A Study of Nebulized Magnesium Sulphate on the Incidence of Postoperative Sore throat

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Abstract

Background: Research trials have been conducted on various pharmacological and nonpharmacological measures for ameliorating POST with a varied success rate. Magnesium has antagonistic property towards NMDA receptors and hence it acts as anti-nociception and antiinflammatory agent and so when used as premedication before surgery the incidence of POST could be reduced. **Aim of Objective:** The main aim is to study the attenuating effect of Magnesium sulphate nebulization on the incidence of postoperative sore throat. **Materials and Methods:** This is a prospective, comparative and observational study conducted in the Department of Anaesthesia and Intensive care unit, NC Medical College and Hospital over 1 year. 90 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 N were nebulized with 3 ml of normal saline and the patients in Group M were nebulized with 3 ml of 225 mg isotonic nebulized magnesium sulfate for 15 min. The incidence of POST at rest and on swallowing at 0, 2, 4, 12, and 24 h in the postoperative period was evaluated. **Results:** There was no significant difference in POST at rest, at 0th, 2nd, and 4th h between normal saline and MgSO4. The significant difference was seen at 24th h, where MgSO4 lessened POST. There is no significant difference in POST on swallowing at 0th and 2nd h between normal saline and MgSO4. The significant difference was seen at 4th h, where MgSO4 lessened POST.

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Conclusion: POST is common in patients undergoing GA with a tracheal tube for routine surgical cases for up to 24 hr. We conclude that the use of magnesium sulfate in the form of nebulization as a pre-medication agent significantly reduces the incidence of POST compared to normal saline.

Keywords: Incidence, Post-operative sore throat, Magnesium sulphate, endotracheal intubation, pharyngitis, normal saline, nebulization.

Introduction

Modern anaesthesia is safe, versatile, and indispensable to patient. Quality assurance is becoming increasingly important in improving postoperative outcomes. Therefore, it is important to decrease incidence and severity of anaesthesia related complication. Postoperative sore throat is still a major complaint despite all efforts made over years in patients undergoing general anaesthesia with endotracheal intubation. Postoperative sore throat (POST) is a well-recognized complication that remains unresolved in patients undergoing endotracheal intubation for general anesthesia. After tracheal intubation, the incidence of sore throat varies from 6.6 - 90%, and after laryngeal mask insertion from 5.8% to 34%. [1] The wide variation in these figures is presumably due to different skills and techniques among anesthetists and to differences between patients in the definition of sore throat. Avoiding POST symptoms is a major priority for these patients because preventing postoperative complications contributes to patient satisfaction. POST has been rated by patients as the 8th most undesirable outcome in the postoperative period. [2] It increases the duration of hospital stay and delays discharge, especially in daycare surgeries. [3] Routine endotracheal intubation for elective surgical procedures and inadvertent trauma to the airway accounts for POST symptoms. Awareness of the potential factors that are responsible for the increased frequency of POST and appropriate precautions, especially during endotracheal intubation can help to reduce the incidence of POST. Numerous non-pharmacological and pharmacological measures have been used for attenuating POST. Among the non-pharmacological methods smaller sized endotracheal 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, minimizing intracuff pressures<20mm Hg and extubation when the endotracheal tube is fully deflated, have been reported to decrease the incidence of POST. [4]

Pharmacological measures for attenuating POST are inhalation of beclomethasone and fluticasone, gargling with azulene sulfonate, ketamine, a local spray of benzydamine hydrochloride, and Intra cuff administration of alkalinized lignocaine. [5] The discomfort associated with airway inflammation can be reduced by the application of locally active anti-

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inflammatory and analgesic agents pre-emptively. In this regard, ketamine (phencyclidine derivative) and benzidine hydrochloride (topical NSAID) have been used independently as a preoperative gargle and noted to decrease the incidence and severity of POST. [6] It is known that n-methyl-d-aspartate (NMDA) has a role in nociception and inflammation. NMDA receptors are found in peripheral nerves and the central nervous system. Hence NMDA antagonists such as ketamine work on peripheral nerve endings in pharyngeal mucosa and can decrease the incidence of sore throat. [7] Magnesium is also an antagonist of the NMDA receptor ion channel. [8]

Since very few studies had been conducted using magnesium in the form of nebulisation and not much work has been carried out in this part of the state the current study was conducted to assess the efficacy of magnesium sulphate nebulization to reduce the incidence of POST. The drug is easily available and nebulization may be a simple, cost-effective method to decrease POST symptoms.

Materials and Methods

This is a prospective, comparative and observational study conducted in the Department of Anaesthesia and Intensive care unit, Shri Rawatpura sarkar institute of medical sciences and research Centre, Nava Raipur ,Raipur

Inclusion Criteria

- Adults aged between 18- 60 years of both the sex.
- ASA Grade I & II patients.
- Surgery lasting for more than 2 hours under GA.

Exclusion Criteria

- Patients with neuromuscular disease
- Allergy or hypersensitivity of drugs.
- Patients/Parents /Guardian's refusal.
- Patients undergoing neck surgeries and laparoscopic surgeries.
- Difficult intubation. (CL grade 3 and 4).
- Intubation requiring more than one attempt.
- Duration of Intubation more than 15 seconds.
- Patients with history of recurrent sore throat.
- Intubation resulted in injury or bleeding.

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To accommodate any exclusion 45 in each group were taken. 90 patients of 18- 60 years of age group fulfilling all the inclusion and exclusion criteria and posted for surgery under general anesthesia are divided into two groups (i.e.45 in each group) as follows:

Group M (n-45) received 3ml of 225mg isotonic nebulized magnesium sulphate nebulization for 15 min.

Group N (n-45) received 3ml of normal saline nebulization for 15 min.

Study Procedure: A detailed history and a thorough general examination were done for all the patients who were undergoing surgery under general anesthesia. Pre-operative explanation of the procedure was done to gain the confidence of the patients and written consent was taken.

All the patients were kept fasting overnight before the scheduled day of operation. Patients were evaluated for vital parameters like pulse rate, respiratory rate, oxygen saturation (SpO2), blood pressure, and ECG changes in the pre-operative room. Preoperatively, Group M patients were nebulized with 3 ml of 225 mg isotonic magnesium sulphate and Group N were nebulized with 3ml of normal saline for 15 minutes, ending 5 minutes before induction of anesthesia. Before the commencement of anesthesia, patients were instructed on the methods of study. The non-invasive monitor was connected and baseline values of heart rate, blood pressure, and oxygen saturation were noted. All the patients were pre-oxygenated, following which patients were premeditated with injection glycopyrrolate 0.2mg IV, injection Fentanyl 100mcg IV, midazolam 1mg IV, and induced with injection propofol 2mg/kg IV. Muscle relaxation was facilitated by injection vecuronium, ventilated for 4min, followed which trachea was incubated with a soft seal cuffed sterile polyvinyl chloride tracheal tube of 7.5mm inner diameter in females and 8mm in male patients. The endotracheal tube was inflated with air. Ventilation was controlled and no gastric tube was inserted. Anesthesia was maintained with nitrous oxide, oxygen, and sevoflurane, and an intermittent dose of vecuronium was given to maintain adequate depth of anesthesia. The last dose of vecuronium was given 20 minutes before the end of surgery. At the end of the surgery, the muscle relaxation was reversed with a combination of neostigmine and glycopyrrolate. The patient was extubated after extubation criteria were met and the patient was shifted to the post-anesthesia care unit.

The presence of sore throat was noted at rest and on swallowing immediately after extubation (0h) and 2h, 4h, 12hr, and 24h postoperatively. In the ward, patients were also monitored for any drug-related side effects. Mean and 95% confidence interval of mean were used to express data. For continuous variables like age, weight, and gender, the Kolmogorov-Smirnov test was used. Categorical data between groups were compared using Pearson Chi-Square, and Fisher's exact test. $P < 0.04$ was considered statistically significant.

Results

The age, gender distribution and weight were comparable in the two groups.

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

Variables	Normal saline	Magnesium sulfate	*P-value*
Age (years) (mean ± SD)	36.2±9.5	39.6±9.2	0.200
Gender (male/female)	24/21	22/23	0.4
Weight (kg) (mean ± CI)	56.11±2.243	57.15±2.36	0.060

CI = Confidence interval, SD = Standard deviation

Table 2: Postoperative sore throat "at rest"

Time (h)	Nebulized drug	POST (*n* = 45) (%)	Pearson Chi-square *P* value	RR when NS is used
0	NS	12(27)	0.694	1.30
	$MgSO_4$	7 (15)		
2	NS	10(22)	0.271	1.51
	$MgSO_4$	6 (13)		
4	NS	10(22)	0.923	2.0
	$MgSO_4$	4 (9)		
24	NS	6 (13)	0.016	-
	$MgSO_4$	0(0)		

RR = Relative risk, NS = Normal saline

There was no significant difference in POST at rest at 0th, 2nd, and 4th h between normal saline and magnesium sulfate. Significant difference was seen at 24th h with Chi square test, where $MgSO_4$ lessened POST, but not with Fisher's Exact tests [Table 2].

Table 3: Postoperative sore throat "on swallowing"

Time (h)	Nebulized drug (*n* = 45)	POST (*n* = 45) (%)	*P* value	RR when NS is used
0	NS	9 (20)	0.094	1.000
	$MgSO_4$	9 (20)		
2	NS	13 (29)	0.089	1.802
	$MgSO_4$	7(15)		

4	NS	12 (27)	0.041	2.300
	$MgSO_4$	5(11)		
24	NS	7(15)	0.005	8.920
	$MgSO_4$	1 (2)		

RR = Relative risk, NS = Normal saline

No significant difference in POST was observed "on swallowing" was observed between normal saline and magnesium sulfate at 0 and 2 h. A significant difference was seen at 4th and 24 h with both Chi-square and Fisher's Exact tests, where MgSO4 lessened POST [Table 3]. Concerning age, there was no significant difference in POST at swallowing between normal saline and magnesium sulfate. The exception to the age category was 30-45 years; at 2nd h and 4th h "on swallowing" are significant, where there was an increased incidence of POST in patients nebulized with normal saline. Concerning gender, there was no significant difference in POST "at rest" and "on swallowing" between normal saline and magnesium sulfate.

Discussion

The current study attempted to compare the effect of pre-operative nebulization with normal saline versus Magnesium sulphate in reducing the incidence of postoperative sore throat (POST) following GA with endotracheal tube for elective surgeries lasting for less than 4 hours with ASA grade of 1 or 2 among the age group between 18 and 60 years.

The causative mechanism for postoperative sore throat could be multiple 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, along with de-epithelialization and local inflammatory damage of the mucosa. Literature about the use of nebulized magnesium sulphate for attenuation of POST is scarce. Numerous nonpharmacological and pharmacological measures have been used for attenuating POST with variable success. Among the non-pharmacological 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, minimizing intra cuff pressures <20 mm Hg, and extubation when the tracheal tube is fully deflated, have been reported to decrease the incidence of POST. [9]

An endotracheal tube-related post-operative sore throat might be a consequence of localized traumatic inflammation of the pharyngeal mucosa. It is known that N-methyl-D-aspartate (NMDA) has a role in nociception and inflammation. [10] NMDA receptors are found in peripheral nerves and the central nervous system. [11] Magnesium is also an antagonist of the NMDA receptor ion channel. [12] We decided to study the efficacy of magnesium sulphate nebulization to reduce the incidence of POST as the drug was easily available and as nebulization may be a simple, cost-effective method to decrease symptoms of POST.

Our results in the control group were consistent with previous findings. We avoided using lignocaine jelly, to minimize the confounding factors, which could cause disparity and confusion in the accuracy of the results of our study. Kori et al. [13] and Maruyama et al. [14] found a higher incidence and severity of POST when lignocaine 2% jelly was used as a lubricant on the tracheal tube. The effectiveness of magnesium lozenges 30 min preoperatively was studied by Borazan et al. [15] who found it effective in reducing both the incidence and severity of POST in the immediate postoperative period. These results are comparable to our study results.

Gupta et al [16] also assessed the efficacy of preoperative nebulization of magnesium sulphate and found that the incidence and severity of POST were reduced at rest and on swallowing at all-time points ($P < 0.05$). Though our study couldn't demonstrate an effective reduction in the incidence of sore throat right after extubation at rest and swallowing, a clear advantage of a significant reduction in the incidence of sore throat on swallowing from two hours after extubation was observed. There was no associated risk of local or systemic toxicity as the dose used was around one-tenth of the systemically used dose for the treatment of pre-eclampsia and eclampsia and the mucosal drug absorption would not anywhere match the systemic levels of parenteral administration of the same drug similar to the conclusions of by Blitz et al. [17] who used nebulized magnesium sulphate for treatment of acute asthma. [18] The mucosal absorption although stated to be variable is also low to the level of around 10%. The drawback of our study was the absence of measurements of serum magnesium levels making it difficult to rule out the contribution of systemic effects of magnesium.

In our study, magnesium sulphate nebulization reduced the incidence of postoperative sore throat at rest after four hours with a significant difference compared to the group which received nebulization with normal saline. The magnesium sulphate group also had a significantly lesser incidence of postoperative sore throat on swallowing after two hours in comparison to the normal saline nebulization group.

Conclusion

POST is common in patients undergoing GA with a tracheal tube for routine surgical cases for up to 24 hr. We conclude that the use of magnesium sulphate in the form of nebulization as a pre-medication agent significantly reduces the incidence of POST compared to normal saline and it was found to be safe, simple, and effective in preventing the occurrence of postoperative sore throat.

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