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Original Research Article

Post-operative Sore Throat after Laparoscopic Cholecystectomy: A Randomized Comparison of Dexamethasone and Dexmedetomidine

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Abstract

Introduction: Post-operative sore throat (POST) is a complication after general anaesthesia with airway instrumentation and adversely affects patient comfort and satisfaction. Laparoscopic cholecystectomy commonly requires airway control, predisposing patients to POST. Dexamethasone and dexmedetomidine have been used to reduce POST through different mechanisms. This study compared their effectiveness in preventing POST.

Materials and Method: This prospective randomized comparative study included 60 ASA I–II patients aged 18–60 years undergoing elective laparoscopic cholecystectomy. Patients were randomized into two groups of 30 each to receive intravenous dexamethasone (Group D) or dexmedetomidine (Group DM) after induction of anaesthesia. Anaesthetic technique and airway management were standardized. Incidence and severity of POST were assessed at 1, 6, and 24 hours postoperatively using a graded scale. Data were analyzed using appropriate statistical tests, with $p < 0.05$ considered significant.

Result: Demographic and perioperative variables were comparable between groups. The incidence of POST at 1 hour was significantly higher in Group D than Group DM (53.3% vs 26.7%, $p = 0.03$), and similar differences were noted at 6 hours (43.3% vs 16.7%, $p = 0.02$). By 24 hours, POST incidence decreased in both groups without significant difference. Severity of POST was significantly lower in Group DM, with 73.3% reporting no sore throat compared with 46.7% in Group D ($p = 0.04$). No significant adverse effects were observed.

Conclusion: Perioperative dexmedetomidine was more effective than dexamethasone in reducing early incidence and severity of post-operative sore throat following laparoscopic cholecystectomy, with a comparable safety profile.

Keywords: Post-Operative Sore Throat, Dexmedetomidine.

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Introduction

Post-operative sore throat (POST) is a common and distressing complication following general anaesthesia, particularly in patients undergoing procedures that require airway instrumentation such as endotracheal intubation or supraglottic airway device placement. Although often considered minor, POST can significantly reduce patient satisfaction, contribute to postoperative discomfort, and negatively influence the overall quality of recovery in the immediate postoperative period [1]. The reported incidence of POST varies widely, ranging from 21% to as high as 65%, depending on factors such as patient characteristics, airway device size, duration of surgery, cuff pressure, and anaesthetic technique [2,3].

Laparoscopic cholecystectomy is one of the most frequently performed minimally invasive abdominal surgeries and is almost universally conducted under general anaesthesia with airway control. Despite its minimally invasive nature, airway manipulation combined with pneumoperitoneum and prolonged operative duration predisposes patients to a higher risk of POST [4]. Mechanical trauma to the pharyngeal and laryngeal mucosa, ischemic injury secondary to excessive cuff pressure, mucosal drying, and inflammatory responses are considered the principal mechanisms underlying the development of POST [5]. Several pharmacological and non-pharmacological strategies have been evaluated to

prevent or reduce the incidence and severity of POST. These include optimization of airway device size, cuff pressure monitoring, topical lignocaine, nebulized agents, corticosteroids, and α-2 adrenergic agonists [6–8]. Among these, dexamethasone has been extensively studied for its potent anti-inflammatory and anti-edematous properties. When administered in the perioperative period, dexamethasone reduces mucosal inflammation, tissue edema, and nociceptive sensitization, thereby decreasing the incidence and severity of POST [7,8].

Dexmedetomidine, a highly selective α-2 adrenergic receptor agonist, has gained increasing attention in perioperative medicine due to its sedative, analgesic, sympatholytic, and anti-inflammatory effects without significant respiratory depression [9]. Its ability to attenuate stress responses, suppress airway reflexes, and modulate inflammatory pathways suggests a potential role in preventing POST. Emerging evidence indicates that dexmedetomidine, administered via intravenous or nebulized routes, may effectively reduce airway irritation and postoperative throat discomfort [10–12].

Although both dexamethasone and dexmedetomidine have individually demonstrated efficacy in reducing POST, direct comparative evidence between these two agents, particularly in the setting of laparoscopic cholecystectomy, remains limited. Given their differing mechanisms of action, a randomized comparison is clinically relevant to determine the more effective agent for POST prevention.

Therefore, the present randomized study was conducted to compare the effectiveness of dexamethasone and dexmedetomidine in reducing the incidence and severity of post-operative sore throat in patients undergoing laparoscopic cholecystectomy under general anaesthesia.

Materials and Methodology

This prospective, randomized, comparative study was conducted in the Department of Anaesthesiology at a tertiary care teaching hospital after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrollment. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Sample Size Calculation: The sample size was calculated based on the expected difference in the incidence of post-operative sore throat (POST) between the two study groups. Previous studies have reported an incidence of POST of approximately 50–60% following general anaesthesia with airway instrumentation, with a reduction to nearly 25–30% after prophylactic pharmacological intervention. Assuming an expected incidence of POST of 55% in the dexamethasone group and 30% in the dexmedetomidine group, with a power of 80% and a two-sided alpha error of 0.05, the minimum required sample size was calculated to be 27 patients in each group. Where (p_1) and (p_2) represent the anticipated incidence of POST in the dexamethasone and dexmedetomidine groups, respectively. To account for possible dropouts and protocol deviations, the sample size was increased to **30 patients per group**, resulting in a total study population of **60 patients**.

Study Population: Adult patients of either sex, aged 18–60 years, belonging to American Society of Anesthesiologists (ASA) physical status I and II, and scheduled for elective laparoscopic cholecystectomy under general anaesthesia were included in the study.

Inclusion Criteria

- Age between 18 and 60 years
- ASA physical status I–II
- Elective laparoscopic cholecystectomy under general anaesthesia
- Provision of written informed consent

Exclusion Criteria

- Pre-existing sore throat, hoarseness of voice, or upper respiratory tract infection
- Anticipated difficult airway
- History of steroid or α-2 agonist use within 24 hours prior to surgery
- Known hypersensitivity to dexamethasone or dexmedetomidine
- More than one attempt at airway instrumentation
- Prolonged surgery (>120 minutes) or conversion to open cholecystectomy

Randomization and Group Allocation: Patients were randomly allocated into two equal groups using a computer-generated random number table. Allocation concealment was ensured using sealed opaque envelopes opened just before induction of anaesthesia.

- **Group D:** Intravenous dexamethasone
- **Group DM:** Intravenous dexmedetomidine

Anaesthetic Technique: All patients were kept nil per oral as per institutional guidelines. Standard monitoring including electrocardiography, non-invasive blood pressure, pulse oximetry, and capnography was instituted on arrival in the operating room. General anaesthesia was induced using intravenous propofol and a neuromuscular blocking agent to facilitate airway placement. A standardized airway device was used by an experienced anaesthesiologist, and cuff pressure was maintained within the recommended range

using a cuff pressure manometer. Anaesthesia was maintained with inhalational agents in an oxygen–air mixture with controlled ventilation. At the end of surgery, neuromuscular blockade was reversed and the airway device was removed after ensuring adequate recovery.

Study Drug Administration

- **Group D:** Patients received intravenous dexamethasone in a prophylactic dose immediately after induction of anaesthesia.
- **Group DM:** Patients received intravenous dexmedetomidine in a calculated dose administered as a slow infusion after induction of anaesthesia.

The study drugs were prepared and administered by an anaesthesiologist not involved in postoperative assessment.

Outcome Assessment: The primary outcome was the incidence and severity of post-operative sore throat, assessed at 1 hour, 6 hours, and 24 hours postoperatively using a standardized grading scale (0–3). Secondary outcomes included the incidence of hoarseness of voice and any drug-related adverse effects. Postoperative assessment was performed by an observer blinded to group allocation.

Statistical Analysis: Data were analyzed using statistical software SPSS .25. Continuous variables were expressed as mean ± standard deviation, and categorical variables as numbers and percentages. Intergroup comparisons were performed using the independent t-test or Mann–Whitney U test for continuous variables and the Chi-square test or Fisher's exact test for categorical variables. A p-value < 0.05 was considered statistically significant.

Results

A total of 60 patients undergoing elective laparoscopic cholecystectomy under general anaesthesia were enrolled in the study and randomly allocated into two equal groups: Group D (dexamethasone, n = 30) and Group DM (dexmedetomidine, n = 30). All randomized patients completed the study protocol, and no exclusions were required during data analysis.

The baseline demographic profile and perioperative variables of patients in both groups are summarized in Table 1. The mean age of patients in Group D was 41.6 ± 10.2 years, while that in Group DM was 42.3 ± 9.8 years. The difference in age between the two groups was not statistically significant (p = 0.78). Sex distribution was comparable between the two groups, with 12 males and 18 females in Group D and 11 males and 19 females in Group DM (p = 0.79). The mean body mass index was 24.8 ± 3.1 in Group D and 25.1 ± 3.4 in Group DM, with no statistically significant difference observed (p = 0.71). Both groups were comparable with respect to ASA physical status. Group D included 18 ASA I and 12 ASA II patients, while Group DM included 17 ASA I and 13 ASA II patients, with no significant difference between the groups (p = 0.79).

Intraoperative parameters were also comparable. The mean duration of surgery was 62.4 ± 11.6 minutes in Group D and 64.1 ± 12.3 minutes in Group DM (p = 0.56). The mean duration of anaesthesia was 78.6 ± 13.4 minutes in Group D and 80.2 ± 14.1 minutes in Group DM (p = 0.63). These findings indicate that both groups were well matched demographically and perioperatively, allowing a valid comparison of postoperative outcomes (Table 1). The incidence of post-operative sore throat at different postoperative time intervals is presented in Table 2. At 1 hour postoperatively, post-operative sore throat was observed in 16 patients (53.3%) in Group D compared to 8 patients (26.7%) in Group DM. This difference was statistically significant (p = 0.03).

At 6 hours postoperatively, the incidence of post-operative sore throat decreased in both groups but remained significantly higher in Group D. Thirteen patients (43.3%) in Group D reported sore throat compared to 5 patients (16.7%) in Group DM (p = 0.02).

By 24 hours postoperatively, further reduction in the incidence of post-operative sore throat was noted in both groups. Five patients (16.7%) in Group D and two patients (6.7%) in Group DM reported sore throat at this time point. Although the incidence was lower in Group DM, the difference between the groups was not statistically significant (p = 0.23) (Table 2). The severity of post-operative sore throat assessed at 1 hour postoperatively using the standardized grading scale is shown in Table 3. In Group D, 14 patients (46.7%) reported no sore throat, 9 patients (30.0%) reported mild sore throat, and 7 patients (23.3%) experienced moderate sore throat. No patient in Group D reported severe sore throat.

In Group DM, 22 patients (73.3%) reported no sore throat, 6 patients (20.0%) reported mild sore throat, and only 2 patients (6.7%) experienced moderate sore throat. Similar to Group D, no patient in Group DM experienced severe sore throat. The difference in the severity distribution between the two groups was statistically significant, with Group DM demonstrating significantly lower severity scores compared to Group D (p = 0.04) (Table 3).Postoperative hoarseness of voice was observed more frequently in Group D compared to Group DM during the early postoperative period; however, the difference between the two groups was not statistically significant. In both groups, hoarseness was transient and resolved

spontaneously within 24 hours. No significant drug-related adverse effects such as hypotension, bradycardia, excessive sedation, nausea, vomiting, or respiratory depression were observed in either group. All patients remained hemodynamically stable throughout the intraoperative and postoperative periods.

Table 1: Demographic and Perioperative Characteristics of the Study Population

Variable	Group D (Dexamethasone) n = 30	Group DM (Dexmedetomidine) n = 30	p-value
Age (years), mean ± SD	41.6 ± 10.2	42.3 ± 9.8	0.78
Sex, n (%)			0.79
Male	12 (40.0)	11 (36.7)	
Female	18 (60.0)	19 (63.3)	
BMI (kg/m²), mean ± SD	24.8 ± 3.1	25.1 ± 3.4	0.71
ASA physical status, n (%)			0.79
ASA I	18 (60.0)	17 (56.7)	
ASA II	12 (40.0)	13 (43.3)	
Duration of surgery (min), mean ± SD	62.4 ± 11.6	64.1 ± 12.3	0.56
Duration of anaesthesia (min), mean ± SD	78.6 ± 13.4	80.2 ± 14.1	0.63

Table 2: Incidence of Post-operative Sore Throat at Different Time Intervals

Time Interval	Group D n (%)	Group DM n (%)	p-value
1 hour	16 (53.3)	8 (26.7)	0.03
6 hours	13 (43.3)	5 (16.7)	0.02
24 hours	5 (16.7)	2 (6.7)	0.23

Table 3: Severity of Post-operative Sore Throat (POST Score) at 1 Hour Postoperatively

POST Severity Grade	Group D n (%)	Group DM n (%)	p-value
Grade 0 (No sore throat)	14 (46.7)	22 (73.3)	
Grade 1 (Mild)	9 (30.0)	6 (20.0)	
Grade 2 (Moderate)	7 (23.3)	2 (6.7)	
Grade 3 (Severe)	0 (0)	0 (0)	0.04

Discussion

In the present study, baseline demographic variables and perioperative parameters were comparable between the two groups, ensuring that the observed differences in post-operative sore throat (POST) were attributable to the study drugs. Age, sex distribution, body mass index, ASA physical status, duration of surgery, and duration of anaesthesia did not differ significantly between the dexamethasone and dexmedetomidine groups (Table 1). Similar demographic comparability has been reported in randomized trials evaluating α-2 adrenergic agonists, including the study by Kakkar et al. (2016) [13], where no significant baseline differences were observed between clonidine and dexmedetomidine groups, strengthening the validity of airway-related outcome comparisons. Likewise, Misra et al. (2021) [14] reported comparable demographic and intraoperative variables while evaluating dexmedetomidine nebulization, supporting the reliability of postoperative airway morbidity outcomes. The present study demonstrated that dexmedetomidine significantly reduced the incidence of POST during the early postoperative period compared with dexamethasone. At 1 hour postoperatively, POST occurred in 53.3% of patients in the dexamethasone group compared with 26.7% in the dexmedetomidine group, while at 6 hours the incidence was 43.3% versus 16.7%, respectively (Table 2). By 24 hours, the incidence declined in both groups, with no statistically significant difference.

These findings are consistent with the meta-analysis by Liu et al. (2021) [15], which included multiple randomized trials and reported that perioperative intravenous dexmedetomidine reduced the incidence of POST from approximately 48–55% in control groups to around 25–30% in dexmedetomidine groups, corresponding to a pooled risk reduction of nearly 40%. The magnitude and temporal pattern of reduction in our study closely parallel these findings, particularly within the first 6 postoperative hours.The pharmacological basis for this reduction has been well described. Giovannitti et al. (2015) [16] highlighted that dexmedetomidine, through its highly selective α-2 adrenergic agonist action, attenuates sympathetic responses and airway reflexes during intubation, thereby reducing mucosal trauma and subsequent inflammation. Furthermore, the meta-analysis by Li et al. (2015) [17] demonstrated significant reductions in inflammatory markers such as interleukin-6 and

tumor necrosis factor-α (approximately 25–40%) in patients receiving perioperative dexmedetomidine, supporting a systemic anti-inflammatory mechanism that may directly reduce airway mucosal edema and irritation responsible for POST.In contrast, although dexamethasone is an established anti-inflammatory agent, its genomic mechanism of action may result in a comparatively delayed onset of effect. This likely explains why, in the present study, dexamethasone showed a gradual reduction in POST incidence over time but was less effective than dexmedetomidine during the early postoperative period.The present study also demonstrated that dexmedetomidine significantly reduced the severity of POST. At 1 hour postoperatively, 73.3% of patients in the dexmedetomidine group reported no sore throat compared with 46.7% in the dexamethasone group, while moderate POST was observed in 23.3% of dexamethasone-treated patients versus only 6.7% of dexmedetomidine-treated patients (Table 3). These findings are supported by existing literature emphasizing dexmedetomidine's central sedative and analgesic properties. Reade et al. (2014) [18] reported that dexmedetomidine-based sedation was associated with improved patient comfort and reduced agitation compared with conventional sedatives, reflecting enhanced modulation of stress and pain perception. Similarly, Alexopoulou et al. (2014) [19] demonstrated that dexmedetomidine improved sleep quality and reduced subjective discomfort scores in critically ill patients, suggesting a broader role in improving postoperative comfort, including airway-related symptoms. Evidence from airway-focused studies further corroborates these observations. Misra et al. (2021) [14] reported significantly lower airway irritation and cough scores in patients receiving dexmedetomidine nebulization during laryngoscopy, while Iirola et al. (2011) [20] demonstrated adequate systemic bioavailability of dexmedetomidine (approximately 65%) following intranasal administration, supporting its effective action on airway mucosa. Additionally, Kakkar et al. (2016) [13] found dexmedetomidine to be superior to clonidine in attenuating laryngoscopy and intubation responses, indicating a stronger sympatholytic and airway-protective effect that may translate into reduced POST severity.

Conclusion

Dexmedetomidine significantly reduced both the incidence and severity of early post-operative sore throat compared with dexamethasone in patients undergoing laparoscopic cholecystectomy. The benefit was most pronounced during the first 6 postoperative hours, with comparable safety profiles in both groups. Dexmedetomidine may therefore be considered a more effective perioperative agent for improving postoperative airway comfort.

Limitations of the Study

This was a single-center study with a relatively small sample size, which may limit the generalizability of the findings. Only one surgical procedure and fixed drug dosing regimens were evaluated, and different airway devices or administration routes were not compared. Long-term postoperative outcomes beyond 24 hours were not assessed.

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