

Comparison Between Betamethasone Gel and Lignocaine Gel Applied Over Endotracheal Tube to Prevent Postoperative Sore Throat and Hoarseness of Voice

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doi.org/10.56974/pmjn.954
www.pmjn.org.np

Submission Date:

2026, January 27

Acceptance Date:

2026, February 23

Published Date:

2026, February 27

ABSTRACT

Introduction: Post-operative sore throat (POST) and hoarseness of voice (HOV) are common complications following general anaesthesia with endotracheal intubation. Various preventive strategies have been investigated, including the application of lignocaine and steroid gel over the endotracheal tube. This study was designed to compare the effectiveness of betamethasone gel and lignocaine gel in preventing POST and HOV.

Methods: This prospective, double-blinded, comparative study was conducted over six months at Nepalgunj Medical College Teaching Hospital after institutional ethical approval. Ninety-nine ASA I–II patients aged 18–70 years undergoing general anaesthesia with planned endotracheal intubation were enrolled. Using a sealed envelope technique, patients were randomly divided into three groups: betamethasone gel (Group 1), lignocaine gel (Group 2), and normal saline (Group 3) applied to the endotracheal tube before intubation.

Results: The incidence of POST and HOV was significantly lower in the betamethasone group compared with the lignocaine and control groups (POST: $p = 0.046$ and 0.005 ; HOV: $p = 0.024$ and 0.013 , respectively). POST severity at 1 and 6 hours was also significantly lower in the betamethasone group. HOV severity at 1 hour was reduced with betamethasone (p -values 0.012). Outcomes in the lignocaine and control groups were comparable. Across all groups, POST and HOV decreased significantly over time (p -values 0.001).

Conclusions: Betamethasone gel effectively reduces the incidence and severity of POST and HOV, particularly in the early postoperative period, when compared to lignocaine.

Keywords: *Betamethasone gel; lignocaine gel; endotracheal tube; post-operative sore throat; hoarseness of voice*

INTRODUCTION

Trauma to the pharyngo-laryngeal mucosa, contact of endo-tracheal tube with vocal cords, and pressure induced tracheal mucosal capillary hypoperfusion, all lead to mucosal lesions and secretion of arachidonic acid and cytokines leading to mucosal edema and inflammatory changes resulting in post-operative pharyngo-laryngotracheal sequelae.

This is commonly manifested as Post-operative sore throat (POST) and hoarseness of voice (HOV), the recognized complications of general anesthesia, caused by endotracheal intubation.³⁻⁵

These post-operative upper airway symptoms following an uneventful general anesthesia, although not incapacitating, can cause extreme discomfort to the patients.⁶

To mitigate these intubation-related postoperative local morbidities, many studies have been published exploring the role of application of steroid gel and lignocaine gel over the endotracheal tube, application of topical oropharyngeal steroid spray, lignocaine nebulization, ketamine gargle, magnesium sulphate gargle, intravenous steroids, use of low-pressure cuff and small-size ET tubes.^{3,7-9} These studies show varying results for each method.

Among these techniques, application of 2% lignocaine gel and 0.05% betamethasone gel in the endotracheal tube is widely used with different success rates.^{1,10} So, in this study, we intended to compare these two methods.

METHODS

This study was conducted in ASA I-II patients of age 18-70 years, undergoing elective surgeries in general anesthesia with planned endotracheal intubation. This study was conducted at Nepalgunj Medical College Teaching Hospital, over 6 months from 17th June 2025 to 17th Dec 2025, after obtaining approval from the institutional review committee. (IRC Ref: 70/081-082)

Patients unwilling to give consent for the study, patients undergoing head and neck surgery, patients with impaired cognitive ability, upper respiratory tract infection, and patients on steroids and nasogastric tube were excluded from the study. Patients requiring more than two attempts of intubation, more than two hours of intubation, throat pack or double-lumen tube were also excluded.

A simplified formula based on the non-centrality parameter for the Kruskal-Wallis test was applied to calculate sample size taking 95% confidence interval, 80% β power and moderate effect size assumption, which showed required sample size as 90. Adding 10% dropout, the total required sample size calculated was 99.^{11,1}

All the patients included in the study went through routine pre-anesthetic checkups and routine premedications, as per institutional protocol. Upon arrival in the operating room, their vitals were monitored as per ASA standards for basic vitals monitoring protocol. Multimodal analgesia with fentanyl, ketorolac, paracetamol, dexmedetomidine, and a preemptive dose of ketamine were given. Glycopyrrolate, midazolam, fentanyl, propofol, were used for induction, and rocuronium for the intubation. Patients were divided into three groups randomly: group 1, group 2, and group 3, with a 1:1:1 ratio, after concealment with a sequential numbered opaque sealed envelope technique. The ET tube in group 1 were lubricated with 0.05% betamethasone gel, in group 2 with 2% lignocaine, and no lubrication in group 3 by an anesthesia assistant, who blinded the anesthesiologist intubating the patient. After ET tube placement, the tube cuff was inflated with air keeping the pressure 20-30 cmH₂O. Maintenance of anesthesia was done with isoflurane. Oral suction was done just before and after the extubation. Patients were reversed with sugammadex and extubated after deflating the cuff when the patients were fully awake. The ET tube contact duration, which was defined as the time from ET tube intubation to extubation, was recorded for comparison. The incidence and severity of the POST and post-operative HOV were assessed by either experienced nurses or anesthesiologists in post-operative ward at 1

hour, 6 hours and 24 hours post-operatively. The severity of POST was graded from 0 to 3, with values 0-No sore throat at any time since the operation, 1-Minimal/ Patient answered in the affirmative when asked, 2- Moderate/ Patient complained on his/her own, 3- Severe/ Patient is in obvious distress.¹²

The severity of HOV was graded from 0-3, with values 0/ No complaint of hoarseness at any time since the operation, 1- Minimal/ Patient answered in the affirmative when asked, 2-Moderate/ Patient complains on his/her own, 3- Severe/ Gross change.¹

Statistical analysis was performed using IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, NY).¹³ To compare the 3 groups, the ANOVA test for continuous data, the chi-square test for dichotomous data, Kruskal-Wallis test for ordinal data, Cochran's Q for repeated measure binary data were applied. Man-Whitney U test was applied for comparing ordinal data of 2 groups.

RESULTS

The mean age, distribution of sex, surgical procedure distribution and the mean intubation times compared between the three groups were not statistically significantly different, with p-values of 0.718, 0.073, 0.140 and 0.0841, respectively. These comparisons were performed using one-way ANOVA and Chi-square tests, as appropriate. There was female predominance, and laparoscopic surgery was the most commonly performed surgery in all the groups.

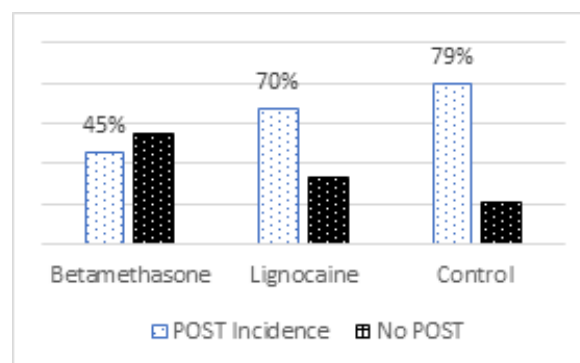


Figure 1. Incidence of POST within 24 hours

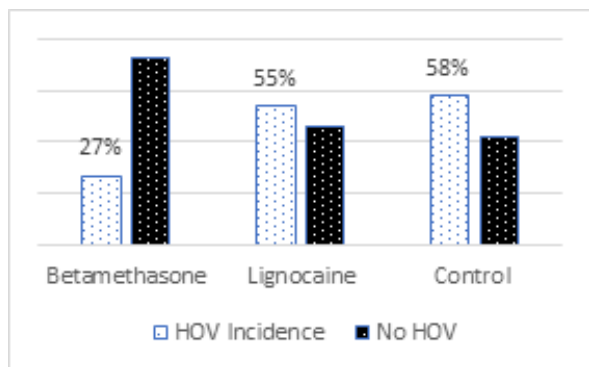


Figure 2. Incidence of HOV within 24 hours

Pearson-Chi Square test P-value 0.014

Pearson-Chi Square test P-value 0.025

Incidence of POST and HOV: The incidence of POST observed was 15 (45%), 23 (70%) and 26 (79%) in the betamethasone, lignocaine and control group respectively. The incidence of HOV observed was 9 (27%), 18 (55%) and 19 (58%) in the betamethasone, lignocaine and control group respectively. The Pearson Chi-square test, applied for three-group comparison, showed statistically significant differences in the incidence of both POST and HOV, with p-values of 0.014 and 0.025, respectively. (Fig. 1,2)

Table 1. Pairwise comparison of the incidence of POST and HOV

Groups	Total	POST incidence		P-value	HOV incidence		P-value
		Present	Absent		Present	Absent	
Betamethasone	33	15	18	0.046	9	24	0.024
Lignocaine	33	23	10		18	15	
Betamethasone	33	15	18	0.005	9	24	0.013
Control	33	26	7		19	14	
Lignocaine	33	23	10	0.398	18	15	0.804
Control	33	26	7		19	14	

*Chi-square test

Pairwise comparisons demonstrated that the incidences of POST and HOV were statistically significantly lower in the betamethasone group compared with the lignocaine and control groups, with p-values of 0.046 and 0.005 for POST and 0.024 and 0.013 for HOV, respectively. In contrast, the incidences of POST and HOV were statistically similar between the lignocaine and control groups, with p-values of 0.398 and 0.804. (Table 1)

Table 2. All groups comparison for the severity of POST and HOV

Time	Group	N	POST Median (IQR)	POST Mean Rank	HOV Median (IQR)	HOV Mean Rank	POST P-value	HOV P-value
1 hour	Betamethasone	33	0 (1)	38.95	0 (1)	39.68	0.009	0.016
	Lignocaine	33	1 (1)	54.64	1 (1)	55.85		
	Control	33	1 (1)	56.41	1 (1)	54.47		
6 hours	Betamethasone	33	0 (0)	41.73	0 (0)	47.00	0.050	0.139
	Lignocaine	33	0 (1)	54.39	0 (0)	54.50		
	Control	33	0 (1)	53.88	0 (0)	48.50		
24 hours	Betamethasone	33	0 (0)	48.00	0 (0)	49.00	0.164	0.133
	Lignocaine	33	0 (0)	52.50	0 (0)	52.00		
	Control	33	0 (0)	49.50	0 (0)	49.00		

*Kruskal-Wallis Test

Severity of POST and HOV: POST severity differed significantly among the three groups at 1 and 6 hours post-operatively, with p-values of 0.009 and 0.050, respectively. Hoarseness of voice severity also showed a statistically significant difference among the groups at 1 hour with a p value of 0.016. No statistically significant differences were observed at 24 hours for POST severity, or for hoarseness

of voice severity at 1 and 6 hours. (Table 2)

At 24 hours, POST was absent in the betamethasone group, whereas three patients in the lignocaine group and one patient in the control group had grade-1 POST. Hoarseness of voice at 24 hours was absent in both the betamethasone and control groups, while two patients in the lignocaine group had grade-1 hoarseness.

Table 3. Pairwise comparison of the severity of POST

Time	Group	N	Mean Rank	P-value*
POST 1 hour	Betamethasone	33	28.36	0.015
	Lignocaine	33	38.64	
POST 6 hours	Betamethasone	33	29.32	0.027
	Lignocaine	33	37.68	
POST 1 hour	Betamethasone	33	27.59	0.005
	Control	33	39.41	
POST 6 hours	Betamethasone	33	29.41	0.030
	Control	33	37.59	
POST 1 hour	Lignocaine	33	33.00	0.810
	Control	33	34.00	
POST 6 hours	Lignocaine	33	33.71	0.918
	Control	33	33.29	

*Mann-Whitney U Test

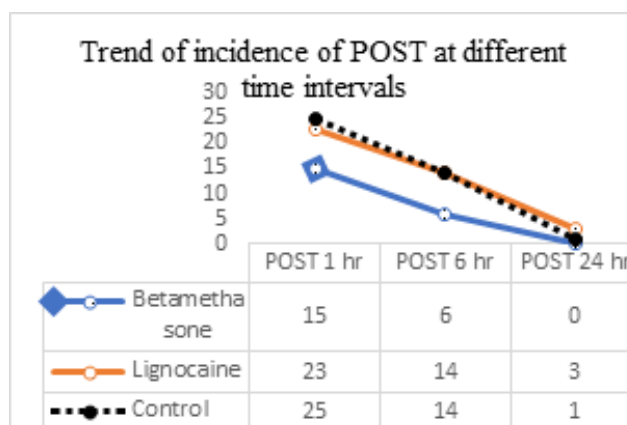
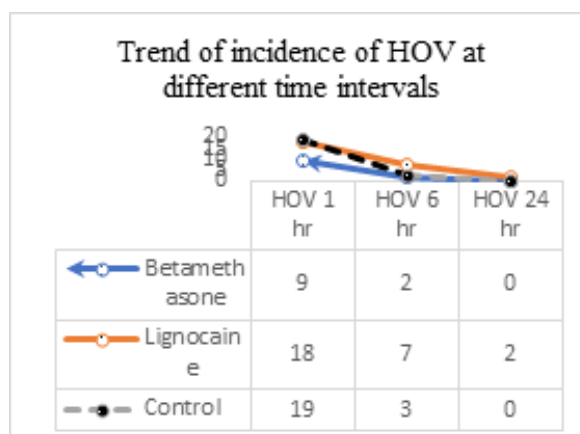
POST severity scores were statistically significantly lower in the betamethasone group compared with both the lignocaine and control groups at 1 hour and 6 hours, with p-values of 0.015 and 0.027 versus lignocaine group, and 0.005 and 0.030 versus control group, respectively. No significant difference was observed between the lignocaine and control groups. (Table 3)

Table 4. Pairwise comparison of the severity of HOV

	Group	N	Mean Rank	P-value*
1 hour	Betamethasone	33	28.32	0.012
	Lignocaine	33	38.68	
	Betamethasone	33	28.36	0.012
	Control	33	38.64	
	Lignocaine	33	34.17	0.754
	Control	33	32.83	

*Mann-Whitney U Test

Pairwise comparison revealed that the severity of HOV at 1 hour was significantly lower in the betamethasone group compared to both the lignocaine and control groups, with p-values of 0.012. No significant difference was found between the lignocaine and control groups. (Table 4)

**Figure 3. Trend of incidence of POST at different time intervals****Figure 4. Trends of incidence of HOV at different time intervals**

Cochran's Q test applied showed that the presence of both POST and HOV statistically significantly decreased over time, with p-values of 0.001 for each variable and group. (Fig 3,4)

DISCUSSION

The lubricating properties and suppression of airway reflexes through the local analgesic property of 2% lignocaine gel applied to the ET tube mitigate tracheal mucosal trauma.^{7,14} Nevertheless, studies report the incidence of postoperative airway morbidities, even with its use, remains high, up to 90%. On the other hand, 0.05% betamethasone gel, a well-known topical steroid, through its anti-inflammatory action decreases the incidence of post-intubation upper airway morbidities by 60%.⁷ Still, in common practice, lignocaine gel is used more frequently, as there are fewer studies that compare these two.⁸

To mitigate this gap between practice and research studies, even more studies and awareness among

anesthesiologists are needed. This is why we intended to conduct this study.

In the present study, the mean age, sex distribution, surgical procedure distribution, and mean intubation times were compared between the three groups, but the differences were not statistically significant. There was female predominance, and laparoscopic surgeries was the most commonly performed surgery in all the groups.

This study evaluated the incidence and severity of POST and HOV following general anesthesia with endotracheal intubation among the study groups. In this study, the incidence of post-operative sore throat (POST) and hoarseness of voice (HOV) was lowest in the betamethasone group and highest in the control group. Statistically, the incidence of both POST and HOV was significantly lower in the betamethasone group compared with both the lignocaine and the control groups. But no statistically significant difference in the incidence of POST and HOV was observed between the lignocaine and control groups.

Similar to our study, a study conducted by Hossain MS in 90 patients showed that the incidence of POST was statistically significantly lower in betamethasone group compared to lignocaine and the control group, however, no significant differences in incidence of POST was found when lignocaine and control groups were compared.¹

Likewise, a study done by Atatfah MBS, Mosleh AH, Al-Adal GIK in 51 patients, compared betamethasone gel, lignocaine gel and NS application in the endotracheal tube during intubation, which showed that the incidence of POST and HOV was significantly lower in the betamethasone group than in the lignocaine group and control group.¹⁵

The reason behind the consistency in our and these studies could be that the peak local anesthetic action of lignocaine gel is 35-40 minutes and last for 2-3 hours.¹⁶ Whereas betamethasone gel being a long acting corticosteroid and acting via modulating gene expression and inflammatory mediators persists for a longer period, even for days.¹⁷

In the present study, betamethasone group had statistically significantly lower POST severity scores compared with both lignocaine and control groups at 1 and 6 hours post-operatively, whereas POST severity scores between the lignocaine and control groups assessed at all time frames were comparable.

Regarding HOV severity, post-operatively at one hour, statistically significantly lower HOV severity in the betamethasone group was seen, compared with both the lignocaine and control groups, while lignocaine and control groups did not differ statistically.

In consistent to our study, a study conducted by Upadhyaya N in 180 patients, where they compared betamethasone, lignocaine jelly and control group, showed that

betamethasone gel applied over tracheal tube effectively reduces the severity of POST and HOV as compared to lignocaine jelly or control group.¹⁸

Similarly, a study done by Sajin CS, Sunil M, Varghese A, Murali CJ in 2024 in 100 patients concluded that the severity of the POST and HOV was statistically significantly lesser in betamethasone group compared to the lignocaine group post-operatively.⁶

In contrast, a study by Thapa P, Shrestha RR, Shrestha S, Bajracharya GR showed that there is no statistically significant difference between the application of betamethasone or lignocaine in the endotracheal tube regarding both the incidence and severity of post-operative HOV.¹⁹

The present study demonstrated that, irrespective of the group, the incidence of POST and HOV decreased significantly over time from the first to the 24th post-operative hour. This finding is in consistent with the findings of a study done in 418 patients by Maruyama K et al., where they found that the incidence of POST and HOV was significantly lower at 24 hours post-operatively compared to the first hours.²⁰ This suggests the transient nature of these symptoms.

In our study, both the incidence and severity of HOV were lower across all groups compared with POST. Consistent with these findings, Saadi et al. in a study comparing beclomethasone inhalation, topical lignocaine gel applied to the endotracheal tube, and a control group in 90 pregnant patients undergoing cesarean section under general anaesthesia, reported that HOV occurred less frequently and with lower severity than POST at all post-operative time points.²¹

Emergence cough can affect the POST and HOV. In our study, we did not study about the emergence cough, or its relation to the POST and HOV. Patients requiring more than two attempts of intubation, more than two hours of intubation, a throat pack or a double-lumen tube were not included in this study. This study was also limited to a single centre.

CONCLUSIONS

Betamethasone significantly reduced the incidence and severity of post-operative sore throat and hoarseness of voice compared with lignocaine and control at early post-operative time points. The lignocaine and control groups showed similar outcomes throughout. Regardless of the intervention, both post-operative sore throat and hoarseness of voice decreased significantly over time, and post-operative sore throat was consistently more common than hoarseness of voice across all groups.

Conflict of Interest: None

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