



International Journal of Medical Anesthesiology

E-ISSN: 2664-3774
P-ISSN: 2664-3766
www.anesthesiologypaper.com
IJMA 2020; 3(4): 23-26
Received: 18-08-2020
Accepted: 21-09-2020

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Effect of magnesium sulphate nebulization on the incidence of post-operative sore throat

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DOI: <https://doi.org/10.33545/26643766.2020.v3.i4a.161>

Abstract

Background: Research trials have been conducted on various pharmacological and non-pharmacological measures for ameliorating POST with a varied success rate. Magnesium has antagonistic property towards NMDA receptors and hence it acts as anti-nociception and anti-inflammatory agent and so when used as premedication before surgery the incidence of POST could be reduced.

Aim: To assess the efficacy of magnesium sulphate nebuliser in reducing the incidence of post-operative sore throat.

Methodology: A total of 100 patients with ASA grade 1 & 2 in the age group of 18-60 years of either sex posted for elective surgeries lasting for the duration of 2hrs or more and requiring tracheal intubation were taken as our study subjects. The Patients in group A (n=50) were nebulised with 3ml of normal saline for 15 minutes, 5 minutes before induction of anaesthesia and similarly patients in group B (n=50) were nebulised with 3ml of solution containing 50 mg/mL of magnesium sulphate. Presence of sore throat was assessed at rest and at swallowing on immediate extubation, and at 2, 4 hours and 24 hours post extubation. In the postoperative ward, patients were also monitored for any drug related side effects.

Results: The incidence of POST was measured at 0hr, 2 hr, 4 hrs and at the end of 24 hrs post-operatively both at rest and at swallowing. It was found that the incidence of sore throat at rest among the normal saline group during was 80%, 80%, 70% and 66% during the above said period and among the magnesium sulphate group it was 44%, 30%, 8% and 0%. Similarly the incidence of sore throat during swallowing was found to be 88%, 84%, 76% and 70% in the normal saline group and in the magnesium sulphate group it was 50%, 32%, 10% and 0% and a statistical significant difference was observed in the incidence of POST between the two groups. The incidence was found to be significantly lesser in the MgSO₄ group when compared to the normal saline group.

Conclusion: 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: Post-operative sore throat, normal saline, magnesium sulphate, nebulisation.

Introduction

One of the most common sequelae of endotracheal intubation is post-operative sore throat (POST), as the previous studies have mentioned the prevalence of post-operative sore throat ranging from 20 to 65% [1, 2]. The possible etiologies mentioned in the studies were mucosal erosion, inflammation and dehydration leading onto the irritation of trachea thereby resulting in POST. Though it is considered as a minor complication in the post-operative period but the major issue is, it leads to patient's dissatisfaction and increases the duration of stay in the hospital [3, 4]. Research trials have been conducted on various pharmacological and non-pharmacological measures for ameliorating POST but the success rate were varied [5]. The various non-pharmacological measures that were tried are reducing the size of endotracheal tubes, reducing the cuff pressure to less than 20 mm Hg and minimising the attempts made for laryngoscopy and similarly the various pharmacological measures that were attempted are use of ketamine gargle, ketamine nebulisation, lignocaine spray, beclomethasone gel and magnesium sulphate gargle [6]. Among all these measures ketamine gargle or lozenges had shown the maximum success rate, but the major disadvantage is ketamine has a bitter taste because of which the risk of aspiration is high and that might lead onto serious complications. Because of which administration of drug through nebuliser route in the form of aerosol has become popular among anesthetist and the patient's acceptance was also good [7, 8].

The major receptors responsible for nociception and inflammation are NMDA receptors (N-methyl D-aspartate) receptors and these receptors are present both in central and peripheral nervous system. Both magnesium and ketamine has antagonistic property towards NMDA receptors and hence it acts as anti-nociception and anti-inflammatory agent^[9, 10].

Previous studies have been conducted using analgesic drug, ketamine in the form of gargles and aerosols and few studies had been done using magnesium in the form of gargles, lozenges and nebulisation and varied type of results were shown^[11, 13]. 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 use of magnesium sulphate nebuliser in reducing the incidence of post-operative sore throat.

Methodology

A prospective longitudinal study was conducted for a period of 6 months in the department of anesthesiology at our medical college hospital, Salem. The study was started after getting the approval from the institutional ethical committee and the informed consent was obtained from all the study subjects involved in our study. A total of 100 patients with ASA grade 1 & 2 in the age group of 18-60 years of either sex posted for elective surgeries lasting for the duration of 2hrs or more and requiring tracheal intubation were taken as our study subjects. Patients with neuromuscular diseases, CKD patients, allergy or hypersensitivity to magnesium drugs, patient undergoing ENT, dental, neck surgeries and laparoscopic surgeries were excluded from the study. The entire 100 patients were divided into two groups of 50 each based on computer generated random number basis. All patients were premedicated with tab. Alprazolam 0.5mg and tab. Pantoprazole 40mg on the previous day night before surgery and they were kept nil oral overnight. The Patients in group A were nebulised with 3ml of normal saline for 15 minutes, 5 minutes before induction of anaesthesia and similarly patients in group B were nebulised with 3ml of solution containing 50 mg/mL of magnesium sulphate. Anaesthesia was induced with fentanyl 2mcg/kg and Propofol 2mg/kg followed by Vecuronium 0.1 mg/kg and the trachea was intubated with soft seal cuffed sterile polyvinyl chloride endotracheal tube 7mm inner diameter for female and 8mm for male patients. The tracheal tube cuff was inflated with air by checking with hand over front of neck for any leak.

The cuff pressure was checked initially just after intubation using hand held endotracheal cuff pressure monitor and then every half hour till the end of surgery and maintained at 20 cm of H₂O. At the end of surgery, relaxation of muscle was done with combination of Neostigmine 0.05mg/kg and Glycopyrrolate 0.01mg/kg. Patients were extubated after meeting regular extubation criteria.

Tracheal extubation was done following gentle suctioning of oral secretions by a 14F soft suction catheter and patients were shifted to post anaesthetic care unit. Presence of sore throat was assessed at rest and at swallowing on immediate extubation, and at 2, 4 hours and 24 hours post extubation. In the postoperative ward, patients were also monitored for any drug related side effects.

All data were entered and analysed using SPSS version 24. Mean and standard deviation was calculated for all

parametric variables and percentage was calculated for non-parametric variables. Chi-square test was applied to derive the statistical inference between the two groups on the incidence of post-operative sore throat.

Results

The age and gender wise distribution of the study subjects between the two groups are more or less equally distributed with a mean age of 37.06 and 37.2 among group A and group B respectively with no statistical significant difference between the two groups (table 1).

The mean weight among the group A subjects was 55.8 and among group B it was 56.3 with no statistical significant difference and similarly the airway assessment made through malampatti grading showed an almost equal distribution of subjects between grade I and grade II in both the groups. Anesthesia assessment for the patients was done through ASA grading system and majority of them were in grade I and 15 – 20% were in grade II in both the groups and no statistical significant difference was observed between the groups (table 2). The vital parameters such as pulse rate, systolic and diastolic BP and the respiratory rate among the subjects in both the groups were within normal limits (table 3).

Among the duration of surgery, for majority of the subjects the duration was between 1 and 2 hrs in both the groups with a mean duration of 1.38 hrs among group A and 1.42 hrs among group B.

Only less than 5% of the surgeries in both the groups lasted for more than 3 hrs (table 4). The various type of operative procedures performed were open reduction with internal fixation, tonsillectomy, excisional biopsy, septoplasty, cholecystectomy, etc. and the distribution of these procedures between the two groups were more or less similar. The mean size of the ET tube used in normal saline group was 7.35 mm and in MgSO₄ group it was 7.31 mm and no statistical significant difference was observed between the two groups. The occurrence of sore throat both at rest and during swallowing among both the groups was shown in table 5.

It was assessed and monitored during the post-operative period from 0 hr to 24 hrs.

It clearly shows that the incidence of sore throat both at rest and during swallowing is very much high among the group which used normal saline as nebuliser and it is observed that the incidence was more than 80% in the immediate post-operative period and at the end of 24 hrs the incidence was 65 – 70% both at rest and during swallowing. Among the group which used MgSO₄ as nebuliser the incidence of sore throat in the immediate post-operative period was 45 – 50% and it was 0% at the end of 24% both at rest and during swallowing and a statistical significant difference was observed in the occurrence of sore throat between the two groups.

Table 1: Age and gender wise distribution of the study subjects

Age group	Group A (NS)		Group B (MgSO ₄)		P value
	Male	Female	Male	Female	
20 – 30	9 (33.3%)	6 (26%)	7 (31.8%)	12 (42.8%)	0.865
31 – 40	10 (37%)	8 (34.7%)	6 (27.2%)	6 (21.4%)	
41 – 50	4 (14.8%)	5 (21.7%)	4 (18.1%)	6 (21.4%)	
51 – 60	4 (14.8%)	4 (17.3%)	5 (22.7%)	4 (14.2%)	
Total	27 (100%)	23 (100%)	22 (100%)	28 (100%)	
Mean ± SD	37.06 ± 11.4		37.2 ± 11.7		

Table 2: Weight, Mallampatti grading of airway and ASA grading among the study subjects

Variable	Group A (NS)	Group B (MgSo4)	P value	
Weight	40 – 50	5 (10%)	2 (4%)	0.592
	51 – 60	23 (46%)	25 (50%)	
	61 – 70	19 (38%)	20 (40%)	
	>70	3 (6%)	3 (6%)	
Mallampatti grading	Grade I	26 (52%)	24 (48%)	0.739
	Grade II	24 (48%)	26 (52%)	
ASA grading	Grade I	40 (80%)	42 (84%)	0.838
	Grade II	10 (20%)	8 (16%)	

Table 3: Mean and SD of the vital parameters among the study subjects

Vital parameter	Group A (NS)		Group B (MgSo4)		P value
	Mean	SD	Mean	SD	
Pulse rate	80	9.2	76	10.6	0.715
Systolic BP	128	11.4	132	12.4	0.414
Diastolic BP	86	10.4	88	11.2	0.629
Respiratory rate	16	3.5	18	2.8	0.824

Table 4: Distribution of the study subjects based on the duration of the operative procedure

Duration of operative procedure	Group A (NS)		Group B (MgSo4)		P value
	Frequency	Percentage	Frequency	Percentage	
<1 hr	2	4%	2	4%	0.694
1 – 2 hrs	43	86%	44	88%	
2 – 3 hrs	3	6%	2	4%	
3 – 4 hrs	2	4%	2	4%	
Total	50	100%	50	100%	
Mean ± SD	1.38 ± 0.32		1.42 ± 0.41		

Discussion

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

Recent studies quote that prophylactic management of POST is highly recommended to improve the quality of anaesthesia care both in terms of duration of stay as well as the cost incur by the patients. Literature shows that patients with POST had a 14min longer stay in the post anaesthesia care unit and 25 min longer stay in the ambulatory care unit and were discharged 51 min later from the facility compared to those who did not complain of POST [14].

In the present study we compared the incidence of POST between normal saline and magnesium sulphate which was

given in the form of nebulization as pre-operative medication. The incidence of POST was measured at 0hr, 2 hr, 4 hrs and at the end of 24 hrs post-operatively both at rest and at swallowing. It was found that the incidence of sore throat at rest among the normal saline group during was 80%, 80%, 70% and 66% during the above said period and among the magnesium sulphate group it was 44%, 30%, 8% and 0%. Similarly the incidence of sore throat during swallowing was found to be 88%, 84%, 76% and 70% in the normal saline group and in the magnesium sulphate group it was 50%, 32%, 10% and 0% and a statistical significant difference was observed in the incidence of POST between the two groups. The incidence was found to be significantly lesser in the MgSo4 group when compared to the normal saline group.

In a study done by Kori *et al.* and Maruyama *et al.* a very high incidence of POST, was reported and it was found that using lignocaine 2% jelly as a lubricant on the tracheal tube was the triggering factor for it [15, 16]. Another study done by Borazan *et al.* using magnesium lozenges 30 min preoperatively found an effective reduction in the incidence and severity of POST in the immediate post-operative period [17]. Similarly a study done by Gupta *et al.* using magnesium sulphate as pre-operative nebulisation found a significant reduction in the incidence and severity of POST both at rest and at swallowing, which is almost similar to our findings [18]. Few other studies done earlier had used topical application of lignocaine, ketamine or corticosteroid in the tracheal tubes as a preventive measure in the reduction of POST and it all showed a varied results [19, 22]. Some of the studies had used magnesium sulphate in the form of lozenges or oral gargles for reduction in POST but a study done by Jain *et al.* clearly highlighted the advantage of using magnesium sulphate in the form nebulisation as this method ensures that the drug is equally and effectively distributed all over the pharynx and up to the beginning of the respiratory tract. In addition, nebulisation prevents the user variability associated with gargling and confounded the issue of taste of the medications [23].

In our study we did not experience any severe local or systemic adverse events except for dry mouth and bitter sensation and one patient developed mild transient hypotension and it is similar to the study done by Blitz *et al.* where he used nebulized magnesium sulfate for treatment of acute asthma without experiencing any sort of serious adverse events. In presence of alkaline pH magnesium is highly concentrated in the inflamed tissue producing analgesic and anti-inflammatory action with a very minimal systemic absorption, producing a prolonged action and very minimal systemic side effects [24].

Table 5: Incidence of sore throat at rest and during swallowing among the study subjects

Duration post-operatively	Group A (NS) (n=50)		Group B (MgSo4) (n=50)		P value (comparing between group A and B)	P value (comparing between group A and B)
	Sore throat at rest	Sore throat during swallowing	Sore throat at rest	Sore throat during swallowing		
0 hr	40 (80%)	44 (88%)	22 (44%)	25 (50%)	<.001	<.001
2 hrs	40 (80%)	42 (84%)	15 (30%)	16 (32%)	<.001	<.001
4 hrs	35 (70%)	38 (76%)	4 (8%)	5 (10%)	<.001	<.001
24 hrs	33 (66%)	35 (70%)	0	0	<.001	<.001

Conclusion

POST is common in the 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 and it was found to be safe, simple and effective in preventing the occurrence of postoperative sore throat.

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