ISSN 2394–806X (Print), ISSN 2454-5139 (Electronic)
IJHRMLP, Vol: 03 No: 02 July, 2017
Printed in India




**ORIGINAL PAPER**

# Effect of Intracuff Plain Lignocaine and Alkalinized Lignocaine for Prevention of Postoperative Sore Throat

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***Received** on Jan 30, 2017; **editorial approval** on May 12, 2017*

**ABSTRACT**

***Background:** Emergence phenomena such as sore throat, coughing, hoarsness, etc.m are common following endotracheal tube extubation and various methods have been tried to reduce its incidence. Recently, there have been reports of using alkalinized intracuff lidocaine on ameoloration of emergence phenomenon. **Aims:** The study had been undertaken to determine the effectiveness of intracuff alkalinized lignocaine on endotracheal tube induced emergence phenomenon. **Methods:** The study was a prospective, double blinded, randomized, control one conducted in 90 adult patients of either sex, ASA I or II with Mallampati score 1, undergoing surgery under general anaesthesia with endotracheal tube, which were randomly allocated into three groups of 30 patients each to receive either intracuff air(C), plain lignocaine(PL) or alkalinized lignocaine(AL) respectively. Post-operative sore throat, hoarsness, dysphonia, haemodynamic changes, etc. were recorded for first 24 hours. **Results:** The spontaneous ventilation and extubation time were prolonged in the AL group ($P<0.001$) as compared with the other two groups. The incidence of sore throat and other throat disorders were also significantly lesser in the AL group, even though PL group is better than C group. **Conclusion**: Use of intracuff alkalinized lignocaine increased the endotracheal tube tolerance by reducing the incidence of emergence phenomena.*

***Keywords**: Endotracheal Tube Extubation, ASA I Or II With Mallampati Score 1, Emergence Phenomena*

## INTRODUCTION

Endotracheal tube (ETT) intubation is usually associated with emergence phenomena following extubation which include coughing, sore throat, dysphonia, hoarseness, hemodynamic changes, nausea and vomiting and can result in dangerous patient movement, arrhythmias, myocardial ischemia, surgical bleeding, bronchospasm and increase in intracranial and intraocular pressure.[1] These emergence phenomena are mainly due to irritation of tracheal mucosa rapidly adapting stretch receptors (RARs) by the inflated cuff, which will result in increased airway secretions and exacerbates cough.[2,3,4]

Various methods have been studied to decrease the emergence phenomena after extubation. These include use of high volume low pressure cuff endotracheal tube, use of small size endotracheal tube, "deep" extubation, administration of intravenous (i/v)opioids or intravenous lidocaine, inhalation of steroids, local lidocaine spray, and intracuff lidocaine[1]; and other pharmacological methods like beclamethasone inhalation and gargling with azulenesulfonate or ketamine.[5] The above methods could not fully control the phenomena and has got its own limitation.[1,6] Recently, there have been reports of using alkaline intracuff lidocaine on ameoloration of emergence phenomenon.

Endotracheal tube cuff are made up of polyvinyl chloride (PVC), which is hydrophobic in nature and so non ionized drug can diffuse across the cuff.[1] Commercially available lidocaine is acidic and large amount of lidocaine (200-500mg) is required for adequate control on emergence phenomena[7,8] and this could be dangerous if the cuff ruptures. Thus, addition of bicarbonates resulted in 63 fold increase in the rate and duration of diffusion of lidocaine through the endotracheal tubecuff [1,8,9,10] and prevent emergence phenomena from general anaesthesia, particularly, during surgery of long duration.[3,6,8,11]

As no such study had been undertaken in this part of the country

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to determine the effect of alkalinization of intracuff lidocaine on endotracheal tube induced emergence phenomena, the present study had been chosen.

## MATERIALS AND METHODS

The study was a prospective, double blinded, randomized, control one conducted at a Tertiary care centre, Manipur from October 2014 to September 2016. After taking approval from the Institutional Ethical Committee and written informed consent from 90 adult patients of either sex, aged 18-60 yrs, ASA I or II with Mallampati score 1 and who were to undergo surgery under general anaesthesia with endotracheal tube were enrolled for the study. The enrolled patients were randomly allocated into three groups of 30 patients each using computer generated randomization method to receive 2 ml of intracuff plain lidocaine (Group PL), Group AL - 8.4% Sodium bicarbonate intracuff alkalinized lidocaine and Group C -to receive intracuff air.

A uniform anaesthetic technique was planned for all the patients. The time of extubation (time between surgical closure and dressing ($T_0$) and extubation), and spontaneous ventilation time (time between emergence of spontaneous breathing and extubation) were recorded. The sore throat was measured in the recovery room, at post-extubation periods of 15 minutes and 1, 3, and after 24 hours, by a blinded anaesthesiologist using a four point scale (0-3)[5] as -0= no sore throat, 1= mild,2=moderate and 3= severe sore throat.

Sample size of 30 patients for each group was determined based on the study conducted by Estebe J P et al.[8] The parameters recorded were compared between the three groups using appropriate Statistical test with Statistical Package for Social Sciences (SPSS Inc., version 21, Chicago, IL, USA) and Pd" 0.05 was deemed significant.

## RESULTS AND OBSERVATIONS

All the enrolled patients completed the study protocol. The demographic parameters (**Table 1**) such as age, sex, weight distribution and duration of surgery were comparable in all the three groups and did not affect the study outcome.

**Table 1** showing the demographic data of patients in the three groups

| Demographic parameters | Groups | | | f-value & $\chi^2$ value* | P-value |
|---|---|---|---|---|---|
| | AL (n=30) | PL (n=30) | C (n=30) | | |
| Age (yrs) (mean ± SD) | 40.33 ± 12.27 | 38.70 ± 12.42 | 40.43 ± 14.49 | 0.166 | 0.848 |
| Sex distribution (M:F) | 3:27 | 9:21 | 5:25 | 4.061* | 0.131 |
| Duration of Surgery (min) (mean ± SD) | 71.57 ± 30.218 | 62.23 ± 15.60 | 62.73 ± 11.29 | 1.932 | 0.151 |
| Weight (kg) (mean ± SD) | 60.90 ± 7.13 | 58.80 ± 9.01 | 61.27 ± 8.96 | 0.751 | 0.475 |

*P<0.05 is significant*

The post-operative sore throat was least in the AL group and maximum in the C group, and this distribution was statistically significant (**Table 2**) at all-time points in the first 24 hours. Thus, at 24 hours 17(56.67%) and 5(16.67%) patients complained of pain in the C and PL groups respectively, whereas there was no patient with sore throat in the AL group (P<0.001).

**Table 2** showing the distribution and comparison of sore throat in all the three groups

| Sore throat | | Groups | | | $\chi^2$ value | P value |
|---|---|---|---|---|---|---|
| | | AL (n=30) | PL (n=30) | C(n=30) | | |
| 15min | No pain | 28 (93.33%) | 19 (63.33%) | 6 (20%) | 34.35 | <0.001* |
| | Mild pain | 2 (6.67%) | 11 (36.67%) | 23 (76.67%) | | |
| | Moderate pain | 0 | 0 | 1 (3.33%) | | |
| | Severe pain | 0 | 0 | 0 | | |
| 1 hour | No pain | 28 (93.33%) | 22 (73.33%) | 10 (33.33%) | 25.79 | <0.001* |
| | Mild pain | 2 (6.67%) | 8 (26.67%) | 19 (63.33%) | | |
| | Moderate pain | 0 | 0 | 1 (3.33%) | | |
| | Severe pain | 0 | 0 | 0 | | |
| 3 hour | No pain | 29 (96.67%) | 23 (76.67%) | 12 (40%) | 34.12 | <0.001* |
| | Mild pain | 1 (3.33%) | 7 (23.33%) | 18 (60%) | | |
| | Moderate pain | 0 | 0 | 0 | | |
| | Severe pain | 0 | 0 | 0 | | |
| 24 hours | No pain | 30 (100%) | 25 (83.33%) | 13 (43.33%) | 27.55 | <0.001* |
| | Mild pain | 0 | 5 (16.67%) | 17 (56.67%) | | |
| | Moderate pain | 0 | 0 | 0 | | |
| | Severe pain | 0 | 0 | 0 | | |

*P<0.05 is significant*

**Table 3** Spontaneous ventilation time & Extubation time between the three groups *(mean ± SD)*

| Variable | Groups | | | f-value | P value |
|---|---|---|---|---|---|
| | AL (n=30) | PL (n=30) | C (n=30) | | |
| Spontaneous ventilation time (min)(SVT) | 3.69±0.41 | 3.14±0.33 | 2.56±0.26 | 82.979 | <0.001* |
| Extubation time (min) (ET) | 5.03±0.88 | 4.28±0.47 | 3.46±0.32 | 50.883 | <0.001* |

*P<0.05 is significant*

The spontaneous ventilation time was recorded least in group C and longer in AL group (Table 3). So, the longer extubation time in group AL as compared with the other groups (P<0.001) showed that it can withstand longer time with the tube in situ during extubation.

**Table 4** Endotracheal tube induced emergence phenomena between the three groups

| Variable | Groups | | | $\chi^2$ value | P value |
|---|---|---|---|---|---|
| | AL (n=30) | PL (n=30) | C (n=30) | | |
| Cough (%) | 1 (3.33%) | 5 (16.66%) | 9 (30%) | 7.680 | 0.021 |
| Restlessness (%) | 0 | 1 (3.33%) | 1 (3.33%) | 1.023 | 0.600 |
| Hoarseness (%) | 5 (16.66%) | 16 (53.33%) | 19 (63.33%) | 14.670 | 0.001* |
| Dysphonia (%) | 1 (3.33%) | 7 (23.33%) | 11 (36.66%) | 10.141 | 0.006* |
| PONV (%) | 0 | 0 | 2 (6.66%) | 4.091 | 0.129 |
| Trouble for swallowing reflex (%) | 0 | 0 | 0 | | |
| Bucking | 2 (6.66%) | 17 (56.66%) | 19 (63.33%) | 23.593 | <0.001* |

*P<0.05 is significant*

Emergence phenomena were recorded least with 5 patients of hoarsness in group AL as compared with the other two groups. Significant emergence phenomena with maximum number of cases were noted in the control group (**Table 4**).

**Table 5** Distribution of haemodynamics variables in the three groups (mean ± SD)

| Parameters | | Groups | | | f-value | P value |
|---|---|---|---|---|---|---|
| | | AL (n=30) | PL (n=30) | C (n=30) | | |
| ***Heart rate (per min)*** | *Pre operative* | 82.70 ± 6.79 | 81.13±8.41 | 80.37±7.308 | 0.747 | 0.477 |
| | *Extubation* | 98.97±6.41 | 100.27±7.50 | 107.53±11.20 | 8.611 | <0.001* |
| ***MAP (mm Hg)*** | *Pre operative* | 95.53±10.12 | 96.03±11.41 | 94.10±7.62 | 0.312 | 0.733 |
| | *Extubation* | 111.33±12.43 | 113.67±10.28 | 119.87±7.93 | 5.419 | 0.006* |

*P<0.05 is significant*

The haemodynamic parameters such as heart rate and mean arterial pressure (MAP), as shown in table 5, at extubation time was maximum with C group and least in the AL group as compared with the preoperative value and this distribution was statistically significant (P<0.05).

## DISCUSSION

Quality assurance of anaesthesia has become increasingly important for improving post-operative outcome.[5] Post-operative sore throat occurs in up to 90% of intubated patients and is the most common complaint after tracheal intubation.[12] During nitrous oxide anaesthesia, airfilled cuff volume increased due to diffusion of $N_2O$ and damages the tracheal mucosa.[13] The cough receptors in the tracheal mucosa can be blocked topically by filling the endotracheal tube cuff with buffered lidocaine, as this helps in diffusion of the uncharged base form of the drug across the hydrophobic polyvinyl chloride (PVC) wall of endotracheal tube cuff.[9,14] With this background knowledge, this study was undertaken to determine the benefits of filling endotracheal tube cuff with buffered lidocaine, plain lidocaine or air to prevent endotracheal tube induced sore throat after extubation.

Estebe J P et al[8] used visual analogue scale from 0-100 mm to assess the post-operative sore throat at 15minutes, 1hour, 2hours, 3hours, and 24hours where they found a more pronounced decrease in sore throat in the alkalinized lignocaine group (VAS-1±3 and 0±3 respectively) at 15 minutes and 24 hours post-operative, when compared to control group (VAS-30±20 and 13±9 respectively) and plain lignocaine (VAS-12±18 and 10±13 respectively). Similar results were recorded in our study where post-operative sore throat was highest in the control group and least in the AL (alkalinized lignocaine) group. It was also found that sore throat decreased gradually over 24 hours in all three

groups. Ahmady M S et al[15] also found significant reduction in the incidence of post-operative sore throat in the alkalinized lignocaine group in the post anaesthetic care unit (PACU) (12%) and 24 hours post extubation (4%) when compared to saline group(44% and 28% in the PACU and 24 hours post extubation respectively). Our study was comparable to the findings in this study except that intracuff air was used in our study instead of intracuff saline. Navarro LHC et al[16] in their study also found that there was no incidence of post-operative sore throat in the alkalinized lignocaine group in the post anaesthetic care unit (PACU) and 24 hours after extubation, when compared to saline group [5(20%) and 3(12%) in the PACU and 24 hours post extubation respectively].

Coughing during emergence from general anaesthesia may be effectively suppressed for a short duration (5 min) by intravenous lidocaine as reported by Yukioka H et al.[17] Lower incidence of cough was reported in our study with alkalinized lignocaine group which was also supported on the study of Ahmady MS et al[15] and Navarro LHC et al.[16] However, Estebe J P et al[8] recorded higher incidence of cough which may be due to the prone positioning of patients as against supine in our study. There was no incidence of restlessness in the AL group with lower incidence of dysphonia and hoarsness, which were in accordance with the study conducted by Estebe J P et al.[8]

The spontaneous ventilation and extubation time was prolonged in the AL group in our study and was also reported by Estebe J P et al.[8] This resulted in increase in endotracheal tube tolerance allowing early reduction of anaesthesia and spontaneous ventilation towards the end of surgery and also decreased adverse effects like postoperative nausea and vomiting.

The haemodynamic variables such as heart rate and blood pressure were increased in all the three groups during extubation, and was recorded highest in the control group and least in the AL group. These similar results were also recorded in the study conducted by Estebe J P et al.[8]

There were several limitations implicated in sore throat that we did not take into account in this study. We did not use humidity moisture exchangers in the delivery circuit, and dry airway gases have been implicated in the development of postoperative sore throat.[18] Airway suction is associated with postoperative sore throat and this was not standardized. Intubation was done by residents and staff with wide range of experience. Another limitation was that the plasma concentration of lignocaine was not measured in our study.

The incidence of sore throat was less when intracuff alkalinized lignocaine was used rather than plain lignocaine. Throat pain, restlessness, dysphonia and hoarseness were most common in the control group in which air was the inflating medium and lesser in the alkalinized lignocaine group. Moreover in our study we used a solution closer to the physiological pH and a small dose of lignocaine hydrochloride, which reduced the risk of vascular absorption and mucosal irritation of local anaesthetic in case of endotracheal tube cuff rupture, although there was no incidence of cuff rupture.

## CONCLUSION

Our study demonstrated a decrease in the incidence of sore throat and other indirect effects of tracheal extubation such as hemodynamic changes, restlessness, dysphonia and hoarseness during the postoperative period when the endotracheal tube cuff was inflated with alkalinized lignocaine rather than plain lignocaine or air. To conclude, use of intracuff alkalinized lignocaine will increase the endotracheal tube tolerance by reducing the incidence of emergence phenomena.

**Acknowledgements:** None declared.

**Conflict of interest:** None declared.

**Funding:** None declared

**Ethical clearance:** Prior approval taken from the Institutional Ethical Committee.

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