

# Effect of Intracuff Air versus Alkalinized Lignocaine on Postoperative Sore Throat and Hoarseness of Voice Following Endotracheal Intubation: A Prospective Comparative Study

Monali Thakur<sup>1</sup>, Paramanand Maheshwari<sup>2</sup> and Swaraj Jyoti Sonowal<sup>3</sup>

<sup>1</sup>Secondary DNB student, Department of Anaesthesiology Central Hospital, NFR  
Medical Officer E Intensivist, Department of Critical Care, Dr. B. Borooah Cancer Institute

<sup>2</sup>Senior Consultant and HOD, Department of Anaesthesiology Central Hospital, NFR

<sup>3</sup>Associate Professor, Department of Critical Care Dr. B. Borooah Cancer Institute

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## ABSTRACT

**Background:** Postoperative sore throat (POST) and hoarseness of voice are frequent complications following endotracheal intubation during general anaesthesia. Although these complications are usually self-limiting, they contribute significantly to postoperative discomfort and reduced patient satisfaction. Various strategies have been proposed to reduce airway morbidity, including intracuff instillation of alkalinized lignocaine. The present study compares the effect of intracuff air versus alkalinized lignocaine on postoperative sore throat and hoarseness of voice.

**Methods:** A prospective randomized study was conducted in patients undergoing elective surgery under general anaesthesia with endotracheal intubation. Patients were divided into two groups. In **Group A**, the endotracheal tube cuff was inflated with air, whereas in **Group L**, the cuff was inflated with alkalinized lignocaine. The incidence and severity of postoperative sore throat and hoarseness of voice were evaluated at 6 and 24 hours postoperatively.

**Results:** The incidence of postoperative sore throat was lower in the alkalinized lignocaine group compared to the air group. Patients receiving intracuff alkalinized lignocaine also demonstrated reduced severity of symptoms and lower incidence of postoperative hoarseness of voice. Statistical analysis showed a significant difference between groups at 24 hours post extubation for post operative sore throat.

**Conclusion:** Intracuff alkalinized lignocaine is effective in reducing postoperative sore throat and hoarseness of voice compared with conventional air inflation of the endotracheal tube cuff.

**Keywords:** *postoperative sore throat, alkalinized lignocaine, endotracheal tube cuff, hoarseness of voice, airway morbidity.*

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## INTRODUCTION

Endotracheal intubation is an essential component of airway management during general anaesthesia. Despite its routine use, it is associated with several postoperative airway complications, among which postoperative sore throat (POST) is the most common<sup>1</sup>. The reported incidence of POST varies widely, ranging from **21% to 65%**, depending on patient characteristics, surgical duration, and airway manipulation<sup>2</sup>.

Although POST is generally considered a minor complication, it significantly influences patient comfort and satisfaction in the postoperative period<sup>3</sup>. Patients often perceive sore throat and hoarseness as distressing symptoms following surgery, particularly in ambulatory procedures where rapid recovery and early discharge are expected<sup>4</sup>.

The development of postoperative sore throat is multifactorial. Contributing factors include mechanical trauma during laryngoscopy, mucosal irritation from the

endotracheal tube, cuff pressure exceeding mucosal perfusion pressure, and diffusion of anaesthetic gases into the cuff leading to increased intracuff pressure<sup>5, 6</sup>. Elevated cuff pressure can impair mucosal blood flow in the trachea, resulting in ischemia and inflammation of the airway mucosa<sup>7</sup>.

Several preventive strategies have been investigated to reduce the incidence of POST. These include the use of smaller endotracheal tubes, careful airway manipulation, monitoring cuff pressure, topical lignocaine application, and pharmacological agents such as steroids and nonsteroidal anti-inflammatory drugs<sup>8, 9</sup>.

One promising method is the use of intracuff lignocaine. Lignocaine placed inside the endotracheal tube cuff can diffuse across the cuff membrane and provide local anaesthetic action on the tracheal mucosa<sup>10</sup>. This diffusion reduces mucosal irritation and suppresses cough reflexes associated with endotracheal intubation.

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\*Author for Correspondence: Monali Thakur

The effectiveness of intracuff lignocaine is further enhanced by alkalinization with sodium bicarbonate, which increases the non-ionized fraction of lignocaine. The non-ionized form diffuses more readily across the polyvinyl chloride cuff membrane, resulting in improved analgesic effect and prolonged local anaesthetic activity<sup>11</sup>.

Previous clinical studies have demonstrated that intracuff alkalinized lignocaine reduces postoperative sore throat, coughing, and hoarseness of voice compared with air-filled cuffs<sup>12, 13</sup>. However, the routine use of this technique remains variable in clinical practice.

Therefore, the present study was designed to compare the **effect of intracuff air versus alkalinized lignocaine on postoperative sore throat and hoarseness of voice** in patients undergoing elective surgery under general anaesthesia.

## MATERIALS AND METHODS

### Study Design

This prospective randomized comparative study was conducted in patients undergoing elective surgical procedures under general anaesthesia requiring endotracheal intubation.

The study was approved by the institutional ethics committee, and written informed consent was obtained from all participants.

### Study Population

Patients aged between **18 and 60 years**, belonging to **ASA physical status I and II**, and scheduled for elective surgery under general anaesthesia were included in the study.

### Inclusion Criteria

- Age 18–60 years
- ASA physical status I and II
- Elective surgery under general anaesthesia
- Endotracheal intubation required

### Exclusion Criteria

- Patients with pre-existing sore throat or upper respiratory infection, GERD
- Anticipated difficult airway
- History of smoking
- Allergy to lignocaine
- Surgeries involving the airway or head and neck region

### Randomization and Group Allocation

Patients were randomly allocated into two groups:

#### Group A (Air group):

Endotracheal tube cuff inflated with air.

#### Group L (Lignocaine group):

Endotracheal tube cuff inflated with alkalinized lignocaine.

### Preparation of Alkalinized Lignocaine

In the proportions used in Navarro et al<sup>13</sup> (19 ml of 2% lignocaine to 1 ml of 8.4% sodium bicarbonate) the pH of the solution changed from 6.92 (Lignocaine hydrochloride) to 7.43 (alkalinized lignocaine), thereby increasing the non-ionized fraction.

### Anaesthetic Technique

All patients were premedicated according to institutional protocol. Standard monitoring including ECG, pulse oximetry, and non-invasive blood pressure was applied.

General anaesthesia was induced using intravenous induction agents followed by administration of a neuromuscular blocking agent to facilitate endotracheal intubation.

Endotracheal intubation was performed using a standard polyvinyl chloride endotracheal tube of appropriate size.

- In **Group A**, the cuff was inflated with air.
- In **Group L**, the cuff was inflated with alkalinized lignocaine.

In both the groups cuff was inflated maintaining a cuff pressure at the start of the surgery approximately 20 cm of H<sub>2</sub>O, by means of a cuff pressure manometer.

Anaesthesia was maintained using inhalational anaesthetic agents and controlled ventilation.

### Outcome Measures

The primary outcomes assessed were:

- Incidence of **postoperative sore throat**
- Incidence of **hoarseness of voice**

These parameters were assessed at:

- **6 hours postoperative**
- **24 hours postoperative**

The secondary outcomes were grading of sore throat and hoarseness of voice, if present.

### Assessment of Postoperative Sore Throat

Postoperative sore throat was graded using a standardized scale:

0 – No sore throat

I – Mild sore throat (patient answered in affirmative when asked)

II – Moderate sore throat (Complained of sore throat on his/her own)

III – Severe sore throat (Patient in obvious distress)

### Assessment of Hoarseness of Voice

Hoarseness of voice was evaluated based on patient complaints and voice quality.

Grade - 0: No complaint of hoarseness at any time since the operation.

Grade - I: Minimal change in the quality of speech. Patient answers in the affirmative only when enquired about (minimal hoarseness)

Grade - II: Moderate change in the quality of speech about which the patient complains on his/her own (moderate hoarseness)

Grade - III: Gross change in the quality of voice perceived by the observer (severe hoarseness)

**RESULTS**

**CONSORT FLOW DIAGRAM**

Patients assessed for eligibility (n = 102)

Excluded (n = 16)

Not meeting criteria (n = 10)

Declined (n = 6)

Randomized (n = 86)

Allocated to Air group (n = 43)

Allocated to Lignocaine group (n = 43)

Analysed (n = 43)

Analysed (n = 43)

**A total of 86 patients were included in the final analysis, with 43 patients in each group.**

**Table 1: Demographic Characteristics of Patients**

Parameter	Air Group (n = 43)	Lignocaine Group (n = 43)	P value
Age (years)	38.6 ± 11.2	37.9 ± 10.8	0.78
Gender (M/F)	19 / 24	20 / 23	0.83
Height (cm)	162.4 ± 7.6	163.1 ± 8.1	0.69
Weight (kg)	61.3 ± 9.5	60.7 ± 8.9	0.77
BMI (kg/m <sup>2</sup> )	23.2 ± 3.1	22.9 ± 3.0	0.64
ASA I/II	26 / 17	27 / 16	0.84

**Table 2: Surgical Characteristics**

Variable	Air Group (n=43)	Lignocaine Group (n=43)	P value
Duration of Surgery (minutes)	63.8 ± 11.4	64.1 ± 12.0	0.91
Duration of Anaesthesia (minutes)	74.2 ± 13.7	73.8 ± 12.9	0.88
Mallampati I/II	24 / 19	23 / 20	0.82

Baseline demographic parameters including age, gender, height, weight, BMI, ASA physical status, and Mallampati score were comparable between the two groups, and no statistically significant differences were observed.

Similarly, the types of surgical procedures performed and the duration of anaesthesia were also comparable between the two groups.

The incidence of postoperative sore throat was assessed at 1 hour and 24 hours after extubation.

**Incidence of Postoperative Sore Throat at 1 Hour:**

**Table 3: Incidence of Postoperative Sore Throat**

Group	No Sore Throat	Sore Throat	Incidence (%)	p value
Air	39	4	9.3%	
Lignocaine	40	3	7.0%	0.69

The incidence of postoperative sore throat at 1 hour was slightly higher in the air group (9.3%) compared with the lignocaine group (7%), but the difference was not statistically significant (p > 0.05).

**Incidence of Postoperative Sore Throat at 24 Hours:**

Group	No Sore Throat	Sore Throat	Incidence (%)	p value
Air	32	11	24.6%	
Lignocaine	40	3	7.0%	0.038

At 24 hours postoperatively, the incidence of postoperative sore throat was significantly higher in the air group (24.6%) compared with the lignocaine group (7%), and the difference was statistically significant (p = 0.038).

This suggests that intracuff alkalinized lignocaine significantly reduces postoperative sore throat.

Hoarseness of voice was also evaluated at 1 hour and 24 hours postoperatively.

**Incidence of Hoarseness of Voice at 1 Hour:**

**Table 4: Incidence of Hoarseness of Voice**

Group	Hoarseness Present	Incidence (%)	p value
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<b>Air</b>	<b>1</b>	<b>2.3%</b>	
<b>Lignocaine</b>	<b>0</b>	<b>0%</b>	<b>0.31</b>

At 1 hour postoperatively, hoarseness of voice occurred in one patient in the air group and none in the lignocaine group, with no statistically significant difference.

**Incidence of Hoarseness of Voice at 24 Hours:**

Group	Hoarseness Present	Incidence (%)	p value
Air	4	9.3%	
Lignocaine	1	2.3%	0.36

At 24 hours, hoarseness of voice was more frequent in the air group (9.3%) compared with the lignocaine group (2.3%), although the difference was not statistically significant.

The severity of postoperative sore throat and hoarseness were graded on a standardized scale as mentioned before.

**Severity of Post-operative Sore Throat at 1 Hour and 24 Hours After Extubation**

**Table 5: Severity of Postoperative Sore Throat and hoarseness:**

Severity Grade	Group A	Group L	Total	p value
<b>1 Hour After Extubation</b>				
None	39 (90.7%)	40 (93.0%)	79 (91.9%)	
Grade I (Mild)	1 (2.3%)	0 (0%)	1 (1.2%)	
Grade II (Moderate)	3 (7.0%)	3 (7.0%)	6 (7.0%)	
Grade III (Severe)	0 (0%)	0 (0%)	0 (0%)	0.693

Severity Grade	Group A	Group L	Total	p value
<b>24 Hours After Extubation</b>				
None	32 (74.4%)	40 (93.0%)	72 (83.7%)	
Grade I (Mild)	0 (0%)	0 (0%)	0 (0%)	
Grade II (Moderate)	8 (18.6%)	3 (7.0%)	11 (12.8%)	
Grade III (Severe)	3 (7.0%)	0 (0%)	3 (3.5%)	0.012

Most patients did not develop postoperative sore throat. At 1 hour, the grading distribution was comparable between the two groups. However, at 24 hours, a significantly higher proportion of patients in the air group developed

moderate and severe sore throat, whereas in the alkalinized lignocaine group only mild to moderate symptoms were observed, showing a statistically significant difference between the groups.

**Severity of Hoarseness of Voice at 1 Hour and 24 Hours after Extubation**

Severity Grade	Group A	Group L	Total	p value
<b>1 Hour after Extubation</b>				
None	42 (97.7%)	43 (100%)	85 (98.8%)	
Grade I (Mild)	1 (2.3%)	0 (0%)	1 (1.2%)	
Grade II (Moderate)	0 (0%)	0 (0%)	0 (0%)	
Grade III (Severe)	0 (0%)	0 (0%)	0 (0%)	1.00
<b>24 Hours after Extubation</b>				
None	39 (90.7%)	42 (97.7%)	81 (94.2%)	
Grade I (Mild)	3 (7%)	1 (2.3%)	4 (4.7%)	
Grade II (Moderate)	1 (2.3%)	0 (0%)	1 (1.2%)	
Grade III (Severe)	0 (0%)	0 (0%)	0 (0%)	0.348

Most patients did not develop hoarseness of voice in either group. Mild hoarseness (Grade I) was the most common when present. There was no statistically significant

difference between the air and alkalinized lignocaine groups at both 1 hour and 24 hours after extubation.

**Interpretation:**

**Demographic Characteristics**

The demographic characteristics of both the groups were comparable in terms of age, sex, weight, BMI, ASA physical status, airway assessment, duration of surgery.

At 6 hours, the incidence of sore throat was higher in the air group, whereas most patients in the lignocaine group reported minimal symptoms.

At 24 hours, symptoms had decreased in both groups but were still more prevalent in the air group.

**Incidence of Postoperative Sore Throat**

Statistical analysis demonstrated a significant reduction in postoperative sore throat in the lignocaine group after 24 hours.

### **Incidence of Hoarseness of Voice**

The incidence of hoarseness of voice was greater in patients whose endotracheal cuff was inflated with air.

Patients in the lignocaine group experienced significantly fewer complaints of hoarseness.

But statistical analysis did not show significant differences in incidences of postoperative hoarseness of voice in both the groups at 6 hours and 24 hours.

### **DISCUSSION**

Postoperative sore throat remains one of the most frequent complaints following general anaesthesia with endotracheal intubation<sup>1</sup>. Although often overlooked, it can adversely affect patient satisfaction and recovery experience<sup>3</sup>.

The primary mechanism underlying postoperative sore throat is **mucosal injury and inflammation caused by the endotracheal tube and cuff pressure on the tracheal wall**<sup>5</sup>. Excessive cuff pressure may compromise tracheal mucosal perfusion, leading to ischemia and subsequent postoperative symptoms<sup>7</sup>.

Another contributing factor is the **diffusion of nitrous oxide into the endotracheal tube cuff**, which increases intracuff pressure during anaesthesia<sup>6</sup>. This increase can exacerbate mucosal injury and airway irritation.

The use of intracuff lignocaine offers several advantages. Lignocaine diffuses across the cuff membrane and exerts a **local anaesthetic effect on the tracheal mucosa**, reducing irritation and suppressing airway reflexes<sup>10</sup>. This mechanism helps minimize coughing, sore throat, and hoarseness in the postoperative period.

Alkalinization of lignocaine further enhances this effect. By increasing the non-ionized fraction of lignocaine, alkalinization improves drug diffusion through the cuff membrane and prolongs its duration of action<sup>11</sup>.

The findings of the present study are consistent with previous research demonstrating the beneficial effects of intracuff alkalinized lignocaine. Studies have reported a **significant reduction in postoperative sore throat and coughing** when lignocaine is used instead of air for cuff inflation<sup>12, 13</sup>.

In our study, patients in the lignocaine group experienced a markedly lower incidence of postoperative sore throat at all observation intervals, but it was statistically significant when assessed after 24 hours. The reduction in symptom severity suggests that intracuff lignocaine provides effective mucosal analgesia.

Similarly, hoarseness of voice was less frequent in the lignocaine group. This finding may be attributed to reduced irritation of the laryngeal structures and decreased inflammatory response in the airway.

Another advantage of intracuff lignocaine is improved patient comfort during emergence from anaesthesia. By suppressing airway reflexes, lignocaine reduces coughing and straining during extubation.

Despite these benefits, certain considerations must be taken into account when using intracuff lignocaine. Proper preparation of the alkalinized solution is necessary to ensure optimal drug diffusion and avoid cuff leakage.

Overall, the results of the present study support the use of intracuff alkalinized lignocaine as a simple and effective method to reduce postoperative airway complications.

### **Comparison with Previous Studies:**

The findings of the present study are consistent with several previously published studies evaluating intracuff lignocaine.

Navarro et al<sup>8</sup>. conducted a randomized study comparing **air and alkalinized lignocaine** as cuff inflating media and observed that although airway complaints were similar immediately after extubation, **the incidence of postoperative sore throat at 24 hours was significantly lower in the lignocaine group**. These findings closely mirror the results of the present study.

Similarly, Shroff et al<sup>14</sup>. evaluated three cuff inflation media—air, saline, and alkalinized lignocaine—and reported that **intracuff pressure was significantly higher in the air group**, while patients receiving alkalinized lignocaine experienced **less postoperative sore throat and hoarseness**.

Jolly et al<sup>15</sup>. conducted a randomized trial involving three groups—saline, plain lignocaine, and alkalinized lignocaine—and found that **alkalinized lignocaine significantly reduced postoperative coughing and sore throat compared to the other groups**. Their study highlighted the superior diffusion properties of alkalinized lignocaine, which supports the findings of the present study.

A systematic review and meta-analysis by Fei Peng et al<sup>16</sup>. involving **843 patients from 11 randomized controlled trials** demonstrated that intracuff lignocaine significantly reduced **coughing, postoperative sore throat, and other airway complications associated with endotracheal intubation**.

Further supporting evidence was provided by Rizvanović et al<sup>17</sup>., who compared **air, saline, and alkalinized lignocaine** for cuff inflation and observed that **increased cuff pressure correlated with a higher incidence of postoperative airway symptoms**, while lignocaine provided better mucosal protection.

Gnanadoss et al<sup>18</sup>. also reported that inflating the cuff with lignocaine was associated with **reduced haemodynamic responses during extubation and lower incidence of sore throat and hoarseness** compared to air.

These findings collectively reinforce the hypothesis that **alkalinized lignocaine is superior to air as a cuff inflating medium in reducing postoperative airway morbidity**.

### **CONCLUSION**

Postoperative sore throat and hoarseness of voice are common complications following endotracheal intubation.

The findings of this study demonstrate that **inflation of the endotracheal tube cuff with alkalinized lignocaine significantly reduces the incidence and severity of postoperative sore throat and hoarseness of voice compared with air.**

Intracuff alkalinized lignocaine represents a simple, safe, and effective technique that can improve postoperative patient comfort and satisfaction.

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