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Original Research Article

Comparative evaluation of incidence of post operative sore throat after nebulization with ketamine and magnesium sulfate in patients undergoing general anaesthesia requiring endotracheal intubation

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ABSTRACT

Introduction: Post-operative pharyngeal discomfort or sore throat is unavoidable outcome of endotracheal intubation. There are some pharmacological and non-pharmacological methods for prevention of postoperative sore throat. Nebulization is better than gargle or other methods as small volume of drug required for effect, easy way of administration, better patient compliance and most importantly no risk of aspiration as seen with gargle.

Materials and Methods: In our study, 88 patients of ASA grading I- **III**, aged between 18-65 years undergoing general anaesthesia on elective basis were randomly divided into two groups. 44 patients received pre-operative nebulization with 1ml ketamine(50mg) with 1ml normal saline while others received nebulization with 500mg Magnesium sulfate with 1ml normal saline. General anaesthesia was given. Number of intubation attempts, duration of laryngoscopy and duration of surgery were recorded. Patients were evaluated for post-operative sore throat, hoarseness of voice and cough at 0hr, 2hr, 4hr, 12hr, and 24hr in postoperative period.

Results: Incidence of post-operative sore throat, cough and hoarseness of voice was reduced statistically significantly with ketamine nebulization when compared to magnesium sulphate nebulization (p=<0.05). There were no systemic side effects with any drug.

Conclusion: Ketamine nebulization was superior than magnesium nebulization in prevention of sore throat.

1. 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. Incidence of postoperative sore throat is 21-65% in different studies worldwide.[1] Post is 8th most common complaint in postoperative period.[2] In most cases it resolves spontaneously. There is a various causative factor of postoperative sore throat which includes mucosal trauma, erosion and inflammation due to endotracheal intubation, lack of airway humidity, suctioning of airway and surgical manipulation of tissue adjacent to airway.

Various pharmacological and non-pharmacological trials have been used to decrease the incidence and severity of sore throat. The non-pharmacological methods include smaller size endotracheal tubes, lubrication of the endotracheal tubes with water soluble jelly, gentle and careful airway instrumentation, intubation after full relaxation, care full oral and pharyngeal suction, minimal intracuff

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pressure and extubation after fully deflating tracheal cuff.[3] Pharmacological measures to decrease POST includes inhalation of steroids like beclomethasone and fluticasone, gargling with azuline sulfonate, aspirin, ketamine, benzydamine hydrochloride, local spray of benzydamine hydrochloride, nebulization with ketamine, magnesium sulfate, lidocaine and intracuff administration of alkalized lignocaine etc.[2,4] This study was undertaken with the need to advance a suitable agent and method to bring down the incidence of sore throat following tracheal intubation.

The primary objective of the study was to compare the efficacy of Ketamine nebulization and Magnesium sulfate nebulization to decrease incidence of post. Secondary objective of the study was to observe incidence of Postoperative cough and Hoarseness of voice in both the groups.

2. Materials and Methods

After approval from institutional ethical committee, a prospective randomized study was conducted in eighty-eight patients between age group 18-65 years of ASA I-III of either sex undergoing general anaesthesia requiring endotracheal intubation with surgery upto 180 minutes were included in the study. Patients with history of preoperative sore throat or recent upper respiratory tract infection, Allergy to any of study drug, oral surgeries, neck surgeries like Thyroid surgery, those who required more than 3 attempts at intubation were excluded from the study.

Based on mean of postoperative sore throat, with respect to specific modalities used from existing literature, with 80% power and 95% confidence interval, sample size was computed to minimum of 44 in each of two groups.[5]

In the recovery room, a large bore intravenous (IV) cannula was secured and standard vitals parameters such as Pulse rate (PR), mean arterial pressure (MAP), and SpO2 were recorded. Twenty minutes before induction of anesthesia, all the patients were nebulized with one of the study drugs diluted to 2mL with normal saline. Patients were allotted to Group K ketamine 50 mg, Group M magnesium sulfate 500 mg. Here we use mgso4 1g/2ml ampule from which 1ml taken and diluted to 1ml normal saline. As soon as nebulization completed, a set of values for the above-mentioned parameters were taken. Premedication was given with Inj. Glycopyrrolate 0.005-0.01 mg/kg iv, Inj. ondansetron 0.1-0.2 mg/kg and 1.5mg/kg Tramadol in 1 g of Paracetamol iv. 20 minutes before induction.

In operation room, multipara monitor such as electrocardiogram, pulseoxymetry and noninvasive blood pressure attached. All vital parameters recorded. Standard technique for general anaesthesia was implemented. Preoxygenation was done with 100% oxygen for 3 minutes. Induction was done with Inj. Propofol 2-2.5 mg/kg iv., Inj. suxamethonium chloride 1-2 mg/kg iv. and IPPV was given and after that oral intubation was done with appropriate size cuffed pvc endotracheal tube. All attempts for endotracheal intubation were recorded and patients with more than 3 attempts were excluded from the study. All the intubation were performed by senior consultant anaesthesiologist using new sterile pvc cuffed ET tube. General anaesthesia was maintained with oxygen, nitrous oxide and inhalation agents (isoflurane or sevoflurane). Neuromuscular blockade was achieved with nondepolarizing muscle relaxant Inj. Vecuronium 0.08-0.1 mg/kg iv. and maintained with Inj. Vecuronium 0.01-0.02mg/kg. Intra-operative standard hemodynamic monitoring was done and recorded at time of laryngoscopy and then at 5min, 10min, 15min, 30min, 60 min and then every 1 hourly up to completion of surgery.

After completion of surgery, neuromuscular blockade was reversed with of Inj. Glycopyrrolate 0.005-0.01mg/kg and Inj. Neostigmine 0.05mg/kg iv. Extubation was done after adequate tidal volume, respiratory rate, and reversal of reflexes, muscle tone and power.

Patient was shifted to recovery room. Humidified O_2 was given at 5L/min flow via ventimask. Vitals were recorded. Patient was asked for sore throat, hoarseness of voice and postoperative cough. The responses were noted at 0, 2, 4, 12, and 24 h in the questionnaire based on the scales described as below:[6]

Table 1:

Grade	Criteria
Post operative sore throat [Post]	
0	**No** sore throat at any time since the operation
1	**Minimal** - Patient answered in the affirmative when asked about sore throat
2	**Moderate** - Patient complained of sore throat on his/her own
3	**Severe** - Patient is in obvious distress
Post operative cough	
0	**No** cough at any time since the operation
1	**Mild**
2	**Moderate**
3	**Severe**
Postoperative Hoarseness of voice	
0	**No** hoarseness at any time since the operation
1	**Minimal** - Minimal change in quality of speech. Patient answers in the affirmative when enquired.
2	**Moderate** - Moderate change in quality of speech of which the patient complains on his/her own
3	**Severe** - Gross change in the quality of voice perceived by the observer

The rescue therapy for POST, especially in patients with Grade 3 score throat, was with the use of a dispersible aspirin 75 mg gargle which was repeated as and when required till patient got relief from the symptoms and number of times the modality had been used was recoreded.

Pre structured proforma was used for data collection and for data analysis Microsoft excel open Epi 3.0 and statistical

software SPSS version 20 was used and data were analyzed with the help of mean, SD, percentage in the form of table, diagrams and test of significance (Independent t-test for intergroup comparison, Chi square test for demographic data) were applied. Significance of P value was suggested as follow: P value > 0.05 was insignificant, P value < 0.05 was significant, P value = 0.000 was highly significant.

3. Results

Comparison of demographic data which include age, weight and sex showed no significant difference between the groups. The mean duration of surgery and intubation attemps between two groups were comparable and non-significant (p= >0.05). Mean duration of surgery in Group K was 165.68±55.84 min and in Group M was 177.27±48.33 min. 56 patients (63.64%) required 1 intubation attempt and 32 patients (36.36%) required 2 intubation attempts.

The mean pulse rate and MAP pre and post nebulization within the group k and within group m were comparable and found statistically non-significant (p=>0.05). Intraoperative Mean HR, SBP, DBP, and MAP were comparable between two groups but statistically non-significant (p=>0.05). The spo2 prenebulization, postnebulization and intraoperative, comparable in both groups.

The incidence of sore throat was assessed at 0hr, 2hr, 4hr, 12hr, and 24hrs in PACU. There was statistically significant reduction in sore throat was seen in group k compare to group m at 0hr (p=<0.01), 2hr (p=<0.01), and 4hr (p=<0.01). there was also decrease in incidence of sore throat in group k compare to group M at 12hr and 24hr but it was statistically insignificant (p=>0.05).

There was statistically significant reduction in hoarseness of voice was seen in group k compare to group m at 2hr (p=<0.01), 4hr (p=<0.01), and 12hr (p=<0.01). There was also decrease in incidence of hoarseness in group k compare to group m at 2hr and 24hr but it was statistically insignificant (p=>0.05).

Reduction in incidence of cough was seen in group k compare to group m at 0hr (p=0.003), 2hr (p=0.004), and 4hr (p=<0.01) which was statistically significant. There was also decrease in incidence of cough in group k compare to group M at 12hr and 24 reduction in incidence of cough hrs but it was statistically insignificant (p=>0.05).

4. Discussion

Postoperative sore throat and cough is remains major complaints among most of the patients who undergone general anaesthesia requiring endotracheal intubation. POST is still not eradicated despite all efforts done over years. It is even more common with prolonged surgeries. In POST, complain ranges from minor irritation of throat to severe throat pain, difficulty in swallowing, and hoarseness of voice, laryngitis, tracheitis. Although POST was a minor complication, it causes significant morbidity, longer hospital stays and patient dissatisfaction. There are multiple factors responsible for POST which includes mucosal injury during laryngoscopy and intubation, pressure by inflated endotracheal tube cuff and tracheal mucosa dehydration. Other contributing factors for POST are age, sex, use of succinylcholine, and cuff pressure.[7] Research indicates that POST can be attenuated using a multi modal approach consisting of non-pharmacological and pharmacological interventions.

Experimental data shows that NMDA receptors are found both in the central nervous system and in the peripheral nerves. Peripherally administered NMDA receptor antagonists are involved with antinociception and anti-inflammatory cascade[2] by reducing NF$\kappa\beta$ activity, TNF-α (tumor necrosis factor α) production, expression of inducible nitric oxide synthase, serum C-reactive protein, IL-6 and IL-10. Ketamine and Magnesium both act on NMDA receptor and antagonize it.

Gargles and nebulization both were effective in prevention of sore throat but as per Bhagyashree Amingad et al.[8] noted that ketamine nebulization had less incidence of sore throat compared to ketamine gargles. However, difference was statistically insignificant. There were also chances of aspiration with gargles and less volume of drug required. So, we decided to give drug via nebulization route.

All demoghraphic parameter like age, sex and weight, intubation attempts, ASA physical status and mean duration of surgery were comparable between both groups and statistically insignificant which was in agreement with many previous studies.

The incidence of sore throat was assessed at 0hr, 2hr, 4hr, 12hr, and 24hrs in PACU. There was statistically significant reduction in sore throat was seen in group k compare to group m at 0hr (p=<0.01), 2hr (p=<0.01), and 4hr (p=<0.01).

Similarly, studies conducted by Rajan, et al.[6] Jain, et al.[9] Segaran, et al[1] Teymourian et al.[10] Thomas, et al.,[11] found that ketamine significantly reduced incidence of postoperative sore throat compared to magnesium nebulization.

In contrast to our study Essam Mostafa et al.[5] observed in their study that incidence of POST was significantly lower in magnesium group compare to ketamine group at 2hr (p=0.023), 4hr (p=0.001), and 8hr (p=0.044). Severity of sore throat was also significantly lower in magnesium group at 4hr (p=0.002) and 8hr (p=0.038). Magnesium sulfate nebulization reduces incidence and severity of POST more effectively than ketamine nebulization.

In our study, we observed that incidence hoarseness and cough was also decreased statistically significantly in group k compare to group m. Similarly, Rajan, et al.[6] noted that ketamine significantly reduced hoarseness compared to control group but there was no significant difference

Table 2: Postoperative sore throat

Time	Severity	Group K		Group M		P-value
		N	Percentage	n	Percentage	
0HR	Nil	32	72.73	12	27.27	<0.01
	Mild	9	20.45	17	38.64	
	Moderate	3	6.82	15	34.09	
	Severe	0	00.00	0	00.00	
2HR	Nil	28	63.64	10	22.73	<0.01
	Mild	15	34.09	30	68.18	
	Moderate	1	2.27	4	9.09	
	Severe	0	00.00	0	00.00	
4HR	Nil	37	84.09	13	29.55	<0.01
	Mild	7	15.91	31	70.45	
	Moderate	0	00.00	0	00.00	
	Severe	0	00.00	0	00.00	
12HR	Nil	40	90.91	36	81.82	0.21
	Mild	4	09.09	8	18.18	
	Moderate	0	00.00	0	00.00	
	Severe	0	00.00	0	00.00	
24HR	Nil	42	95.45	40	90.91	0.39
	Mild	2	4.55	4	9.09	
	Moderate	0	00.00	0	00.00	
	Severe	0	00.00	0	00.00	

Table 3: Hoarseness of voice

Time	Severity	Group K		Group M		P-value
		n	Percentage	n	Percentage	
0HR	Nil	32	72.73	20	45.45	0.072
	Mild	7	15.91	12	27.27	
	Moderate	4	9.09	10	22.73	
	Severe	1	2.27	2	4.55	
2HR	Nil	28	63.64	9	20.45	**<0.01**
	Mild	15	34.09	28	63.64	
	Moderate	1	2.27	7	15.91	
	Severe	0	0.00	0	0.00	
4HR	Nil	37	84.09	10	22.73	**<0.01**
	Mild	7	15.91	34	77.27	
	Moderate	0	0.00	0	0.00	
	Severe	0	0.00	0	0.00	
12HR	Nil	40	90.91	19	43.18	**<0.01**
	Mild	4	9.09	25	56.18	
	Moderate	0	0.00	0	0.00	
	Severe	0	0.00	0	0.00	
24HR	Nil	42	95.45	38	86.36	0.13
	Mild	2	4.55	6	13.64	
	Moderate	0	0.00	0	0.00	
	Severe	0	0.00	0	0.00	

Table 4: Postoperative cough

Time	Severity	Group K		Group M		P-value
		N	Percentage	n	Percentage	
0HR	Nil	30	68.13	13	29.55	0.003
	Mild	10	22.73	20	45.45	
	Moderate	03	6.82	09	20.45	
	Severe	01	2.27	02	4.55	
2HR	Nil	26	59.09	11	25	0.004
	Mild	17	38.64	29	65.91	
	Moderate	01	2.27	04	9.09	
	Severe	00	00.00	00	00.00	
4HR	Nil	35	79.55	13	29.55	<0.01
	Mild	09	20.45	31	70.45	
	Moderate	00	00.00	00	00.00	
	Severe	00	00.00	00	00.00	
12HR	Nil	35	88.64	33	75	0.6
	Mild	09	11.36	11	25	
	Moderate	00	00.00	00	00.00	
	Severe	00	00.00	00	00.00	
24HR	Nil	41	93.18	39	88.64	0.4
	Mild	03	6.82	05	11.36	
	Moderate	00	00.00	00	00.00	
	Severe	00	00.00	00	00.00	

when compare to magnesium. Incidence was cough also decreased in ketamine and magnesium but the difference was statistically insignificant.

There was no incidence of any systemic toxicity or any other adverse reaction seen in post operative period in any study group.

There are a few limitations to our study, the dose we used was a fixed dose and the least effective dose is not known. We did not measure the serum levels of magnesium and ketamine to monitor the drug levels, and laryngoscopy was done by different anaesthetists.

5. Conclusion

We conclude that, preoperative nebulization with Ketamine (50mg) statistically significantly decreased incidence and severity of postoperative sore throat, hoarseness of voice and postoperative cough compared to magnesium sulfate (500mg) nebulization.

6. Source of Funding

None.

7. Conflict of Interest

The authors declare no conflict of interest.

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