IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 14, Issue 10 Ver. IX (Oct. 2015), PP 60-66
www.iosrjournals.org

A Comparative Study Between Intracuff Alkalinized Lignocaine, Intracuff Plain Lignocaine And Intracuff Air For Decreasing Post Intubation Sore Throat And Emergence Phenomena.

Dr. Wasim Salman[1], Dr. Anjum shamim[2], Dr. Raja Suhail Shounthoo[3], Dr. Sabeeha Gul[4]

[1,2.]*Senior Resident, MD(Anaesthesia), Department of Anaesthesia, Government medical college srinagar, Jammu & Kashmir, 190010, India.*

[3.]*Postgraduate, MD(Anaesthesia), Department of Anaesthesia, Government medical college srinagar, Jammu & Kashmir, 190010, India.*

[4.]*Senior Resident, MD(Radiodiagnosis), Department of Radiology, Government medical college srinagar, Jammu & Kashmir, 190010, India.*

Abstract:
Background: *We sought to determine the benefits of using alkalinized lignocaine to fill the cuff of an endotracheal tube to prevent post intubation sore throat and emergence phenomena.*
Aim: *To study between use of intracuff alkalinized lignocaine, intracuff plain lignocaine and intracuff air for decreasing post intubation sore throat and emergence phenomena during endotracheal intubations.*
Methods: *We performed a randomized controlled study on 90 patients of ASA I-II status divided into 3 groups of 30 each. In the control (AIR) group ETT cuff was filled with air, in group PL plain lignocaine was used to inflate the cuff and in group AL alkalinized lignocaine was used to fill the ETT cuff. The degree of sore throat and other side effects of intubation like coughing, restlessness, dysphonia, dysphagia, hoarseness, bucking, and post operative nausea vomiting were assessed over 24 hours post-extubation.*
Results: *In our study incidence of sore throat was less when intracuff alkalinized lignocaine was used rather than plain lignocaine or air. Throat pain, coughing, restlessness, dysphonia, hoarseness, bucking were most common in the control group in which air was the inflating medium. Compared to plain lignocaine group, the incidence of side effects were less in the alkalinized lignocaine group.*
Conclusion: *These data show benefits of using an alkalinized lignocaine filled ETT cuff in preventing post-intubation sore throat and emergence phenomena like coughing, restlessness, hoarseness, dyphonia, dysphagia and bucking.*
Keywords: *Endotracheal tube; Intracuff; Lignocaine; Alkalinization; Sore throat; Intubation; Extubation.*

I. Introduction

Endotracheal tubes (ETT) allow pressure to be maintained in the airways during the inhalation phase of artificial breathing and prevent aspiration of regurgitated gastroesophageal contents. However, the pressure of the ETT cuff is transmitted to the tracheal mucosa. When elevated, may cause ischemia of the mucosal vessels followed by serious complications such as ciliary loss[(1)], inflammation, ulceration[(2)], haemorrhaging[(3)], tracheal stenosis[(4)] and tracheoesophageal fistula[(5)]. These are found when the ETT cuff pressure is greater than the capillary pressure of the tracheal artery,i.e. 30 cm H_2O[(6),] which causes tracheal ischemia proportional to the pressure exerted by the cuff and to the length of exposure[(6).]

Emergence from general anesthesia is frequently complicated by coughing induced by the endotracheal tube. This can result in potentially dangerous patient movement, hypertension, tachycardia or other arrhythmias, myocardial ischemia, surgical bleeding, bronchospasm and increase in intracranial and intraocular pressure. Laryngeal edema and ischemia are also common complications associated with intubation [(7)].

Nitrous oxide (N_2O), a gaseous anesthetic used in daily anesthetic practice, easily diffuses inside ET cuffs, thereby raising their pressure [(2, 8)]. Overinflation of the cuff and the consequent tracheal mucosa lesions result in sore throats, hoarseness, coughing and restlessness thus causing discomfort to patients after the removal of the ETT [(2,9)].

Postoperative sore throat occurs in up to 90% of intubated patients and is the most common complaint after tracheal intubation [(10)].

When lidocaine is injected into the ETT cuff, [(11, 12)] it spreads through the semipermeable membrane wall and induces anesthetic action in the trachea. This increases airway tolerance to tracheal tube [(13)]. After tracheal extubation, the hemodynamic alterations are minimized, thus reducing the incidence of coughing.[(14-18)]

Previous studies have shown that small amounts of lignocaine (L-HCL) diffused slowly across the

ETT cuff; the addition of Sodium bicarbonate ($NaHCO_3$) increases the diffusion [17]. On the basis of this concept, a randomized, controlled study was performed to compare the clinical effect of filling the ETT cuff with Alkalinized Lignocaine, Lignocaine, or AIR on adverse emergence phenomena.

II. Methods

After obtaining institutional ethics committee ap- proval and written informed consent, adult patients (ASA physical status I & II,) scheduled for elective surgery were enrolled in this study. Patients were randomized into one of the three groups: the Lignocaine group (Group PL), the Alkalinized lignocaine group (Group AL), and the Control group (Group AIR).

The experienced anesthetic care team performed the standard anesthesia and the tracheal intubation.The duration of laryngoscopy and intubation was limited to minimum possible time being similar to all patients. Laryngoscopy was done using Machintosh blade 3 or 4.Laryngoscopic view of the larynx was graded according to Cormack Lehane grading. Then tracheal intubation was performed using endotracheal tube (low pressure, high volume; PVC Cuff) 6.5 – 7.5 mm internal diameter in females and 7.5-8.5 mm internal diameter in males.

ETT cuffs were inflated at the minimal occlusive volume (i.e., no leakage was detected under controlled ventilation). In the control group (AIR), the cuff was slowly inflated with 4-6 ml of air. In group-PL, the cuff was filled with 4-5ml of L-HCL 2% (xylocaine). In group-AL, 3 mL of L-HCl 2% (Xylocaine) was initially injected into a cuff, and then a supplementary volume of 2-3ml 8.4% $NaHCO_3$ was added. Cuff pressure was recorded in all the three groups using a pressure manometer with initial pressure less than 30 cm of water. If an air leak was recorded during the surgery: 1 ml of air was added in the group-AIR patients, 1ml of lignocaine in the group-PL patients and 1ml of 8.4% $NaHCO_3$ in the group-AL patients.

The anesthesia care team, unaware of the filling protocol, delivered the anesthesia. Anesthesia was maintained using 66% Nitrous oxide, 33% Oxygen, varying concentrations (0.2-1.5%) of Halothane and intermittent boluses of Rocuronium as and when required. Injection Diclofenac Sodium 1.5mg/kg was also given by slow intravenous infusion intra-operatively during maintenance. At the end of the surgery, reversal of neuromuscular was done with Injection Neostigmine 0.05 mg/kg body weight intravenously and Injection Glycopyrollate 0.01 mg/kg weight intravenously.

When all of the tracheal extubation criteria was met (ability to follow verbal commands, regular spontaneous ventilation), tracheal extubation was performed after proper suctioning.

Following recordings were done:

- Time of spontaneous ventilation time (time between emergence of spontaneous breathing and extubation) was recorded.
- The gas and liquid volumes inflated into the ETT cuffs at intubation and the volumes withdrawn at extubation were recorded.
- Haemodynamic variables which include heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure were checked at the time of extubation and every minute for 5 minutes thereafter.
- Cough reflex and restlessness were checked just before extubation and at (1, 3, 8 and 24 hrs) post extubation.
- Sore throat was assessed in the recovery room with a visual analog scale (VAS : 0 –10 cm) after extubation (at 30 min and 1,3,8 and 24 hr).
- Other complaints of throat discomfort, such as hoarseness, bucking, dysphonia, dysphagia, nausea and vomiting were systematically evaluated as being present or absent.

At the end of the study, all data was compiled and analyzed statistically using Pearsons Chi Square test, tukey HSD test and ANOVA test.

III. Results

90 patients participated in this study. All the patients were intubated in first attempt and there was no problem with endotracheal intubation or cuff inflation.

There was not any statiscal significant difference in the three groups in terms of age, sex, and duration of the surgery (Table 1).

Table 1: Demographic Data of Patients in the Control group (AIR), Lidocaine Group (PL), and Alkalinized Lidocaine Group (AL).

Basic characteristics	AIR Group	PL Group	AL Group	p Value
Age in years (Mean ± SD)	41.87 ± 11.785	45.13 ± 8.585	46.17 ± 11.234	0.268
Male : Female	11:19	12:18	12:18	0.954
Duration of procedure in minutes	59.833 ±24.33	61.166 ± 27.99	58.00 ± 27.62	0.899

There was no significant difference in the initial volume injected into the cuff (5.50 ± 0.48 mL, 5.67± 0.47 mL, and 5.52 ± 0.55 mL for Groups AIR, PL, and AL, respectively). However, compared with the volume of liquid inflated into the cuff, the liquid volume removed from the cuff decreased significantly (5.42 ± 0.46 mL and 5.20 ± 0.50 mL for Groups PL and AL, respectively; P < 0.001). The air volume withdrawn at extubation time increased significantly in Group AIR (5.92 ± 0.53 mL; P < 0.001).(Table 2)

Table 2: Comparison of volume (ml) in the three groups of patients. Results are presented in Mean±SD

Volume	Air Group	PL Group	AL Group	p Value Air : PL	p Value Air : AL	p Value PL: AL
For inflation	5.50 ± 0.483	5.67 ± 0.477	5.52 ± 0.557	0.414	0.987	0.504
For deflation	5.92 ± 0.539	5.42 ± 0.460	5.20 ± 0.503			
p Value	<0.001**	<0.001**	<0.001**			

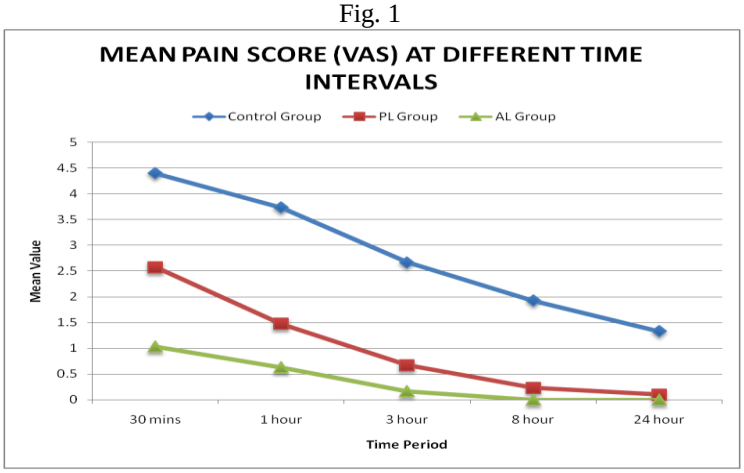
p Value : Significant < 0.05; *Highly significant < 0.001; **Not Significant>0.05

Pain score was based on the VAS scale. The mean ± SD of pain score was calculated in each group and compared. At 30 mins after extubation pain score was least in AL group (1.03 ± 1.24), followed by PL group (2.57 ± 1.35) and was highest in the AIR group (4.40 ± 1.69); P < 0.001.Pain score was highest in the control group at different times of recovery. There was a statistically significant difference among the AIR and PL groups and among the AIR and AL at 30 mins, 1 hr, 3 hr, 8 hr and 24 hrs (p Value < 0.001). However statistically significant difference among the AL and PL groups was present only at 30 mins and 1 hour and remained insignificant thereafter for 3hr, 8hr and 24 hrs after extubation. There was a gradual decrease in the pain score in all 3 groups over 24 hours. Over all the pain score was least in the AL group followed by the PL group and highest in the control group. (Table 3, Figure 1)

Table 3: Visual Analog Scale Values of Sore Throat (0–10) Obtained After Extubation in Patients from the Control Group (AIR), the Lidocaine Group (PL), and the Alkalinized Lidocaine Group (AL).

Study Period	AIR Group		PL group		AL Group		p Value Air : PL	p Value Air : AL	p Value PL : AL
	Mean	SD	Mean	SD	Mean	SD			
30 mins	4.40	1.69	2.57	1.35	1.03	1.24	0.000**	0.000**	0.000**
1 hour	3.73	1.78	1.47	1.13	0.63	0.99	0.000**	0.000**	0.049*
3 hour	2.67	1.49	0.67	0.92	0.17	0.53	0.000**	0.000**	0.166
8 hour	1.93	1.48	0.23	0.56	0.00	0.00	0.000**	0.000**	0.588
24 hour	1.33	1.24	0.10	0.40	0.00	0.00	0.000**	0.000**	0.865

Fig. 1

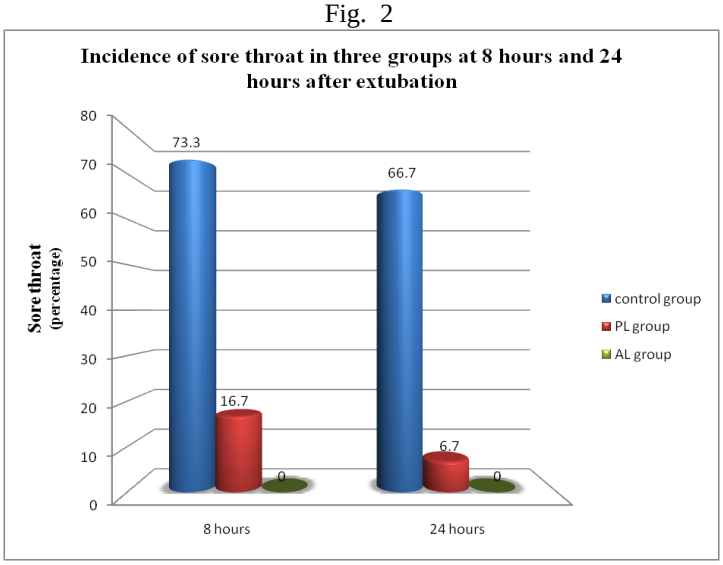


At 8 hours, 77.3% of subjects had sore throat in the AIR group, 16.7% in the PL group and no incidence in AL group. At 24 hours, 66.7% of subjects in control group, 6.7% of subjects in PL group and no subject in AL group had sore throat. There was a statistically significant difference between the 3 groups both at 8 hours (p Value <0.001) as well as at 24 hours after extubation (p Value < 0.001).(Table 4,fig 2)

Table 4: Comparison of incidence of sore throat in the three groups at 8 hours and 24 hours after extubation

Study period	AIR group	PL group	AL group	p Value
8 hours	22(73.3%)	5(16.7%)	0	< 0.001**
24 hours	20(66.7%)	2(6.7%)	0	<0.001**

Fig. 2

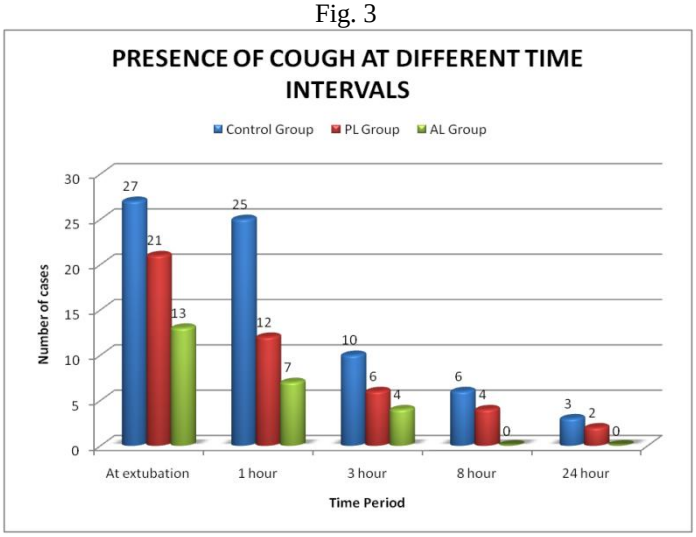


During extubation incidence of cough was highest in the AIR group (90%) followed by PL (70%) and AL group (43.3%). There was a statistically significant difference among AIR and AL (p Value <0.001) and among AL and PL group (p Value = 0.037) at extubation. At 1 hour 83.3% of subjects had cough in the AIR group while in the PL group it was 40% and 23.3% in the AL group. There was a statistically significant difference among AIR and PL (p Value = 0.001) and among control and AL group (p Value <0.001) at 1 hour. At 8 hr and 24 hr, no patients in the AL group had cough. In the PL group, 4% subjects had cough at 8 hours and 2% at 24 hours and in AIR group, 6% subjects had cough at 8 hours and 3% at 24 hours.(Table 5, Figure 3)

Table 5: Comparison of incidence of Cough in three groups of patients.

Study Group	AIR Group	PL Group	AL Group	p Value Air : PL	p Value Air : AL	p Value PL : AL
At extubation	27(90%)	21(70%)	13(43.3%)	0.053	0.000**	0.037*
1 hour	25(83.3%)	12(40.0%)	7(23.3%)	0.001*	0.000**	0.167
3 hour	10(33.3%)	6(20%)	4(13.3%)	0.243	0.067	0.488
8 hour	6(20%)	4(13.3%)	0(0%)	0.488	0.010*	0.038*
24 hour	3(10%)	2(6.7%)	0(0%)	0.640	0.076	0.150

Fig. 3

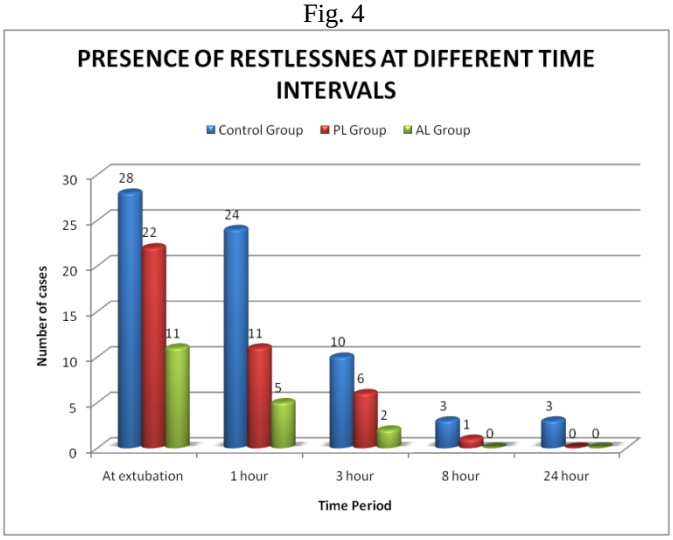


During extubation 93.3% of subjects experienced restlessness in the AIR group while it was 73.3% and 36.7% in PL and AL groups respectively. There was a statistically significant difference between AIR and PL group (p Value = 0.038), between AIR and AL group (p Value = 0.001) and between PL and AL group (p Value = 0.004) at extubation. At 1 hr, restlessness was seen in 80% subjects in the AIR group, 36.7% in PL the group and 16.7% in the AL group, with a statistically significant difference between AIR and PL group (p Value = 0.001) and between AIR and AL group (p Value < 0.001). After 8 hr, there was no incidence of restlessness in the AL group. There was no statistically significant difference between the groups after 8 hours.(Table 6, Figure 4)

Table 6: Comparison of restlessness in three groups of patients.

Study Group	AIR Group	PL Group	AL Group	p Value Air : PL	p Value Air : AL	p Value PL : AL
At extubation	28(93.3%)	22(73.3%)	11(36.7%)	0.038*	0.000**	0.004*
1 hour	24(80%)	11(36.7%)	5(16.7%)	0.001*	0.000**	0.080
3 hour	10(33.3%)	6(20%)	2(6.7%)	0.243	0.010*	0.129
8 hour	3(10%)	1(3.3%)	0(0%)	0.301	0.076	0.313
24 hour	3(10%)	0(0%)	0(0%)	0.076	0.076	-----

Fig. 4



On the basis of dysphagia, dysphonia, and hoarseness, bucking postoperative nausea and vomiting, group AIR displayed least tolerance, and a better tolerance was seen in Group AL compared with Group PL. Arterial blood pressures and heart rates were increased highest in AIR group compared to the liquid groups at the time of extubation.(Table 7)

Table 7: Hemodynamic variables in the three groups at the time of extubation.

Hemodynamic variables at extubation	AIR Group		PL group		AL Group		p Value Air :PL	p Value Air : AL	p Value PL : AL
	Mean	SD	Mean	SD	Mean	SD			
Pulse	100.10	11.00	95.43	6.67	90.60	7.79	0.100	0.000**	0.085
SBP	142.96	10.73	136.03	8.31	135.86	11.59	0.029*	0.025*	0.998
DBP	90.80	9.06	88.96	6.67	86.93	7.20	0.629	0.133	0.566
MBP	110.03	7.90	106.13	7.08	105.33	7.87	0.123	0.050	0.913

IV. Discussion

The major findings of the present study included a decrease in the incidence of sore throat during the postoperative period and decrease in coughing and restlessness at the emergence from the general anesthesia, when the ETT cuff was inflated with alkalinized 2% lidocaine.

In our study it was observed that the initial air volume required to inflate the cuff was not greater than the liquid volume but at the time of extubation air volume in the cuff increased owing to diffusion. In the groups PL and AL there was no significant difference in the volume of liquid required to inflate the cuff. In the group AL, the volume of liquid removed from the cuff was lesser. These results are in agreement with previous studies **Sconso JM et al 1990 [(11)] Dollo G et al 2001[(17)]** and **Estebe JP et al 2002 [(18)]**, is due to the in vivo diffusion of lignocaine across the ETT cuff membrane. The current results also reinforce the assumption that nitrous oxide is the principal causative factor of overpressure in the ETT cuff during balanced anesthesia.

In our study heart rate and blood pressure increased in all three groups during extubation. The increase was higher and statistically significant in the control group, while there was no statistical significant difference between PL and AL group. The heart rate and blood pressure gradually returned towards preoperative value in all three groups. These findings were comparable to study conducted by **Estebe JP et al 2002[(18)]** which concluded haemodyanamic response was highest when air was used to inflate ETT cuff.

In our study the incidence of cough and restlessness was highest in the AIR group followed by PL group and was least present in the AL group. These results were comparable to randomised clinical trial conducted by **Navarro LH et al 2007 [(19)]** which showed incidence of restlessness and agitation was considerably less in the alkalinized lignocaine group than in the air group.

The incidence and severity of sore throat was least in AL group followed by PL group and was highest in AIR group at different times of recovery after extubation. In our study, at 8 hours 73.3% of subjects had complaints of sore throat in the control group, 16.7% in the PL group and 0% in the AL group. At 24 hours, 66.7% of subjects had sore throat in the control group, 6.7% subjects in the PL group and no incidence in the AL group.

V. Conclusion

In conclusion, our study demonstrated a decrease in sore throat in the postoperative period when the cuff was inflated with a small dose of alkalinized lidocaine rather than with lignocaine alone or air. This effect is clinically relevant to all other indirect effects of extubation, i.e. hemodynamic effects, restlessness, coughing, dysphagia, dysphonia, bucking and hoarseness.

Conflict of Interests

The authors declare that there is no conflict of interests regarding publication of this paper.

References

[1]. Klainer AS, Turndorf H, Wu HW, Maewal H, Allender P. Surface alterations due to endotracheal intubation. Am J Med. 1975;58(5):674-83

[2]. Combes X, Schauvliege F, Peyrouset O, Motamed C, Kirov K, Dhonneur G, Duvaldestin P. Intracuff pressure and tracheal morbidity: infl uence of filling with saline during nitrous oxide anesthesia. Anesthesiology. 2001;95(5):1120-4.

[3]. Martins RHG, Braz JRC, Bretan O, Figueiredo PR, Defaveri J. Lesões precoces da intubação endotraqueal. [Early injuries of the endotracheal intubation]. Rev Bras Otorrinolaringol. 1995;61(5):343-8.

[4]. Berlauk JF. Prolonged endotracheal intubation vs. tracheostomy. Crit Care Med. 1986;14(8):742-5.

[5]. Stauffer JL, Olson DE, Petty TL. Complications and consequences of endotracheal intubation and tracheostomy. A prospective study of 150 critically ill adult patients. Am J Med. 1981;70(1):65-76.

[6]. Nordin U. The trachea and cuff-induced tracheal injury. An experimental study on causative factors and prevention. Acta Otolaryngol Suppl. 1977;345:1-71.

[7]. Bidwai AV, Bidwai VA, Rogers CR, Stanley TH. Blood pressure and pulse rate responses to endotracheal extubation with and without prior injection of lidocaine. Anesthesiology. 1979;51(2):171-73.

[8]. Stanley TH, Kawamura R, Graves C. Effects of nitrous oxide on volume and pressure of endotracheal tube cuffs. Anesthesiology. 1974;41(3):256-62.

[9]. Beebe DS. Complications of tracheal intubation. Semin Anesth Perioperat Med Pain. 2001;20:166-72.

[10]. Lev R, Rosen P. Prophylactic lidocaine use preintubation. J Emerg Med. 1994;12(4):499-506.

[11]. Sconzo JM, Moscicki JC, DiFazio CA. In vitro diffusion of lidocaine across endotracheal tube cuffs. Reg Anesth. 1990;15(1):37-40.
[12]. Huang CJ, Tsai MC, Chen CT, Cheng CR, Wu KH, Wei TT. In vitro diffusion of lidocaine across endotracheal tube cuffs. Can J Anaesth. 1999;46(1):82-6.
[13]. Navarro RM, Baughman VL. Lidocaine in the endotracheal tube cuff reduces postoperative sore throat. J Clin Anesth. 1997;9(5):394-7.
[14]. Huang CJ, Hsu YW, Chen CC, et al. Prevention of coughing induced by endotracheal tube during emergence from general anesthesia, A comparison between three different regimens of lidocaine filled in the endotracheal tube cuff. Acta Anaesthesiol Sin. 1998;36(2):81-6.
[15]. Fagan C, Frizelle HP, Laffey J, Hannon V, Carey M. The effects of intracuff lidocaine on endotracheal-tube-induced emergence phenomena after general anesthesia. Anesth Analg. 2000;91(1):201-5.
[16]. Altintas F, Bozkurt P, Kaya G, Akkan G. Lidocaine 10% in the endotracheal tube cuff: blood concentrations, haemodynamic and clinical effects. Eur J Anaesthesiol. 2000;17(7):436-42.
[17]. Dollo G, Estebe JP, Le Corre P, Chevanne F, Ecoffey C, Le Verge R. Endotracheal tube cuffs filled with lidocaine as a drug delivery system: in vitro and in vivo investigations. Eur J Pharm Sci. 2001;13(3):319-23.
[18]. Estebe JP, Dollo G, Le Corre P, Le Naoures A, Chevanne F, Le Verge R, Ecoffey C. Alkalinization of intracuff lidocaine improves endotracheal tube-induced emergence phenomena.Anesth Analg. 2002;94(1): 227-30.
[19]. Navarro LH, Braz JR,Nakamura G, Lima RM, Fredson de paula e silva, Módolo NS. Effectiveness and safety of endotracheal tube cuffs filled with air versus filled with alkalinized lidocaine: a randomized clinical trial. Sao Paulo Med J. 2007;125(6):322-28.