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Original Research Article

COMPARATIVE STUDY BETWEEN ORAL ACETAMINOPHEN AND LIDOCAINE SPRAY ON ENDOTRACHEAL TUBE-RELATED SORE THROAT PAIN IN ADULT INTENSIVE CARE

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ABSTRACT

Background: Endotracheal tube (ETT)-related sore throat is a frequent and distressing complication in adult intensive care patients. This study aimed to compare the analgesic efficacy, dosing requirements, duration of pain relief, and patient satisfaction of oral acetaminophen (500 mg) versus 10% lidocaine spray in managing ETT-related sore throat. **Materials and Methods:** A prospective observational study was conducted at the Department of Anesthesiology, SKIMS, Srinagar, from 2023 to 2025. Sixty-eight adult ICU patients with ETT intubation were randomly assigned to Group A (acetaminophen, n = 34) or Group B (lidocaine spray, n = 34). Pain was assessed using the Wong-Baker Faces Pain Rating Scale at 5 min before, and 30, 60, and 120 min after each dose. Patient satisfaction was assessed with a 5-point Likert-type scale. **Results:** Baseline characteristics (age, gender, ETT size, ETT duration, and ICU stay) were comparable between groups ($p > 0.05$). Lidocaine provided faster pain relief with significantly lower pain scores at 30 min (5.38 vs. 6.15, $p = 0.006$), 60 min (4.85 vs. 5.59, $p = 0.012$), and 120 min (2.91 vs. 3.76, $p < 0.001$). The maximum degree of pain reduction was greater in the lidocaine group (5.1 ± 1.63 vs. 3.7 ± 1.38, $p < 0.001$). However, acetaminophen required significantly fewer doses (1.52 ± 0.507 vs. 3.15 ± 0.857, $p < 0.001$) and the total duration required for symptom relief was significantly shorter in the acetaminophen group (9.3 ± 2.98 h; 95% CI: 8.21–10.32) compared to the lidocaine group (19.1 ± 5.25 h; 95% CI: 17.28–20.95; $p < 0.001$). **Conclusion:** Both agents effectively manage ETT-related sore throat. Lidocaine spray offers faster onset and greater peak pain reduction but requires repeated dosing. Oral acetaminophen provides sustained, longer-lasting analgesia with fewer doses required. Clinical context should guide choice of agent.

INTRODUCTION

Endotracheal intubation is a routine, often life-saving procedure in adult intensive care units (ICUs) for patients requiring airway protection or mechanical ventilation. Despite its clinical necessity, the prolonged presence of an endotracheal tube (ETT) is frequently associated with post-extubation sore throat (POST), a complication that causes significant patient discomfort and can adversely affect recovery and satisfaction.[1]

The pathophysiology of ETT-related sore throat is multifaceted, involving mechanical trauma from direct mucosal pressure, inflammatory cytokine release (IL-1, IL-6), and neural sensitisation, including NMDA receptor-mediated central sensitisation.[2] Factors such as ETT size, cuff pressure, and duration of intubation are recognised determinants of sore throat severity.[3-5]

A range of pharmacological strategies has been evaluated for POST management, including topical lidocaine, corticosteroids, benzydamine, and systemic analgesics. Lidocaine spray, a local anaesthetic, provides rapid symptomatic relief by blocking mucosal sodium channels; however, its short duration of action necessitates repeated administration.[6,7] Oral acetaminophen (paracetamol), a well-established analgesic, exerts its effects by centrally inhibiting prostaglandin synthesis and modulating descending serotonergic pathways,

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thereby providing more prolonged systemic analgesia.[8,9]

While prior studies have investigated these agents individually, head-to-head comparative data specifically in adult ICU patients with ETT-related sore throat remain limited. A single prior study by Lim et al. (2021) addressed this comparison in a similar population.[10] The present study aims to systematically compare the analgesic efficacy, dosing frequency, duration of pain relief, and patient satisfaction between oral acetaminophen and lidocaine spray in this clinical setting.

MATERIALS AND METHODS

Study Design and Setting

This prospective observational study was conducted in the Department of Anesthesiology, Sher-I-Kashmir Institute of Medical Sciences (SKIMS), Soura, Srinagar, from January 2023 to December 2025. The study was approved by the Institutional Ethics Committee (IEC) before commencement, and written informed consent was obtained from all participants or their legal guardians.

Sample Size: Sample size was calculated using G*Power software (Version 3.0.10), based on 90% power, an effect size of 0.4, and a significance level of 5%. A minimum of 34 patients per group was required, yielding a total of 68 participants.

Participants: Adult ICU patients (aged 18–70 years) who had undergone endotracheal intubation for respiratory failure or airway protection and who were conscious and able to self-report pain were eligible for inclusion. Patients with a known allergy or adverse reaction to acetaminophen or lidocaine, those requesting additional sedatives or analgesics, pregnant females, and those refusing consent were excluded.

Randomisation and Treatment: Patients were randomly allocated to one of two groups:

Group A (Acetaminophen): 500 mg oral acetaminophen tablet administered on patient request for ETT-related sore throat.

Group B (Lidocaine): 10% lidocaine spray (10 mg per spray; maximum 20 sprays/dose) applied topically to the oropharyngeal mucosa on patient request.

Medication was administered each time the patient experienced ETT-related sore throat and requested treatment. Any adverse effects (lidocaine: mucosal irritation, central nervous system changes, seizures; acetaminophen: allergic reactions, hepatic changes) were recorded and treatment was immediately discontinued if they occurred.

Outcome Measures: The primary outcome was pain severity, assessed using the Wong-Baker Faces Pain Rating Scale (0–10) at 5 min before treatment and at 30, 60, and 120 min post-treatment for each dose. Secondary outcomes included: number of doses required, total duration required for pain relief (hours), maximum degree of pain reduction, and patient satisfaction assessed using a 5-point Likert scale upon ICU discharge.

Statistical Analysis: Data were analysed using standard statistical methods. Continuous variables are expressed as mean ± SD with 95% confidence intervals. Between-group comparisons were made using the independent samples t-test and chi-squared test as appropriate. A p-value < 0.05 was considered statistically significant.

RESULTS

Baseline Characteristics

Sixty-eight patients were enrolled (34 per group). Baseline demographics and clinical parameters were comparable between the two groups (Table 1). The mean age was 47.6 ± 13.02 years (Group A) and 46.7 ± 12.89 years (Group B), with no significant difference (p = 0.781). Gender distribution was balanced (Group A: 52.9% male; Group B: 55.9% male; p = 0.807). ETT intubation duration (2.47 ± 0.615 vs. 2.58 ± 0.608 days; p = 0.431), ETT size (7.36 ± 0.224 vs. 7.31 ± 0.237 mm; p = 0.601), and ICU length of stay (3.82 ± 0.576 vs. 3.61 ± 0.604 days; p = 0.154) were also similar.

Table 1: Comparison of baseline characteristics between Group A (Acetaminophen) and Group B (Lidocaine)

Parameter	Group A (ACT) n = 34	Group B (LIDO) n = 34	p-value
Age (years), mean ± SD	47.6 ± 13.02	46.7 ± 12.89	0.781
Male gender, n (%)	18 (52.9)	19 (55.9)	0.807
ETT duration (days), mean ± SD	2.47 ± 0.615	2.58 ± 0.608	0.431
ETT size (mm), mean ± SD	7.36 ± 0.224	7.31 ± 0.237	0.601
ICU stay (days), mean ± SD	3.82 ± 0.576	3.61 ± 0.604	0.154

ACT = acetaminophen; LIDO = lidocaine

Dosing Requirements and Duration of Pain Relief

The mean number of doses required was significantly lower in Group A (1.52 ± 0.507; 95% CI: 1.35–1.71) compared to Group B (3.15 ± 0.857; 95% CI: 2.85–3.45; p < 0.001). The total duration required for symptom relief was significantly shorter in the acetaminophen group (9.3 ± 2.98 h; 95% CI: 8.21–10.32) compared to the lidocaine group (19.1 ± 5.25 h; 95% CI: 17.28–20.95; p < 0.001). [Table 2]

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Table 2: Comparison of the number of doses required and the total duration required for symptom relief

Outcome	Group A (ACT)	Group B (LIDO)	95% CI (A)	95% CI (B)	p-value
No. of doses, mean ± SD	1.52 ± 0.507	3.15 ± 0.857	1.35–1.71	2.85–3.45	< 0.001*
Duration for pain relief (h), mean ± SD	9.3 ± 2.98	19.1 ± 5.25	8.21–10.32	17.28–20.95	< 0.001*

**Statistically significant (p < 0.05). ACT = acetaminophen; LIDO = lidocaine*

Pain Score Reduction Over Time

In Group A (acetaminophen), a progressive decline in pain scores was observed from 7.65 ± 1.203 before the first dose to 3.76 ± 0.954 at 120 min post-treatment ($p < 0.001$). A similar trend continued for the second dose (pre-treatment: 6.17 ± 1.201; 120 min: 2.39 ± 0.608; $p < 0.001$).

In Group B (lidocaine), significant pain score reductions were observed across all doses ($p < 0.001$). Before the first dose, the mean pain score was 7.94 ± 0.919, declining to 2.91 ± 0.965 at 120 min. Similar patterns were observed across doses 2, 3, and 4. Despite effective pain reduction per dose, the recurrence of pain necessitated more frequent re-dosing.

Intergroup comparison revealed that pain scores were similar at baseline ($p = 0.261$). However, lidocaine demonstrated significantly greater pain reduction at 30 min (5.38 ± 0.954 vs. 6.15 ± 1.258; $p = 0.006$), 60 min (4.85 ± 1.078 vs. 5.59 ± 1.209; $p = 0.012$), and 120 min (2.91 ± 0.965 vs. 3.76 ± 0.954; $p < 0.001$) post-treatment. [Table 3]

Table 3: Intergroup comparison of pain scores (Wong-Baker Faces Pain Rating Scale) at various time intervals

Time Interval	Group A (ACT) Mean ± SD	Group B (LIDO) Mean ± SD	p-value
5 min before treatment	7.65 ± 1.203	7.94 ± 0.919	0.261
30 min after treatment	6.15 ± 1.258	5.38 ± 0.954	0.006*
60 min after treatment	5.59 ± 1.209	4.85 ± 1.078	0.012*
120 min after treatment	3.76 ± 0.954	2.91 ± 0.965	< 0.001*

**Statistically significant (p < 0.05). Scores based on the first dose for both groups. ACT = acetaminophen; LIDO = lidocaine*

Maximum Degree of Pain Reduction and Patient Satisfaction

The maximum reduction in pain score was significantly greater in Group B (5.1 ± 1.63; 95% CI: 3.87–6.95) compared to Group A (3.7 ± 1.38; 95% CI: 2.63–5.14; $p < 0.001$). [Table 4]

Patient satisfaction was high in both groups. In Group A, 85.3% of patients strongly agreed and 14.7% agreed that their treatment was effective. In Group B, 79.4% strongly agreed and 20.6% agreed. No patient in either group expressed dissatisfaction. The difference was not statistically significant ($p = 0.524$).

Table 4: Maximum degree of pain reduction and patient satisfaction

Outcome	Group A (ACT)	Group B (LIDO)	p-value
Max pain reduction, mean ± SD	3.7 ± 1.38	5.1 ± 1.63	< 0.001*
95% CI for mean	2.63–5.14	3.87–6.95	
Strongly agree, n (%)	29 (85.3%)	27 (79.4%)	0.524
Agree, n (%)	5 (14.7%)	7 (20.6%)	

**Statistically significant (p < 0.05).*

DISCUSSION

This prospective study demonstrates that both oral acetaminophen and 10% lidocaine spray are effective in managing ETT-related sore throat in adult ICU patients; however, their analgesic profiles are fundamentally different. Lidocaine spray provided a faster onset and greater peak pain reduction, while acetaminophen offered more sustained analgesia with fewer doses required.

The comparable baseline characteristics between groups — including age, gender, ETT duration, ETT size, and ICU stay — strengthen the internal validity of our comparative analysis. The predominance of patients in the 51–60-year age group mirrors epidemiological trends in ICU populations, where increased comorbidities and greater risk of prolonged intubation are well recognised.[11]

Lidocaine's superior immediate pain relief aligns with its mechanism as a sodium channel blocker, providing rapid local anesthesia of oropharyngeal mucosa. However, its short elimination half-life (~1.6 h in healthy subjects) and concentration-dependent toxicity profile limit its sustained use.[6,12] The three-fold higher dosing frequency in the lidocaine group (3.15 vs. 1.52 doses; $p < 0.001$) underscores this limitation and introduces potential safety considerations at higher cumulative doses. Consistent with our findings, Lim et al. (2021) also reported significantly more analgesic requests in the lidocaine group (4.7 vs. 1.3; $p < 0.001$).[10]

The longer duration of pain relief in the acetaminophen group (9.3 h vs. 19.1 h) to full resolution ($p < 0.001$) reflects the systemic mechanism of acetaminophen — centrally inhibiting prostaglandin synthesis and modulating descending serotonergic nociceptive pathways.[8,9] This mechanistic advantage translates into more durable clinical benefit, as corroborated by Lim et al. (2021),

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who similarly found a substantially shorter resolution time in the acetaminophen group.[10]

The paradoxical finding that lidocaine reduced pain scores more rapidly per dose yet required nearly twice the total duration to achieve full resolution can be explained by the recurrence of pain between doses. Although lidocaine achieves greater peak pain reduction per application (5.1 vs. 3.7 units, $p < 0.001$), the short window of analgesia necessitates repeated doses and prolongs total management time. Hung et al. (2010) and Mekhemar et al. (2016) further caution that lidocaine spray may paradoxically exacerbate mucosal irritation in some cases, potentially due to excipient components.[13,14] Additionally, mucosal inflammation following ETT intubation may exacerbate pain perception, leading to hyperalgesia, as noted by Grinde B et al. (2016). This highlights the need for careful evaluation of LIDO's effects in POST management. On the other hand, ACT exerts its analgesic effects through multiple mechanisms.[15] Studies by Sharma C et al. (2013), Botting R et al. (2005), and Shimodaira T et al. (2019) indicate that ACT not only inhibits central prostaglandin synthesis but also modulates nociceptive processing via the descending serotonergic pathways.[16-18] This may explain its prolonged pain relief, as ACT reduces the perception of noxious stimuli over time. Despite its slower onset, the sustained action of ACT offers an advantage by minimizing the need for frequent dosing. Although several studies, including those by Soltani H et al. (2002), Lee S et al. (2012), and Kogler V et al. (2008), support the efficacy of LIDO in reducing POST, the potential for localized irritation must be considered.[19-21]

Patient satisfaction was equivalently high in both groups (85.3% vs. 79.4% strongly satisfied; $p = 0.524$), suggesting that both agents are acceptable from the patient perspective regardless of their differing pharmacodynamic profiles. This echoes findings by Lim et al. (2021), who also observed no statistically significant difference in satisfaction scores between groups.[10]

The choice between agents may therefore depend on clinical priority: lidocaine spray is preferable when rapid symptom relief is urgently needed, while oral acetaminophen may be the preferred first-line agent for sustained management with fewer repeat doses and a more favourable systemic safety profile.

This study has several limitations. The single-center design and relatively modest sample size may limit generalizability to broader ICU populations. Pain assessment relied on patient self-reporting (Wong-Baker Faces Scale), introducing subjectivity and potential bias from individual pain tolerance and communication barriers. Confounding variables such as anxiety, pre-existing pain disorders, and operator variability in intubation technique were not controlled for. Follow-up was limited to the acute ICU period, without capturing longer-term outcomes. Future multicenter randomized controlled trials with standardized protocols are warranted.

CONCLUSION

Both oral acetaminophen and lidocaine spray are effective analgesic interventions for ETT-related sore throat in adult ICU patients. Lidocaine spray provides faster onset and greater immediate pain reduction but requires significantly more frequent dosing and achieves resolution more slowly overall. Oral acetaminophen offers sustained, longer-lasting analgesia with fewer doses. Patient satisfaction was high and comparable between both treatments. These findings support context-guided selection: lidocaine for rapid symptom relief and acetaminophen for durable analgesic management. Future research should investigate combination strategies and optimal dosing protocols.

Declarations

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Ethics Approval and Consent to Participate

Approved by the Institutional Ethics Committee, SKIMS, Srinagar. Written informed consent was obtained from all participants or their legal guardians, as per the Declaration of Helsinki.

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

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Authors' Contributions

MH: study design, data collection, analysis, and manuscript preparation. BA: supervision, guidance, and manuscript review. RJ, BM: data collection and manuscript revision. All authors approved the final version of the manuscript.

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