] .

Som et al. highlighted that dexamethasone, when combined with a 5-HT3 antagonist, was superior to monotherapy, suggesting that 4 mg dexamethasone is an effective component of combination prophylaxis in laparoscopic surgery [2].

Corticosteroids are associated with adverse effects such as increase in blood glucose level [7], wound infections, delayed wound healing, gastric ulcer and avascular necrosis. However, these effects were appear to be minimal with low-dose administration of dexamethasone. The PADDI trial analysis showed no significant increase in persistent wound pain or infection with perioperative dexamethasone use, supporting its safety [5].

Dose-comparison studies outside laparoscopic surgery have shown no clear superiority of 8 mg over 4 mg for PONV prevention, while higher doses may be associated with increased metabolic effects [6,7]. Liu et al. also demonstrated that effective antiemetic control could be achieved with lower doses of dexamethasone (2.5mg) in major gynecological surgery, further supporting dose minimization [18].

In our study, we used 4mg dexamethasone just before induction[12] without any anti emetic and showed that the incidence of PONV was significantly lower in the dexamethasone group during the early postoperative period (0–12 hours) compared with the saline group with p-value<0.01. Furthermore, dexamethasone significantly reduced the incidence of PONV irrespective of the duration of pneumoperitoneum. Although the difference in PONV at 24 hours was not statistically significant, this may be attributed to the administration of rescue anti-emetic therapy to symptomatic patients, which likely attenuated intergroup differences at later postoperative intervals.

The requirement for rescue anti-emetic medication was markedly lower in patients receiving dexamethasone 17.1% compared with 85.7% in saline group, highlighting its clinical efficacy. While dexamethasone administration was associated with a greater postoperative increase in random blood sugar levels compared with saline (11.34mg/dl and 5.70 g/dl respectively), the rise was mild, clinically insignificant, and not associated with any adverse glycaemic events.

Conclusion

Administration of 4mg IV dexamethasone before induction of anesthesia was effective in preventing PONV and can be recommended as part of a multimodal perioperative management strategy for patients, including those with well-controlled diabetes, undergoing laparoscopic surgery.

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