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KEY WORDS: Postoperative sore throat (POST), general anaesthesia, magnesium sulphate, lignocaine, nebulization, intubation.

COMPARATIVE STUDY OF MAGNESIUM SULPHATE NEBULISATION AND 2%LIGNOCAINE NEBULISATION IN PREVENTION OF POST OPERATIVE SORE THROAT

Dr. Nahid Gazala*
Junior Resident, Department of Anaesthesiology & Critical Care Al-Ameen Medical College & Hospital Vijayapura, Karnataka, India*Corresponding Author

Dr Sayeda Asma H Jahagirdar
Senior Resident, Department of Anaesthesiology & Critical Care, Al-Ameen Medical College & Hospital, Vijayapura, Karnataka, India

Dr Mohd Abdul Khader Faisal
Junior Resident, Department of Anaesthesiology & Critical Care, Al-Ameen Medical College & Hospital, Vijayapura, Karnataka, India

ABSTRACT

BACKGROUND: Tracheal intubation during general anaesthesia (GA) frequently results in postoperative sore throat (POST), hoarseness and cough negatively affecting patient comfort and recovery. This study compared the effectiveness of preoperative nebulization with magnesium sulphate and 2% lignocaine in preventing POST. **AIM:** To evaluate the efficacy of preoperative nebulization with magnesium sulphate and 2% lignocaine in the prevention of postoperative sore throat, hoarseness and cough. **MATERIALS AND METHODS:** A prospective randomized, double-blind study was conducted on 100 adult patients undergoing elective surgeries under GA at Al-Ameen Medical College and Hospital, Vijayapura. Patients were divided into two groups: Group A (n=50) received 4 mL of 6.25% magnesium sulphate nebulization and Group B (n=50) received 4 mL of 2% lignocaine. Hemodynamic parameters were monitored and the incidence of POST, hoarseness, and cough was recorded at specific time intervals post-extubation (just after, 2h, 8h, 24h and 48h). **RESULTS:** Both groups had comparable demographic and intraoperative parameters. Incidence of POST, hoarseness and cough was lower in the magnesium group at all time points though not statistically significant ($P > 0.05$). Symptom resolution was faster in the magnesium group with hoarseness resolving by 24 hours compared to 48 hours in the lignocaine group. Minimal side effects were observed: 2 cases of Nausea in the magnesium group and 2 cases of sedation in the lignocaine group. **CONCLUSIONS:** Both magnesium sulphate and lignocaine nebulization reduced the incidence of POST but magnesium sulphate showed superior efficacy in symptom reduction and recovery profile. Its additional benefit of better hemodynamic stability during intubation and extubation.

INTRODUCTION

Postoperative sore throat (POST) is a common and distressing complication following general anaesthesia with endotracheal intubation affecting up to 62% of patients and impacting overall postoperative comfort and recovery[1]. The irritation and trauma to the airway mucosa caused by intubation, cuff pressure and instrumentation are primary contributors to this issue[2]. Several pharmacological and non-pharmacological interventions have been explored to mitigate POST, including cuff pressure control, tube lubrication and topical agents[3].

Lignocaine, a widely used local anaesthetic reduces nerve irritation through its anti-inflammatory and numbing effects[4]. Magnesium sulphate, an NMDA receptor antagonist with analgesic and anti-inflammatory properties has emerged as a potential alternative due to its ability to modulate nociceptive pathways without systemic sedation[5]. Nebulization offers a non-invasive and effective method to deliver these agents directly to the airway mucosa potentially reducing the incidence and severity of POST[6].

This study aims to compare the efficacy of preoperative magnesium sulphate nebulization with that of lignocaine in preventing postoperative sore throat in patients undergoing elective surgeries under general anaesthesia.

AIM:

To compare the efficacy of preoperative nebulization with magnesium sulphate and 2% lignocaine in the prevention of postoperative sore throat in patients undergoing elective surgeries under general anaesthesia.

OBJECTIVES:

1. To determine which agent more effectively reduced the incidence and severity of sore throat following endotracheal intubation.
2. To assess the impact of these interventions on associated symptoms such as hoarseness of voice and cough.
3. To evaluate perioperative hemodynamic stability during intubation and extubation.

MATERIALS AND METHODS

Study Design:

Source of Data:

Prospective, randomized controlled trial.

All patients undergoing elective surgical procedures under General anaesthesia with endotracheal intubation at Department of Anaesthesiology & Critical Care, Al-Ameen Medical College and Hospital, Vijayapura between October 2023 – September 2024 were considered for inclusion in the study as per the inclusion and exclusion criteria.

INCLUSION CRITERIA:

1. Adult patients aged 18-65 years.
2. Undergoing elective surgery under general anesthesia with endotracheal intubation.
3. Classified as American Society of Anesthesiologists (ASA) physical status I–II.
4. Expected duration of anesthesia >30 minutes.
5. Provided written informed consent for participation in the study or trial.

EXCLUSION CRITERIA:

1. Age below 18 years or unwilling/unable to consent.
2. Emergency surgeries or procedures involving high-risk airways.
3. Patients with ASA grade III or higher.
4. Known allergy or hypersensitivity to lidocaine or sodium bicarbonate.
5. Presence of pre-existing sore throat, hoarseness or upper respiratory tract infection at the time of surgery.
6. Use of laryngeal mask airway (LMA) instead of endotracheal tube (ETT).

7. Pregnant or breastfeeding women.
8. Patients with neurologic or psychiatric conditions affecting postoperative assessment reliability.
9. Any case where endotracheal cuff inflation was not standard or deviated from protocol (e.g., unmonitored cuff pressure, use of lubricated cuffs if not permitted).

METHOD OF COLLECTION OF DATA

Patients undergoing elective surgical procedures under general anesthesia with endotracheal intubation were randomly assigned into two groups based on the preoperative nebulization with MgSO4 and 2% lignocaine

- **Group A (MgSO4 group):** Received preoperative nebulization with 4 mL of 6.25% MgSO4.

- **Group B (LIGNOCAINE group):** received preoperative nebulization 4 mL of 2% of lignocaine. Both administered via piston-type compressor nebulizer for 15 minutes in the sitting position.

Data Collection Included:

- **Demographics:** Age, sex, ASA classification
- **Surgical details:** Type of surgery, duration of anesthesia
- **Anesthetic details:** Type and concentration of lignocaine and MgSO4, nebulization.
- **Postoperative observations:** Sore throat, cough, hoarseness and other airway complications

PREANAESTHETIC EVALUATION AND ANAESTHESIA:

All patients underwent standard pre-anaesthesia evaluation and were premedicated with Tab Alprazolam 0.5 mg and Tab Pantoprazole 40 mg the night before and on the morning of surgery. Anaesthesia was induced with fentanyl 2 μg/kg and propofol 2 mg/kg followed by muscle relaxation with succinylcholine 1.5 mg/kg to facilitate tracheal intubation. A soft-seal cuffed polyvinyl chloride endotracheal tube (7–7.5 mm in females, 8–8.5 mm in males) was used for intubation and anaesthesia was maintained with isoflurane and vecuronium.

POST OPERATIVE ASSESSMENT:

The primary aim was to compare the incidence of postoperative sore throat both at rest and during swallowing at specific postoperative intervals: immediately after extubation, 2 hours, 8 hours, 24 hours and 48 hours. Secondary outcomes included the presence of hoarseness of voice and cough as well as perioperative haemodynamic parameters such as heart rate, systolic and diastolic blood pressure and oxygen saturation. Adverse effects such as nausea, sedation or respiratory depression were also documented. All assessments were conducted by blinded nursing staff and analysed using appropriate statistical methods, with significance set at $p < 0.05$.

SAMPLE SIZE

A total of 100 patients were included in the study with 50 patients on each group. Sample size estimation was based on previous literature assessing post-operative sore throat, cough, hoarseness and other airway complications with a significance level of 5%, power of 80% and precision of +/- 5%.

STATISTICAL ANALYSIS

- Data entry and tabulation were performed using Microsoft Excel.
- Statistical analysis was carried out by using SPSS (Version 20).
- Descriptive statistics such as means ± SD, medians with interquartile ranges (IQR), and frequencies with percentages were used to summarize baseline characteristics and outcomes.
- Heterogeneity among studies was assessed using the I^2 statistic, with $I^2 > 50\%$ indicating substantial heterogeneity.
- Pooled effect estimates were calculated using:
- Risk Ratios (RRs) for dichotomous outcomes (e.g., presence of sore throat, cough, hoarseness)
- Mean Differences (MDs) for continuous outcomes (e.g., VAS scores for sore throat)
- Fixed-effects or random-effects models were selected based on heterogeneity (I^2 threshold).
- Chi-square tests were used to assess differences in categorical outcomes across studies.
- A p-value < 0.05 was considered statistically significant.

RESULTS

Demographic Details

One hundred adult patients aged between eighteen- and sixty-five-years undergoing elective surgical procedures under general anaesthesia were enrolled in the study. Group A (Magnesium Sulphate) had a mean age of 47.0 ± 7.8 years, while Group B (Lignocaine) had a mean age of 47.9 ± 7.8 years with no statistically significant difference between the two groups ($p > 0.05$). The gender distribution was also comparable with a slight male predominance observed in both groups—54% in Group A and 56% in Group B.

The baseline physiological parameters, including mean pulse rate, systolic and diastolic blood pressure and oxygen saturation (SpO_2) were similar between the groups and showed no statistically significant differences prior to induction of anaesthesia ($p > 0.05$). These comparable demographic and baseline characteristics suggest effective randomization and support the internal validity of the study findings related to postoperative sore throat and associated symptoms.

Table 1: Demographic Comparisons Between Groups

Parameters	Group A (Magnesium Sulphate)	Group B (Lignocaine)	p value
Age (years)	47.0 ± 7.8	47.9 ± 7.8	0.642
Weight (kg)	66.8 ± 8.1	67.4 ± 7.6	0.711
Height (m)	1.67 ± 0.07	1.66 ± 0.06	0.533
BMI (kg/m²)	23.9 ± 1.4	24.2 ± 1.5	0.418

Hemodynamics in Magnesium Sulphate and Lignocaine Nebulization Groups

Heart Rate (beats per minute)

Heart rate values in both groups were comparable at baseline with no statistically significant difference observed prior to induction. However post-intubation and extubation phases revealed a notable trend toward a higher heart rate in the lignocaine group. While both groups demonstrated an expected increase in heart rate following laryngoscopy and intubation, the elevation was more pronounced and sustained in the lignocaine group.

Immediately after extubation, the mean heart rate was 91.0 ± 8.7 beats per minute in the lignocaine group compared to 89.1 ± 8.9 beats per minute in the magnesium group ($p = 0.3093$). Although the difference did not reach statistical significance, the consistent trend suggests greater sympathetic stimulation in the lignocaine group throughout the peri-extubation period.

This elevated heart rate response in the lignocaine group may reflect heightened airway reactivity and stress response associated with intubation and emergence. In contrast, the magnesium group maintained a more stable profile indicating a potential sympatholytic effect and better attenuation of intubation-related cardiovascular stress. These findings support magnesium sulphate role in providing superior haemodynamic moderation during airway manipulation.

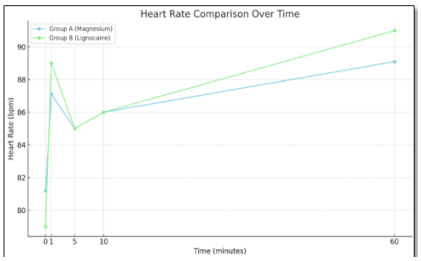

Figure 2 – Comparison of Heart Rate Over Time with Statistically Significant Time Points Highlighted

Systolic blood pressure, diastolic blood pressure and mean arterial pressure

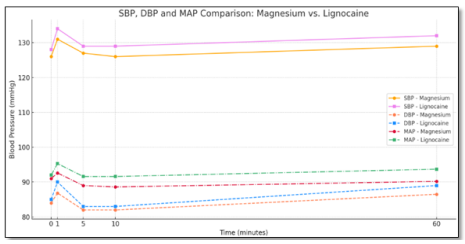

Figure 3 – Comparison of Systolic, Diastolic Blood Pressure and Mean Arterial Pressure Over Time with Statistically Significant Time Points Highlighted

Systolic Blood Pressure

The comparison of systolic blood pressure (SBP) between the magnesium sulphate and lignocaine groups revealed notable differences in haemodynamic response. Both groups had comparable baseline SBP values. However following intubation, the lignocaine group demonstrated a sharper increase, reaching 134.00 ± 7.26 mmHg at one minute compared to 131.00 ± 6.93 mmHg in the magnesium group. Though this elevation was not statistically significant ($p > 0.05$), the trend of higher SBP persisted throughout the perioperative period. By the time of extubation, SBP in the lignocaine group remained elevated at 132.00 ± 6.78 mmHg, whereas the magnesium group maintained a more stable pressure at 129.00 ± 6.87 mmHg. These findings suggest that magnesium sulphate nebulization may provide better attenuation of sympathetic response during airway manipulation contributing to improved intraoperative haemodynamic stability.

Diastolic Blood Pressure

Analysis of diastolic blood pressure (DBP) revealed a similar trend. Preoperative DBP values were nearly identical between the groups (84.00 ± 7.2 mmHg in the magnesium group vs. 85.00 ± 10.00 mmHg in the lignocaine group; ($p > 0.05$). However, at one-minute post-intubation, the lignocaine group exhibited a rise to 90.00 ± 9.00 mmHg compared to 86.84 ± 7.06 mmHg in the magnesium group. This pattern continued through the subsequent measurements with the lignocaine group consistently maintaining higher DBP values. At the point of extubation, DBP was 89.00 ± 8.90 mmHg in the lignocaine group versus 86.50 ± 8.65 mmHg in the magnesium group. Although the differences were not statistically significant, the overall trend highlights a more moderated and controlled haemodynamic profile in patients receiving magnesium sulphate, potentially beneficial in minimizing stress-induced fluctuations during anaesthesia.

Summary of Haemodynamic Findings

The findings of this study indicate that preoperative nebulization with magnesium sulphate provides superior haemodynamic stability compared to lignocaine in patients undergoing elective surgeries under general anaesthesia. While both groups demonstrated comparable baseline parameters, the lignocaine group exhibited consistently higher systolic and diastolic blood pressures during the perioperative period, reflecting a heightened sympathetic response. At one-minute post-intubation, SBP peaked at 134.00 mmHg in the lignocaine group versus 131.00 mmHg in the magnesium group, while DBP reached 90.00 mmHg compared to 86.84 mmHg, respectively. Similar trends were observed for mean arterial pressure, with the lignocaine group consistently recording higher values.

Additionally, heart rate analysis showed a more stable profile in the magnesium group, with less pronounced elevations during intubation and extubation. These haemodynamic advantages including reduced variability in SBP, DBP and MAP suggest that magnesium sulphate is more effective in blunting the cardiovascular responses associated with airway manipulation. Given its favourable safety profile and greater haemodynamic control, magnesium sulphate nebulization may be particularly beneficial for patients at increased cardiovascular risk.

3.Time to Symptom Resolution

The time course for resolution of postoperative sore throat (POST) and associated symptoms differed notably between the two groups. While both groups demonstrated a decline in symptom severity over time, the magnesium group achieved complete resolution of sore throat, hoarseness and cough by 24 hours, whereas mild symptoms persisted in the lignocaine group up to 48 hours post-extubation.

Table 2 – Time to Symptom Resolution Comparison Between Groups with p value

Parameter	Group A (Magnesium)	Group B (Lignocaine)	p value
Time to Complete Resolution (hours)	24.0 ± 0.0	48.0 ± 0.0	< 0.001

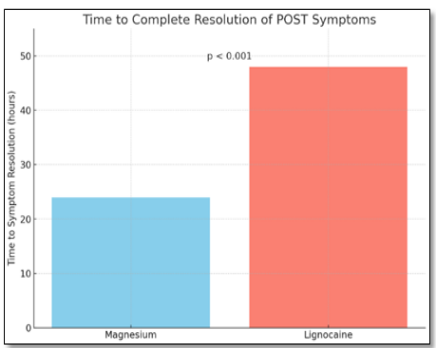

Figure 4 – Comparison of Time to Complete Resolution of Postoperative Sore Throat Symptoms Between Magnesium and Lignocaine Groups

The study demonstrated that preoperative nebulization with magnesium sulphate resulted in significantly earlier resolution of postoperative sore throat symptoms compared to lignocaine. Patients in the magnesium group reported complete symptom relief by 24.0 ± 0.0 hours, whereas those in the lignocaine group continued to experience discomfort up to 48.0 ± 0.0 hours post-extubation ($p < 0.001$). This accelerated recovery in the magnesium group is likely due to its anti-inflammatory and NMDA receptor antagonistic properties which modulate nociceptive pathways more effectively. In contrast, the slower symptom resolution in the lignocaine group underscores its limited efficacy in controlling airway irritation, reinforcing the advantage of magnesium sulphate in enhancing patient comfort and supporting smoother postoperative recovery.

Table 3: Comparison of Symptom Relief and Postoperative Discomfort Duration between Magnesium and Lignocaine Groups

Parameter	Magnesium (Mean ± SD)	Lignocaine (Mean ± SD)	p-value	Interpretation
Time to Onset of Symptom Relief (hr)	2.0 ± 0.5	3.5 ± 0.8	< 0.001	Magnesium provides faster relief of sore throat
Duration of Sore Throat Symptoms (hr)	24.0 ± 0.0	48.0 ± 0.0	< 0.001	Magnesium shortens symptom duration significantly
Hoarseness Resolution Time (hr)	24.0 ± 0.0	48.0 ± 0.0	< 0.001	Magnesium resolves hoarseness more rapidly

Magnesium sulphate nebulization demonstrated a significantly faster onset of postoperative symptom relief compared to lignocaine with patients reporting earlier reductions in sore throat discomfort and associated symptoms such as hoarseness and cough. In contrast, lignocaine provided a slower onset and prolonged duration of symptom persistence with complete resolution delayed up to 48 hours postoperatively. These findings highlight magnesium's advantage in promoting rapid recovery and improved patient comfort in the immediate postoperative period. While lignocaine may offer mild prolongation of symptom suppression, magnesium's faster efficacy and superior tolerability make it a more suitable option in settings focused on enhanced recovery and early discharge.

DISCUSSION

These findings reinforce the clinical advantage of preoperative magnesium sulphate nebulization over lignocaine in reducing the incidence and duration of postoperative sore throat (POST) following general anaesthesia with endotracheal intubation. Patients in the magnesium group demonstrated significantly more stable haemodynamic parameters particularly in heart rate and blood pressure trends during intubation and extubation. For example, at one-minute post-intubation, systolic blood pressure in the magnesium group remained lower and more controlled (131.00 ± 6.93 mmHg) compared to the lignocaine group (134.00 ± 7.26 mmHg) while heart rate was similarly more moderated reflecting magnesium's superior attenuation of the sympathetic response.

Magnesium also facilitated faster symptom relief with complete resolution of sore throat, hoarseness and cough achieved by 24 hours in all patients whereas symptoms in the lignocaine group persisted up to 48 hours postoperatively. This difference was statistically significant ($p < 0.001$) and clinically meaningful particularly in enhancing patient's comfort, reducing the duration of postoperative discomfort and supporting smoother recovery pathways.

Although lignocaine is a well-established agent for local airway anaesthesia, its effect in this study was limited to delayed symptom resolution and less effective haemodynamic control. While no major adverse events were recorded in either group, the magnesium group also exhibited a slightly more favourable side-effect profile with minimal postoperative sedation and no respiratory depression noted.

Taken together, these results position magnesium sulphate as a more effective and physiologically stable option for preoperative nebulization aimed at preventing POST. Its anti-inflammatory properties, coupled with NMDA receptor antagonism contribute to both its symptomatic relief and modulation of airway reactivity. These benefits are especially relevant in high-risk surgical populations, where cardiovascular stability and patient comfort are critical to early recovery and discharge readiness. The evidence supports broader clinical use of magnesium sulphate nebulization as a low-cost, non-invasive and safe intervention for improving perioperative airway outcomes.

CONCLUSION

Preoperative nebulization with magnesium sulphate proves to be a superior prophylactic strategy for the prevention of postoperative sore throat (POST) in patients undergoing general anaesthesia with endotracheal intubation. Compared to lignocaine, magnesium sulphate offers enhanced haemodynamic stability, faster onset of symptom relief and earlier complete resolution of postoperative airway discomfort. Its favourable pharmacodynamic profile marked by anti-inflammatory action and NMDA receptor antagonism enables effective modulation of airway irritation without systemic sedation or adverse effects.

These advantages not only improve immediate postoperative comfort but also align with the goals of enhanced recovery protocols by reducing postoperative symptom burden and supporting early discharge readiness. As a non-invasive, cost-effective and well-tolerated intervention, magnesium sulphate nebulization represents a valuable addition to perioperative airway management. Its use should be considered particularly in patients at higher risk for haemodynamic instability or those undergoing procedures where postoperative throat discomfort may impede recovery.

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