RESEARCH ARTICLE

Comparison of intra-cuff lidocaine vs alkalinized lidocaine effects for prevention of post-operative sore throat

Sarosh Ul Hassan, Nighat Abbas, Ali Asghar, Sabahat Tariq, Nadeem Naqvi, Muhammad Rafique

Abstract

Objective: To compare the effect of intra-cuff lidocaine versus alkalinized lidocaine in the prevention of post-operative sore throat.

Method: The cross-sectional study was conducted from June 15 to July 15, 2019, at the Department of Anaesthesiology, Liaquat National Hospital and Medical College, Karachi, and comprised patients of either gender aged 15-50 years classified as American Society of Anaesthesiologist class 1-2 and undergoing general anaesthesia with endotracheal intubation expected to last more than one hour. The patients were randomised into Group L and Group LA. General anaesthesia was given using induction dose of propofol 2-3mg/kg, nalbuphine 0.1mg/kg and atracurium 0.5mg/kg and female patients were intubated with 7.0mm size endotracheal tube and males patients with 8.0mm. All intubations were performed by an anaesthesiologist with minimum of two-year experience. The endotracheal tube cuff was inflated by using plain lidocaine 2% in group L and 2% lidocaine with 8.4% sodium bicarbonate in LA group till the air leak diminished. Post-surgery, the patients were assessed on extubation for any emergence phenomenon and were re-assessed at 1st, 6th, 12th and 24th hour. The assessment was done by the on-call anaesthesiology resident who was blinded to the study group. Data was collected using a proforma. The analysis was done using software IBM SPSS Statistics 23.0. Chi-Square Test was applied to analyse the data.

Results: Of the 58 patients, 33(56.9%) were male and 25(43.1%) were female. There were 26(44.8%) patients aged 25-36 years, while 12(20.7%) each were aged 36-45 years and 46-55 years. There were 29(50%) patients in each of the 2 groups. After 24 hours, 44(75.9%) patients in Group L did not complain of any pain, while in group LA the corresponding number was 56(96.6%). Both in terms of cough and hoarseness at 24 hours, 56(96.6%) patients in Group L did not have complaints, while in Group LA there were no such complaints. In Group L, heart rate 60-80 was noted in 20(69%) patients and 81-100 in 9(31%). In Group LA, the corresponding values were 17(58.6%) and 12(41.4%).

Conclusion: Alkalinized lidocaine was found to be highly effective in preventing post-operative throat complications compared to lidocaine.

Keywords: Alkalanized lidocaine, Hoarseness, Intra-cuff lidocaine, Sore throat. (JPMA 72: 2422; 2022)

DOI: https://doi.org/10.47391/JPMA.4269

Introduction

Post-operative sore throat (POST) is a highly reported adverse effect of general anaesthesia (GA). Sore throat is generally defined as the irritation of the pharynx. However, there are common symptomatic conditions contributing to sore throat, like laryngitis, hoarseness, dysphagia, cough tracheitis and others including mucosal dehydration, irritation and such other pathologies.[1] Dry cough is reported more after surgery in both adults and children, causing tremors in some patients in which involuntary twitching of body parts is reported. These involuntary jerks have influence on the incised region, leading to increase in sufferings. Breathing and increase in body temperature, when reported, may eventually extend the recovery time.[2]

Department of Anaesthesia, Liaquat National Hospital, Karachi, Pakistan.

Correspondence: Sarosh Ul Hassan. Email: dr.sarosh09@gmail.com

Discomfort ranging from mild to critical is more dependent on the surgical duration. Patients undergoing other types of anaesthesia, like spinal anaesthesia, twilight sedation or regional block, generally do not report sore throat. Two major reasons that cause POST are dehydration due to the stopping of food and water intake a couple of hours before surgery till a few hours after surgery, and intubation with an endotracheal tube (ETT) that is inserted from the mouth down to the throat. One end of it is attached to the ventilator machine for providing oxygen during surgery. When patients recover from anaesthesia, they feel irritation in mouth, throat, vocal cord and tongue. Depending on the age, gender and nature of operation, low to high burning sensation is also reported.[3,4] Some researchers are of the opinion that POST has no relationship with the nature of surgery.[5] One of the main reasons reported for throat injury is that usually inhalational anaesthesia has nitrous oxide (NO). This contributes to the burning sensation or pain in the

throat or mucosal damage of trachea affecting the inner lining of the oesophagus.[6] NO is commonly used in GA. It is easily penetrable from the cuff membrane. This causes pressure and, as a result, lesions occur in tracheal mucosa, causing change of voice, a discomfort in breathing, headache, coughing, and throat dryness.[7] Studies have reported cough after patient regains consciousness is due to applied pressure of cuff on the tracheal wall. The over-pressure of cuff stimulates the nociceptive fibres of tracheal mucosa which causes cough reflex after extubation. This condition is worst in patients who happen to be smokers.[8]

Lidocaine is a numbing medication used for local anaesthesia. Its main advantage is its quick onset of action. It is further utilised to cure ventricular tachycardia. Besides, in GA, lidocaine is administered in cuff which diffuses slowly to reduce POST effect.[9] The intra-cuff trial is effective to reduce POST chances. Depending on the nature of operation, the dose and mode of administration are decided. Lidocaine in spray and gel forms is available in the market, have different potencies and efficacy. The rate of diffusion also varies and depends on the patient health.[10]

The prime function of lidocaine is to inhibit neuronal pathways through inactivating the fast voltage gated sodium channels in cell membrane of neurons. This action further includes the preventive capability of postsynaptic neuron to depolarise which is the source of generating action potential. This inhibition in other words is the inhibition of pain receptors having the anaesthetic effect to propagate into the brain.[11] Due to chances of toxicity, the dose 200-400mg is merely given to the patient. Intra-cuff lidocaine is more reported is cases of cuff membrane damage the exact reason for which is still under investigation. However, reports suggest that this may be due to alteration in potential of hydrogen (pH) of the cuff, the diffusion coefficient and the thickness of mucous which takes time for the reflex action in terms of cough suppression.[12]

The alkalinised lidocaine is more advantageous than intra-cuff lidocaine. Alkalinised lidocaine is applied more to resolve POST. It diffuses steadily and constantly from the cuff membrane towards the tracheal membrane. This causes the local anaesthetic effect on tracheal receptors. The slow and constant property of alkalinised lidocaine assists in eliciting the emergence of cough. Though the operation time might be more, it aids in the management of POST.[13] Alkalinised lidocaine usually consists of bicarbonate solution or saline. It has inhibitory ability against pharynx or tracheal receptors. Cough experience is least reported in patients having alkalinised lidocaine during GA.[14]

In most of the anaesthetic drugs, pH is reported around 7.4. A number of studies documented that pH of alkalinised lidocaine is usually 7.9. At this pH, half of the drug is in the uncharged form and half is in the charged form. Both forms are required by the body which assist in permeating from specific tissue barriers. The uncharged form causes easy penetration from lipid blockades, while the charged form can also diffuse via interstitial fluids or other fluid blockades in tissues. These mechanisms ultimately inhibit the vocal cord, lubricate the throat and the sub-organ of the breathing system.[15] Generally, low dose (40mg) of alkalinised lidocaine easily diffuses from the cuff membrane and causes less sedation in patients, while the high dose diffuses comparatively slowly; and between the two, the low dose is found to be highly effective.[16]

The current study was planned to compare the effect of intra-cuff lidocaine versus alkalinized lidocaine in the prevention of POST.

Patients and Methods

The cross-sectional study was conducted from June 15 to July 15, 2019, at the Department of Anaesthesiology, Liaquat National Hospital and Medical College (LNHMC), Karachi.

After approval from the institutional ethics review board, the sample size was calculated on the basis of POST with intra-cuff lidocane 63.33% versus alkalinized lidocaine 93.33%[16] at confidence level 95% and power 80% using the formula $n= z^2p (1-P) /d^2$.

The enrolled patients were randomised using the computer generated randomisation method into 2 groups of 29 each. Those included were patients of either gender aged 15-50 years classified as American Society of Anaesthesiologist (ASA) class 1-2 or being subjected to GA with endotracheal intubation expected to last more than one hour.

Patients outside the age range, those classified as ASA class 3-4, patients with a difficult airway involving multiple intubation attempts, patients with history of sore throat, upper respiratory infections, allergy, chronic obstructive pulmonary disease (COPD), cases where surgery would last for less than one hour, and patients not giving informed consent were excluded.

After taking informed consent from the volunteering patients, they were randomised into lidocaine Group L and alkalinised lidocaine Group LA. GA was given using induction dose of propofol 2-3mg/kg, nalbuphine

0.1mg/kg and atracurium 0.5mg/kg and female patients were intubated with 7.0mm size ETT and male patients with 8.0mm. All intubations were performed by an anaesthesiologist with minimum of two-year experience. The ETT cuff was inflated by using plain lidocaine 2% in group L and 2% lidocaine with 8.4% sodium bicarbonate in the LA group till the air leak diminished. Post-surgery, the patients were assessed on extubation for any emergence phenomenon and were re-assessed at 15mins, 1st, 3rd and 24th hour. The assessment was done by the on-call anaesthesiology resident who was blinded to the study group. Any patient who developed POST was given intravenous (IV) dexamethasone 8mg stat, and advised warm normal saline gargles.

Data was collected using a proforma. The Dataset was compiled and analysis was done using software IBM SPSS Statistics 23.0.

Results

Of the 58 patients, 33(56.9%) were male and 25(43.1%) were female. There were 26(44.8%) patients aged 25-36 years, while 12(20.7%) each were aged 36-45 years and 46-55 years (Table-1). There were 29(50%) patients in each

Table-1: Patient profile.

	No. (%)
Age (years)	
25-35	26 (44.8)
36-45	12 (20.7)
46-55	12 (20.7)
56-65	8 (13.8)
Total	58 (100)
Gender	
Male	33 (56.9)
Female	25 (43.1)
Total	58 (100)
Co-Morbids	
NKCM	37 (63.8)
Diabetic	5 (8.6)
Hypertensive	8 (13.8)
Asthma	1 (1.7)
DM + HTN	3 (5.2)
DM + HTN + Others	2 (3.4)
Hypo/ Hyperthyroid	2(3.4)
Total	58 (100)

NKCM: No Known Co Morbids, DM: Diabetes mellitus, HTN: Hypertension.

Table-2: Incidence of intra-operative and post-operative sore throat (POST), cough, hoarseness and spasm in the two groups at various time points.

	Group L (Total No.: 29)	Group LA (Total No.: 29)	(Total No.: 58)
Sore Throat - Reported No Pain (%)			
15min	29 (100)	29 (100)	58 (100)
1hour	25 (86.2)	29 (100)	54 (93.1)
3hour	23 (79.3)	29	52 (89.7)
24hour	22 (75.9)	29	50 (86.2)
Cough (%)			
15mins	8 (27.6)	2 (6.9)	10 (17.2)
1hour	4 (13.8)	0	4 (6.9)
3hour	2 (6.9)	0	2 (3.4)
24hour	1 (3.4)	0	1 (1.7)
Hoarseness (%)			
15mins	2 (6.9)	2 (6.9)	4 (6.9)
1hour	5 (17.2)	0	5 (8.6)
3hour	2 (6.9)	0	2 (3.4)
24hour	1 (3.4)	0	1 (1.7)
Spasm (%)			
15mins	0	0	0
1hour	0	0	0
3hour	0	0	0
24hour	0	0	0

Table-4: Intra-operative and post-operative heart rate variation in the study groups.

	Group L (Total No.: 29)	Group LA (Total No.: 29)	(Total No.: 58)
15 minutes			
Less than 60	3 (10.3)	2 (6.9)	5 (8.6)
60-80	9 (31)	10 (34.5)	19 (32.8)
80-100	13 (44.8)	12 (41.4)	25 (43.1)
More than 100	4 (13.8)	5 (17.2)	9 (15.5)
1 Hour			
Less than 60	0	1 (3.4)	1 (1.7)
60-80	17 (58.6)	7 (24.1)	24 (41.4)
80-100	12 (41.4)	20 (69)	32 (55.2)
More than 100	0	1 (3.4)	1 (1.7)
3 Hours			
Less than 60	0	1 (3.4)	1 (1.7)
60-80	18 (62.1)	17 (58.6)	35 (60.3)
80-100	11 (37.9)	11 (37.9)	22 (37.9)
More than 100	0	0	0
24 Hours			
Less than 60	0	0	0
60-80	20 (69)	17 (58.6)	37 (63.8)
80-100	9 (31)	12 (41.4)	21 (36.2)
More than 100	0	0	0

Table-3: Intensity of sore throat in the study groups.

	15mins (%)			1 Hour (%)			3 Hour (%)			24 Hours (%)		
	Mild	Moderate	Severe	Mild	Moderate	Severe	Mild	Moderate	Severe	Mild	Moderate	Severe
Group L	6 (20.7)	2 (6.9)	0	1 (3.4)	2 (6.9)	1 (3.4)	4 (13.8)	1 (3.4)	1 (3.4)	5 (17.2)	2 (6.9)	0
Group LA	3 (10.3)	0	0	0	0	0	0	0	0	0	0	0

of the 2 groups.

Sore throat, cough, horaseness and spasms were noted in both the groups at 15min, 1h, 3h and 12h post-surgery (Table-2). Intensity of sore throat in the study groups was noted at 1h, 3h and 24h (Table-3).

After 24 hours, 75.9% patients in Group L did not complain of any pain, while in group LA the corresponding number was 96.6%. Both in terms of cough and hoarseness at 24 hours, 96.6% patients in Group L did not have complaints, while in Group LA there were no such complaints. In Group L, heart rate (HR) 60-80 was noted in 20(69%) patients and 81-100 in 9(31%). In Group LA, the corresponding values were 17(58.6%) and 12(41.4%) (Table-4).

Discussion

An increase in lidocaine pH increases the diffusion rate 65-fold. One study recommended that alkalinised lidocaine is superior to saline in terms of avoiding POST.[17] This finding correlates with the current study. Lidocaine formulations have prolonged sedative effects, while alkalinised lidocaine does not cause delayed awakening. Delayed awakening leads to throat dryness and other symptoms that cause POST.[18] This finding also correlates with the current findings. Some other studies have also reported similar results.[19] A meta-analysis said alkalinised lidocaine was associated with less sore throat, cough and hoarseness, and was, therefore, more effective.[20] This correlates with the current findings. The current study's findings match with another study[21] which concluded that intracuff alkalinised lignocaine reduced the incidence of emergence phenomena and increased ETT tolerance.[21]

There were certain limitations in our study that should be considered in further work. The change of Heat and Moisture exchanger was not considered among the patients. Post-operative suctioning may even play a role in the consequences. Also, we did not consider if the level of difficulty of intubations lead to post-operative airway issues.

Conclusion

Alkalinised lidocaine was found to have more efficacy than lidocaine.

Disclaimer: None.

Conflict of Interest: None.

Source of Funding: None.

References

1. El-Boghdadly K, Bailey CR, Wiles MD. Postoperative sore throat: a systematic review. Anaesthesia 2016;71:706-17. doi: 10.1111/anae.13438.
2. Myles PS, Chan MT, Kasza J, Paech MJ, Leslie K, Peyton PJ, et al. Severe Nausea and Vomiting in the Evaluation of Nitrous Oxide in the Gas Mixture for Anesthesia II Trial. Anesthesiology 2016;124:1032-40. doi: 10.1097/ALN.0000000000001057
3. Sayilan AA, Dereli E. Postoperative Respiratory Complications. In: Alexandrova E, Shapekova NL, AK B, Ozcanaslan F, eds. Health Sciences Research in the Globalizing World. Sofia, Bulgaria: St. Kliment Ohridski University Press, 2018; pp 177-84. [Online] 2018 [Cited 2022 August 12]. Available from URL: https://www.researchgate.net/profile/Sinem_Erem2/publication/337044601_Alternative_Treatments_in_Menopausal_Period/links/5dc22218299bf1a47b190302/Alternative-Treatments-in-Menopausal-Period.pdf#page=190
4. Keles S, Kocaturk O. Postoperative discomfort and emergence delirium in children undergoing dental rehabilitation under general anesthesia: comparison of nasal tracheal intubation and laryngeal mask airway. J Pain Res 2018;11:e103-10. doi: 10.2147/JPR.S153637.
5. Chang JE, Kim H, Han SH, Lee JM, Ji S, Hwang JY. Effect of Endotracheal Tube Cuff Shape on Postoperative Sore Throat After Endotracheal Intubation. Anesth Analg 2017;125:1240-5. doi: 10.1213/ANE.0000000000001933.
6. Tanaka Y, Nakayama T, Nishimori M, Tsujimura Y, Kawaguchi M, Sato Y. Lidocaine for preventing postoperative sore throat. Cochrane Database Syst Rev 2015;2015:CD004081. doi: 10.1002/14651858.CD004081.pub3.
7. Lee J, Lee YC, Son JD, Lee JY, Kim HC. The effect of lidocaine jelly on a taper-shaped cuff of an endotracheal tube on the postoperative sore throat: a prospective randomized study: A CONSORT compliant article. Medicine (Baltimore) 2017;96:e8094. doi: 10.1097/MD.0000000000008094.
8. Kusunoki T, Sawai T, Komasawa N, Shimoyama Y, Minami T. Correlation between extraction force during tracheal intubation stylet removal and postoperative sore throat. J Clin Anesth 2016;33:37-40. doi: 10.1016/j.jclinane.2015.12.024.
9. Watanabe J, Ikegami Y, Tsuda A, Kakehi E, Kanno T, Ishikawa S, Kataoka Y. Lidocaine spray versus viscous lidocaine solution for pharyngeal local anesthesia in upper gastrointestinal endoscopy: Systematic review and meta-analysis. Dig Endosc 2021;33:538-48. doi: 10.1111/den.13775.
10. Mekhemar NA, El-Agwany AS, Radi WK, El-Hady SM. Comparative study between benzydamine hydrochloride gel, lidocaine 5% gel and lidocaine 10% spray on endotracheal tube cuff as regards postoperative sore throat. Rev Bras Anestesiol 2016;66:242-8. doi: 10.1016/j.bjan.2016.02.011.
11. Kandil E, Melikman E, Adinoff B. Lidocaine Infusion: A Promising Therapeutic Approach for Chronic Pain. J Anesth Clin Res 2017;8:697. doi: 10.4172/2155-6148.1000697.
12. Hutson PR, Abd-Elsayed A. Lidocaine Infusion Therapy. In: Abd-Elsayed A, eds. Infusion Therapy, 1st ed. Switzerland: Springer Cham, 2019; pp 1-16.
13. Momota Y, Kakudo T, Miyatani N, Miyake T, Tamura I, Oshita N, et al. Effect of distribution and membrane structure of alkalinized lidocaine across an endotracheal tube cuff. J Osaka Dent Univ 2016;50:1-6. doi: 10.18905/jodu.50.1_1
14. Amucheazi AO, Ajuzieogu VO, Madu I. Intracuff alkalinized lidocaine and the incidence of cough and postoperative sore throat after anesthesia in children: A randomized clinical trial. Trends Anaesth Crit Care 2019;25:38-40. doi: 10.1016/j.tacc.2018.10.003
15. Rizvanović N, Čaušević S, Hrnčić N, Hatibović H. Effect of intracuff

alkalinized 2% lidocaine on endotracheal tube cuff pressure and postoperative throat symptoms in anaesthesia maintained by nitrous oxide. Med Glas (Zenica) 2019;16:7-12. doi: 10.17392/991-19.

16. Takhelmayum SH, Longjam DE, Raj M, Gojendra R, Rupendra TS, Nongthombam RS. Effect of Intracuff Plain Lignocaine and Alkalinized Lignocaine for Prevention of Postoperative Sore Throat. Int J Health Res Medico Leg Prac 2017;3:64-8.
17. Kulkarni LM, Holyachi R, Kurdi MS. Vegetable gum based gel lubrication of endotracheal tube cuffs improves efficacy of alkalinized intracuff lignocaine in preventing postoperative sore throat: A randomized controlled study. Anaesth Pain Intensive Care 2019;21:423-8.
18. Paulson B. A study on the effectiveness of intracuff instillation with alkalinized 2% lidocaine versus ketamine in attenuating post operative sore throat. Indian J Appl Res 2019;9:24-5. doi: 10.36106/ijar.
19. Estebe JP, Gentili M, Le Corre P, Dollo G, Chevanne F, Ecoffey C. Alkalinization of intracuff lidocaine: efficacy and safety. Anesth Analg 2005;101:1536-41. doi: 10.1213/01.ANE.0000180995.24211.89.
20. Chen ZX, Shi Z, Wang B, Zhang Y. Intracuff alkalinized lidocaine to prevent postoperative airway complications: A meta-analysis. World J Clin Cases 2021;9:10626-37. doi: 10.12998/wjcc.v9.i34.10626.
21. Singh TH, Devi EL, Raj M, Rajkumar G, Singh RT, Singh RN. The effects of intracuff lidocaine on endotracheal-tube-induced emergence. Int J Health Res Medico Leg Prac 2017;3:64-8.