



ASSESSMENT AND COMPARISON OF LARYNGOTRACHEAL MORBIDITY BY INFLATING ENDOTRACHEAL TUBE (ETT) CUFF WITH AIR, 0.9% SALINE, 1% PROPOFOL AND HYDROCORTISONE

Dr Chirumamilla Sai Lakshman¹, Dr k Vishnu Vandana², Dr Vijaya Rekha³, Dr Ravulapalli Harish Babu⁴

^{1,2,3,4}Department of anesthesia, narayana medical college, DR NTR UNIVERSITY, Andhra Pradesh

ABSTRACT

Background and aim: Endotracheal intubation while administering general anaesthesia and inflation of the cuff with air is a common practice. Continuous pressure exerted by cuff on mucosa may lead to postoperative complaints such as sore throat, cough, and dysphagia, which are very disturbing to the patient. Hence, we hypothesized that inflation of cuff with propofol may reduce the incidence of these complications as a result of cushioning effect as well as non-diffusion of nitrous oxide into it. Our aim was to compare the effects of inflation of endotracheal tube cuff with 0.9% saline, 4% lignocaine, and 1% propofol on the incidence of postoperative laryngotracheal morbidity in terms of cough, sore throat, dysphagia and hoarseness of voice with general anaesthesia. **Methods:** Patients scheduled for elective surgery under general anaesthesia were randomly allocated into four groups of thirty each according to cuff inflation media: air (Group A), 0.9% saline (Group S), 1% propofol (Group P) and hydrocortisone (Group HC). The incidence of cough was noted at 15, 30 and 60 min intervals after extubation. The occurrence and severity of postoperative sore throat (POST) was evaluated at 2, 6, and 24 h after extubating. **Results:** The incidence of cough was maximum in Group A and minimum in Group P ($P < 0.05$). The occurrence of POST was highest in Group A, followed by Group S and Group HC, and least in Group P. The hemodynamic parameters were comparable with no statistical difference in all the four groups. **Conclusion:** 1% propofol is found to be superior to hydrocortisone and normal saline in the prevention of cough and sore throat postoperatively, when compared to air.

Keywords: Endotracheal tube cuff, Propofol, General anaesthesia, Postoperative sore throat, Laryngotracheal morbidity

Introduction

Even with short-duration anaesthesia, tracheal intubation is frequently associated with laryngotracheal morbidities. The most common symptom described following tracheal intubation is sore throat, however patients frequently report hoarseness and dysphagia. Decrease in tracheal mucosa perfusion occurs when the cuff exerts pressure greater than 30 cm H₂O. This is probably the first step in development of mucosal damage.¹

Although we now use high-volume low-pressure cuffs rather than low volume high pressure cuffs made of red rubber tubes, inflation of the cuff stimulates stretch receptors in the tracheal mucosa, resulting in an uncontrollable cough during extubation and the postoperative period. Coughing during emergence and in the post anaesthesia care unit is not only distressing for the patient, but it can also lead to potentially dangerous complications such as hypertension, cardiac arrhythmias, myocardial ischemia, and raised intracranial pressure, all of which can be harmful to patients with cardiac or intracranial pathologies. Air is commonly used to inflate the ETT cuff, and nitrous oxide can permeate into the cuff's air interface, causing an increase in pressure within the cuff. To prevent postoperative sore throat (POST), cough, dysphagia, and dysphonia, the cuff has been inflated with a variety of media, including anaesthetic gases, saline, xylocaine, alkalized xylocaine, and ketamine. Very few studies have compared propofol and hydrocortisone to other media.² So we hypothesised that propofol and hydrocortisone could minimise the effects of cuff inflation with air and provide better cushioning effect. The primary objective of the present study is to compare postoperative laryngotracheal morbidity following inflation of endotracheal tube (ETT) cuff in each group in terms of cough response post-extubation, sore throat, dysphagia and hoarseness of voice. The secondary objective was to compare haemodynamic parameters like heart rate, systolic blood pressure and diastolic blood pressure in each group at specific intervals.

Methodology

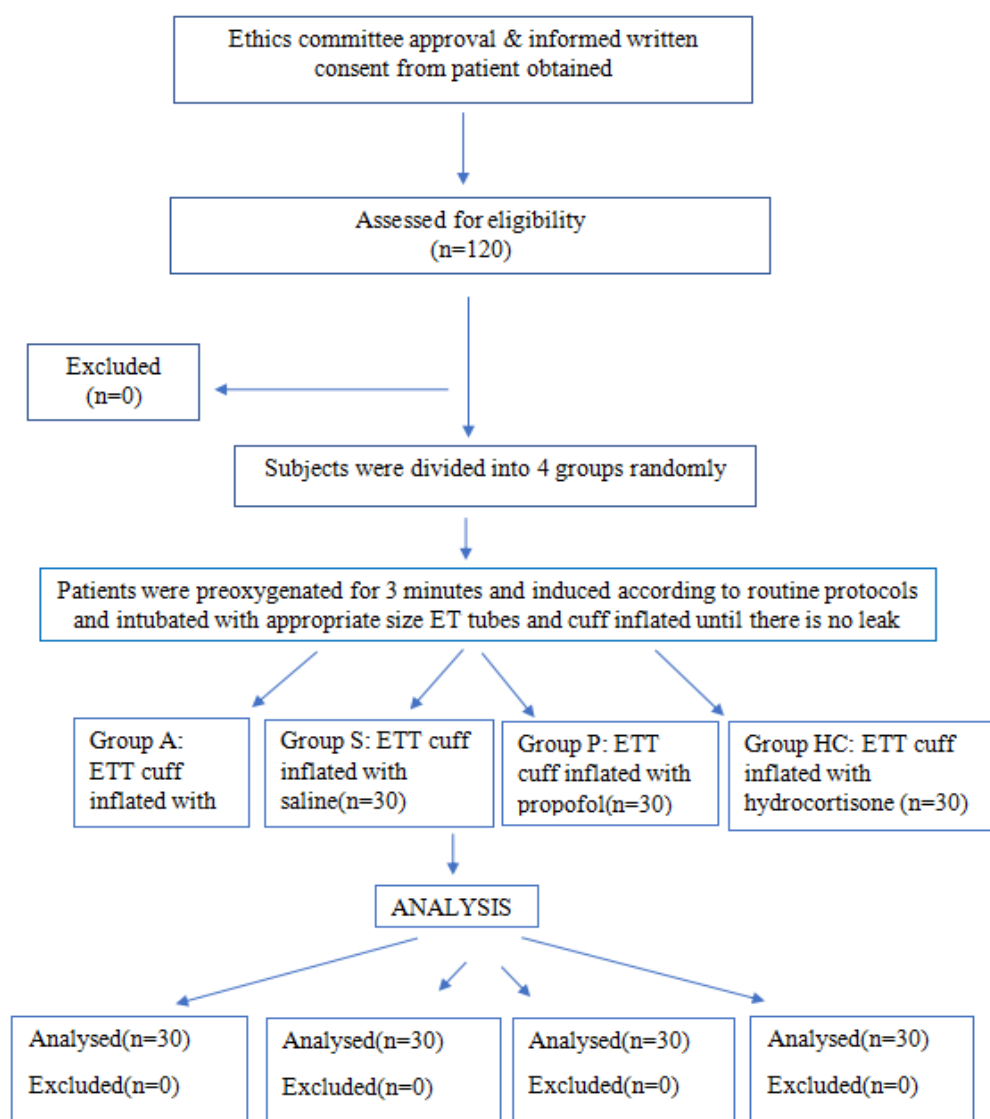
The current prospective, randomized, double-blind comparative study was conducted at Narayana Medical College and Hospital over a period of 6 months (August 2025–January 2026) obtaining clearance from the Institute Ethics Committee, IEC number: IEC/NMC/16th May 2025/10. Written informed consent was obtained from each patient prior to enrolment in the study. The procedures followed the guidelines laid down in the Declaration of Helsinki. Sample size was calculated assuming an error of 0.05, power of 80%, and confidence interval of 95%. Thus, a total of 120 patients were obtained. We assessed 120 patients with 30 in each of the group.

The patients were randomly divided into four groups of thirty each using envelope method. The inclusion criteria were age 18–60 years of either gender, ASA physical status Classes I and II, Mallampati class I and II, scheduled for surgeries lasting less than 2 hours, performed under general anaesthesia in supine position. Patients who refused to provide consent to study and having laryngotracheal disease, chronic cough, asthma, undergoing ear nose throat and laryngotracheal surgeries, ASA Classes III and IV, body mass index $>30 \text{ kg.m}^{-2}$, anticipated difficult airway were excluded from the study. Similarly, those requiring multiple attempts at intubation were also excluded. After thorough preoperative evaluation patients were shifted into operating room, all standard American Society of Anaesthesiologists (ASA) monitors were connected, wide bore iv line secured and ringer lactate was started. Patients were preoxygenated for 3 min with 100% oxygen. Patients were premedicated with 0.2mg glycopyrrolate, midazolam 0.05 mg/kg, and induced with fentanyl 2 mic/kg, and propofol 2 mg/kg. Preservative free lignocaine 1.5mg/kg was used to blunt the intubation response. Injection cisatracurium 0.2 mg/kg i.v. was administered to ease endotracheal intubation. ETT of appropriate size was inserted, preferably 7 mm–7.5 mm internal diameter for female patients and 8 mm–8.5 mm internal diameter for male patients. High-volume low-pressure cuffed ETT of standard sizes of similar make (Portex® Blue line™) were used for intubation. The ETTs were prechecked for any leaks before and after procedure.

For Group A: air, Group S: 0.9% saline, Group P: 1% propofol and Group HC: hydrocortisone were used to inflate the cuff until there was no leak. An anaesthesiologist not associated with the study carried out laryngoscopy and intubation, as well as inflated the cuff as per the group. Continuous monitoring for arterial oxygen saturation, electrocardiogram, non-invasive blood pressure, and end-tidal carbon dioxide concentration was carried out using the multiparameter monitor. Anaesthesia was maintained with air: oxygen 50:50% and sevoflurane dial concentration around 1% and boluses of cisatracurium 0.02 mg.kg^{-1} . At the end of the surgery, the residual neuromuscular blockade was reversed with i.v. neostigmine 0.05 mg.kg^{-1} and glycopyrrolate 0.01 mg.kg^{-1} . Oral suctioning was done gently, under vision to avoid trauma.

Haemodynamic parameters like heart rate, SBP, DBP were recorded before intubation, during intubation and at intervals of 5,15,30,60,120 minutes and patients were assessed for incidence and severity of cough at the time of emergence. Airway morbidity measurement was done by the parameters of cough, sore throat, dysphagia, and hoarseness of voice. The cough was recorded at 15 min, 30 min, and 60 min after extubation. The sore throat was recorded at 2, 6, and 24 h after extubation. It was graded as 0 = no sore throat, 1 = mild (scratch throat), 2 = moderate (similar to that noted with cold), and 3 = severe (more severe than cold). Dysphagia was noted at 24 h after extubating and graded as 0 = no dysphagia, 1 = mild (pain on swallowing solids), 2 = moderate (pain on swallowing liquids), and 3 = severe (pain on swallowing saliva). Hoarseness of voice was noted. at 24 h after extubating and graded as Grade 0 = (none) no hoarseness of voice, Grade 1 = (mild) noted by the patient, Grade 2 = (moderate) obvious to observer, and Grade 3 = (severe), patient not able to speak.

Data Analysis:



Results

In the present study demographic variables were comparable in all the 4 groups. In the overall study population 51.6% were males and 49.4% were females. The comparison between the groups showed equal gender distribution among all the four groups (Table 1). In this study the mean age of the patients in group A, S, P and HC were 40.3 ± 11.474 , 39.13 ± 11.419 , 40.83 ± 11.644 and 40.03 ± 11.321 years respectively. There was no statistical difference between the mean age among all the

four groups (Table 2). The incidence of cough after extubation was highest in group A and least in group P which was statistically significant till 30 minutes after extubation. At 15 minutes 13 patients in group A, 9 in group S, 3 in group P and 5 in group HC had cough. At 30 minutes post extubation 10 patients in group A, 5 in group S, 2 in group P and 3 in group HC had cough. No statistical significance was observed at 60 minutes post extubation. The severity of sore throat at 2 hours postoperatively was least in group P followed by group HC, group S and highest in group A. Similar trend was observed until 24 hours postoperatively. Hoarseness of voice and dysphagia were not observed in any of the groups. Perioperative haemodynamics were comparable in all the four groups.

TABLE 1: DEMOGRAPHIC VARIABLES

	AIR	SALINE	PROPOFOL	HYDROCORT	P VALUE
AGE(YRS)	40.3±11.474	39.13±11.419	40.83±11.644	40.03±11.321	0.951
GENDER	M: 15(50%) F:15 (50%)	M: 14 (46.6%) F: 16 (53.3%)	M: 17 (56.6%) F: 13 (43.3%)	M: 16 (53.3%) F: 14 (46.6%)	

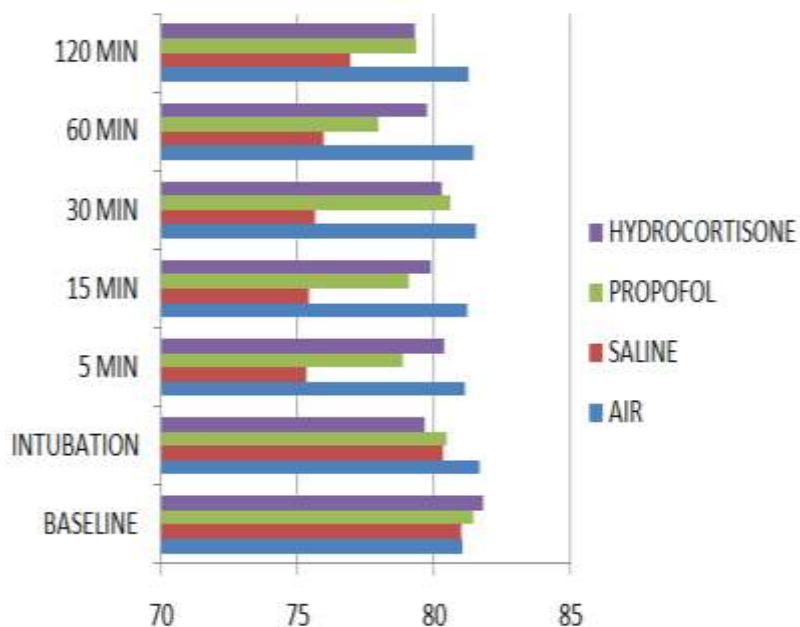
TABLE 2: COUGH RESPONSE

	AIR	SALINE	PROPOFOL	HYDROCORTISONE	CHI SQUARE	P-VALUE
15 MIN	13	9	3	5	10.4889	0.0148 (S)
30 MIN	10	5	2	3	9.12	0.02773 (S)
60 MIN	5	3	1	1	4.8	0.18704 (NS)

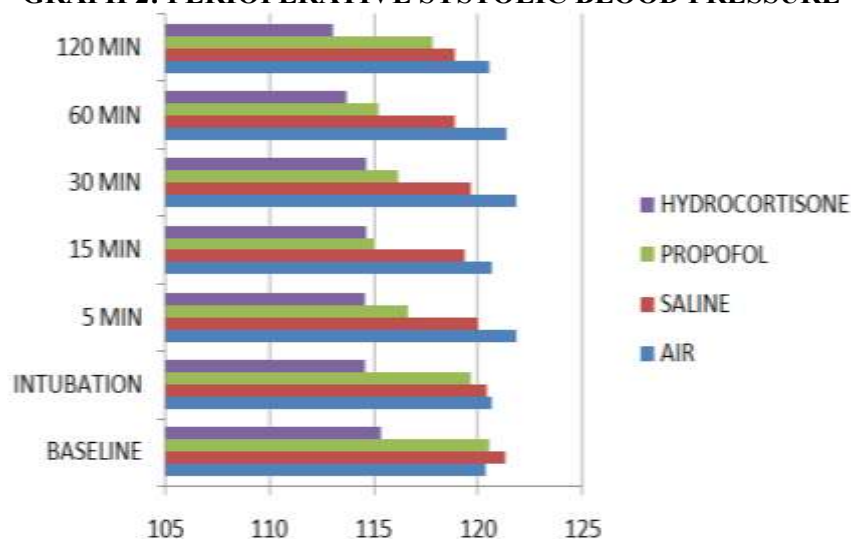
TABLE 3: INCIDENCE OF SORE THROAT

TIM E↓	NO OF PATIENT S→	AI R	SALI NE	PROPOF OL	HYDROCORTIS ONE	CHI SQUA RE	P- V A L U E
2 HOU RS	GRADE 0	8	10	25	24	34.635 4	0.0 00 69 (S)
	1	8	7	3	3		
	2	5	6	1	2		
	3	9	7	1	1		
6 HOU RS	GRADE 0	10	10	24	24	28.615 1	0.0 00 75 2 (S)
	1	8	10	3	2		
	2	8	5	2	3		
	3	4	5	1	1		
24 HOU RS	GRADE 0	11	15	26	25	24.543 1	0.0 35 2 (S)
	1	8	7	2	3		
	2	6	5	1	1		
	3	5	3	1	1		

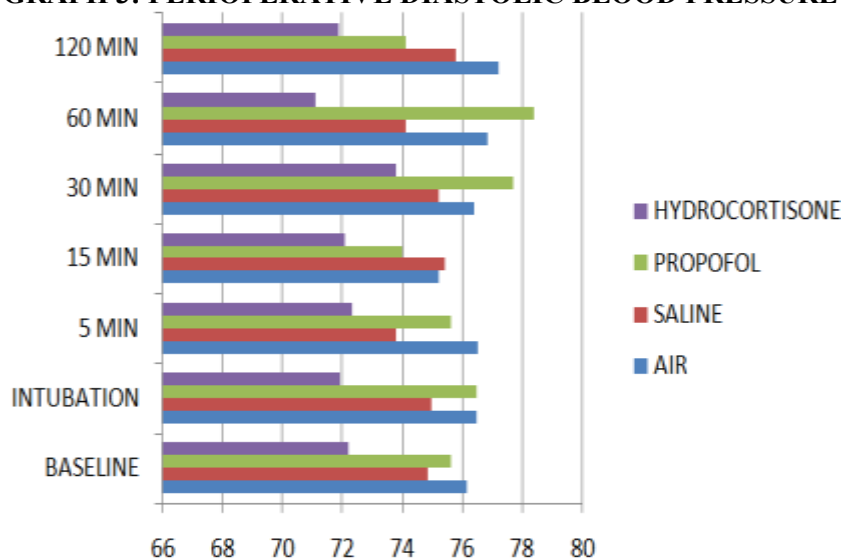
GRAPH 1: PERIOPERATIVE HEART RATE



GRAPH 2: PERIOPERATIVE SYSTOLIC BLOOD PRESSURE



GRAPH 3: PERIOPERATIVE DIASTOLIC BLOOD PRESSURE



Discussion

Endotracheal intubation is typically performed during surgeries under general anaesthesia to control respiration, but there are several undesirable effects associated with endotracheal intubation, including POST, cough, hoarseness of voice, and PONV, all of which result in a lack of patient satisfaction and a significant increase in overall laryngotracheal morbidity. POST depends on a variety of parameters, including the type of ETT cuff, the pressure inside the cuff, the duration of surgery, the patient's position, and the number of intubation attempts.³ The drying effects of anaesthetic gases and the anti-sialagogue actions of anticholinergic medications also play a role.⁴ Several pharmacological and non-pharmacological approaches have been attempted to reduce post-extubation airway issues. When injected into the cuff, lignocaine works as a reservoir, preventing the diffusion of N₂O into the cuff. It also permeates through the semipermeable membrane of the polyvinyl chloride cuff, providing a soothing effect on the tracheal mucosa and lowering pressure-induced necrosis and cough reflex. Intracuff hydrocortisone distributes the drug in smaller quantities and avoids direct contact with the patient's airway, giving a cushioning effect while minimizing pressure on the tracheal mucosa. Propofol, as a suspension medium, may have a more soothing effect on the tracheal mucosa, lowering the risk of necrosis and preventing postoperative

laryngotracheal morbidities.

Gupta P et al⁵ conducted a similar study to compare the effects of inflation of endotracheal tube cuff with 0.9% saline, 4% lignocaine, and 1% propofol on the incidence of postoperative morbidity in terms of cough, sore throat, dysphonia, and dysphagia with general anaesthesia and observed that occurrence of POST was highest with air, followed by saline and lignocaine and least with Propofol which was similar to the current study.

The study conducted by Budania et al⁶ was contradictory to the present study where ETT cuff inflation with air, anesthetic gas mixture, 2% lignocaine, and saline were comparable in terms of incidence of postextubation cough and postoperative airway morbidity symptoms such as sore throat, hoarseness of voice, and dysphagia.

In a study conducted by Rashmi N R et al⁷ inflation of endotracheal tube cuff with lignocaine, lignocaine with sodium bicarbonate and ketamine showed a reduction the incidence and severity of POST compared to air. Tube tolerance was better with ketamine, but with slight increase in arterial blood pressure at extubation. These findings were consistent with the present study where liquid media showed lower incidence of POST maintaining stable hemodynamics.

In a study conducted by Shah et al⁸ it was observed that ETT cuff inflated with air (Group A) was not as effective as alkalized 2% lidocaine (Group L) in controlling vital parameters such as heart rate, systolic blood pressure, diastolic blood pressure & mean arterial pressure at the time of extubation, 2, 4, 6, 8, 10 & 15 minutes after extubation. Incidence of cough and sore throat was also seen in the air group. But the hemodynamics in the current study were comparable in both the groups though cough and sore throat were higher in air group compared to liquid media especially propofol and hydrocortisone.

Conclusion:

The present study concluded that inflation of ETT cuff with liquid media reduces the incidence of POST as compared to air. Of the liquid media, viscous/ emulsion agents such as 1% propofol is better followed by hydrocortisone and 0.9% saline.

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Conflicts Of Interest: NIL

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