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Original Article

Anaesthesia Section

Effect of Dexmedetomidine-Lidocaine and Magnesium Sulphate-Lidocaine Gargles versus Lidocaine alone on Haemodynamic Response to Laryngoscopy and Postoperative Sore Throat: A Double-blinded Randomised Controlled Trial

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ABSTRACT

Introduction: Direct laryngoscopy and tracheal intubation may cause a transient sympathetic surge causing tachycardia and hypertension, which may be worrisome in surgical patients. Postoperative Sore Throat (POST) is another frequent complication to endotracheal intubation that affects the comfort of the patient.

Aim: To compare the effectiveness of dexmedetomidine-lidocaine and magnesium sulphate-lidocaine against lidocaine alone on haemodynamic responses during laryngoscopy and POST in elective surgical patients.

Materials and Methods: This double-blinded randomised controlled trial was conducted on 180 adult participants (American Society of Anaesthesiologists (ASA) I-II) that were subjected to elective surgery under general anaesthesia. The participants were separated into three categories (n = 60 each): dexmedetomidine - lidocaine (Dex + Lido), magnesium sulphate - lidocaine ($MgSO_4$ + Lido), and lidocaine alone. Patients rinsed their allocated solution 20 minutes prior to anaesthesia induction. The heart rate and Mean Arterial Pressure (MAP) were recorded at different positions. The statistical significance was determined as p-value <0.05, and it was tested with the help of One-way Analysis of Variance (ANOVA) and Chi-square tests.

Results: The demographic and clinical baseline information including age, weight, surgery time, and ASA status did not differ between the groups (p-value> 0.05). The combination of dexmedetomidine and lidocaine significantly reduced the haemodynamic response, resulting in lower heart rates (85.82±9.45 vs 89.42±11.51 vs 93.82±10.19 bpm at 0 min; p-value=0.001) and MAP (97.18±7.21 vs 100.30±7.90 vs 102.45±9.14 mmHg; p-value=0.002). VAS scores were consistently lower for the dexmedetomidine group (2.50±0.78 vs 3.41±0.69 vs 4.50±0.81 at 24 hours; p-value<0.001).

Conclusion: Preinduction gargling of dexmedetomidine - lidocaine is effective at attenuating the haemodynamic response to laryngoscopy and at reducing POST compared with magnesium sulphate - lidocaine or lidocaine alone. This simple intervention may act as an effective adjunct in improving peri-intubation haemodynamic stability and postoperative patient comfort.

Keywords: Airway management, General anaesthesia, Intratracheal intubation, Pain measurement

INTRODUCTION

Laryngoscopy and endotracheal intubation cause a major stress response. The mechanical stimulation of the supraglottic and pharyngeal tissues during laryngoscopy elicits a reflex sympathetic response, which is often called the “pressor response,” which is characterised by temporary but significant increase in heart rate, systemic vascular resistance, and arterial blood pressure [1]. This reflex is triggered by sensory input from airway receptors to the brainstem, resulting in a large release of catecholamines into the bloodstream. In clinical scenarios, blood pressure can increase by 40-50% and heart rate is higher by 20% of baseline, peaking 1 min after intubation after which blood pressure and heart rate decrease back to baseline within 5-10 minutes [2].While these physiological changes are self-limiting in the healthy patient, they can have adverse effects on susceptible persons. Therefore, anaesthesiologists often attempt to reduce the reflex pressor response during laryngoscopy and intubation.

Attenuation strategies target at different locations of the reflex arc. Afferent blockade can be done by topical airway anaesthesia (e.g., Lidocaine spray or gargle), which desensitise mucosa receptors [3]. Central strategies include the use of opioids, adjusting anaesthetic depth or alpha 2 adrenergic agonists to inhibit brainstem reflexes [4]. Efferent blockade may be achieved by using beta-blockers or vasodilators against the cardiovascular response mediated by catecholamines [4]. In practice, intravenous agents such as fentanyl, esmolol and magnesium sulphate have been used for their sympatholytic effects. Magnesium sulphate is a vasodilator which prevents sympathetic responsiveness and blocks catecholamine secretion from nerve endings and the adrenal medulla [5]. Intravenous lidocaine and dexmedetomidine are also used, the alpha-2 agonist properties of dexmedetomidine provides sedation and sympatholysis [5]. Several studies support the use of dexmedetomidine in lowering the incidence of hypertension and tachycardia with intubation [6-9]. Similarly, intravenous magnesium has shown to stabilise blood pressure than lidocaine during laryngoscopy. However, each intervention has its limitations and there is no one method that is universally the best.

Sore throat after surgery (POST) is a common and irritating complication after endotracheal intubation [10]. It includes pain in the pharynx, the voice box or the windpipe during the early postoperative period. The incidence of POST is particularly high -

some studies consider that it affects approximately 20% to 60% of patients after surgery with an endotracheal tube [11]. The causative factors of POST are multifactorial. Direct mechanical damage by the laryngoscope and endotracheal tube may cause damage and inflammation of the mucosa of the pharynx and supraglottis. Excessive cuff pressures or prolonged intubation may lead to localised mucosal ischaemia and any unintentional injuries and contact with blood may worsen local irritation. Risk factors which have been identified include female gender, larger size of the tube, prolonged duration of anaesthesia and presence of blood at the time of extubation. Although generally self-limited, a severe sore throat can slow recovery and have a major adverse impact on patient satisfaction with anaesthesia [11].

In recent times, dexmedetomidine has also been studied as another option to prevent POST [12]. Systemic dexmedetomidine has been shown to reduce coughing and emergence agitation and it has been reported to reduce the severity of sore throat. Furthermore, topical application of dexmedetomidine (e.g., gargling or intratracheal) appears to improve the throat discomfort [13]. Dexmedetomidine added to a lidocaine gargle to provide postoperative analgesia was significantly associated with reduced postoperative throat pain compared to lidocaine gargle alone. Similarly, magnesium, which is an NMDA-antagonist; a calcium-channel blocker with local numbing properties, has been researched for its role in the prevention of POST. Studies conducted in India also reported that the preoperative gargling with magnesium sulphate was superior to that of the lidocaine gargle in reducing POST and also offered more stable intraoperative haemodynamics [14]. Despite these advancements, there are still major gaps in the literature. Numerous trials concentrate on single agents or dichotomous comparisons and still there remains limited evidence directly comparing dexmedetomidine-lidocaine, magnesium sulphate-lidocaine, and plain lidocaine gargles within a single randomised controlled framework [7,13,14]. This trial therefore was designed to fill that gap by comparing these three gargling regimens in adult surgical patients, the study determined which method was most effective in attenuating the sympathetic surge associated with intubation and in reducing POST. The primary objective was to evaluate the effectiveness of dexmedetomidine-lidocaine and magnesium sulphate-lidocaine compared to lidocaine alone on haemodynamic responses during laryngoscopy. The secondary objective was to assess POST incidence and severity.

MATERIALS AND METHODS

This double-blinded parallel-group randomised controlled trial was carried out in the Department of Anaesthesiology at SRM Medical College Hospital and Research Centre from March 2025 to February 2026. Approval from the Institutional Ethics Committee (IEC) was obtained (SRMIEC- ST0125-2442), and the research was registered with the Clinical Trial Registry of India (CTRI) (CTRI/2025/05/086144). All participants provided written informed consent before enrolling in the study.

Sample size: Sample size calculation was conducted using OpenEpi software. The sample size was based on the main outcome, which was the difference in MAP between groups after laryngoscopy and endotracheal intubation. The effect size was derived from the haemodynamic results reported in the randomised clinical study by Abedzadeh E et al., [13]. This study evaluated dexmedetomidine, magnesium sulphate, and lidocaine gargle regimens. Effect size for sample size estimation was calculated as Cohen's f for One-way ANOVA using the expected post-intubation MAP values at 15 minutes. Based on mean MAP values at of 99.71, 99.00, and 99.30 mmHg, with corresponding standard deviations of 8.10, 7.50, and 7.80, the calculated effect size was 0.57. With this as effect size, alpha (two-sided) as 0.05, Power=90%. The sample size formula used was:

Z1-α/2: Standard normal deviate for significance level (1.96 for α=0.05);

Z1–β: Standard normal deviate for study power (1.28 for 90% power);

α: Type I error probability;

β: Type II error probability;

d: Effect size (Cohen's f for ANOVA);

g: Number of groups (g = 3):

$n \geq (1+\sqrt{(g-1)}\ (Z1-\alpha/2+Z1-\beta)2\ /d2 + Z1-\alpha/2\ 2\sqrt{(g-1)}/2(1+\sqrt{(g-1)}$

$n \geq (1+\sqrt{(3-1)}\ (1.96+0.84)^2\ /\ (0.57)^2 + (1.96)^2\sqrt{(3-1)}/2(1+\sqrt{(3-1)}$

$n \geq 2.4142*(2.8)^2/\ (0.57)^2 + 3.84\sqrt{2}/2(1+\sqrt{2})$

$n \geq 2.4142*\ (7.84/0.3244) + (5.43/4.828)$

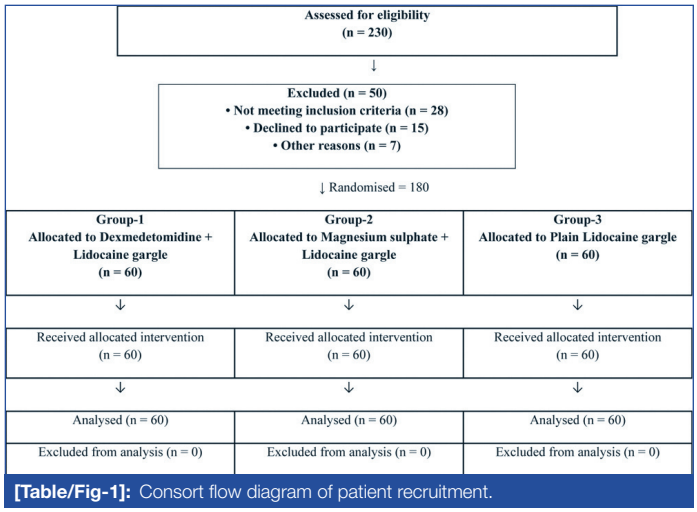
$n \geq 2.4142\ *\ (24.1305+1.1124)$

$n \geq 60$

Inclusion criteria: Adult patients aged 20-60 years, classified as ASA physical status I-II, who were undergoing elective moderate to major laparoscopic gynaecological, urological, and orthopaedic surgeries performed under general anaesthesia with endotracheal intubation with expected duration >30 minutes were included in the study.

Exclusion criteria: Patients with known hypersensitivity to the study drugs, anticipated difficult airway (Mallampati grade ≥ III), recent upper respiratory tract infections, gastroesophageal reflux disease, airway trauma during extubation, chronic use of opioids or steroids, significant cardiovascular or renal conditions, pregnancy or breastfeeding, more than three attempts at laryngoscopy, or contraindications to preoperative gargling (such as oropharyngeal pathology). Procedures involving head-and-neck surgeries, prolonged prone positioning, and surgeries expected to last more than three hours were also excluded to minimise potential confounding effects on POST incidence and haemodynamic responses.

Randomisation: A total of 180 patients were enrolled and randomly assigned to three groups (n=60 each) using computer-generated block randomisation (block size 3). An independent anaesthesiologist generated the allocation sequence, and group assignment was implemented with sealed, opaque envelopes to ensure concealment. All randomised patients were included in the final analysis. A consort flow diagram was shown in [Table/Fig-1].



[Table/Fig-1]: Consort flow diagram of patient recruitment.

Study Procedure

Randomisation was done using a computer by an independent anaesthesiologist. The investigator carried out patient enrolment, and allocation was concealed with sequentially numbered opaque sealed envelopes. Patients, the attending anaesthesiologist, and the outcome assessor were kept blind throughout the process, which reduced the bias. A standard postoperative recovery and pain relief plan was followed. Twenty minutes before the induction of anaesthesia, the patients performed a supervised gargle of 20 mL of the study solution according to their group allocation. The solutions were made to look the same by an independent

anaesthesiologist. Each solution contained 100 mg of lidocaine (2%, 5 mL) with 10 mL of 25% dextrose added to it, with the following specific additions for each group: 1) Dexmedetomidine group: dexmedetomidine 1.0 µg/kg added to the lidocaine solution; 2) Magnesium group: magnesium sulphate 2 g (20% solution) added; 3) Control group: no extra medication (lidocaine + dextrose only). The total volume (20 mL) was split into two equal amounts of (10 mL each) [13,15]. The patients gargled the first 10 mL for 15 seconds and expectorated, then gargled the second 10 mL for another 15 seconds. No other premedication and sedative was provided prior to the gargle. All other aspects of anaesthetic management were standardised.

Anaesthesia was started using fentanyl 2 µg/kg i.v., thiopental 4 mg/kg i.v., and atracurium 0.5 mg/kg i.v. to aid in tracheal intubation. After three minutes of mask ventilation, patients were intubated via a cuffed endotracheal tube (endotracheal tube 7.0-7.5 mm internal diameter for females, endotracheal tube 7.5-8.0 mm endotracheal tube for males) by an experienced anaesthesiologist who was blinded to the study group and used a Macintosh laryngoscope of appropriate size. Cuff pressure was corrected to 25 cmH_2O instantly using a manometer. Anaesthesia was maintained using isoflurane in oxygen, bolus fentanyl as needed for pain relief and more atracurium for muscle relaxation. Ventilations were adjusted to maintain end tidal CO_2 concentrations of 35-40 mmHg. At the end of surgery, neuromuscular blockade was reversed using neostigmine 0.05 mg/kg and glycopyrrolate 0.01 mg/kg and the patient was extubated after becoming awake. No local anaesthesia or topical airway block was given.

Non invasive measurements of haemodynamic parameters were taken. Heart rate and MAP were measured at baseline (just before gargling), immediately before induction, immediately after intubation (minute 0) and at 5, 10, 15, 30 minutes after intubation. SpO_2 and ECG were observed continuously throughout the procedure. The primary outcome was the change in heart rate and MAP after laryngoscopy/intubation. Secondary outcomes were the incidence and severity of POST. An observer blinded to group allocation measured POST, cough and hoarseness. Patients assessed sore throat severity by a 10 cm visual analogue scale (VAS; 0 = no sore throat, 10 = worst imaginable) in the post anaesthesia care unit and at 2, 4, 8, 12 and 24 hours postextubation. Patients with a VAS score of 5 or higher were given 500 mg of oral paracetamol as rescue analgesia and the need for rescue was noted.

STATISTICAL ANALYSIS

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 25.0 (SPSS, IBM Corp., Armonk, NY, USA). Data was tested for normality (Shapiro-Wilk test). Continuous variables are presented as mean±SD, and compared between the groups with One-way ANOVA. Categorical variables are presented as numbers (percentages) and are compared with the Chi-square test. Changes in haemodynamic variables and VAS scores over time were assessed over time using a Repeated Measures ANOVA in each of these groups. All tests were two-tailed and p-value <0.05 was considered statistically significant.

RESULTS

The three groups were similar in age, weight, duration of surgery, ETT size, sex distribution, ASA status, and the number of laryngoscopy attempts, showing sufficient baseline homogeneity (p-value >0.05 for all) [Table/Fig-2].

A significant intergroup difference in heart rate was observed immediately after intubation and at five minutes, with the lowest increase seen in the dexmedetomidine group (p-value=0.001), while values became comparable after 15 minutes. Similarly, MAP showed significantly lower values in the dexmedetomidine group at 0, 5, and 10 minutes (p-value <0.05), with no significant differences thereafter [Table/Fig-3].

Variables	Dex+Lido (n=60)	$MgSO_4$+Lido (n=60)	Plain Lido (n=60)	p-value
Age (years)	39.63±11.86	41.62±9.95	42.18±10.58	0.401
Weight (kg)	69.00±9.53	67.00±12.18	71.61±10.92	0.071
Surgery duration (mins)	76.60±17.95	77.72±17.59	74.78±20.32	0.686
ETT size (mm)	7.48±0.36	7.42±0.37	7.56±0.36	0.102
Sex, n (%)				
Male	35 (58.3)	28 (46.7)	31 (51.7)	0.439
Female	25 (41.7)	32 (53.3)	29 (48.3)	
ASA, n (%)				
I	41 (68.3)	36 (60.0)	36 (60.0)	0.552
II	19 (31.7)	24 (40.0)	24 (40.0)	
Laryngoscopy attempts, n (%)				
1	44 (73.3)	51 (85.0)	50 (83.3)	0.316
2	11 (18.3)	7 (11.7)	9 (15.0)	
3	5 (8.3)	2 (3.3)	1 (1.7)	

[Table/Fig-2]: Baseline demographic and clinical characteristics.
Continuous variables compared using One-way ANOVA and Categorical variables compared using Chi-square test

Time point	Dex + Lido (n=60)	$MgSO_4$ + Lido (n=60)	Plain Lido (n=60)	p-value
Heart Rate (HR) (bpm)				
Baseline	83.35±9.06	83.22±10.56	83.68±9.73	0.965
Post intubation at 0 min	85.82±9.45	89.42±11.51	93.82±10.19	0.001*
5 mins	85.67±9.04	88.20±10.72	92.83±10.56	0.001*
10 mins	85.43±9.21	87.53±11.62	90.52±9.81	0.026
15 mins	84.58±9.41	87.13±11.26	88.72±10.71	0.096
30 mins	84.05±9.60	84.70±10.74	86.13±10.20	0.520
Mean Arterial Pressure (MAP) (mmHg)				
Baseline	94.38±6.50	94.47±6.97	93.55±7.44	0.729
Post intubation at 0 min	97.18±7.21	100.30±7.90	102.45±9.14	0.002*
5 mins	96.82±6.89	98.38±7.58	100.78±7.27	0.012*
10 mins	96.45±6.88	98.73±7.68	99.92±8.57	0.047
15 mins	96.57±7.32	96.65±7.92	98.88±9.31	0.219
30 mins	94.72±6.94	94.90±7.86	95.38±8.27	0.887

[Table/Fig-3]: Haemodynamic response to laryngoscopy and intubation.
Values are expressed as Mean±SD. Between-group comparisons at each timepoint performed using One-way ANOVA

Postoperative haemodynamic variables, including HR, SBP, DBP, MAP, RR, and $EtCO_2$, were comparable among the three groups at all-time points assessed (2 to 24 hours), with no statistically significant differences (p-value >0.05). This indicates stable profiles after surgery [Table/Fig-4].

The VAS scores were consistently lower in the dexmedetomidine group at each time point from 0 to 24 hours compared to the other groups (p-value <0.001). The occurrence of clinically significant POST and the need for rescue analgesics were also significantly less in the dexmedetomidine group compared to those receiving magnesium sulphate and plain lidocaine (p-value <0.001) [Table/Fig-5].

The Ramsay sedation score and the time to reach an Aldrete score greater than eight were significantly higher in the dexmedetomidine group (p-value=0.001), indicating deeper sedation and a longer recovery period. However, the frequency of adverse events such as bradycardia, hypotension, and nausea/vomiting was similar across all groups (p-value >0.05) [Table/Fig-6].

DISCUSSION

In this randomised study, preinduction gargling with dexmedetomidine-lidocaine produced the greatest reduction in the haemodynamic response during laryngoscopy and intubation when compared to magnesium-lidocaine and lidocaine alone. The increase in heart rate

Time point	Parameter	Dex + Lido (n=60)	$MgSO_4$ + Lido (n=60)	Plain Lido (n=60)	p-value
2 hours	HR (beats/min)	83.47±8.45	84.65±9.41	84.17±9.17	0.728
	SBP (mmHg)	123.10±9.18	123.42±9.12	123.89±10.03	0.846
	DBP (mmHg)	80.45±9.25	81.87±9.37	82.18±9.91	0.759
	MAP (mmHg)	94.18±7.96	94.55±8.14	94.92±8.67	0.812
	RR (breaths/min)	13.81±2.35	14.23±2.49	14.45±2.89	0.670
	$EtCO_2$ (mmHg)	35.01±1.93	35.21±2.10	35.34±2.56	0.735
4 hours	HR (beats/min)	82.87±9.45	83.45±10.41	84.17±10.17	0.732
	SBP (mmHg)	122.80 ±10.18	122.92 ±11.12	123.68 ±11.63	0.841
	DBP (mmHg)	79.12±8.45	79.00±9.07	80.18±10.01	0.765
	MAP (mmHg)	93.68±7.96	93.95±7.73	94.12±8.08	0.803
	RR (breaths/min)	13.93±2.15	14.45±2.70	14.67±2.88	0.654
	$EtCO_2$ (mmHg)	35.08±2.12	35.33±2.80	35.41±3.02	0.721
6 hours	HR (beats/min)	83.07±10.35	83.05±11.93	83.37±11.67	0.985
	SBP (mmHg)	121.90 ±11.58	120.52 ±13.62	120.88 ±11.83	0.818
	DBP (mmHg)	78.72±9.55	78.00±10.07	77.98±9.67	0.896
	MAP (mmHg)	93.18±6.96	92.15±8.73	92.32±7.88	0.744
	RR (breaths/min)	14.23±2.25	14.88±2.60	14.77±2.28	0.284
	$EtCO_2$ (mmHg)	35.28±2.92	35.62±3.00	35.47±3.14	0.833
12 hours	HR (beats/min)	83.30±9.37	83.85±11.22	83.63±10.29	0.958
	SBP (mmHg)	122.20±14.09	121.63±12.44	121.17±13.12	0.912
	DBP (mmHg)	78.52±8.95	78.10±10.59	78.82±10.59	0.926
	MAP (mmHg)	93.02±7.80	92.58±8.48	92.90±8.77	0.958
	RR (breaths/min)	14.47±2.39	14.57±2.41	14.28±2.63	0.818
	$EtCO_2$ (mmHg)	35.62±3.00	35.60±2.96	35.43±3.04	0.934
24 hours	HR (beats/min)	83.40±9.55	83.15±10.51	83.80±9.98	0.938
	SBP (mmHg)	122.22±14.24	121.10±13.09	121.13±12.68	0.873
	DBP (mmHg)	78.40±9.08	78.35±9.26	78.03±10.16	0.974
	MAP (mmHg)	93.00±7.90	92.60±8.11	92.38±8.80	0.918
	RR (breaths/min)	14.37±2.25	14.30±2.61	14.85±2.62	0.423
	$EtCO_2$ (mmHg)	35.10±3.23	35.58±3.09	35.55±3.08	0.642

[Table/Fig-4]: Postoperative haemodynamic parameters.
Values are expressed as Mean±SD. Between-group comparisons at each timepoint performed using One-way ANOVA.

Variable	Dex + Lido (n=60)	$MgSO_4$ + Lido (n=60)	Plain Lido (n=60)	p-value
VAS at 0 hour	0.94±0.40	1.26±0.40	1.91±0.42	<0.001*
VAS at 30 mins	1.00±0.42	1.32±0.46	1.95±0.47	<0.001*
VAS at 1 hours	1.17±0.45	1.44±0.47	2.18±0.50	<0.001*
VAS at 2 hours	1.36±0.56	2.07±0.56	2.87±0.55	<0.001*
VAS at 4 hours	1.78±0.63	2.24±0.59	3.26±0.60	<0.001*
VAS at 6 hours	2.04±0.76	2.87±0.61	3.88±0.62	<0.001*
VAS at 8 hours	2.17±0.78	3.01±0.58	4.16±0.69	<0.001*
VAS at 12 hours	2.35±0.79	3.29±0.61	4.62±0.72	<0.001*
VAS at 24 hours	2.50±0.78	3.41±0.69	4.50±0.81	<0.001*
Clinically significant POST (n, %)	25 (41.6)	40 (66.6)	55 (91.7)	<0.001*
Rescue analgesic requirement (n, %)	5 (8.3)	12 (20.0)	16 (26.7)	<0.001*

[Table/Fig-5]: Incidence and severity of Postoperative Sore Throat (POST).
Values are expressed as Mean±SD. Between-group comparisons at each timepoint performed using One-way ANOVA

and blood pressure were significantly lower in the dexmedetomidine group, showing better sympatholysis. This matches the known action of dexmedetomidine as a selective α2-adrenergic agonist that lowers central sympathetic outflow and catecholamine release. Similar results were noted by Oriby ME et al., who found reduced heart rate responses with intravenous dexmedetomidine compared

Variable	Dex + Lido (n=60)	$MgSO_4$ + Lido (n=60)	Plain Lido (n=60)	p-value
Ramsay Sedation Score (Recovery)	2.87±0.47	2.42±0.53	2.13±0.68	0.001*
Time to Aldrete >8 (mins)	12.47±2.76	11.87±3.07	9.27±2.82	0.001*
Bradycardia (n, %)	4 (6.7)	2 (3.3)	0	0.126
Hypotension (n, %)	5 (8.3)	4 (6.7)	2 (3.3)	0.508
Nausea/Vomiting (n, %)	2 (3.3)	3 (5.0)	6 (10.0)	0.284

[Table/Fig-6]: Recovery profile and adverse events.
Continuous variables compared using One-way ANOVA and Categorical variables compared using Chi-square test

to fentanyl-midazolam during laryngoscopy [16]. Additionally, Misra S et al., also reported that nebulised dexmedetomidine effectively reduced the pressor response [17]. The stable MAP observed in our study also aligns with Misra S et al., findings that suggested dexmedetomidine dampens the rise in MAP without causing significant hypotension [17]. Therefore, the combined sedative, pain-relieving, and sympatholytic effects of dexmedetomidine likely explain the improved haemodynamic stability observed.

The magnesium-lidocaine group showed a moderate reduction in the haemodynamic response. While there was a decrease in tachycardia and hypertension compared to the control group, the effect was less significant than with dexmedetomidine. Magnesium works mainly by blocking NMDA receptors and calcium channels, thus decreasing catecholamine release and lowering vascular tone. Our results are similar to those of Nooraei N et al., who found better blood pressure control with intravenous magnesium compared to lidocaine during intubation, although dexmedetomidine was still superior in providing sympatholysis [5]. These findings suggest that magnesium can help reduce stress responses, but its effectiveness is limited in comparable clinical situations.

The lidocaine-only group had the least reduction in the pressor response, with greater increase in heart rate and blood pressure after intubation. While topical lidocaine can numb the airway by providing mucosal anaesthesia, it was not enough to suppress the sympathetic response in the present study group. Previous studies have shown that lidocaine spray or gargle leads to only minor reductions in haemodynamic parameters [17,18]. In some cases, lidocaine spray was no better than placebo, highlighting the need for more effective anaesthetic techniques. Furthermore, the meta-analysis by Li H et al., showed that while intravenous and intracuff lidocaine reduce postoperative throat pain, topical methods like gel or spray offer little benefit [18]. The short action and shallow effectiveness of topical lidocaine likely account for the continued sympathetic responses in the control group.

For POST, the incidence and severity were lowest in the dexmedetomidine-lidocaine group at all measured time points, followed by the magnesium and lidocaine groups. This finding underscores the dual advantage of dexmedetomidine in lowering both haemodynamic stress and postoperative pain. Comparable results were noted by Abedzadeh E et al., who found lower POST scores with dexmedetomidine-lidocaine gargles compared to magnesium and ondansetron gargles [13]. The mechanism might involve the combined effects of lidocaine's local anaesthesia and dexmedetomidine's ability to reduce pain and inflammation [8]. Chen Z et al., and Puyo CA et al., also found that dexmedetomidine reduces inflammatory markers and changes pain response after airway procedures [19,20]. On the other hand, magnesium showed limited effectiveness in decreasing POST, likely due to its weaker topical analgesic effect. Lidocaine alone was the least effective, possibly because of inconsistent coverage and dilution by secretions, as noted by Li H et al., [18].

In the present study, the incidence of POST was 41.6% in the dexmedetomidine group, 66.6% in the magnesium group, and 91.7% in the lidocaine group at 12 hours. The figures presented are at the upper end of the spectrum when compared to the

incidence reported by Mazzota E et al., which ranges from 30% to 60% following endotracheal intubation [10]. Despite this, the dexmedetomidine group showed a clinically meaningful reduction in severity, with mostly mild symptoms. This trend was consistent with earlier study by Abedzadeh E et al., suggesting that agents like dexmedetomidine and ketamine are more effective than lidocaine in reducing POST [13]. While POST cannot be completely avoided, dexmedetomidine significantly enhances patient comfort.

Patients in the dexmedetomidine group had higher sedation scores and took slightly longer to become discharge-ready (Aldrete score ≥8), due to its known sedative properties. However, this delay was small and clinically acceptable. Mahajan L et al., also suggested that mild sedation (Ramsay score of 3) might even be beneficial right after surgery, as long as proper monitoring is done [14]. Notably, there were no significant increases in adverse events like bradycardia, hypotension, or nausea/vomiting among the groups, which indicates the safety of the treatment. These results suggest that dexmedetomidine-lidocaine gargle is a safe and effective pre-induction method, although caution should be taken in patients with cardiovascular issues due to the effects of α2-agonists.

Limitation(s)

This investigation was done as a single centre trial and larger multicentre studies would be required to generalise these results. Furthermore, serum concentrations of dexmedetomidine or magnesium were not determined, so it was not possible to determine the extent of systemic absorption from gargling. The period of follow-up was only 24 hours, thus, longer term assessments beyond the immediate postoperative period were not assessed.

CONCLUSION(S)

Dexmedetomidine-lidocaine gargle is more effective than magnesium-lidocaine and plain lidocaine in reducing intubation-related haemodynamic stress and POST. The present study also showed that the addition of dexmedetomidine to a topical anaesthetic represents a practical means of improving intraoperative stability as well as patient comfort. The interventions used are simple and cost-effective and therefore appropriate for routine elective surgery, especially in environments of limited resources. Future studies could build on this research by looking at other patient populations and examining how to use the treatment in the most beneficial ways, in terms of optimal doses or timing.

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