Original Article

Effect of alkalinized lidocaine versus air as intracuff inflating agent in general anaesthesia: a comparative study

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Abstract

Background: *Post-operative sore throat, cough and hoarseness of voice are undesired and neglected occurrences after general anaesthesia with endotracheal intubation. Tracheal intubation results in stretch stimuli in the trachea caused by the tube and its cuff. Targeted delivery of lidocaine to the mucosa in contact with the tracheal tube (ETT) cuff can be used as a method for decreasing tracheal stimuli.*

Methods: This study is a randomized controlled trial. A total of 60 Patients who underwent elective surgical procedures under general anaesthesia at ShSMCH Dhaka were included in this study. They were randomized into two groups; group A and group L. In group A, (n = 30) air was used to fill the endotracheal tube cuff. In group L, (n = 30) 2% lidocaine (3-5) ml with 7.5% NaHCO3 (2-3) ml was used to fill the endotracheal tube cuff. Chi –Square test with Yates correction was used to analyze the categorical variables, shown with cross tabulation. Student t-test was used for continuous variables. P values <0.05 was considered as statistically significant. Postoperatively, patients were directly asked about the presence of sore throat, cough and hoarseness of voice at two intervals; 1 to 3 hours and 22 to 24 hours.

Results: *Both the groups were comparable with regard to age, gender, height, weight and ASA physical status. The mean duration of operation and mean duration of anaesthesia were found statistically non-significant (p>0.05) between two groups. At the end of surgery, mean cuff pressure was found 24.3±2.1 cmH2O in group A and 22.9±1.8 cmH2O in group L, which was statistically significant (p<0.05) between two groups. Seven (23.3%) patients had sore throat after 1-3 hours in group A and 2(6.7%) in group L. Eleven (36.7%) patients had sore throat after 22-24 hours in group A and 3(10.0%) in group L. Sore throat after 22-24 hours was statistically significant (p<0.05) between two groups. Eight (26.7%) patients had cough after 1-3 hours in group A and 3(10.0%) in group L. Twelve (40.0%) patients had cough after 22-24 hours in group A and 4(13.3%) in group L. Cough after 22-24 hours was statistically significant (p<0.05) between two groups. Fifteen (50.0%) patients had hoarseness after 1-3 hours in group A and 7(23.3%) in group L. Eight (26.7%) patients had hoarseness after 22-24 hours in group A and 2(6.7%) in group L. The difference wasstatistically significant (p<0.05) between two groups.*

Conclusion: *Our study shows that sore throat, cough and hoarseness were significantly decreased in postoperative period by using ETT cuff inflated with 2% alkalinized lidocaine better than cuff inflated with air.*

Keywords: *Lidocaine, Endotracheal tube (ETT) cuff inflating agent, Sore throat, Cough, Hoarseness*

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Introduction

Tracheal intubation is often required during general anaesthesia to secure the airway and facilitate ventilation. The process of laryngoscopy and placement of tracheal tube is associated with post-operative throat complications such as sore throat, cough and hoarseness of voice.[1] Contributory mechanism included : (1) Trauma to the tonsillar pillars, pharynx, tongue, larynx, and trachea.[2] (2) Stimulation of rapidly adapting stretch receptor (RARs) located throughout the inner circumference of the trachea.[3,4] (3) Neuropraxia of the recurrent laryngeal nerve due to compression from excessive intracuff pressure have been implicated in the pathogenesis of post-operative hoarseness.[5]

The incidence of these throat complications vary between 15%-94% that can result in potentially dangerous complications such as hypertension, cardiac dysrhythmias, myocardial ischaemia, surgical bleeding, bronchospasm, raised intraocular and intracranial pressure.[6,7] Measures used in prevention of post-operative throat complications include use of a small sized tracheal tube, use of topical or intravenous lidocaine, topical application of corticosteroids as spray or gel and ketamine gargle.[8,9,10]

Intra ETT cuff lidocaine has been found to be a practical and efficient way to anesthetize the tracheal mucosa by blocking the rapidly adapting stretch receptors (RARs).[3,11] Only the non-ionized base form of drug diffuses across the hydrophobic polyvinyl chloride walls of the ETT cuff.[11,12] Increasing the p^H of the solution can predictably increase the percentage of the non-ionized fraction of the drug. Addition of bicarbonate resulted in a 63-fold increase in the diffusion of lidocaine across the ETT cuff.[11,13,14]

The aim of this study was to investigate the effectiveness of intracuff alkalinized lidocaine in reducing cough, sore throat and hoarseness after general anaesthesia.

Materials & Methods

This randomized clinical trial was carried out in the department of Anesthesia, Intensive care and Pain medicine of Shaheed Suhrawardy Medical College Hospital (ShSMCH), Dhaka, from January, 2018 to June, 2018. Prior to the commencement of this study, the research protocol was submitted to the ethical review committee of ShSMCH. Patients of either sex, ASA grade l and ll, who were scheduled for elective surgical procedures under general anaesthesia with intubation were included in this study. Patients having a history of sore throat in last six-week, smoker, tobacco chewers and patients with Nasogastric tube in-situ were excluded from the study.

Total 60 patients aged between 10 to 45 years were selected. After obtaining written informed consent, they were randomized into two groups on even and odd number basis. Even number for Group-A and odd number for Group-L.

After reaching to the operating room, an 18G IV cannula was inserted in a peripheral vein and was infused with ringer's lactate solution. Patient's baseline vital parameters were recorded using pulse oximeter, ECG and non-invasive blood pressure (NIBP). Both groups received injection fentanyl (1-1.5 mcg/kg) IV. Then the patient was pre-oxygenated with 100% oxygen and the induction agent was administered by another anesthetist.

Induction was achieved with (2-3) mg/kg intravenous propofol. A fresh high volume-low pressure ETT, choosing 7.5 mm for women and 8.0 mm for man, thus standardizing the type and size of the tube. Intubation was facilitated by 2mg/kg intravenous succinylcholine and muscle relaxation was maintained with 0.1 mg/kg vecuronium bromide and maintenance was done by one-third dose of the initial dose.Anaesthesia was maintained with oxygen 33% and nitrous oxide 66% with halothane. The tidal volume and the ventilatory frequency were adjusted and intermittent positive pressure ventilation (IPPV) was continued to maintain end tidal carbon dioxide between 30 – 40 mm Hg.

Intra operative intracuff pressure was measured continuously by connecting the pilot balloon to a cuff manometer via a 120 cm extension polyvinyl chloride tube.

At the end of surgery, the effect of muscle relaxant was reversed with 0.04 mg/kg of neostigmine and atropine 0.02 mg/kg. Patients were extubated, shifted to the recovery room and monitoring of hemodynamic, analgesic, sedation and post-operative side effects.

Postoperatively, patients were directly asked about the presence of sore throat, cough and change of voice (hoarseness of voice). Binary scale

was used on the two groups of patients to assess the presence and absence of sore throat, cough and hoarseness of voice at two intervals, (1 to 3) hours and (22 to 24) hours postoperatively. Data were collected in a specially designed 'data sheet'.

Ethical consideration

Prior to the commencement of this study, the research protocol was approved by ethical review committee of ShSMCH. The aims and objective of the study along with its procedure, alternative methods, risk and benefits were explained to the patients in easily understandable local language and then informed consent had been taken from each patient. It was assured that all records would be kept confidential and the procedure would be helpful for both the physician and patients in making rational approach regarding management of the case.

Statistical analysis

All the observations were recorded in a preformed data sheet. The mean and median values were calculated for continuous variables. The qualitative observations were indicated by frequencies and percentages. Chi-Square test was used to analyze the categorical variables and Student t-test or fisher exact test was used for quantitative variables. P values < 0.05 was considered as statistically significant.

Results

Total number of 60 subjects aging 10-45 years of either sex were recruited successfully. They were divided into two groups. Group A received Air and group L received 2% lidocaine with 7.5% $NaHCO_3$ as cuff inflating agent.

Table 1: showed the demographic and clinical characteristics of the studied population.

Variables	Group A (n=30)		Group L (n=30)		P value
Age(years) Mean±SD	32.2±12.7		33.1±11.8		0.777^{ns}
Sex	n	%	n	%	
Male	18	60.0	20	66.7	0.592^{ns}
Female	12	40.0	10	33.3	
Weight (kg)Mean±SD	58.7±11.4		60.0±12.7		0.678^{ns}
Durationof operation (min) Mean ±SD	117.4±28.8		120.6±29.5		0.672^{ns}
Duration of anaesthesia(min)	142.7±53.0		157.6±50.4		0.269^{ns}

P-values were calculated by chi-square test and unpaired t-test test (parametric &nonparametric).
(NS: Not significant)
P-value was significant at <0.05

Table 2: MeanCuff pressure in the two studied groups (NS: Not significant)

Cuff pressure (cm H_2O)	Group A (n=30)	Group B (n=30)	P value
	Mean±SD	Mean±SD	
Start of surgery	20.1±1.7	19.6±1.1	0.182^{ns}
End of surgery	24.3±2.1	22.9±1.8	0.008^{s}

The mean cuff pressure at the beginning and at the end of surgery were 20.1±1.7 cm H2O and 24.3±2.1 cm H2O in group A respectively. In group L, mean cuff pressure at the beginning and at the end of surgery were 19.6±1.1cm H2O and 22.9±1.8cm H2O respectively. Mean cuff pressure were showed in table 2. Mean cuff pressure were statistically insignificant at the start of surgery but at the end of surgery it was statistically significant.
s= significant, ns= not significant
P value reached from chi square test

Table 3: Sore throat in the two studied groups s= significant, ns= not significant P value reached from chi square test

Sore throat	Group A (n=30)		Group B (n=30)		P value
	n	%	n	%	
After 1-3 hours					
Yes	7	23.3	2	6.7	0.071^{ns}
No	23	76.7	28	93.3	
After 22-24 hours					
Yes	11	36.7	3	10.0	0.015^{s}
No	19	63.3	27	90.0	

Table 3 showed, seven (23.3%) patients had sore throat after 1-3 hours in group A and 2(6.7%) patients in group L. Eleven (36.7%) patients had sore throat after 22-24 hours in group A and 3(10.0%) patients in group L. Sore throat after 22-24 hours was statistically significant (p<0.05) between two groups.

s= significant, ns= not significant
P value reached from chi square test

Table 4: Cough in the two studied groups s= significant, ns= not significant
P value reached from chi square test

Cough	Group A (n=30)		Group B (n=30)		P value
	n	%	n	%	
After 1-3 hours					
Yes	8	26.7	3	10.0	0.095[ns]
No	22	73.3	27	90.0	
After 22-24 hours					
Yes	12	40.0	4	13.3	0.020[s]
No	18	60.0	26	86.7	

The incidence of cough was 8(26.7%) in group A and 3(10.0%) in group L after 1-3 hours. Twelve (40.0%) patients had cough after 22-24 hours in group A and 4(13.3%) in group L. Cough after 22-24 hours was statistically significant ($p<0.05$) between two groups. Table 4 demonstrated the incidence of cough.

s= significant, ns= not significant
P value reached from chi square test

Table 5:Hoarseness in the two studied groups

Hoarseness	Group A (n=30)		Group B (n=30)		P value
	n	%	n	%	
After 1-3 hours					
Yes	15	50.0	7	23.3	0.032[s]
No	15	50.0	23	76.7	
After 22-24 hours					
Yes	8	26.7	2	6.7	0.038[s]

Out of 60 patients, fifteen (50.0%) patients had hoarseness after 1-3 hours in group A and 7(23.3%) in group L. Eight (26.7%) patients had hoarseness after 22-24 hours in group A and 2(6.7%) in group L. Hoarseness was significantly higher in group A than group B after 1-3 hours and after 22-24 hours. Table 5 revealed the hoarseness in the two groups.

s= significant

P value reached from chi square test

Discussion

In this study, we observed that the majority (40.0%) patients were belonged to age 31-40 years. The difference was not statistically significant ($p>0.05$) between two groups. Similar observation was found by other studies[2, 15, 16]. They have found no statistically significant difference between the comparison groups.

The majority (60.0%) patients were male in group A and 20(66.7%) in group L.There was no statistically significant difference ($p>0.05$) between the two groups. Other studies showed no significant gender difference[15, 16].

In our study, the mean weight was found 58.7±11.4 kg in group A and 60.0±12.7 kg in group L. No statistically significant difference ($p>0.05$) was observed between the two groups.Ningawal et al.[15] and Gaur et al.[16] also reported similar observations.

In the present study, the mean duration of operation was found 117.4±28.8 minutes in group A and 120.6±29.5 minutes in group L. The difference was not statistically significant ($p>0.05$) between the two groups. Chari and Paul[6]found the mean duration of surgery was 124.33±45.31 minute in topical benzydamine hydrochloride group, 115.0±39.81 minute in 2% lignocaine gel group and 110.0±49.32 minute in normal saline group. The difference was not statistically significant ($p>0.05$) between the groups. In a study done by Jaichandran et al.[20] reported the mean duration of surgery was 137.80±40.88 minute in group A and 143.80±38.17 minute in group L. Budania et al.[19] also reported the similar findings.

In this current trial, we observed that the mean duration of anaesthesiawas 142.7±53.0 minute in group A and 157.6±50.4 minute in group L. The difference was not statistically significant ($p>0.05$) between the two groups. The mean duration of anaesthesiawas also comparable in other studies[7,10,16].

In this study, almost two third (63.3%) patients were found ASA grade I in group A and 21(70.0%) in group L. Ali et al.[2] and Gaur et al.[16] also observed the similar findings. No statistically significant ($p>0.05$) difference was found between the two groups.

At the end of surgery, mean cuff pressure was found 24.3**±2.1** cmH_2O in group A and 22.9**±1.8**

cmH_2O in group L which was statistically significant ($p<0.05$). An air filled ETT cuff within the trachea represents a gas filed pocket in the body. So intracuff pressure increases due to diffusion of nitrous oxide into the air-filled cuff. Jaichandran et al.[20] reported that the mean initial intracuff pressure was 24.92±2.89 cmH_2O in group A and 22.52±2.42 cmH_2O in group L and final cuff pressure was found 56.68±10.59 cmH_2O in group A and 23.64±2.67 cmH_2O in group L. Final cuff pressure was statistically significant ($p<0.05$) between two groups. Ningawal et al.[15] observed that in group L the mean cuff pressure at the end of surgery was significantly lower than group A. Similar findings have been observed in other studies[6,16].

In this study, the incidence of sore throat was not significant after 1-3 hours but sore throat after 22-24 hours was statistically significant ($p<0.05$) between the two groups. Sore throat more common in group A because N_2O diffuses in to the air-filled cuff and increases cuff pressure, subsequently tracheal mucosa was over stretched for prolonged period. In group L intra cuff pressure is not increased at the end of the surgery and lidocaine spread through the semi permeable membrane wall and induces anesthetic action in the trachea. So, occurrence of Sore throat significantly decreases. Ali et al.[2] only 5% in the lidocaine group had sore throat after 22-24 hours compared to 20% in the distilled water group and 45% in the air group. Bennett et al.[21] observed statistical significance between air and saline groups. Ningawal et al.[15] reported that 7(14%) patients had sore throat after 1 hour in alkalinized lignocaine group (group L) as compared to 18 (36%) patients in intracuff air group (group A). At 24 hour the incidence of sore throat with alkalinized lignocaine was 12% as compared to 52% in intracuff air group. There was a significant statistical difference between the alkalinized lignocaine group and intracuff air group. Another study[7] compared the incidence of sore throat and hemodynamic changes between intracuff alkalinized lignocaine, intracuff saline and intracuff air and concluded that incidence of sore throat is significantly lower in intracuff alkalinized lignocaine group.

In our study, presence of cough after 22-24 hours was significantly higher in group A ($p<0.05$) than group L. Because N_2O diffuses in to the air-filled cuff and increases cuff pressure, subsequently tracheal mucosa was over stretched for prolonged period. Gaur et al.[16] shows incidence of cough at immediately, 1 h and 24 h postoperatively was significantly higher in air group in comparison to lignocaine group. These results are coherent with other studies[2,20,22,23]. Ningawal et al.[15] observed that at 24 hour the incidence of cough with alkalinized lignocaine was 12% as compared to 52% in intracuff air group. There was a significant statistical difference between the alkalinized lignocaine group and intracuff air group.

In present study, we observed that Hoarseness was more common in group A and the difference was statistically significant ($p<0.05$). Ali et al.[2] shows twenty three percent complained of hoarseness in the lidocaine group as compared to 35% and 53% in the distilled water and air groups respectively after 1-3 hours. This completely disappeared in the lidocaine group but persisted in 20% and 45% in the other groups after 22-24 hours. Navarro et al.[24] used lidocaine as ETT cuff inflating agent and found that there was a significant reduction of incidence and severity of postoperative sore throat but there was no comment on dysphasia or hoarseness of voice. The incidence of early and late postoperative sore throat, agitation, coughing, hoarseness, dysphonia was significantly lower in lignocaine group.[25] Thus sore throat, cough and hoarseness were significantly decreased in postoperative period using 2% alkalinized lidocaine as cuff inflating agent.

Conclusion

Use of 2% alkalinized lidocaine as cuff inflating agent is simple and effective way to prevent postoperative sore throat, cough and hoarseness. It also maintains a stable cuff pressure during oxygen nitrous anaesthesia.

Limitation

1. The study population was selected from one selected hospital in Dhaka city, so that the results of the study may not reflect the exact picture of the country.
2. Small sample size was also a limitation of the present study. Therefore, in future further study may be under taken with large sample size.

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