A comparative study between ketamine nebulization and betamethasone gel applied over the endotracheal tube cuff for reduction of post-operative sore throat

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Abstract

Background: Endotracheal intubation is necessary in general anesthesia (GA) to control respiration and to protect airway. Larynx and trachea are the most common sites of injury during intubation and usually manifested as local irritation, inflammation, and even necrosis. **Aims:** This study was undertaken to compare the efficacy of ketamine nebulization and betamethasone gel applied over the endotracheal tube cuff for reduction of postoperative sore throat (POST). **Materials and methods:** This is a randomized, prospective study of evaluating the efficacy of ketamine nebulisation with betamethasone gel and lignocaine jelly applied over the endotracheal tube cuff for the reduction of postoperative sorethroat (POST). Patients were randomly divided in to ketamine group (group K), betamethasone group (group B) and lignocaine group (group L). In the postoperative period patients were observed at immediately after extubation (0 h), 2, 6, 12 and 24 h for POST which was graded on a four-point scale. **Results:** The overall incidence of POST in this study was 30%. Out of this POST occurred only in 20% of the patients in ketamine group (K), 23.3% of the patients in betamethasone group (B) compared to 46.6 % in lignocaine group (L) (control). The incidence of POST at 0, 2, 6, 12, 24 hrs was 10%, 10%, 16.6%, 10% and6.6% respectively in ketamine nebulisation group; 10%, 16.6%, 13.3%, 10% and6.6% respectively in study was, 36.6 % in lignocaine gel group and 33.3%, 40%, 46.6%, 40%, 36.6 % in lignocaine gel applied over endotracheal tube cuff are equally effective in reduction of POST.

Key Word: ketamine nebulization, betamethasone gel.

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INTRODUCTION

Endotracheal intubation is necessary in general anesthesia (GA) to control respiration and to protect airway. Though endotracheal intubation has remained the foundation stone of modern anesthetic practice and critical care, it is not without complications. Almost all patients who were intubated for long term or short-term operation had some degrees of airway injury resulting in Post-operative sore throat (POST), hoarseness of voice, cough and pain. Larynx and trachea are the most common sites of injury during intubation and usually manifested as local irritation,

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inflammation, and even necrosis. Although most of the injuries to the trachea are minor and reversible, however, may become severe. Due to edema and granuloma formation, injury to the trachea after extubation may manifest as POST and may increase in severity as acute or chronic obstruction of the airway that may be severe enough to necessitate surgical intervention. These injuries can also impair normal function of the larynx and their protective roles and predispose the patient to pulmonary aspiration.¹Sore throat and hoarseness in the first 24 hours after the procedure were among the most common complications of endotracheal intubation.² Post-operative sore throat (POST) occurs in 21-65% of patients receiving general anaesthesia (GA) with endotracheal intubation .3 Though considered as a minor complication, it may cause significant post-operative morbidity and patient dissatisfaction. Different factors were known to modify the occurrence of these complications, including age, season, h/o smoking, people with hyper-reactive airway, anesthetic drugs and gases used in GA, numbers of trials and trauma during intubation, duration of intubation, size of endotracheal tube & its type, cuff type & its size, site of the surgery, ketamine nebulization and application of lidocaine, steroid application over cuff of endotracheal tube. Ketamine is an NMDA receptor antagonist with the primary site of action in the central nervous system, and parts of the limbic system while its use via nasal route, gargle, and rectal route suggests its peripheral effect.⁴. The topical effect of ketamine nebulization that attenuated the local inflammation and also due to peripheral analgesic effect of ketamine. Although local anaesthetic jelly along with its lubricating properties limits the potential damage to the tracheal mucosa by suppressing bucking on the tracheal tube, its role in prevention of postoperative sore throat is inconclusive as it does not possess any intrinsic anti-inflammatory action. Recognizing the potential role of inflammation in postoperative airway sequelae, steroids are used via inhaled and topical routes because of their anti-inflamatory action.

AIMS AND OBJECTIVES

- 1. To evaluate the role of nebulized Ketamine for attenuation of POST in patients undergoing surgery under GA with endotracheal intubation.
- 2. To evaluate the role of Betamethasone gel applied over the endotracheal tube cuff for attenuation of POST in patients undergoing surgeries under GA with endotracheal intubation and compare it with Ketamine nebulization.
- 3. To evaluate any adverse effects of Ketamine nebulization and Betamethasone gel (steroid) applied over endotracheal tube cuff.

MATERIALS AND METHODS

Type of Study: Randomized controlled prospective study Sample Size: 90 patients

Inclusion Criteria: Age group 18-70 years of either sex with ASA physical status Grade I & II and mallampati grade 1 & 2 Undergoing surgery under GA lasting for more than 1 hr.

Exclusion Criteria:

- 1. Patients >70 years of age, <18yrs age with ASA physical status Grade III & IV.
- 2. Pregnant women.
- 3. Patients with a history of pre-operative sore throat, cough and hoarseness of voice.
- 4. Patients with history of smoking, asthma, chronic obstructive pulmonary disease.
- 5. Patients undergoing oral surgeries, head and neck surgeries.
- 6. Recent history of patient taking non-steroidal antiinflammatory drugs.
- 7. Patients who required more than one attempt at intubation.
- 8. Patients who had traumatic intubation.

After the institutional ethical committee clearance and written informed consent, All 90 Patients are randomized into three groups of 30 each. Group (K): received Ketamine (preservative free) 50 mg (1.0 ml) along with 4.0 ml of normal saline [total 5 ml] nebulization for 15 min via nebulization mask connected to wall mounted oxygen driven source at the rate of 8 lit /min, 25 min before surgery. Group (B): received 3 ml of water soluble 0.05% Betamethasone gel applied over endotracheal tubes cuff. Group (L): received 3 ml of water soluble 2% Lignocaine jelly applied over endotracheal tube cuff, taken as control. In the postoperative period patients were observed at immediately after extubation (0 h), 2, 6, 12 and 24 h for POST which was graded on a fourpoint scale (0–3);

0 = no sore throat;

1 = mild sore throat (complains of sore throat only on questioning);

2 = moderate sore throat (complains of sore throat on his/her own);

3 = severe sore throat (change of voice or hoarseness, associated with severe throat pain).

The data collected was entered in an excel sheet and was transported to the EPI INFO software (7.0). The categorical data was analysed using the frequencies and percentages. The quantitative data was presented by using measures of the central tendency. The Chi square test was used as the significance test for the categorical variables. P value <0.05 is considered as significant. Analysis of Variance was used as the test of significance for the quantitative variables.

RESULTS

Table 1: Demographic data						
Age Distribution	Ketamine nebulization	Betamethasone gel	Lignocaine Jelly (L)			
	group (K) n=30	(B) group (n=30)	group (n=30)			
Mean age in years ± SD	38.8 ± 10.88	19	60			
Min age (years)	40.2 ± 10.46	20	65			
Max age (years)	39.6 ± 8.00	21	59			
Sex Distribution						
Males	13 (43%)	14 (47%)	15 (50%)			
Females	17 (57%)	16 (53%)	15 (50%)			
P-Value	0.87					
ASA Grade						
ASA 1	19 (63.3%)	19 (63.3%)	21 (70%)			
ASA 2	11(36.7%)	11 (36.7%)	9 (30%)			
P-Value	0.82					

There was no significant difference between the Age, Gender and ASA grades in different groups (P>0.05).



Figure 1: Mean duration of surgery between study groups Figure 2: Distribution of the study groups according to incidence of POST In all groups the duration of surgery was found comparable with the p value being > 0.05 which is not significant. In this study an overall incidence of POST is 30%. Out of this POST occurred only in 20% of the patients in ketamine group (K), 23.3% of the patients in betamethasone gel group (B) compared to 46.6% in lignocaine jelly group (L). There is significant reduction in the incidence of POST in K group and B group when compared to L group (P<0.05). There is no statistical difference between K group and B group in reduction of POST.

Table 2: Incidence and severity of POST at all time intervals					
		Ketamine nebulisation	Betamethasone	Lignocaine jelly group	
	POST grading	group (K) n=30	gel group (B)n=30	(L) n=30	
0 hr	No sore throat (0)	27 (90%)	27 (90%)	20 (66.7%)	
	Mild sore throat (1)	3 (10%)	3 (10%)	6 (20%)	
	Moderate sore throat (2)	0	0	4 (13.3%)	
2ndhr	No sore throat (0)	27 (90%)	25 (83.3%)	18 (60%)	
	Mild sore throat (1)	3 (10%)	5 (16.7%)	7 (23.3%)	
	Moderate sore throat (2)	0	0	5 (16.7%)	
6 th hr	No sore throat (0)	25 (83.3%)	26 (86.7%)	16 (53.3%)	
	Mild sore throat (1)	4 (13.3%)	2 (6.7%)	11 (36.7%)	
-	Moderate sore throat (2)	1 (3.3%)	2 (6.7%)	3 (10%)	
12 th hr	No sore throat (0)	27 (90%)	27 (90%)	18 (60%)	
	Mild sore throat (1)	2 (6.7%)	3 (10%)	8 (26.6%)	
	Moderate sore throat (2)	1 (3.3%)	0	4 (13.4%)	
24 th hr	No sore throat (0)	28 (93.3%)	28 (93.3%)	19 (63.3%)	
	Mild sore throat (1)	2 (6.7%)	2 (6.7%)	8 (26.7%)	
	Moderate sore throat (2)	0	0	3 (10%)	

None of the patients in all three groups experienced severe sorethroat (grade 3). Incidence and severity of POST at all time intervals was significantly low in Ketamine nebulisation group (K) and betamethasone gel group (B) when compared to lignocaine jelly group (L) (p<0.05). There is no statistical difference between K group and B group in reduction of incidence and severity of POST at all time intervals. None of the patients in all three groups experienced severe sore throat. Patients in all three groups remained haemodynamically stable.

DISCUSSION

The artificial maintenance of airway is the essence of general anaesthesia (GA). The airway is often established during GA by endotracheal intubation. It has advantages including the provision of the reliable airway, prevention of aspiration and smooth delivery of the anaesthetic gases. But, all the patients who were intubated for long term or short term operations, experience some degrees of airway injury. The usual complications of the airway include airway trauma, physiological reflexes like tachycardia and hypertension, malposition, laryngospasm, narrowing and increased airway resistance as well as negative pressure pulmonary oedema.⁵Post-operative sore throat, cough and hoarseness of the voice are often common, uncomfortable sequelae after tracheal intubation. ⁶ The prevalence of these complications were reported to be around 21% - 65% as per the literature available. The wide variation on these figures is presumably due to different skills and techniques of anaesthetists and to differences between individual anaesthetists and patients in the definition of sore throat.⁷Postoperatively, it seems most plausible that the symptoms are the result of mucosal injury with resulting inflammation caused by the process of airway instrumentation (i.e. laryngoscopy & suctioning) or the irritating effects of a foreign object (i.e. endotracheal tube, LMA or oral airway).⁸ A number of pharmacological and non-pharmacological measures are often used for alleviating the postoperative sore throat, cough and hoarseness of voice with varying degree of success. The endotracheal tubes, lubricating small sized the endotracheal tubes with water soluble jelly, careful airway instrumentation. intubation after full relaxation, minimizing the intracuff pressure, gentle oropharyngeal suctioning and extubation when the tracheal tube cuff is fully deflated are some non-pharmacological measures followed to prevent these complications. ⁹ The pharmacological measures including Aspirin gargles, ketamine gargle, benzydamine hydrochloride (BH) gargles, Ketamine nebulization, magnesium nebulization, transdermal ketoprofen, lignocaine 10% spray, Strepsils lozenges and betamethasone gel on tracheal tube and magnesium sulfate lozenges have been tried as per the literature available. ¹⁰ In this study an overall incidence of POST is 30%, out of this POST occurred only in 20% of the patients in ketamine group, 23.3% of the patients in betamethasone group compared to 46.6 % in lignocaine group (control). Study conducted by Ahuja et al reported an overall incidence of post is 33% and in ketamine neb group is 20%. These findings correlate with our study. The demographic variables are comparable in all 3 groups. In a study conducted by Junchiogata et al 11, have used sodium azulene sulfonate (water soluble derivative of Azulene, a chamomile extract, has anti-inflamatory

effects) gargling as compared with tap water gargling for attenuation of POST. They concluded that gargling with sodium azulene effectively attenuates POST. This study is comparable with our study where we have used antiinflamatary agent, a steroid betamethasone gel for reduction of Post. Thomas et al in 2007¹² conducted a randomized, placebo-control, double-blinded study, to evaluate the efficacy of intravenously administered dexamethasone in reducing the incidence and severity of POST in patients receiving GA with endotracheal intubation. POST was significantly reduced (p <0.01) postoperatively at 1st hr, 3rd hr and 6th hour in dexamethasone group as compared to saline group. The author concluded that steroid IV dexamethasone reduced the incidence and severity of POST which is comparable with present study in which a similar steroid betamethasone used in the form of gel applied over endotracheal tube to reduce POST. Asif Kazemiet al^{13} conducted a double blinded clinical trial to determine the effects of betamethasone gel applied over endotracheal tube in reducing the POST, hoarseness and cough in patients receiving GA with endotracheal intubation. They observed that 78% of the patients for whom betamethasone gel was applied over ET tube had relief from POST as compared to 54 % in control group (application of KY jelly over ET tube) which is statistically significant. The present study results are in concurrence with this study where 77% patients in betamethasone gel group had relief from POST as compared to 53% in Lignocaine group.

P. A. Sumathiet al in 2008¹⁴ conducted a study to compare the incidence of POST, cough, and hoarseness of voice after GA when applying Betamethasone gel or Lidocaine jelly on the tracheal tube. The incidence of POST in the first 24 hrs was 40% in betamethasone group, 100% in lignocaine group and control groups. This study concluded that wide spread application of betamethasone gel applied on the ET tube decreases the incidence and severity of POST. In the present study the incidence of POST was 23% in betamethasone group and 46% in lignocaine group which is in concurrence with this study. O. Canbayet al in 2008¹⁵ conducted a prospective, randomized, placebocontrolled, and single-blinded study to compare the effectiveness of ketamine gargles with placebo in preventing POST after endotracheal intubation. Significantly more patients suffered severe POST in control group at 4 and 24 h compared with Ketamine gargling group (P<0.05). In our study Ketamine nebulisation is used preoperatively for reduction of POST which significantly reduced the incidence and severity of POST at 0 hr, 2nd hr, 6th hr, 12th hr, and 24th hr when compared with lignocaine gel group(P<0.05). Nasrin Faridi et al in 2010¹⁶ results shows incidence of sore throat was significantly lower in group F (3.33%) compared with

the control group (36.67%) (P < 0.05), not only in the first postoperative hour but also 24 hours after surgery (13.33% in group F vs 40% in the control group). The authors concluded that Inhaled fluticasone propionate decreases the incidence and severity of postoperative sore throat, cough, and hoarseness in patients undergoing caesarean delivery under GA. Our study results are in concurrence with this study in which a similar steroid betamethasone used in the form of gel applied over endotracheal tube to reduce POST. Safaviet al in 2014¹⁷ concluded that prophylactic use of 0.2 mg/kg of IV dexamethasone plus ketamine gargle significantly reduced the incidence and severity of POST compared with using each of these drugs alone or using placebo. The synergistic effect of both medications may be responsible for reduced incidence of POST inIV dexamethasone plus ketamine gargle group. In 2015, Adamu Muhammad Sarki et al 18 conducted a prospective study to compare the efficacies of lidocaine jelly and betamethasone gel in the prevention of postoperative sore throat where the outer surface of the tracheal tube used in intubating was lubricated with one of three agents (2% lidocaine jelly, 0.05% betamethasone gel or KY jelly) from the distal tip of the tube to the 15 cm mark. The incidence of sore throat was 36.7%, 66.7% and 80% for the betamethasone, lidocaine and KY jelly groups, respectively. They concluded that application of betamethasone gel on endotracheal tube effectively reduces incidence of POST when compared to lidocaine jelly (P < 0.05). In our study the incidence of sore throat was 23% in betamethasone gel group in comparison with 53% in lidocaine jelly group which is statistically significant (P < 0.05). The results from our study concurred with the observation made by the author Muhammad Sarki et al¹⁸. BhagyashreeAmingad et al¹⁹ in 2016 conducted a prospective, randomized study to compare ketamine nebulisation with ketamine gargle in reducing the incidence and severity of POST. Patients in group GK received preservative free ketamine 50mg in 29 ml of saline, gargled for 30 seconds and Group NK received ketamine 50 mg in 4ml of normal saline via nebulisation for 15 min. The incidence of POST at 0, 2, 4, 24 hrs was 27%, 25%, 20% and 17% respectively in GK group and 20%, 17.5%, 2.5% and 7.5% in NK group respectively with no statistical difference between the two. They concluded that Ketamine nebulisation is an effective alternative to ketamine gargle in attenuating POST. In our study the incidence of POST in ketamine nebulisation group at 0hr, 2nd hr,6th hr,12th hr, 24th hr are 10%, 10%, 16.6%, 10%, 6.6% respectively. The local anaesthetic agents such as Lidocaine jelly or spray are known to be ineffective in preventing the sore throat after endotracheal intubation. These agents are known to limit the injury to the tracheal mucosa and prevent cough, they cannot be

effective in preventing sore throat since they lack antiinflammatory effects. The studies have also proven that the application of local anaesthetic jelly limits potential damage to the tracheal mucosa due to its lubricating properties which supresses the bucking on the tracheal tube. There are a few limitations of our study. No formal sedation scale was used to know the sedative effect of ketamine. Endotracheal tube cuff pressure monitoring was not done. Plasma ketamine and betamethasone levels were not measured during the study period, as not feasible in our institution. Number of episodes of bucking at the time of extubation were not recorded.

CONCLUSION

i) Nebulisation with ketamine (50 mg in 5ml) preoperatively and application of 3 ml of betamethasone gel over endotracheal tube cuff are equally effective in reduction of POST ii) Nebulisation with ketamine preoperatively and betamethasone gel applied over endotracheal tube cuff are superior to lignocaine jelly application over endotracheal tube cuff in minimizing the postoperative sore throat. The study is of the view, between nebulisation by ketamine and applying betamethasone gel over endotracheal tube cuff, applying betamethasone gel over endotracheal tube cuff is cost-effective, easily available, ease of application and economical. Hence it is recommended for minimizing the postoperative sore throat.

REFERENCES

- Pribe HJ, Henke W, Hedley-White J, Effects of tracheal intubation on laryngeal acoustic waveforms; Anesth Analog;67;219-27,1988⁽¹¹⁾_{SEP}
- Stock MC, Downs JB; Lubrication of tracheal tubes to prevent sore throat from intubation; Anaesthesiology;75;418-20,1982
- 3. Higgins PP, Chung F, Mezei G. Postoperative sore throat after ambulatory surgery. Br J Anaesth 2002; 88:582-4
- Zhu MM, Zhou QH, Zhu MH, Rong HB, Xu YM, Qian YN,*et al*. Effects of nebulized ketamine on allergeninduced airway hyperresponsiveness and inflammation in actively sensitized Brown-Norway rats. J Inflamm (Lond) 2007; 4:10.
- Morgan EG. Jr, Mikhail MS, Murray MJ, Clinical Anaesthesiology. 4th ed. Lange Medical Books; McGrawn-Hill Medical Publishing Division; 2008, 97-110.
- Ayoub CM, Ghobashy A, Koch ME, McGrimley L, Pascale V, Qadir S, *et al.* Widespread application of topical steroids to decrease sore throat, hoarseness, and cough after tracheal intubation. AnesthAnalg. 1998;87(3):714-6.
- MC Hardy, Chung F, *et al*, Postoperative sore throat; Cause, prevention and treatment Anaesthesia 1999 May; 54(5): 444-453
- 8. Phillip E.Scuderi, Postoperative Sore Throat: More answers than Questions. Anaesthesia and analgesia.org

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Oct 2010. Volume 111. Number 4

- Harding CJ, McVey C: Interview method affects incidence postoperative sore throat. Anaesthesia; 1987, 42:1104-7
- Al-Qahtani AS, Messahel FM: Quality improvement in anesthetic practice- incidence of sore throat after using small tracheal tube. Middle East J Anesthesiol; 2005, 18:179-83.
- Junchi Ogata, Kouichiro Minami, TakafumiHorishita *et al.* Gargling with Sodium Azulene Sulfonate Reduces the Postoperative Sore Throat After Intubation of the Trachea; Anesthesia & Analgesia:July 2005 - Volume 101 - Issue 1 - pp 290-293.
- Thomas S, Beevi S. Dexamethasone reduces the severity of postoperative sore throat. Can J Anaesth 2007; 54:897-901.
- 13. Asif Kazami, AfshiniAmini. The effect of Betamethasone gel in reducing sore throat, cough, and hoarseness after laryngo-tracheal intubation. M.E.J Anesth 19 (1), 2007
- 14. Sumathi PA, Shenoy T, Ambareesha M, Krishna HM. Controlled comparison between betamethasone gel and lidocaine jelly applied over tracheal tube to reduce postoperative sore throat, cough, and hoarseness of voice.

Br J Anaesth. 2008; 100:215-8.

- Canbay O, Celebi N, Sahin A, Celiker V, Ozgen S, Aypar U. Ketamine gargle for attenuating postoperative sore throat. Br J Anaesth 2008; 100:490-3.
- NasrinFaridiTazeh-kand, MD, BitaEslam *et al.* Inhaled Fluticasone Propionate Reduces Postoperative Sore Throat, Cough, and Hoarseness. AnesthAnalg 2010; 111:895–8.
- 17. MohammadrezaSafavi, Azim Honarmand *et al.* Intravenous dexamethasone versus ketamine gargle versus intravenous dexamethasone combined with ketamine gargle for evaluation of post-operative sore throat and hoarseness. Adv Biomed Res. 2014 Oct 20; 3:212. 3–9.
- Adamu Muhammad Sarki, AlhassanDatti Mohammed. A comparison of betamethasone gel and lidocaine jelly as prophylaxis against intubation-associated throat complications. Nigerian Journal of Basic and Clinical Sciences / Jul-Dec 2015 / Vol 12 | Number 2.
- BhagyashreeAmingad, ShruthiJayaram *et al.* Comparison of ketamine nebulisation with ketamine gargle in attenuating postoperative sore throat. Indian Journal of Clinical Anaesthesia, 2016;3(3): 342-346

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