



EFFECT OF PREOPERATIVE NEBULIZED KETAMINE V/S NEBULIZED ROPIVACAINE ON POST OPERATIVE SORE THROAT IN ENT SURGERIES AFTER EXTUBATION

Anaesthesiology

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ABSTRACT

Background: Postoperative sore throat (POST) is a common and distressing complication following endotracheal intubation during general anesthesia, particularly in ENT surgeries, resulting from mechanical trauma and airway irritation. Various pharmacological agents have been investigated to reduce its incidence and severity, with ketamine and ropivacaine showing promising results when administered via preoperative nebulization. **Objectives:** This study aimed to compare the efficacy of preoperative nebulized ketamine and ropivacaine in reducing the incidence and severity of POST, and to evaluate associated airway-related complications and adverse effects in patients undergoing elective ENT surgeries. **Materials and Methods:** A prospective, randomized, comparative study was conducted in 80 adult patients (ASA I–II, aged 18–60 years) scheduled for elective ENT surgeries under general anesthesia. Patients were randomized into two groups: Group K received 50 mg ketamine diluted with normal saline to a total volume of 5 mL, while Group R received 5 mL of 0.75% ropivacaine, administered via nebulization 15 minutes prior to induction. Primary outcomes included the incidence and severity of POST at 1, 6, 12, and 24 hours post-extubation. Secondary outcomes included hoarseness, cough, hemodynamic stability, and adverse events. Data were analyzed using appropriate parametric and non-parametric statistical tests, with $p < 0.05$ considered significant. **Results:** Ketamine nebulization significantly reduced the incidence of POST compared to ropivacaine at 1 hour (70.0% vs 37.5%, $p = 0.01$) and 6 hours (80.0% vs 50.0%, $p = 0.01$), with near-complete resolution by 12 hours (92.5% vs 77.5%, $p = 0.06$) and total resolution by 24 hours. No significant adverse events were observed, and first-attempt intubation success was high in both groups. **Conclusion:** Preoperative nebulized ketamine is more effective than ropivacaine in preventing and attenuating POST, with excellent safety and tolerability, representing a clinically valuable intervention to improve postoperative airway comfort in ENT surgical patients.

KEYWORDS

Postoperative sore throat, ketamine nebulization, ropivacaine nebulization, endotracheal intubation, ENT surgery, airway morbidity.

INTRODUCTION

The upper airway plays a pivotal role in respiration, phonation, and protection against aspiration. Anatomically, it consists of the nasal cavity, pharynx, larynx, and trachea, lined by a ciliated epithelium that maintains mucociliary clearance and airway integrity. Any mechanical or inflammatory insult to these structures can disrupt function, leading to discomfort and compromised patient outcomes¹. In surgical practice, airway instrumentation, particularly endotracheal intubation, remains an essential yet potentially injurious intervention.

Postoperative sore throat (POST) is one of the most common airway-related complications following general anesthesia with endotracheal intubation. It is characterized by throat pain, hoarseness, and cough, which can range from mild irritation to severe discomfort affecting swallowing and speech. The prevalence of POST varies widely, reported between 30% and 65%, with higher rates observed in surgeries involving extensive airway manipulation such as ENT procedures^{2,3}. Both patient-related factors (age, gender, airway anatomy) and procedural variables (tube size, cuff pressure, intubation duration) contribute to its incidence⁴.

Clinically, POST impacts patient satisfaction, recovery quality, and perioperative care metrics. Even though it is self-limiting, persistent throat discomfort can delay discharge, increase analgesic requirements, and reduce patient willingness for future procedures⁵. Globally, millions of patients undergoing surgeries with endotracheal intubation are at risk, and the incidence is particularly significant in countries with high surgical volumes and resource-constrained settings⁶. Despite preventive measures like smaller tubes and careful cuff management, gaps remain in effective, standardized prophylaxis⁷.

Nebulization has emerged as a non-invasive technique to deliver local

analgesic and anti-inflammatory agents directly to the airway mucosa, providing targeted protection against POST. Agents such as ketamine and ropivacaine have demonstrated efficacy in attenuating airway irritation through NMDA receptor antagonism and sodium channel blockade, respectively^{8,9}. Several studies support the use of nebulized pharmacological agents to reduce POST incidence and severity^{10,11}.

Given the high prevalence of POST in ENT surgeries and the limited comparative data between ketamine and ropivacaine in the local hospital context, this study seeks to evaluate their efficacy in reducing postoperative airway morbidity, optimize patient comfort, and provide evidence-based guidance for clinical practice¹². This rationale establishes the need for the current research, leading into the study aim.

MATERIAL AND METHODS

Study Design:

This was a prospective, randomized, comparative study conducted to evaluate the effect of preoperative nebulized ketamine versus nebulized ropivacaine on the incidence and severity of postoperative sore throat (POST) in patients undergoing elective ENT surgeries under general anesthesia with endotracheal intubation. Randomization minimized selection bias and ensured comparable baseline characteristics between groups.

Study Setting:

The study was conducted at the Department of Anaesthesiology, BRD Medical College, Gorakhpur, a tertiary care teaching hospital with modern anesthesia workstations, standard monitoring, and a dedicated postoperative care unit. Preoperative evaluations, nebulization, anesthesia induction, intraoperative management, and postoperative assessments were carried out within the department to ensure standardization.

Study Population: Adults aged 18–60 years, ASA I–II, with Modified Mallampati Score I–II, scheduled for elective ENT surgeries requiring endotracheal intubation.

Sample Size: Based on an anticipated 50% reduction in POST incidence from a reported baseline of 65%, with $\alpha = 0.05$, 95% confidence interval, and 90% power, the required sample size was 40 patients per group, totaling 80 participants.

Inclusion Criteria: Adult patients aged 18–60 years, classified as ASA I–II, with Modified Mallampati Score I–II, scheduled for elective ENT surgeries requiring general anesthesia with endotracheal intubation.

Exclusion Criteria: Patients who refused participation; those with pre-existing sore throat, respiratory infections, asthma, or known allergy to ketamine or ropivacaine; pregnant or lactating women; recent upper respiratory tract infection or smokers; and patients requiring more than two intubation attempts.

Data Collection and Investigations: Postoperative assessment included POST, hoarseness, and cough, graded on standardized 4-point scales at 0, 2, 4, 6, 12, and 24 hours post-extubation. Adverse effects and hemodynamic parameters were also recorded.

Ethical Consideration: Ethical clearance was obtained from the Institutional Human Ethics Committee, and written informed consent was taken from all participants. Confidentiality was strictly maintained.

Statistical Analysis: Data were analyzed using SPSS v24. Continuous variables were compared using Student's t-test and ANOVA; categorical variables were analyzed with Chi-square or Fisher's exact test. POST severity was compared using Mann–Whitney U test. A p-value < 0.05 was considered statistically significant.

RESULTS

Table 1. Baseline Demographic and Clinical Characteristics of Study Participants

Variable	Ketamine (Mean $\pm$ SD)	Ropivacaine (Mean $\pm$ SD)	P Value
Age (years)	32.2 $\pm$ 9.5	31.0 $\pm$ 11.3	0.60
BMI (kg/m ²)	23.6 $\pm$ 4.3	22.4 $\pm$ 2.4	0.10
Duration of Surgery (min)	169.0 $\pm$ 54.9	159.9 $\pm$ 56.4	0.46

Table 1 presents the baseline demographic and clinical characteristics of participants in the ketamine and ropivacaine groups. The mean age, body mass index (BMI), and duration of surgery were comparable between the groups, with no statistically significant differences ($p > 0.05$). This indicates homogeneity of the study population, ensuring reliable comparison of postoperative outcomes.

Table 2: Gender Distribution of the study population

Gender	Number Of Patients	% of patients	Number of Patients	% of patients	P Value
Female	28	70.0%	26	65.0%	0.63
Male	12	30.0%	14	35.0%	

Table 2 shows the gender distribution of the study population across the ketamine and ropivacaine groups. Females comprised 70.0% in the ketamine group and 65.0% in the ropivacaine group, while males accounted for 30.0% and 35.0%, respectively. The difference was not statistically significant ($p = 0.63$), indicating comparable gender distribution between groups.

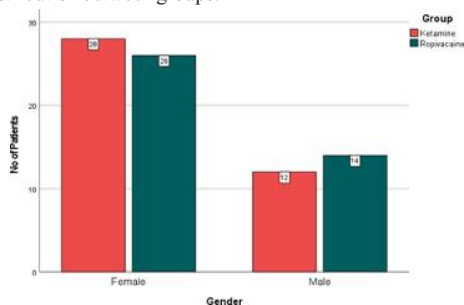


Figure 1: Gender Distribution of the study population

Table 3: Distribution of the Number of Intubation Attempts Among Study Groups

		Group				P Value
		Ketamine		Ropivacaine		
		N	%	N	%	
Number of Intubation Attempts	1	39	97.5%	40	100.0%	0.31
	2	1	2.5%	0	0.0%	
Total		40	100.0%	40	100.0%	

Table 3 presents the distribution of intubation attempts between the ketamine and ropivacaine groups. Most patients were successfully intubated on the first attempt (97.5% in ketamine, 100% in ropivacaine), while only one patient in the ketamine group required a second attempt. The difference was not statistically significant ($p = 0.31$), indicating comparable intubation conditions across groups.

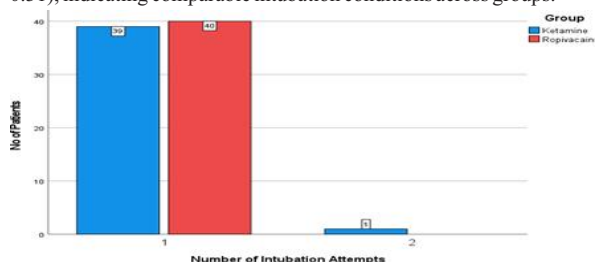


Figure 2: Distribution of the Number of Intubation Attempts Among Study Groups

Table 4. Distribution of Surgical Procedures Across Study Groups

	Group				Total	
	Ketamine		Ropivacaine		Number of Patients	% of patients
	Number of Patients	% of patients	Number of Patients	% of patients		
tonsillectomy	0	0.0%	1	2.5%	1	1.3%
Hemithyroidectomy	2	5.0%	1	2.5%	3	3.8%
Keratinous cyst	1	2.5%	0	0.0%	1	1.3%
submandibular gland excision	0	0.0%	1	2.5%	1	1.3%
Mastoidectomy	13	32.5%	17	42.5%	30	37.5%
Nasal bone fracture reduction	1	2.5%	0	0.0%	1	1.3%
Preauricular sinus excision	0	0.0%	2	5.0%	2	2.5%
DCR	0	0.0%	1	2.5%	1	1.3%
submandibular gland excision	1	2.5%	1	2.5%	2	2.5%
supraclavicular swelling excision	1	2.5%	0	0.0%	1	1.3%
Septoplasty	3	7.5%	2	5.0%	5	6.3%
Tympanoplasty	18	45.0%	14	35.0%	32	40.0%
Total	40	100.0	40	100.0	80	100.0%

Table 4 displays the distribution of surgical procedures across the ketamine and ropivacaine groups. Tympanoplasty and mastoidectomy were the most frequently performed procedures in both groups, accounting for 40.0% and 37.5% of total cases, respectively. Other surgeries, including septoplasty, hemithyroidectomy, and minor excisions, were less common. The overall surgical profile was balanced, supporting comparability between groups.

Table 5. Incidence of Postoperative Sore Throat

Post op timeline		Ketamine		Ropivacaine		P value
		Number of Patients	% of patients	Number of Patients	% of patients	
1 Hour	None	28	70.0%	15	37.5%	0.01*
	Mild	9	22.5%	20	50.0%	
	Moderate	3	7.5%	5	12.5%	
	Severe	0	0%	0	0%	
6 Hours	None	32	80.0%	20	50.0%	0.01*
	Mild	7	17.5%	18	45.0%	
	Moderate	1	2.5%	2	5.0%	
	Severe	0	0%	0	0%	

Table 5 presents the incidence and severity of postoperative sore throat

12 Hours	None	37	92.5%	31	77.5%	0.06*
	Mild	3	7.5%	9	22.5%	
	Moderate	0	0%	0	0%	
	Severe	0	0%	0	0%	
24 Hours	None	40	100.0%	40	100.0%	-
	Mild	0	0%	0	0%	
	Moderate	0	0%	0	0%	
	Severe	0	0%	0	0%	

(POST) in the ketamine and ropivacaine groups. At 1 and 6 hours postoperatively, a significantly higher proportion of patients in the ketamine group were asymptomatic compared to the ropivacaine group ($p = 0.01$). By 12 hours, the difference approached significance, and all patients were symptom-free by 24 hours.

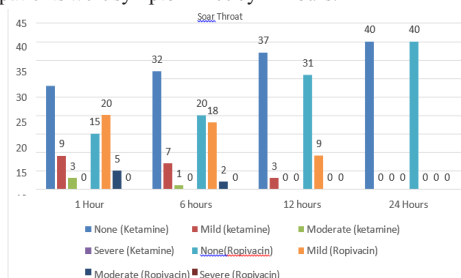


Figure 3: Incidence of Postoperative Sore Throat

Table 6: Adverse events in the study population

Adverse events	Frequency	Percent
Nausea/ Vomiting	0	0
Hypersalivation	0	0
Hallucination Dysphoria	0	0

Table 6 shows the incidence of adverse events in the study population. No patients in either the ketamine or ropivacaine groups experienced nausea, vomiting, hypersalivation, or hallucination/dysphoria. This indicates that both nebulized ketamine and ropivacaine were well tolerated, demonstrating an excellent safety profile in the study cohort.

DISCUSSION

The baseline demographic and clinical characteristics, including age, BMI, and duration of surgery, were comparable between the ketamine and ropivacaine groups, with mean ages of 32.2 ± 9.5 years and 31.0 ± 11.3 years ($p = 0.60$), mean BMI of 23.6 ± 4.3 kg/m² and 22.4 ± 2.4 kg/m² ($p = 0.10$), and mean surgery durations of 169.0 ± 54.9 minutes versus 159.9 ± 56.4 minutes ($p = 0.46$). These results align with Bhatta et al. (2020)⁶, Mehta et al. (2022)⁸, and Patodi et al. (2022)¹², where demographic variables were statistically similar across groups. Ittoop et al. (2023)⁴ also reported comparable age and BMI in patients receiving nebulized ketamine or dexmedetomidine. Meta-analyses by Yu et al. (2020)¹ and Singh et al. (2020)² included wider age ranges, creating minor heterogeneity, but individual trials maintained internal balance. These findings confirm homogeneity, ensuring that observed differences in postoperative outcomes reflect drug effects rather than population variability.

The gender distribution revealed 70.0% females and 30.0% males in the ketamine group versus 65.0% females and 35.0% males in the ropivacaine group, with no significant difference ($p = 0.63$). This is consistent with Bhatta et al. (2020)⁶ and Mehta et al. (2022)⁸, which also reported female predominance in ketamine groups while maintaining statistical equivalence between arms. Patodi et al. (2022)¹² documented similar proportions, supporting comparability. Orji et al. (2020)⁷ showed a more balanced male-to-female ratio, influencing POST incidence slightly. The current findings indicate that gender is unlikely to confound postoperative sore throat, hoarseness, or cough. Comparable gender distribution ensures that outcome differences are attributable to ketamine or ropivacaine effects rather than demographic variation, confirming validity in evaluating airway morbidity and safety across groups.

The distribution of intubation attempts indicated that 97.5% of patients in the ketamine group and 100% in the ropivacaine group were intubated successfully on the first attempt, with only one patient in the ketamine group requiring a second attempt ($p = 0.31$). These findings are similar to Mehta et al. (2022)⁸ and Patodi et al. (2022)¹², who

reported first-attempt success above 95% with ketamine. Orji et al. (2020)⁷ also reported high success rates (>96%) with ketamine nebulization. Contrastingly, Ittoop et al. (2023)⁴ found slightly lower first-attempt success (92–94%) with dexmedetomidine or ketamine. The current data highlight near-universal first-attempt intubation, ensuring procedural standardization and that variations in intubation attempts did not confound postoperative sore throat, hoarseness, or cough outcomes.

The distribution of surgical procedures shows that tympanoplasty (45.0% in the ketamine group, 35.0% in the ropivacaine group) and mastoidectomy (32.5% versus 42.5%) were the most frequently performed surgeries, together accounting for 77.5% of cases. These findings are similar to Mehta et al. (2022)⁸ and Patodi et al. (2022)¹², which reported a predominance of ear surgeries in cohorts receiving ketamine nebulization. Wang et al. (2021)⁵ and Yu et al. (2020)¹ also noted that ENT procedures dominated patient populations in POST studies. Less common procedures such as hemithyroidectomy and preauricular sinus excision were infrequent, reflecting procedural variability, yet the overall distribution ensured comparable airway exposure, validating the assessment of POST and airway-related outcomes across groups.

The incidence of postoperative sore throat was consistently lower in the ketamine group at all time points. At 1 hour, 70.0% of ketamine patients were asymptomatic versus 37.5% with ropivacaine ($p = 0.01$), at 6 hours 80.0% versus 50.0% ($p = 0.01$), and at 12 hours 92.5% versus 77.5% ($p = 0.06$), reaching 100% resolution in both groups at 24 hours. These findings align with Bhatta et al. (2020)⁶ and Mehta et al. (2022)⁸, which demonstrated significant reduction in early POST with ketamine nebulization. Patodi et al. (2022)¹² similarly observed lower POST incidence with ketamine. In contrast, Ittoop et al. (2023)⁴ reported slightly higher early POST with ketamine compared to dexmedetomidine, but the current data demonstrate effective and rapid symptom resolution with ketamine.

No adverse events were reported in either group, including nausea, vomiting, hypersalivation, or hallucination/dysphoria, confirming excellent tolerability. These results are consistent with Mehta et al. (2022)⁸, Patodi et al. (2022)¹², Bhatta et al. (2020)⁶, and Varma and Vazhakalayil (2024)¹⁰, which reported minimal to no complications with ketamine or ropivacaine nebulization. Unlike Varma and Vazhakalayil (2024)¹⁰, where mild hallucinations occurred in a few ketamine patients, no such events were observed. The complete absence of adverse events in both groups emphasizes the safety of preoperative nebulized ketamine and ropivacaine for preventing POST and associated airway morbidity during elective ENT surgeries under general anesthesia.

CONCLUSION

The findings of this study demonstrate that preoperative nebulization with ketamine significantly reduces both the incidence and severity of postoperative sore throat compared to nebulized ropivacaine in patients undergoing elective ENT surgeries under general anesthesia with endotracheal intubation, with 70.0% of patients in the ketamine group remaining asymptomatic at 1 hour and complete resolution by 24 hours. The study population was well-matched in terms of age, BMI, gender, and duration of surgery, eliminating confounding demographic or procedural variables and ensuring that observed effects are attributable to the pharmacological intervention. High first-attempt intubation success rates in both groups confirm standardized airway management, while the distribution of surgical procedures, predominantly tympanoplasty and mastoidectomy, provides a representative ENT surgical context. The absence of adverse effects such as nausea, vomiting, hypersalivation, or hallucinations highlights the safety and tolerability of nebulized ketamine, making it a clinically effective and reliable prophylactic measure for minimizing postoperative airway morbidity in this patient cohort, supporting evidence-based improvements in perioperative care.

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