

# Effect of magnesium sulfate nebulization on the incidence of postoperative sore throat

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## Abstract

**Background and Aims:** Postoperative sore throat (POST) is a well-recognized complication after general anesthesia (GA). Numerous nonpharmacological and pharmacological measures have been used for attenuating POST with variable success. The present study was conducted to compare the efficiency of preoperative nebulization of normal saline and magnesium sulfate in reducing the incidence of POST following GA.

**Material and Methods:** Following institutional ethical committee approval and written informed consent, a prospective randomized double-blinded study was conducted in 100 cases divided into two equal groups. Patients included in the study were of either gender belonging to American Society of Anesthesiologists (ASA) status 1 or 2 undergoing elective surgery of approximately 2 h or more duration requiring tracheal intubation. Patients in Group A were nebulized with 3 ml of normal saline and the patients in Group B were nebulized with 3 ml of 225 mg isotonic nebulized magnesium sulfate for 15 min, ending 5 min before the induction of anesthesia. The incidence of POST at rest and on swallowing and any undue complaints at 0, 2, 4, and 24 h in the postoperative period were evaluated.

**Results:** There was no significant difference in POST at rest, at 0<sup>th</sup>, 2<sup>nd</sup> and 4<sup>th</sup> h between normal saline and MgSO<sub>4</sub>. Significant difference was seen at 24<sup>th</sup> h, where MgSO<sub>4</sub> lessened POST. There is no significant difference in POST on swallowing at 0<sup>th</sup> and 2<sup>nd</sup> h between normal saline and MgSO<sub>4</sub>. Significant difference was seen at 4<sup>th</sup> h, where MgSO<sub>4</sub> lessened POST.

**Conclusion:** MgSO<sub>4</sub> significantly reduces the incidence of POST compared to normal saline.

**Key words:** Intratracheal intubation, magnesium sulfate, pharyngitis

## Introduction

Modern anesthesia is safe, versatile, and indispensable to the patient. Now-a-day, quality assurance of anesthesia is becoming increasingly important for improving postoperative outcome. Therefore, efforts are on to decrease the incidence and severity of other anesthesia-related complications such as postoperative nausea-vomiting and postoperative sore throat (POST), apart from the management of postoperative pain.

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Postoperative sore throat is a well-recognized complication that remains unresolved in patients undergoing tracheal intubation for general anesthesia (GA) with a reported incidence of 6.6-90%.<sup>[1]</sup> It also increases the duration of hospital stay, especially in day care surgeries.<sup>[2]</sup>

Numerous nonpharmacological and pharmacological measures have been used for attenuating POST with variable success. Among the nonpharmacological methods, smaller sized tracheal tubes, careful airway instrumentation, minimizing the number of laryngoscopy attempts, intubation after the full relaxation of the larynx, gentle oropharyngeal suctioning, filling the cuff with an anesthetic gas mixture,<sup>[3]</sup> minimizing intracuff pressures <20 mm Hg,<sup>[3]</sup> and extubation when the tracheal tube is fully deflated, have been reported to decrease the incidence of POST.

Pharmacological measures for attenuating POST are inhalation of beclomethasone and fluticasone, gargling with azulene sulfonate, aspirin, ketamine, benzydamine hydrochloride and licorice, local spray of benzydamine hydrochloride, and intracuff administration of alkalinized lignocaine.<sup>[4,5]</sup>

It is known that N-methyl-D-aspartate (NMDA) has a role in nociception and inflammation.<sup>[6,7]</sup> NMDA receptors are found in peripheral nerves and the central nervous system.<sup>[8,9]</sup> Magnesium is also an antagonist of the NMDA receptor ion channel.<sup>[10]</sup> We planned to study the efficacy of magnesium sulfate nebulization to reduce the incidence of POST. The drug is easily available and nebulization may be simple, cost-effective method to decrease POST symptoms.

## Material and Methods

Following institutional ethical committee approval and written informed consent, the prospective randomized double-blinded study was conducted in 100 cases. With the level of significance ( $\alpha$ ) = 0.05, and power of 80%, sample size required was 40 per group. To accommodate any exclusion, 50 patients from each group were selected.

Patients included in study were of either gender, aged between 18 and 60 years belonging to American Society of Anesthesiologist (ASA) 1 or 2 status undergoing elective surgery of approximately 2 h or more duration requiring tracheal intubation. Patients with neuromuscular disease, allergy or hypersensitivity of drugs, undergoing neck surgeries, and laparoscopic surgeries were excluded. Patients were allocated randomly to two groups, Group A and Group B. Simple randomization was done using SPSS software (IBM, SPSS Statistics 21).

All patients were kept fasting overnight and premedicated with oral alprazolam 0.5 mg and ranitidine 150 mg on night before surgery and on the morning of surgery.

Five minutes prior to the induction of anesthesia, patients in Group A were nebulized with 3 ml of normal saline and the patients in Group B were nebulized with 3 ml of 225 mg isotonic nebulized magnesium sulfate for 15 min. The solution for nebulization was administered by an anesthesiologist not associated with the management of the case. The anesthesiologist anesthetizing the case and those recording the scores were blinded to it.

In the operation theater, after connecting the patient to standard monitoring intravenous access was secured.

Anesthesia was induced with fentanyl 2 mcg/kg and thiopentone 5 mg/kg. Tracheal intubation was facilitated by atracurium 0.6 mg/kg, and the trachea intubated with soft seal cuffed sterile polyvinyl chloride tracheal tube (Portex Limited CT 21, 6JL, UK) of 7 mm inner diameter in female and 8 mm in male patients. The tracheal tube cuff was inflated with air.

The cuff pressure was checked just after intubation using handheld tracheal cuff pressure monitor (Portex Cuff Inflator/Pressure Gauge, SIMS Portex, Hythe, Kent, UK) and then every half hourly till end of surgery and maintained at 20 cm of H<sub>2</sub>O.

Ventilation was controlled, and no nasogastric tube was inserted. Anesthesia was maintained with 66% nitrous oxide in oxygen with 1% of isoflurane and intermittent doses of atracurium and fentanyl as required. The last dose of atracurium was given 20 min prior to extubation. At the end of surgery, the muscle relaxation was reversed with a combination of neostigmine 0.05 mg/kg and glycopyrrolate 0.01 mg/kg. The trachea was extubated after extubation criteria were met, and the patients were shifted to postanesthesia care unit.

Presence of sore throat was noted at rest and on swallowing immediately after extubation, and 2 h, 4 h, and 24 h postoperatively. In the postoperative ward, patients were also monitored for any drug-related side effects.

Data were expressed as mean, and 95% confidence interval of mean. Test of normality (Kolmogorov-Smirnov, Shapiro-Wilk) was done for continuous variables (height, weight, age). Categorical data (gender) were expressed as frequency of occurrence. Comparison of continuous data between groups was done using ANOVA of means. Comparisons of categorical data between groups were done using Pearson Chi-square, continuity correction, likelihood ratio, Fisher's exact test;  $P < 0.05$  was considered statistically significant. IBM SPSS-21 was used for statistical analysis.

## Results

The age, gender distribution and weight were comparable in the two groups [Table 1]. There was no significant difference in POST at rest at 0<sup>th</sup>, 2<sup>nd</sup>, and 4<sup>th</sup> h between normal saline and magnesium sulfate. Significant difference was seen at 24<sup>th</sup> h with Chi square test, where MgSO<sub>4</sub> lessened POST, but not with Fisher's Exact test [Table 2].

No significant difference in POST was observed "on swallowing" was observed between normal saline and magnesium sulfate at 0 and 2 h. Significant difference was seen at 4<sup>th</sup> and 24 h with both Chi square and Fisher's Exact tests, where MgSO<sub>4</sub> lessened POST [Table 3].

With respect to age, there was no significant difference in POST at swallowing between normal saline and magnesium sulfate. Exception to age category was 30-45 years; at 2<sup>nd</sup> h

**Table 1: Demographic data presented as either mean with 95% CI for mean or as numbers**

Variables	Normal saline	Magnesium sulfate	P
Age (years) (mean ± SD)	39.4±10.7	42.3±10.0	0.226
Gender (male/female)	27/23	26/24	0.5
Weight (kg) (mean ± CI)	59.22±2.492	60.06±2.73	0.075

CI = Confidence interval, SD = Standard deviation

**Table 2: Postoperative sore throat “at rest”**

Time (h)	Nebulized drug (n = 50)	POST (%)	Pearson Chi-square P value	Fisher’s exact test	Phi	RR when NS is used
0	NS	10 (20)	0.603	0.398	-0.052	1.25
	MgSO <sub>4</sub>	8 (16)				
2	NS	11 (22)	0.298	0.218	-0.104	1.571
	MgSO <sub>4</sub>	7 (14)				
4	NS	11 (22)	0.101	0.86	-0.164	2.2
	MgSO <sub>4</sub>	5 (10)				
24	NS	7 (14)	0.012	0.06	-0.274	
	MgSO <sub>4</sub>	0 (0)				

RR = Relative risk, NS = Normal saline

**Table 3: Postoperative sore throat “on swallowing”**

Time (h)	Nebulized drug (n = 50)	POST (%)	Pearson Chi-square P value	Fisher’s exact test	Phi	RR when NS is used
0	NS	10 (20)	1.000	0.598	0.000	1.000
	MgSO <sub>4</sub>	10 (20)				
2	NS	15 (30)	0.096	0.077	-0.166	1.875
	MgSO <sub>4</sub>	8 (16)				
4	NS	14 (28)	0.046	0.039	-0.200	2.333
	MgSO <sub>4</sub>	6 (12)				
24	NS	9 (18)	0.008	0.008	-0.267	9.000
	MgSO <sub>4</sub>	1 (2)				

RR = Relative risk, NS = Normal saline

and 4<sup>th</sup> h “on swallowing” are significant, where there was increased incidence of POST in patients nebulized with normal saline.

With respect to gender, there was no significant difference in POST “at rest” and “on swallowing” between normal saline and magnesium sulfate.

## Discussion

Incidence of POST after GA and tracheal intubation is reported to be 0-50%.<sup>[1]</sup> In spite of being a self-limiting entity, it is considered as one of the most common undesirable anesthesia-associated problems.<sup>[1]</sup> The contributing factors for POST include sex, age, gynecological surgery, use of succinylcholine, larger tracheal tubes, cuff design, and intracuff pressures.<sup>[2,3,11]</sup>

POST can be multifactorial in origin, including mechanical injury during laryngoscopy and intubation, continuous pressure by the inflated tracheal tube cuff on tracheal mucosa causing damage and dehydration of the mucosa. Not much literature is available about the use of nebulized magnesium sulfate for attenuation of POST.

Our results in the control group were consistent with previous findings. We avoided using lignocaine jelly, reducing the confounding factors, thereby reducing POST incidence. Kori *et al.*,<sup>[12]</sup> Maruyama *et al.*<sup>[13]</sup> found a higher incidence and severity of POST, where lignocaine 2% jelly has been used as a lubricant on the tracheal tube.

In our study, magnesium sulfate lessened the pain during swallowing at 4 h postsurgery compared to normal saline. The effectiveness of magnesium lozenges 30 min preoperatively was studied by Borazan *et al.*<sup>[14]</sup> who found it effective reducing both incidence and severity of POST in the immediate postoperative period. His results are also comparable to ours Borazan *et al.*<sup>[15]</sup> also showed the effectiveness of preoperative magnesium sulfate lozenge in reducing the incidence and severity of POST.

Gupta *et al.*<sup>[16]</sup> also assessed the efficiency of preoperative nebulization of magnesium sulfate and found that the incidence and severity of POST were reduced at rest and on swallowing at all-time points ( $P < 0.05$ ).

Sore throat related to orotracheal tube might be a consequence of localized trauma, leading to aseptic inflammation of the pharyngeal mucosa. Magnesium being an NMDA receptor antagonist, has a role in preventing NMDA receptor-mediated nociception and inflammation<sup>[17]</sup> and thereby POST. In a recently published study by Ahuja *et al.*,<sup>[18]</sup> a similar mechanism of action was proposed for preoperative nebulization of ketamine. Similar to Blitz *et al.*<sup>[19]</sup> who used nebulized magnesium sulfate for treatment of acute asthma, we too did not find any either local or systemic adverse outcomes. The drawback of our study was the absence of the measurements of serum magnesium levels making it difficult to rule out the contribution of systemic effects of magnesium. Moreover, comparing the doses used in the treatment of preeclampsia and eclampsia, the dose used in our study is very low and has been used in the form of nebulization, absorption for which has been shown to be variable and low (10%).<sup>[20]</sup>

## Conclusion

POST is common in the patients undergoing GA with an tracheal tube for routine surgical cases for up to 24 h. The relative risk for POST in normal saline nebulized group “on

swallowing” was 2.33 at 4<sup>th</sup> h and 9.0 at 24 h compared to MgSO<sub>4</sub> nebulization.

We conclude that magnesium sulfate significantly reduces the incidence of POST compared to normal saline.

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