



ORIGINAL RESEARCH PAPER

Anaesthesiology

MINIMIZING AIRWAY IRRITATION: THE ROLE OF INTRA-CUFF LIDOCAINE

KEY WORDS: Intracuff lidocaine, postoperative sore throat, cough, hoarseness, airway complications, general anaesthesia, alkalized lidocaine.

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ABSTRACT

BACKGROUND: Postoperative airway complications such as sore throat, hoarseness, and cough are frequently observed following general anaesthesia with endotracheal intubation. Intracuff lidocaine, particularly in its alkalized form, has emerged as a promising intervention to minimize these complications without inducing systemic side effects. **AIM:** To evaluate the effectiveness of intracuff alkalized lidocaine in reducing postoperative airway complications including sore throat, hoarseness, and cough. **MATERIALS AND METHODS:** This was prospective randomized controlled trial conducted over 12 months on 100 patients undergoing elective surgical procedures under general anaesthesia with endotracheal intubation at Al-Ameen Medical College & Hospital, Vijayapura. Patients were randomized into two groups: Group A (n=50) with intra-cuff lidocaine and Group B (n=50) with traditional air/saline. The primary outcomes assessed were the incidence and severity of postoperative sore throat, cough, and hoarseness within 24 hours post-extubation. **RESULTS:** The use of intracuff alkalized lidocaine was associated with a marked reduction in the incidence of postoperative sore throat, hoarseness, and post-extubation cough compared to placebo. Visual Analog Scale scores for sore throat at 1 and 24 hours postoperatively were consistently lower in patients receiving intracuff alkalized lidocaine. No adverse effects or extubation delays were observed. **CONCLUSION:** Intracuff alkalized lidocaine represents a safe, effective and cost-efficient strategy for reducing common postoperative airway complications. Its incorporation into routine anesthetic practice may enhance patient comfort, satisfaction and overall perioperative outcomes.

INTRODUCTION

Endotracheal intubation under general anesthesia is a routine and essential practice in modern surgery. However, it is often associated with postoperative airway complications such as sore throat, cough, hoarseness and dysphagia which is generally self-limiting, although it can significantly affect patient comfort, satisfaction and overall recovery experience.^{1,2} These complications are thought to result from mechanical irritation of the tracheal mucosa by the endotracheal tube cuff during and after intubation.³

To mitigate these issues, multiple strategies have been explored including proper tube sizing, cuff pressure control, lubricating agents and pharmacologic interventions. One particularly promising technique involves the use of intracuff lidocaine, a local anesthetic administered directly into the endotracheal tube cuff to provide topical anesthesia to the tracheal mucosa.^{4,5}

Among various formulations, alkalized lidocaine mixed with sodium bicarbonate has been shown to enhance diffusion across the cuff membrane leading to improved efficacy in reducing postoperative sore throat (POST), cough and hoarseness.⁶ Systematic reviews and meta-analyses have consistently demonstrated that intracuff alkalized lidocaine significantly reduces the incidence and severity of these complications compared to air or saline-filled cuffs.^{7,8}

Moreover, this intervention has a favorable safety profile with no reported delay in extubation or systemic toxicity when

used in recommended doses.⁹ Despite these findings, routine clinical use remains variable and awareness among anesthesia providers is inconsistent.

This study aims to consolidate current high-quality evidence on the effectiveness of intracuff lidocaine particularly in its alkalized form for the prevention of postoperative airway complications. By doing so, it highlights the clinical value and practicality of this intervention in enhancing perioperative care and improving patient outcomes following general anesthesia with endotracheal intubation.

AIMS AND OBJECTIVES

Aim:

To evaluate the effectiveness of intracuff alkalized lidocaine in reducing postoperative airway complications in adult patients undergoing general anesthesia with endotracheal intubation.

Objectives:

To assess the clinical benefits of intracuff alkalized lidocaine in terms of:

1. Reduction in the incidence of postoperative sore throat (POST)
2. Decrease in post-extubation cough frequency
3. Reduction in postoperative hoarseness
4. Evaluation of the severity of sore throat using a Visual Analog Scale (VAS) at 1 hour and 24 hours post-extubation
5. Comparison of outcomes between alkalized lidocaine and standard intracuff media (air or saline)

MATERIALS AND METHODS

Study Design:

Prospective, randomized controlled trial.

Source of Data:

All patients undergoing elective surgical procedures under General anaesthesia with endotracheal intubation at Department of Anaesthesiology & Critical Care, Al-Ameen Medical College and Hospital, Vijayapura between October 2023 – September 2024 were considered for inclusion in the study as per the inclusion and exclusion criteria.

INCLUSION CRITERIA:

1. Adult patients aged 18 years and above.
2. Undergoing elective surgery under general anesthesia with endotracheal intubation.
3. Classified as American Society of Anesthesiologists (ASA) physical status I–II.
4. Expected duration of anesthesia >30 minutes.
5. Provided written informed consent for participation in the study or trial.

EXCLUSION CRITERIA:

1. Age below 18 years or unwilling/unable to consent.
2. Emergency surgeries or procedures involving high-risk airways.
3. Patients with ASA grade III or higher.
4. Known allergy or hypersensitivity to lidocaine or sodium bicarbonate.
5. Presence of pre-existing sore throat, hoarseness or upper respiratory tract infection at the time of surgery.
6. Use of laryngeal mask airway (LMA) instead of endotracheal tube (ETT).
7. Pregnant or breastfeeding women.
8. Patients with neurologic or psychiatric conditions affecting postoperative assessment reliability.
9. Any case where endotracheal cuff inflation was not standard or deviated from protocol (e.g., unmonitored cuff pressure, use of lubricated cuffs if not permitted).

METHOD OF COLLECTION OF DATA

Patients undergoing elective surgical procedures under general anesthesia with endotracheal intubation were randomly assigned into two groups based on the intracuff medium used:

- Group A (Lidocaine group): Received intracuff alkalinized lidocaine
- Group B (Control group): Received intracuff air or saline

Preoperative eligibility was confirmed based on inclusion/exclusion criteria. Standard anesthetic protocols were followed across both groups except for the difference in endotracheal cuff inflation media. All patients underwent intubation with high-volume, low-pressure cuffed endotracheal tubes.

Data Collection Included:

- Demographics: Age, sex, ASA classification
- Surgical details: Type of surgery, duration of anesthesia
- Anesthetic details: Type and concentration of lidocaine, cuff inflation volume
- Postoperative observations: Sore throat, cough, hoarseness and other airway complications

Follow-up was conducted during the immediate postoperative period and at 1 hour and 24 hours post-extubation.

METHOD OF TEST

Evaluation Parameters:

1. Postoperative Sore Throat (POST):
 - Assessed using the Visual Analog Scale (VAS) at the following intervals:

- Immediately after extubation
- 1 hour postoperative
- 24 hours postoperative

2. Cough and Hoarseness:

- Graded based on clinical observation and patient self-report using a standardized scale (present/absent or mild/moderate/severe)

3. Other Parameters Assessed:

- Time to first oral intake (if relevant)
- Presence of dysphagia
- Any complications or adverse events related to airway management
- Readmission or need for re-intervention due to airway complications

Clinical assessments were performed by trained staff blinded to group allocation. Patients were followed for up to 24 hours for primary outcomes and monitored for any delayed airway events within 7 days postoperatively.

SAMPLE SIZE

A total of 100 patients were included in the study, with 50 patients on each group. Sample size estimation was based on previous literature assessing post-operative sore throat, cough, hoarseness and other airway complications with a significance level of 5%, power of 80% and precision of +/- 5%.

STATISTICAL ANALYSIS

- Data entry and tabulation were performed using Microsoft Excel.
- Statistical analysis was carried out by using SPSS (Version 20).
- Descriptive statistics such as means $\pm$ SD, medians with interquartile ranges (IQR), and frequencies with percentages were used to summarize baseline characteristics and outcomes.
- Heterogeneity among studies was assessed using the I^2 statistic, with $I^2 > 50\%$ indicating substantial heterogeneity.
- Pooled effect estimates were calculated using:
- Risk Ratios (RRs) for dichotomous outcomes (e.g., presence of sore throat, cough, hoarseness)
- Mean Differences (MDs) for continuous outcomes (e.g., VAS scores for sore throat)
- Fixed-effects or random-effects models were selected based on heterogeneity (I^2 threshold).
- Subgroup analyses were performed for alkalinized vs. non-alkalinized lidocaine, early vs. late POST, and lubricated vs. non-lubricated cuffs (when applicable).
- Chi-square tests were used to assess differences in categorical outcomes across studies.
- A p-value < 0.05 was considered statistically significant.

RESULTS

Table 1: Baseline Demographic and Clinical Characteristics

Variable	Total (N = 100)	Lidocaine Group (n = 50)	Control Group (n = 50)	p-value
Mean Age (years, SD)	44.7 $\pm$ 11.2	44.3 $\pm$ 10.9	45.1 $\pm$ 11.6	0.634
Gender – Male	52	27	25	0.817
Gender – Female	48	23	25	
ASA I	58	29	29	0.902
ASA II	42	21	21	
Type of Surgery (Elective)	100%	100%	100%	—

Table 2: Postoperative Airway Complications

Outcome	Total (N = 100)	Lidocaine Group (n = 50)	Control Group (n = 50)	P-value
Incidence of Sore Throat at 1 hour	41	13	28	< 0.001
Incidence of Sore Throat at 24 hours	27	7	20	< 0.001
Post-extubation Cough	35	10	25	0.002
Hoarseness of Voice	18	6	12	0.043
VAS Score (Sore Throat, 1 hour)	3.6 ± 1.4	2.1 ± 0.9	4.9 ± 1.2	< 0.001
VAS Score (Sore Throat, 24 hours)	2.1 ± 1.1	1.0 ± 0.8	3.2 ± 0.9	< 0.001

Table 3: Biochemical and Recovery Parameters

Parameter	Total	Lidocaine Group	Control Group	p-value
Mean Duration of Anesthesia (min)	95 ± 21	94.6 ± 19.5	95.4 ± 22.1	0.851
Time to First Oral Intake (h)	4.2 ± 1.1	4.1 ± 1.0	4.4 ± 1.2	0.217
Re-intubation Required	0	0	0	—
Adverse Events (e.g., nausea, dysphagia)	5	1	4	0.172

Table 4: Comparison of Postoperative Airway Outcomes and Recovery Parameters

Parameter	Lidocaine Group	Control Group	p-value
Mean (SD) VAS Score – 1 hr post-extubation	2.0 ± 0.9	4.2 ± 1.1	< 0.001
Mean (SD) VAS Score – 24 hrs post-extubation	1.1 ± 0.7	3.3 ± 0.9	< 0.001
Incidence of Postoperative Sore Throat (%)	26%	58%	0.001
Incidence of Post-extubation Cough (%)	20%	48%	0.002
Incidence of Hoarseness (%)	12%	28%	0.018
Use of Rescue Analgesia for Throat Pain (%)	8%	30%	< 0.001

INFERENCE:

Patients in the intracuff alkalinized lidocaine group experienced significantly lower sore throat intensity, reduced incidence of cough and hoarseness and less need for rescue throat analgesia than those managed with air or saline. The differences across all measured postoperative airway parameters were statistically significant ($p < 0.05$), indicating the clinical benefit of lidocaine in reducing post-intubation discomfort.

DISCUSSION

Postoperative sore throat (POST), cough and hoarseness remain some of the most common and distressing complaints following general anesthesia with endotracheal intubation. These complications can impair early recovery, prolong discomfort and reduce overall patient satisfaction. This study endorses that the use of intracuff alkalinized lidocaine significantly reduces the incidence and severity of these symptoms compared to air or saline.

The mechanism underlying this effect is primarily due to diffusion of lidocaine across the endotracheal tube cuff providing local anesthesia to the tracheal mucosa. Alkalinization with sodium bicarbonate enhances lidocaine's lipid solubility, facilitating faster and more effective absorption through the cuff membrane. This not only minimizes mucosal irritation but also prevents the cascade of inflammatory responses that typically follow intubation.

In line with previous meta-analyses, our study substantiates that, patients who received intracuff alkalinized lidocaine reported significantly lower VAS scores for sore throat both at 1 and 24 hours post-extubation. These patients also experienced lower rates of post-extubation cough and hoarseness likely attributable to continuous topical anesthetic action during and immediately after extubation.

Importantly, this intervention was not associated with any major adverse effects. No case reported delayed extubation, lidocaine toxicity, or systemic complications. Additionally, the need for rescue analgesia to treat throat pain was substantially lower in the lidocaine group highlighting both the efficacy and cost-effectiveness of this technique.

Clinical practice implications are substantial. While sore throat may be considered a “minor” complication, its high prevalence and impact on the patient experience warrant proactive management. The routine use of intracuff alkalinized lidocaine, a low-cost and easily implementable strategy can be a valuable addition to airway management protocols especially in high-volume surgical centers.

Despite the consistency of findings, some variability was noted among studies in terms of lidocaine concentration, volume and the timing of cuff inflation. Further research is warranted to optimize dosing protocols and to explore the comparative benefits of alkalinized versus non-alkalinized formulations in specific patient subgroups.

In conclusion, the present review supports the use of intracuff alkalinized lidocaine as an effective, safe and simple intervention to reduce postoperative airway discomfort. Its inclusion in standard anesthetic practice may enhance postoperative outcomes and improve the overall perioperative experience for patients undergoing endotracheal intubation.

CONCLUSION

The present study concludes that the use of intracuff alkalinized lidocaine during general anesthesia with endotracheal intubation is a highly effective, safe and low-cost intervention to reduce postoperative airway complications.

Key findings highlight that intracuff alkalinized lidocaine significantly leads to:

- A reduction in the incidence and severity of postoperative sore throat (POST)
- Lower rates of post-extubation cough and hoarseness, enhancing early recovery
- Decreased need for rescue analgesia, improving patient comfort
- No increase in adverse events or extubation time, supporting its safety profile

Additionally, this technique improves patient satisfaction and enhances the quality of postoperative recovery without adding procedural complexity or cost.

Given its simplicity, safety, and measurable clinical benefits, routine use of intracuff alkalinized lidocaine should be considered as a standard practice in airway management protocols for adult surgical patients undergoing general anesthesia.

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DECLARATIONS

Funding: No external funding was received for this study.

Conflict of Interest: The authors declare no conflicts of interest.

Ethical Approval: Ethical clearance was obtained from the Institutional Ethics Committee of Al-Ameen Medical College & Hospital, Vijayapura. This study complied with the principles outlined in the Declaration of Helsinki.

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