Section: Anesthesia

Original Research Article

COMPARISON OF INTRAVENOUS DEXAMETHASONE AND INTRAVENOUS MAGNESIUM SULPHATE IN PREVENTION OF POSTOPERATIVE SORE THROAT FOLLOWING ENDOTRACHEAL INTUBATION

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ABSTRACT

Background: Postoperative sore throat (POST) is a common complication after endotracheal intubation under general anaesthesia, impacting patient comfort and recovery. Effective pharmacologic interventions are needed to minimize this morbidity. **Objectives:** To compare the efficacy of intravenous dexamethasone and intravenous magnesium sulphate in preventing POST and associated symptoms.

Materials and Methods: This prospective, randomized study included 92 patients (aged 18–60 years, ASA I–II) undergoing elective surgery under general anaesthesia. Patients were divided into two equal groups receiving either IV dexamethasone or IV magnesium sulphate. POST, hoarseness, cough, hemodynamic parameters, and side effects were assessed at multiple postoperative intervals.

Results: Magnesium sulphate showed significantly better outcomes at 2, 4, and 8 hours ($p < 0.05$) for POST reduction. Both agents were hemodynamically stable and well tolerated.

Conclusion: Magnesium sulphate is more effective in early POST prevention, while both drugs remain safe and suitable for clinical use.

Keywords: Postoperative sore throat; dexamethasone; magnesium sulphate; endotracheal intubation; anaesthesia complications; randomized controlled trial.

INTRODUCTION

Postoperative sore throat (POST) is a frequent and distressing complication observed following endotracheal intubation, with an incidence ranging from 21% to 65%.[1] The etiology of POST is multifactorial, including mechanical trauma during laryngoscopy and intubation, irritation from the endotracheal tube, cuff pressure-induced ischemia, and dehydration of the mucosal lining[2,3]. While typically self-limiting, POST contributes significantly to postoperative discomfort, prolongs recovery, and adversely affects overall patient satisfaction.[2,3] Therefore, effective strategies for the prevention of POST are an important component of perioperative anaesthetic management.

Both pharmacological and non-pharmacological interventions have been explored to mitigate the incidence and severity of POST. Among pharmacological agents, intravenous dexamethasone and intravenous magnesium sulphate have shown promise due to their anti-inflammatory and analgesic properties. Magnesium sulphate, an N-methyl-D-aspartate (NMDA) receptor antagonist, modulates calcium influx and attenuates central sensitization, thereby reducing inflammation and nociceptive transmission[4]. Intravenous administration of magnesium has been investigated for its systemic anti-inflammatory effects and potential to reduce POST. Conversely, dexamethasone, a long-acting glucocorticoid, exerts potent anti-inflammatory effects by inhibiting

cytokine production and reducing tissue edema[5]. It has been widely used to prevent various postoperative complications including nausea, vomiting, and throat discomfort.

Although both agents have individually demonstrated efficacy in preventing POST, there is limited direct comparative evidence regarding their effectiveness when administered intravenously. This study aims to compare the effectiveness of intravenous dexamethasone and intravenous magnesium sulphate in the prevention of postoperative sore throat following endotracheal intubation under general anaesthesia.

MATERIALS AND METHODS

This prospective randomized, parallel armed, double blinded, Helminski protocol compliant clinical study was conducted after obtaining ethical clearance from ethical committee of the institute. Informed written consent was obtained from all the participants involved in the trial.

The study population consisted of 46 patients per group aged 18-60 years classified as ASA status I and II who were undergoing short duration(<2hrs) elective surgeries under general anaesthesia.

The study aimed compare efficacy of intravenous magnesium sulphate and dexamethasone in preventing postoperative sore throat following endotracheal intubation.

Patient willing to be part of the trial, known history of hypersensitivity to the study drugs, pregnant patients, significant systemic comorbidities, inability to comprehend the instructions , long duration surgeries, head, neck and thyroid surgery, anticipated difficult airway, patients requiring multiple attempts at intubation(>2 attempts), preoperative sore throat, URTI and prone position surgery were excluded from the trial.

Enrolment of patients concerned in may 2023 and extended till October 2024 covering a total duration of 18 months.

A detailed pre anaesthetic checkup was conducted a day prior to the elective surgery. All patients demographic profile (age, weight, height, BMI) were documented. During the preoperative visit to the patients were familiarised with postoperative sore throat(Grade0-No sore throat at any time since the operation, grade1- minimal- patient answered in the affirmative when asked about sore throat, grade2- moderate- patient complained complained of his/her own, Grade3- Severe- patient in obvious stress), postoperative cough assessment scale(grade0- No cough at any time since operation, Grade1- minimal, Grade2- Moderate, grade3- severe), postoperative hoarseness of voice scale(Grade0- no complaint of hoarseness at any time since operation, grade1- minimal- minimal change in quality of speech patient answered in the affirmity only when enquired, Grade2- moderate- moderate changes in quality of speech of which the patient complains of his/her own, grade3- severe- Gross change in quality of voice perceived by observer.

Preoperatively, all patients were given tablet alprazolam 0.25 mg the night before surgery and were kept nil by mouth as per fasting guidelines. Patients were randomly assigned to two groups using a computer-generated randomization list. Group 1 received intravenous dexamethasone (2 ml) with 3 ml of saline, and Group 2 received intravenous magnesium sulphate (2 ml) with 3 ml of saline.

In the preoperative area prior to intravenous administration of the study drugs, an 18G intravenous cannula was planned.

Intravenous in the operating room standard anaesthesia monitoring was attached which included ECG, Spo2, NIBP. Anaesthesia protocol was standardised for all patients.

Anaesthesia was induced with IV fentanyl (2 µg/kg) and IV propofol (2 mg/kg), followed by muscle relaxation with IV vecuronium (0.1 mg/kg). Endotracheal intubation was performed with a cuffed PVC tube, and anaesthesia was maintained with a 50:50 oxygen/airmixture and isoflurane.

Escalation in MAP or HR (>20% of baseline) was treated with aliquots of propofol(20mg), Injection esmolol10mcg aliquots were reserved as a rescue drug for rise in BP/HR not responding to propofol.

Cuff pressure monitoring was done at 30minutes interval to ensure cuff pressure was<30mmH2O at all given points intraoperatively. After the completion of surgical procedure residual neuromuscular blockade was reverse by administering IV neostigmine0.05mg/kg + Inj. Glycopyrolate 0.005mg/kg. Patient were extubated following a gentle oral suctioning to remove all secretions.

Haemodynamic parameters were monitored at baseline, intravenous, post-induction, post-intubation, and at various intervals throughout the surgery.

The primary outcome, postoperative sore throat severity, was assessed at 0, 2, 4, 6, 8, 12, and 24 hours post-extubation by a blinded observer.

Secondary outcomes included hemodynamic monitoring and documenting any side effects attributed to the study drugs during the perioperative period.

Statistical Analysis

Med Calculator statistical software was needed for data analysis. Continuous variables are presented as mean ± SD and median categorical scale is displayed as percentage and absolute values. Prior to statistical analysis, the normality of the data was verified. Mann-whitney u- test was employed for variables not normally distributed. whereas impaired t test was needed to compare continuous variable that were normally distributed. For categorical variance fischer exact or chisquare test were needed. For intragroup comparison, paired t test was needed. P-value less than 0.05 were used to depict a

significant difference for all statistical tests. The sample size was calculated based on a previous study by Rajanet al,[6] using G-power software. A total of 92 patients were enrolled with 46 patients in each group accounting for 10% dropout rate.

RESULTS

In our study, Table 1 shows no statistically significant difference in age, sex, or ASA grade distribution between the groups ($p > 0.05$). Most participants were aged between 20–40 years and predominantly female. ASA Grade II was more common overall, especially in Group 1. This homogeneity confirms appropriate baseline comparability across groups receiving IV dexamethasone and IV magnesium sulphate. [Table 1]

Figures 1 & 2 show that heart rate and mean arterial pressure trends were consistently recorded at multiple intraoperative intervals. While minor variations were observed, no significant hemodynamic instability was noted across the groups. The use of preoperative intravenous administration appeared hemodynamically safe. Both groups maintained stable vitals throughout the perioperative period.

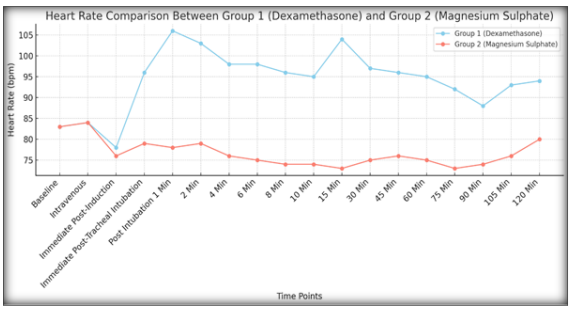

Figure 1: Heart Rate Comparison Between the Groups

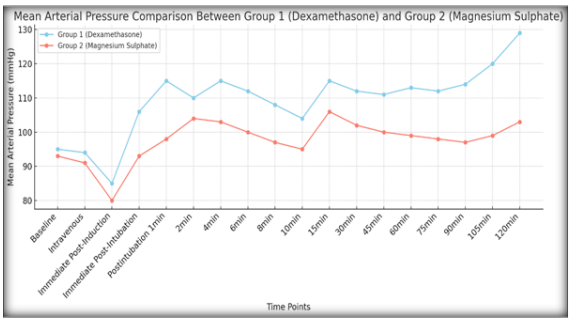

Figure 2: Mean Arterial Pressure Comparison Between the Groups

Table 1: Distribution of Demographic and ASA Grade Characteristics Across Study Groups

	Category	Group 1 (n=46)	Group 2 (n=46)	P-value
Age Group	20–40 years	32 (69.57%)	34 (73.91%)	0.784
	40–60 years	14 (30.43%)	12 (26.09%)	
Sex	Female	30 (65.22%)	25 (54.35%)	0.563
	Male	16 (34.78%)	21 (45.65%)	
ASA	Grade I	17 (36.96%)	23 (50.00%)	0.094
	Grade II	29 (63.04%)	23 (50.00%)	

Table 2 reveals that the mean BMI and duration of anaesthesia and surgery were comparable between the groups, with no statistically significant differences ($p > 0.05$). This uniformity suggests procedural and physical factors were equally distributed. The average surgery time remained around 92 minutes, minimizing time-related confounders. Thus, any outcome variations can be more confidently attributed to the IV interventions.

Table 2: Comparison of BMI, Duration of Anaesthesia, and Surgery Across Study Groups

Parameter	Group 1 (Mean ± SD)	Group 2 (Mean ± SD)	P-Value
BMI (kg/m²)	21.98 ± 2.05	22.01 ± 2.66	0.088
Duration of Anaesthesia (min)	104.89 ± 19.39	104.63 ± 19.03	0.941
Duration of Surgery (min)	92.61 ± 19.60	92.52 ± 19.43	0.994

Table 3 shows that the incidence of sore throat was significantly lower in Group 2 (IV Magnesium Sulphate) than Group 1 (IV Dexamethasone) at 2, 4, and 8 hours post-extubation ($p < 0.05$). This suggests magnesium sulphate was more effective in early postoperative periods. However, by 12 and 24 hours, differences were not significant. Thus, magnesium offered superior early symptom control.

Table 3: Postoperative Sore Throat Response (Group 1 vs Group 2)

Time	Response	Group 1 (Dexamethasone)	Percent	Group 2 (Magnesium Sulphate)	Percent	P-Value (Group 1 vs Group 2)
0 Hours	0	33	71.74%	35	76.09%	0.445
	1	10	21.74%	5	10.87%	
	2	3	6.52%	1	2.17%	
2 Hours	0	36	78.26%	43	93.48%	0.021*
	1	7	15.22%	3	6.52%	
	2	3	6.52%	0	0.00%	

4 Hours	0	38	82.61%	46	100.00%	0.042*
	1	7	15.22%	0	0.00%	
	2	1	2.17%	0	0.00%	
8 Hours	0	38	82.61%	45	97.83%	0.037*
	1	8	17.39%	1	2.17%	
12 Hours	0	41	89.13%	44	95.65%	0.332
	1	5	10.87%	2	4.35%	
24 Hours	0	39	84.78%	37	80.43%	0.747
	1	7	15.22%	4	8.70%	

Table 4 shows that postoperative hoarseness was minimally observed and limited to later hours, with no significant differences between Group 1 (IV Dexamethasone) and Group 2 (IV Magnesium Sulphate) at any time point ($p > 0.05$). The incidence was low and transient in both groups. These results suggest both agents are similarly effective in preventing voice changes. Hoarseness did not persist beyond 24 hours.

Table 4: Postoperative Hoarseness of Voice (Group 1 vs Group 2)

Time	Response	Group 1 (Dexamethasone)	Percent	Group 2 (Magnesium Sulphate)	Percent	P-Value (Group 1 vs Group 2)
0 Hours	0	0	0.00%	0	0.00%	-
2 Hours	0	0	0.00%	0	0.00%	-
4 Hours	0	0	0.00%	0	0.00%	-
8 Hours	0	2	4.35%	0	0.00%	0.157
12 Hours	0	2	4.35%	0	0.00%	0.157
24 Hours	0	1	2.17%	0	0.00%	0.398

Table 5 indicates that postoperative cough incidence was low and not significantly different between Group 1 (IV Dexamethasone) and Group 2 (IV Magnesium Sulphate) at any observed time point ($p > 0.05$). Both groups demonstrated mild to moderate symptoms that resolved spontaneously. The findings indicate that neither dexamethasone nor magnesium sulphate led to a higher cough frequency. IV administration was well tolerated.

Table 5: Postoperative Cough Assessment (Group 1 vs Group 2)

Time	Response	Group 1 (Dexamethasone)	Percent	Group 2 (Magnesium Sulphate)	Percent	P-Value (Group 1 vs Group 2)
0 Hours	0	5	10.87%	3	6.52%	0.445
2 Hours	0	5	10.87%	3	6.52%	0.450
4 Hours	0	1	2.17%	0	0.00%	0.764
8 Hours	0	2	4.35%	1	2.17%	0.609
12 Hours	0	1	2.17%	0	0.00%	0.171
24 Hours	0	1	2.17%	0	0.00%	0.155

Table 6 shows that side effects such as sore throat, hoarseness, and cough were reported between the groups with mild to moderate severity, but differences were not statistically significant ($p > 0.05$). Group 1 (IV Dexamethasone) showed a slightly higher rate of "no symptoms" across all parameters. Overall, both IV agents were well tolerated. No serious adverse effects were recorded.

Table 6: Side Effects Among Study Groups

Side Effect	Severity	Group 1(Dexamethasone) *n (%)*	Group 2 (Magnesium Sulphate) *n (%)*	P-Value
Sore Throat	None	28 (60.87%)	24 (52.17%)	0.318
	Mild	12 (26.09%)	14 (30.43%)	
	Moderate	5 (10.87%)	6 (13.04%)	
	Severe	1 (2.17%)	2 (4.35%)	
Hoarseness of Voice	None	30 (65.22%)	27 (58.70%)	0.442
	Mild	10 (21.74%)	12 (26.09%)	
	Moderate	5 (10.87%)	6 (13.04%)	
	Severe	1 (2.17%)	1 (2.17%)	
Cough	None	31 (67.39%)	29 (63.04%)	0.536
	Mild	10 (21.74%)	11 (23.91%)	
	Moderate	4 (8.70%)	5 (10.87%)	
	Severe	1 (2.17%)	1 (2.17%)	

DISCUSSION

In this study, the distribution of age, sex, and ASA physical status was well balanced between the two groups, with no statistically significant differences ($p > 0.05$). Most patients were between 20 and 40 years of age, with a predominance of female participants, and ASA Grade II was slightly more common, particularly in the dexamethasone group. This even distribution indicates that randomization was effective and that the baseline characteristics of the groups were comparable. This is crucial in clinical research, as it ensures that any differences in outcomes can be attributed to the interventions rather than to pre-existing disparities. A similar pattern was observed in the study by Sheikh et al,[7] where both groups showed no significant demographic or ASA differences. Bagchi et al,[8] also reported a well-matched cohort in their randomized trial on dexamethasone, lending support to the reliability of our group selection. However, Sane et al.9 included a predominantly male population and a broader age range, which may influence mucosal sensitivity and the incidence of sore throat differently. Park et al,[10] included a slightly older and more balanced male-to-female cohort, suggesting some demographic variation that could affect generalizability but not the internal validity of our findings.

In terms of body mass index and operative characteristics, both groups were comparable. The mean BMI values were almost identical (21.98 ± 2.05 kg/m² and 22.01 ± 2.66 kg/m²), and the average duration of anaesthesia and surgery was approximately 104 and 92 minutes, respectively, with no significant difference ($p > 0.05$). These findings confirm that both groups underwent similar procedures under comparable conditions, eliminating procedural variation as a confounding factor. Sheikh et al,[7] also found similar BMI and operative durations across groups, supporting the standardization of conditions seen in our study. Bagchi et al,[8] demonstrated the same procedural consistency, emphasizing its importance in evaluating treatment outcomes. In contrast, Park et al,[10] reported longer operative durations averaging over 130 minutes, which might increase airway irritation and POST risk. Similarly, Sane et al,[9] recorded broader variations in anaesthesia time, possibly impacting their results differently. Our uniform timings reduce such influences and allow a cleaner assessment of the drug effects.

Throughout surgery, both groups maintained stable heart rate and mean arterial pressure, with no episodes of hemodynamic instability. This suggests that both intravenous dexamethasone and magnesium sulphate are well-tolerated and safe for perioperative use. These observations are consistent with previous reports by Sheikh et al,[7] and Park et al,[10] who noted similar cardiovascular stability during surgeries involving the same agents. Bagchi et al,[8] also observed hemodynamic stability with dexamethasone, further confirming its safety. Sane et al,[9] did report minor reductions in mean arterial pressure in the magnesium group, but these were not statistically significant and did not require intervention—similar to the minor variations seen in our data.

A statistically significant reduction in the incidence of postoperative sore throat (POST) in the group receiving intravenous magnesium sulphate compared to the dexamethasone group during the early postoperative period was found, specifically at 2, 4, and 8 hours post-extubation ($p = 0.021$, 0.042, and 0.037, respectively). This trend supports the early anti-inflammatory and antinociceptive effects of magnesium sulphate, particularly in the initial hours following airway instrumentation. Similar results were observed by Sheikh et al,[7] who reported a lower incidence of sore throat at comparable postoperative intervals in the magnesium group versus the dexamethasone group, concluding magnesium to be more effective in immediate symptom control. Park et al,[10] also found magnesium sulphate to be non-inferior and even slightly better than dexamethasone in reducing early symptoms of POST, especially at 4 and 8 hours. Sane et al,[9] reported a reduction in POST incidence with magnesium, particularly within the first 6 hours, further supporting the current findings. In contrast, Bagchi et al,[8] who used only dexamethasone, reported significant reductions in sore throat incidence with the steroid alone but did not provide comparative data against magnesium, limiting direct contrast. By 12 and 24 hours post-extubation, the differences between the groups in our study were no longer statistically significant, indicating that magnesium's benefit is more pronounced in the immediate postoperative period, a finding also noted in Park et al,[10] and Sheikh et al.[7]

In evaluating postoperative hoarseness, both groups showed minimal and transient symptoms, with no statistically significant differences at any time point ($p > 0.05$). These findings mirror those of Sheikh et al,[7] and Park et al,[10] who also reported that neither magnesium sulphate nor dexamethasone significantly influenced hoarseness, likely because this symptom is less sensitive to anti-inflammatory intervention and more influenced by mechanical trauma or vocal cord contact. Bagchi et al,[8] similarly noted low incidences of voice change postoperatively, further supporting that dexamethasone does not significantly impact this outcome.

Postoperative cough incidence remained low and comparable between the two groups at all observed time points ($p > 0.05$), with symptoms resolving spontaneously in both cohorts. This parallels the outcomes reported by Sheikh et al,[7] who found no significant differences in cough between dexamethasone and magnesium groups. Park et al,[10] also observed minimal cough post-extubation

with both agents, reinforcing the conclusion that neither drug increases cough risk. Bagchi et al,[8] while focusing on dexamethasone, documented similar low incidences of postoperative cough, supporting the safety profile of IV dexamethasone in this regard.

The overall assessment of side effects, including sore throat, hoarseness, and cough, revealed no significant differences in severity between the groups ($p > 0.05$). Interestingly, Group 1 (IV dexamethasone) demonstrated a slightly higher proportion of patients reporting no symptoms across all categories, though this was not statistically significant. These findings are consistent with those of Sheikh et al,[7] who observed that both dexamethasone and magnesium sulphate were well tolerated with mild side effect profiles. Park et al,[10] and Bagchi et al,[8] similarly reported that dexamethasone was associated with low adverse event rates. The absence of severe complications or major side effects in either group affirms the safety and acceptability of both drugs for perioperative use. No study among those compared reported any serious adverse events, which aligns with the current findings and confirms the safety of intravenous administration for both agents.

CONCLUSION

We concluded that both intravenous dexamethasone and magnesium sulphate are effective, safe, and well-tolerated agents for reducing postoperative sore throat, hoarseness, and cough following endotracheal intubation under general anaesthesia. Magnesium sulphate demonstrated significantly superior efficacy in the early postoperative period, offering rapid symptom relief without compromising hemodynamic stability. Dexamethasone, however, may provide more sustained benefits over time. Given their low incidence of adverse effects, both agents are suitable for routine use, with magnesium sulphate emerging as the preferred option for early intervention.

Limitations

This study has a few limitations. First, the sample size, although calculated based on previous studies, may not fully account for variations in larger, more diverse populations. Secondly, the follow-up period was limited to 24 hours, meaning long-term effects and potential complications beyond this period were not evaluated. Lastly, while the study was randomized, the lack of blinding could have introduced bias in subjective outcome assessments like sore throat and hoarseness evaluation. These limitations should be considered when interpreting the results.

Strengths

The strengths of this study lie in its randomized, controlled design and the inclusion of well-matched groups, which ensures that the observed outcomes are primarily due to the treatments administered. The study also evaluated multiple postoperative outcomes, such as sore throat, hoarseness, and cardiovascular parameters, providing a comprehensive assessment of the effectiveness of Magnesium Sulphate and Dexamethasone. Additionally, the use of a clear, standardized protocol for anaesthesia and intubation further strengthens the reliability of the results.

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