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Original Article

# Post-intubation Sore Throat: A Comparative Study Between Intracuff Alkalinized Lignocaine versus Intracuff Plain Air

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## Abstract

**Aim:** The study aims to determine and compare the effect of intracuff alkalinized lignocaine and intracuff plain air in decreasing post-intubation sore throat.

**Materials and Methods:** After obtaining approval from the Institutional Ethical Committee and informed written consent, 84 patients of ASA physical class I and II were taken up for study. The experiment was conducted in a single-blind fashion, observational study with random numbers being created. The study groups included: ETT cuff was dilated with Plain air in Group A, ETT cuff was dilated with alkalinized 2% lignocaine in Group-L. There were 42 patients in each group, ranging in age from 20 to 60 years old.

**Results:** Vital signs, sore throat incidence, and endotracheal intubation side effects such as changes in hemodynamics and hoarseness were examined between the groups. A total of 84 patients took part in the research.

**Conclusion:** In conclusion, when the cuff of an ETT was inflated with alkalinized lignocaine rather than air, the incidence of sore throat during the post-operative period was reduced. When the inflating medium of the ETT cuff was alkalinized lignocaine, the incidence of tracheal intubation side effects such as hemodynamic abnormalities, restlessness, dysphonia, and hoarseness was lower.

**Key words:** Alkalinized lignocaine, Hoarseness of voice, Intracuff pressure

## INTRODUCTION

Post-intubation sore throat, this is the most prevalent complaint after tracheal intubation accounting for 90% of intubated patients.[1] Coughing caused by the endotracheal tube complicates the recovery from general anesthesia. Patient movement that is potentially harmful can cause hypertension, tachycardia or other arrhythmias, cardiac ischemia, surgical hemorrhage, bronchospasm, and a rise in intracranial and intraocular pressure are all possible outcomes. Intubations are also frequently related with laryngeal edema and ischemia.[2,3]

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Tube size, lateral wall pressure, movement, and hypotension have all been linked to post-operative sore throat. Both cuff-related tracheal damage is influenced by both lateral wall pressure and intubation duration.

When the cuff applies pressure more than 30 cm of $H_2O$, the tracheal mucosal pressure drops. The ETT cuff's pressure against the tracheal wall should be low enough to allow adequate capillary mucous membrane blood flow while being high enough to avoid air leaks and aspiration of regurgitated stomach contents. To avoid ischemia damage, the endotracheal tube cuff pressure should be kept below the mean mucosal capillary perfusion pressure. The use of nitrous oxide during general anesthesia, which is known to diffuse into endotracheal tube cuffs, and the lack of frequent intracuff pressure control during the perioperative period are the two most important factors that contribute to the high incidence of excessive intracuff pressure during the intraoperative period.

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Coughing caused by an ETT can make recovery after general anesthesia more difficult. The tube and its cuff are thought to induce irritant or stretch sensations in the trachea. In the tracheal mucosa, rapidly adapting stretch receptors are thought to be irritating receptors that are involved in the cough reflex.[4,5]

Topically applied local anesthetics block the receptors. Lignocaine can diffuse along the ET tube cuff. Increased non-ionized lignocaine fraction results in increased penetration and diffusion around the cuff. When the pH of a solution is raised, the fraction of non-ionized form rises consistently.[6-8]

The alkalinization of lignocaine enhances the diffusion capacity over the ETT cuff, according to previous research. This study compared the incidence of post-intubation sore throat when alkalinized lignocaine and plain air were used in the cuff.

### Objectives of the Study

*Primary objective*

To determine and compare the effect of intracuff alkalinized lignocaine and intracuff plain air in decreasing post-intubation sore throat.

## METHODOLOGY

### Source of Data

Patients (ASA – I/II/III) undergoing major surgeries lasting 2–5 h and aged 20–60 years were surveyed at Siddhartha Medical College, New Ggh Vijayawada. The research was carried out December 2019–June 2021.

### Inclusion Criteria

1. Patients undergoing major surgical procedures (2–5 h)
2. Patients aged between 20 and 60 years
3. Patients with ASA Status I-III.

### Exclusion Criteria

- Who are allergic to lignocaine
- Patients who are expected to have difficult intubation
- Patients who were unable to be intubated the first try
- Patients with a history of recent sore throat
- Patients with recurrent history of tracheitis or laryngitis
- Patients having a history of COPD and asthma
- Long-standing smokers
- Patients who require elective ventilation after surgery.

## MATERIALS AND METHODS

All patients signed a written informed consent form. The experiment was conducted in a single-blind fashion, observational study with random numbers being created. The study groups included:

- ETT cuff was dilated with plain air in Group A
- ETT cuff was dilated with alkalinized 2% lignocaine in Group-L.

There were 42 patients in each group, ranging in age from 20 to 60 years old and belonging to the ASA I/II/III categories.

### Anesthetic Management

The induction agents used were thiopentone sodium (4–6 mg/kg)/propofol (2–22.5 mg/kg), fentanyl (2 mic/kg), and succinylcholine (1–2 mg/kg), while for maintenance of anesthesia inhalation agents such as sevoflurane and nitrous oxide were used. An adequate-sized ETT with a high volume low-pressure cuff was used for endotracheal intubation. The ETT cuff was inflated to the minimal occlusive pressure; in Group A, the cuff was dilated with plain air, and in Group L, the cuff was dilated with 5 mL of a mixture of 2% lignocaine and 8.4% sodium bicarbonate (10:1) to achieve the minimal occlusive pressure (25–30 cm of H20) using cuff pressure manometer. The volume of air or liquid used to inflate the cuff was noted. Inhalational drugs, as well as intermittent doses of fentanyl l and muscle relaxants (NDMR), were used to maintain anesthesia. Neostigmine and glycopyrrolate were used to reverse neuromuscular inhibition. After all of the following criteria were met, the patient was extubated: Complete reversal of neuromuscular blocking, spontaneous respiration, ability to obey verbal commands, eye-opening, and handgrip. Cough reflexes and hoarseness were assessed after extubation for a period of 24 h (1 h, 12 h, 24 h). A visual analog scale (VAS) was used to quantify the severity of the sore throat in the post-operative recovery room and up to 24 h (VAS 0–10 cm). The VAS scale was used to quantify pain levels, and patients were instructed to point to various face expressions depicted on the scale. Other signs of throat pain were assessed, including hoarseness, restlessness, and dysphonia, as well as hemodynamic indicators.

### Analytical Statistics

The data were combined and the mean and standard deviations were calculated. The ANOVA or student *t*-test was used to compare the results. The homogeneity of baseline features between two groups of patients was determined using analysis of variance. The significance of hemodynamics and adverse effects between two groups of patients was determined using Chi-square test, Pearson Chi-square test. Statistical software SPSS 15.0, Stata 8.0, MedCalc 9.0.1, and other statistical software for data analysis, Systat11.0 was utilized, as well as Microsoft Word and Excel. Excel was used to create graphs, tables, and other graphics.

## OBSERVATION AND RESULTS

A comparative study was done consisting of 84 patients and 42 patients were randomly allotted to each of the following groups, namely Group-A (AIR), Group-L (alkalinized Lignocaine) vital signs, sore throat incidence, and endotracheal intubation side effects such as changes in hemodynamics and hoarseness were examined between the groups. A total of 84 patients took part in the research. When the trachea could not be intubated on the first try, patients were removed from the research. There were no statistically significant variations in age, sex, Asa status, or surgical duration between the two groups. During controlled ventilation, there were no issues with cuff inflation, and no air leaks were detected.

Distribution of study subjects in the two groups based on cough during extubation. Among 42 (100%) subjects in the air group, four (9.5%) did not have a cough and the remaining 38 (90.5%) had a cough. Among 42 (100%) subjects in the intracuff alkalinized lignocaine group, 34 (81.0%) did not have a cough, and the remaining 8 (19.0%) had a cough. This association between cough during extubation and the method of inflating endotracheal tube cuff was found to be statistically highly significant ($P < 0.001$) [Table 1].

Distribution of study subjects in the two groups based on cough 1 h after extubation. Among 42 (100%) subjects in Group-A (Air), six (14.3%) did not have a cough, and the remaining 36 (85.7%) had a cough. Among 42 (100%) subjects in intracuff alkalinized lignocaine group, 38 (90.5%) did not have a cough, and the remaining 4 (9.5%) had a cough. This association between cough 1 h after extubation and the method of inflating endotracheal tube cuff was found to be statistically highly significant ($P < 0.001$) [Table 2].

Distribution of study subjects in the two groups based on the incidence of cough 12 h after extubation. Among 42 (100%) subjects in the air group, 27 (64.3%) did not have a cough and the remaining 15 (35.7%) had a cough. All the 42 (100%) subjects in the intracuff alkalinized lignocaine group did not have a cough. This association between cough 12 h after extubation and the method of inflating endotracheal tube cuff was found to be statistically highly significant ($P < 0.001$) [Table 3].

**Table 1: Distribution of study subjects in the two groups based on cough during extubation**

| Cough during extubation | Group | | Total |
|---|---|---|---|
| | Group-A (air), n (%) | Group-L (plain lignocaine with $NaHCO_3$), n (%) | |
| Absent | | | |
| Count | 4 | 34 | 38 |
| Percentage | 9.5 | 81.0 | 45.2 |
| Present | | | |
| Count | 38 | 8 | 46 |

All the subjects in the two groups did not have cough 24 h after extubation.

Association between hoarseness during extubation and the method of inflating endotracheal tube cuff. All the 42 (100%) subjects in the air group had hoarseness during extubation. Among 42 (100%) subjects in the intracuff alkalinized lignocaine group, 33 (78.6%) did not have hoarseness, and the remaining 9 (21.4%) had it. This association between cough during extubation and the method of inflating endotracheal tube cuff was found to be statistically highly significant ($P < 0.001$) [Table 4].

Distribution of study subjects in the two groups based on hoarseness 1 h after extubation. Among 42 (100%) subjects in the air group, 13 (30.1%) did not have hoarseness and the remaining 29 (69. 9%) had it. Among 42 (100%) subjects in the intracuff alkalinized lignocaine group, 40 (95.2%) did not have hoarseness and the remaining 2 (4.8%) had the same. This association between hoarseness 1 h after extubation and the method of dilating endotracheal tube cuff was found to be statistically highly significant ($P < 0.001$) [Table 5].

Distribution of study subjects in the two groups based on hoarseness 12 h after extubation. Among 42 (100%) subjects in the air group, 39 (92.8%) did not have hoarseness and the remaining 3 (7.2%) had it 12 h after extubation. All the 42 (100%) subjects in the intracuff alkalinized lignocaine group did not have hoarsenes 12 h after extubation. However, this association between hoarseness 12 h after extubation and the endotracheal tube cuff dilating method was not found to be statistically highly significant ($P = 0.078$) [Table 6].

All the subjects in the two groups did not have hoarseness 24 h after extubation.

Comparison of the mean pulse rate of subjects between two groups. The pre-operative mean pulse rate was discovered to be significantly higher in the air group (82.88 ± 7.98) compared to the intracuff alkalinized lignocaine group (79.23 ± 7.95) ($P = 0.039$). The mean pulse rate during extubation was comparatively higher in the air group (119.09 ± 8.49) than the intracuff alkalinized lignocaine group (102.35 ± 6.38). This difference was discovered to be statistically highly significant ($P < 0. 001$). The mean pulse rate 1 h after extubation was comparatively higher in the air group (99.52 ± 5.58) than the intracuff

**Table 2: Distribution of study subjects in the two groups based on cough 1 h after extubation**

| Cough 1 h after extubation | Group | | Total |
|---|---|---|---|
| | Group-A (air), n (%) | Group-L (plain lignocaine with $NaHCO_3$), n (%) | |
| Absent | | | |
| Count | 6 | 38 | 44 |
| Percentage | 14.3 | 90.5 | 52.3 |
| Present | | | |
| Count | 36 | 4 | 40 |
| Percentage | 85.7 | 9.5 | 47.7 |
| Total | | | |
| Count | 42 | 42 | 84 |
| Percentage | 100.0 | 100.0 | 100.0 |
| Chi-square test | Value | df | P |
| Pearson Chi-square | 48.873 | 1 | <0.001 association is highly significant |

**Table 3: Distribution of study subjects in the two groups based on cough 12 h after extubation**

| Cough 12 h after extubation | Group | | Total |
|---|---|---|---|
| | Group-A (air), n (%) | Group-L (plain lignocaine with $NaHCO_3$), n (%) | |
| Absent | | | |
| Count | 27 | 42 | 69 |
| Percentage | 64.3 | 100 | 82.1 |
| Present | | | |
| Count | 15 | 0 | 15 |
| Percentage | 35.7 | 0 | 17.9 |
| Total | | | |
| Count | 42 | 42 | 84 |
| Percentage | 100.0 | 100.0 | 100.0 |
| Chi-square test | Value | df | P |
| Pearson Chi-square | 18.261 | 1 | <0.001 association is highly significant |

**Table 4: Association between hoarseness during extubation and method of inflating endotracheal tube cuff**

| Hoarseness during extubation | Group | | Total |
|---|---|---|---|
| | Group-A (air), n (%) | Group-L (plain lignocaine with $NaHCO_3$), n (%) | |
| Absent | | | |
| Count | 0 | 33 | 33 |
| Percentage | 0 | 78.6 | 39.3 |
| Present | | | |
| Count | 42 | 9 | 51 |
| Percentage | 100 | 21.4 | 60.7 |
| Total | | | |
| Count | 42 | 42 | 84 |
| Percentage | 100.0 | 100.0 | 100.0 |
| Chi-square test | Value | df | P |
| Pearson Chi-square | 54.353 | 1 | <0.001 association is highly significant |

alkalinized lignocaine group (89.64 ± 6.60). This disparity was discovered to be statistically highly significant ($P < 0.001$). The mean pulse rate 12 h after extubation was comparatively higher in the intracuff air group (91.28 ± 5.07) than intracuff alkalinized lignocaine group (86.26 ± 5.06). This disparity was discovered to be statistically highly significant ($P < 0.001$). The mean pulse rate 24 h after extubation was found to be almost similar in the air group (80.57 ± 6. 80) and intracuff alkalinized lignocaine group (79.59 ± 7.84) ($P = 0.544$) [Table 7].

Comparison of SBP of subjects between two groups. The pre-operative mean systolic blood pressure was found to be significantly higher in the intracuff alkalinized lignocaine group (132.09 ± 9.52) compared to the air group (124.97 ± 9.49) ($P = 0.001$). The mean SBP during extubation was comparatively higher in the air group (151.11 ± 8.69) than the intracuff alkalinized lignocaine group (139.76 ± 4.69). This disparity was discovered to be statistically highly significant ($P < 0.001$). The SBP 1 h after extubation was found to be almost similar in the air group (132.78 ±

**Table 5: Distribution of study subjects in the two groups based on hoarseness 1 h after extubation**

| Hoarseness 1 h after extubation | Group | | Total |
|---|---|---|---|
| | Group-A (air), n (%) | Group-L (plain lignocaine with $NaHCO_3$), n (%) | |
| Absent | | | |
| Count | 13 | 40 | 53 |
| Percentage | 30.1 | 95.2 | 63.1 |
| Present | | | |
| Count | 29 | 2 | 31 |
| Percentage | 69.9 | 4.8 | 36.9 |
| Total | | | |
| Count | 42 | 42 | 84 |
| Percentage | 100.0 | 100.0 | 100.0 |
| Chi-square test | Value | df | P |
| Pearson Chi-square | 37.271 | 1 | <0.001 association is highly significant |

**Table 6: Distribution of study subjects in the two groups based on hoarseness 12 h after extubation**

| Hoarseness 12 h after extubation | Group | | Total |
|---|---|---|---|
| | Group-A (air), n (%) | Group-L (plain lignocaine with $NaHCO_3$), n (%) | |
| Absent | | | |
| Count | 39 | 42 | 81 |
| Percentage | 92.8 | 100 | 96.4 |
| Present | | | |
| Count | 3 | 0 | 3 |
| Percentage | 7.2 | 0 | 3.6 |
| Total | | | |
| Count | 42 | 42 | 84 |
| Percentage | 100.0 | 100.0 | 100.0 |
| Chi-square test | Value | df | P |
| Pearson Chi-square | 3.111 | 1 | 0.078 association is not significant |

**Table 7: Comparison of the mean pulse rate of subjects between two groups**

| Pulse (beats per min) at different time points | Mean±SD | | *P*-value |
|---|---|---|---|
| | Group-A (air) | Group–L (plain lignocaine with $NaHCO_3$) | |
| Preoperative | 82.88±7.98 | 79.23±7.95 | 0.039 |
| During extubation | 119.09±8.49 | 102.35±6.38 | <0.001 |
| 1 h after extubation | 99.52±5.58 | 89.64±6.60 | <0.001 |
| 12 h after extubation | 91.28±5.07 | 86.26±5.06 | <0.001 |
| 24 h after extubation | 80.57±6.80 | 79.59±7.84 | 0.544 |

SD: Standard deviation

7.08) and intracuff alkalinized lignocaine group (133.57 ± 4.90) ($P = 0.556$). The mean systolic blood pressure 12 h after extubation was comparatively higher in the intracuff alkalinized lignocaine group (126.61 ± 8.05) than the air group (121.50 ± 8.49). This disparity was discovered to be statistically significant ($P = 0.006$). The mean SBP 24 h after extubation was comparatively higher in the intracuff alkalinized lignocaine group (124. 85 ± 9.49) than the air group (119.02 ± 7.70). This disparity was discovered to be statistically significant ($P = 0.003$) [Table 8].

Comparison of DBP of subjects between two groups. The pre-operative mean diastolic blood pressure was found to be almost similar in the intracuff air group (78.92 ± 9.01) and intracuff alkalinized lignocaine group (77.95 ± 6.88) ($P = 0.579$). The mean DBP during extubation was comparatively higher in the intracuff air group (110.50 ± 6.94) than intracuff alkalinized lignocaine group (98.07 ± 7.59). This disparity was discovered to be statistically highly significant ($P < 0.001$). The mean DBP 1 h after extubation was comparatively higher in the intracuff air group (91.38 ± 5.42) than intracuff alkalinized lignocaine group (81.33 ± 5.80). This disparity DBP 12 h after extubation was comparatively higher in the intracuff air group (86.00 ± 4. 34) than the Group-L (76.66 ± 5. 22). This disparity was discovered to be statistically highly significant ($P < 0.001$). The DBP 24 h after extubation was comparatively higher in the air group (77.85 ± 6.77) than intracuff alkalinized lignocaine group (73.83 ± 7.73). This disparity was found to be statistically significant ($P = 0.013$) [Table 9].

Comparison of VAS score for sore throat among subjects between two groups. The mean VAS score for sore throat during extubation was comparatively higher in the intracuff air group (110.50 ± 6.94) than intracuff alkalinized lignocaine group (98.07 ± 7. 59). This difference was found to be statistically highly significant ($P < 0.001$). The mean VAS score for sore throat 1 h after extubation was comparatively higher in the intracuff air group (91.38 ± 5. 42) than intracuff alkalinized lignocaine group (81.33 ± 5.80). This difference was found to be statistically highly significant ($P < 0.001$). The mean VAS score for sore throat 12 h after extubation was comparatively higher in the intracuff air group (86.00 ± 4.34) than intracuff alkalinized lignocaine group (76.66 ± 5.22). This difference was found to be statistically highly significant ($P < 0.001$). The mean VAS score for sore throat 24 h after extubation was comparatively higher in the intracuff air group (2.35 ± 1.03) than intracuff alkalinized lignocaine group (0.61 ± 0.49). This difference was found to be statistically highly significant ($P < 0.001$) [Table 10].

## DISCUSSION

The main aim of this study was to assess the incidence of post-intubation sore throat when intracuff alkalinized lignocaine was used in comparison with intra cuff plain air. According to the findings of this study, all of the patients were identified based on their age, weight, and ASA levels. Grading, operation time.

A VAS scale was used to assess throat pain. Throat pain was the most common complaint in Group A. Pain was less in Group L 1 h after extubation. Throat pain diminished gradually in both groups over the course of 24 h.

Estebe *et al.* in the year 2002 conducted research on intracuff lignocaine alkalinization and the use of gel lubrication to prevent tracheal tube-induced emergence.[9] The researchers found that using an ETT cuff loaded with alkalinized lignocaine and lubricating it with water-soluble gel reduced post-intubation sore throat. According to the above research, we found the similar findings in this study, where the results are in favorable for intra cuff alkalinized lignocaine in decreasing the occurrence of post-intubation sore throat.

The impact of tracheal tube lubrication and cuff design on the occurrence and severity of post-operative sore throat was investigated by Loeser *et al.* in the year 1980.[10] The results demonstrated that the tracheal tube causing the least incidence and severity of post-operative sore throat is one with an unlubricated low residual volume cuff. In

**Table 8: Comparison of systolic blood pressure of subjects between two groups**

| SBP (mm Hg) at different time points | Mean±SD | | *P*-value |
|---|---|---|---|
| | Group-A (air) | Group-L (plain lignocaine with $NaHCO_3$) | |
| Preoperative | 132.09±9.52 | 124.97±9.49 | 0.001 |
| During extubation | 151.11±8.69 | 139.76±4.69 | <0.001 |
| 1 h after extubation | 132.78±7.08 | 133.57±4.90 | 0.556 |
| 12 h after extubation | 121.50±8.49 | 126.61±8.05 | 0.006 |
| 24 h after extubation | 119.02±7.70 | 124.85±9.49 | 0.003 |

SD: Standard deviation, SBP: Systolic blood pressure

**Table 9: Comparison of diastolic blood pressure of subjects between two groups**

| Diastolic blood pressure (mm Hg) at different time points | Mean±SD | | *P*-value |
|---|---|---|---|
| | Group-A (air) | Group-L (plain lignocaine with $NaHCO_3$) | |
| Preoperative | 78.92±9.01 | 77.95±6.88 | 0.579 |
| During extubation | 110.50±6.94 | 98.07±7.59 | <0.001 |
| 1 h after extubation | 91.38±5.42 | 81.33±5.80 | <0.001 |
| 12 h after extubation | 86.00±4.34 | 76.66±5.22 | <0.001 |
| 24 h after extubation | 73.83±7.73 | 77.85±6.77 | 0.013 |

**Table 10: Comparison of visual analog scale score for sore throat among subjects between two groups**

| VAS score for sore throat at different time points | Mean±SD | | *P*-value |
|---|---|---|---|
| | Group-A (air) | Group-L (plain lignocaine with $NaHCO_3$) | |
| During extubation | 7.76±1.14 | 3.90±1.72 | <0.001 |
| 1 h after extubation | 6.28±0.80 | 2.47±0.91 | <0.001 |
| 12 h after extubation | 4.64±0.95 | 1.28±0.55 | <0.001 |
| 24 h after extubation | 2.35±1.03 | 0.61±0.49 | <0.001 |

this study, we used low pressure-High volume cuffed ET tubes, where the incidence of sore throat and other side effects are less with these tubes.

A study by Mandoe *et al*. came to the conclusion that the occurrence of the post-anesthetic sore throat[11] could be significantly decreased by using endotracheal tubes with a short tracheal cuff contact length.

Post-operatively, the most common complaint after tracheal intubation is sore throat, which affects 90% of intubated patients. The insertion of a tracheal tube can cause a hematoma, laceration, or granuloma of the mucosa or arytenoid cartilage injury in the upper respiratory tract. The tube may also cause cord paralysis by damaging the anterior branch of the RLN with the larynx, or cricothyroid muscle paralysis by damaging the external laryngeal nerve. These conditions may cause hoarseness, and some research has attempted to pinpoint the causes.

Sore throat is also attributed to factors such as tube size, tube design, lateral wall pressure, intracuff pressure, use of cleansing agents, tube lubricants, hypotension, local infection, use of steroids, and the duration of intubation. It has been proposed that the occurrence and severity of sore throat after intubation is highly correlated to endotracheal cuff design and was explained based on cuff trachea contact area.

Fagan *et al*.[12] in the year 2000 studied the effects of intracuff lignocaine on endotracheal tube-induced emergence phenomenon after general anesthesia. The study concluded that inflation of the cuff of the endotracheal tube with lignocaine can reduce the incidence of coughing in the initial post-extubation period. Our results in this present study support this research, as there is less incidence of cough in the Group-L during extubation when compared with Group-A.

At a lateral wall pressure of 37 mmHg, Seejobin and van Hasselt[13] in the year 1984 observed indications of blockage to mucosal blood flow at a lateral wall pressure above 30 cm water (22 mmHg), with entire occlusion of flow to the mucosa across the tracheal rings and posterior tracheal wall.[13] Large volume cuffs draping the intercartilaginous mucosa have been postulated to have a sparing impact on capillary blood flow over the cartilaginous rings by applying pressure to the arterioles in the intercartilaginous submucosa, hence raising the effective perfusion pressure. The researchers found that lateral wall pressure affects tracheal capillary blood flow and that tracheal mucosal erosions can be reduced by constant monitoring and avoiding high lateral wall pressures.[13]

In this study, we have used cuff pressure manometer for continuous monitoring of pressures intraoperatively by maintaining at 25–30 cm of h 20.

Stanley *et al*. in the year 1974 studied the nitrous oxide's effects on the pressure and volume of the endotracheal tube cuff.[14] The study demonstrated the capacity of nitrous oxide to diffuse into latex rubber ETT cuffs in significant volumes resulting in over expansion of the cuff. In this study, we used 60% N20 during the maintenance of anesthesia to avoid increase of intracuff pressures in Group-A.

The physicochemical properties and rates of nitrous oxide diffusion into the tracheal tube cuffs were examined by William H. Bernhard in the year 1978.[15]

Diffusion rates into most cuffs were inversely proportional to cuff thickness and proportional to nitrous oxide partial pressure. Diffusion rates vary significantly between cuffs of the same composition with various densities or porosities, as well as between cuffs of different compositions.

Patel RI, TH OL, and Epstein BS in year 1983 investigated the nitrous oxide's effect on pressure changes in tracheal tube cuffs after inflation with air and saline.[16] At a temperature of 37°, the effects of nitrous oxide diffusion on tracheal tube cuff pressure after inflation with air and saline were investigated. The pressure in the air-inflated cuffs rose faster and to a higher level than the pressure in the saline-inflated cuffs.

Cuff pressure and volume rise over time after air inflation, according to previous studies. According to our observations, the initial air volume required to inflate the cuff was substantially greater than the liquid volume. During extubation, the air volume in the cuff rose due to diffusion. In group L, the amount of liquid required to inflate the cuff was not significantly different in all the subjects. In group L, the volume of liquid evacuated from the cuff was decreased. Prior study on lignocaine diffusion across the ETT cuff *in vivo* supports our findings. The new research backs up the theory that nitrous oxide is the main cause of ETT cuff overpressure during balanced anesthesia.

The rate of diffusion of lignocaine alone across an ETT cuff has been reported to be low (1% released ruing 6 h).

During extubation, both groups' heart rates increased in the present study. The increase was greater in group A, but not significantly so in group L. After 1 h, both group heart rates reverted to preoperative levels. During extubation, both groups' blood pressures rose. In Group A, the

increase was the greatest. After extubation, both groups' blood pressure was restored to preoperative levels within 1–2 h. There were no previous studies demonstrating about hemodynamic changes.

In some clinical conditions, coughing during awakening from general anesthesia may be undesirable.

Lignocaine has been used to lubricate ETTs, however, it exacerbated ETT-induced emerging phenomena from anesthesia whether applied as a spray or a jelly. Cuff rupture is also a possibility. In the present study, at extubation, 90.5% of participants in Group- A experienced a cough, which dropped to 85% after an hour. During extubation, 19% of the individuals in group L coughed. In both groups, the cough progressively subsided. In both groups, no participants coughed 24 h after extubation. After 12 h, there was no evidence of cough in group L. Previous research has indicated that lignocaine lowers ETT-induced coughing during emergence from general anesthesia by acting locally on the tracheal mucosa.

In the present research, we found that Post-extubation hoarseness was detected in 100% of participants in group A after 1 h, but only 21% of subjects in group L. After 12 h, there was no evidence of hoarseness in group L. In the present study, the majority of the participants in Group-A experienced a sore throat at 12 h, compared to Group-L. At 24 h, just a few of the subjects in Group A experienced a sore throat, while Group L had none.

When intracuff alkalinized lignocaine was utilized instead of ordinary air in our investigation, the occurrence of sore throat was lower. Throat pain, restlessness, dysphonia, and hoarseness were the most common symptoms in the group that used air to inflate. In comparison to the plain air group, the alkalinized lignocaine group had less adverse effects.

The main result of the present study was that using alkalinized lignocaine instead of air to inflate the ETT cuff reduced the incidence of post-intubation sore throat and its adverse effects.

## CONCLUSION

Post-intubation sore throat and its adverse effects are most common. It depends on various factors as discussed earlier, but the most common factor includes endotracheal tube and cuff inflation technique. Modifying this factor can reduce the post-operative adverse events.

In conclusion, when the cuff of an ETT was inflated with alkalinized lignocaine rather than air, the incidence of sore throat during the post-operative period was reduced. When the inflating medium of the ETT cuff was alkalinized lignocaine, the incidence of tracheal intubation side effects such as hemodynamic abnormalities, restlessness, dysphonia, and hoarseness was lower.

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