



## A Comparative Study on the Incidence and Severity of Post Operative Sore Throat with and without Controlling Endotracheal Tube Cuff Pressure

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### Abstract

**Background:** Endotracheal intubation during general anaesthesia often leads to post procedural complications like post operative sore throat, cough and hoarseness of voice. In this study we tried to determine the effects of controlled ETT cuff pressure in these complications.

**Methods:** After obtaining approval from Research committee and institutional ethical committee, a total of 170 patients who satisfied the inclusion and exclusion criteria constituted the study population. During the first epoch of 3 months of study period the ETT cuff was inflated till there was no audible leak and during the second epoch of 3 months the cuff pressure was measured and adjusted within the range of 18-25mms of Hg/25-34cms of H<sub>2</sub>O with the help of a manometer. Patients were questioned for post operative sore throat( POST) at 0, 12 and 24 hr after the extubation.

**Results:** In the present study the 2 groups were comparable with respect to age, gender, weight, height, BMI and duration of surgery. The incidence of POST at 12 and 24 hr in the group with controlled ETT cuff pressure was significantly lower than the group with uncontrolled ETT cuff pressure. There was no significant difference in the incidence of POST at 0 hr between the 2 groups.

**Conclusion:** Proper control of ETT cuff pressure during general anaesthesia with the help of a manometer significantly reduces the incidence and severity of POST.

**Keywords:** Post operative sore throat, ETT cuff pressure, intubation.

### Introduction

Sore throat is a common post operative complaint.<sup>1</sup> Endotracheal intubation is mandatory during general anaesthesia for control over respiration and to protect airway. Literature shows that the incidence of sore throat varies from 14.4% to 50% after tracheal intubation.<sup>2,3,4,5</sup> Post operative sore

throat will lead to dissatisfaction and discomfort after surgery. This may prolong hospital stay. Though a minor complication, it still remains unresolved in patients undergoing general anaesthesia with endotracheal intubation.<sup>6</sup>

The ETT cuff pressure has been implicated as one of the risk factors for sore throat after general

anaesthesia.<sup>7</sup> The purpose of the cuff system is to provide a seal between the tube and the tracheal wall to prevent passage of pharyngeal contents into the trachea and ensure that no gas leaks past the cuff during positive pressure ventilation. It is desirable that the cuff seal the airway without exerting so much pressure on the trachea. So minimum air is used to inflate the cuff. Severe over inflation of the ETT cuff affects blood flow to the tracheal mucosa, resulting in tracheal mucosal ischaemia, necrosis, ulceration, trachea oesophageal fistula<sup>8,9</sup> or tracheal rupture.<sup>10,11</sup> The usual practice is to use minimal air just enough to prevent audible leak. But as anaesthesia proceeds the cuff pressure increases as a result of absorption of N<sub>2</sub>O into it. So there is a theoretical possibility of reducing the incidence of sore throat if we are able to control the cuff pressure as the surgery and anaesthesia proceeds longer.<sup>12,13</sup>

### Objective

To compare the incidence and severity of post operative sore throat in subjects undergoing general anaesthesia with endotracheal tube placement with and without controlling the cuff pressure.

### Materials and Methods

This study was a prospective observational study conducted in the department of Anaesthesiology at a tertiary care centre after obtaining approval of the Research Committee and Institutional Ethical Committee. Duration of the study was 6 months (May 2014- October 2014)

170 patients who underwent general anaesthesia with endotracheal tube placement during the study period who satisfied the inclusion and exclusion criteria constituted the study population.

#### Inclusion criteria

ASA I and ASA II patients above 18 years who had to undergo general anaesthesia with endotracheal tube placement.

#### Exclusion criteria

1. Patients undergoing thyroid surgeries, oral and laryngopharyngeal surgeries
2. patients with cough and sore throat within 6 weeks before surgery

3. use of nasogastric tube or throat pack during surgery
4. patients with anticipated difficult intubation like micrognathia, post burn contracture of neck, obvious facial anomalies.

### Sample size calculation

$$N = [Z\alpha + Z(1-\beta)]^2 [P_1(1-P_1) + P_2(1-P_2)] / (P_1 - P_2)^2$$

$$\text{Where } [Z\alpha + Z(1-\beta)]^2 = 7.19$$

$$P_1 = 50\%$$

$$P_2 = 30\%$$

By substituting we will get N= 82.5

So we included 85 in each group

Written informed consent to take part in this study was obtained from those patients. General anaesthesia was given to these patients according to the institutional protocol. In the first epoch of 3 months of the study period the cuff of endotracheal tube was inflated after intubation till there was no audible leak. No pressure adjustment thereafter during the entire period of anaesthesia. This comprises the uncontrolled group. In the second epoch of 3 months cuff pressure was measured and adjusted within the range of 18-25 mms of Hg/25-34cms of H<sub>2</sub>O<sub>14</sub> every 15 minutes with the help of a cuff pressure manometer. This comprises the controlled group. After the surgery all study patients were questioned for Post operative sore throat at 0 hr, 12 hr and 24 hr after the extubation. The severity of sore throat was assessed by the following scoring system.

#### SCORE

#### GRADE

- 0 No complaints pertaining to sore throat
- 1 Minimal (complains of sore throat only on asking)
- 2 Moderate (complains of sore throat on his/her own)
- 3 Severe (sore throat associated with hoarseness, cough)

### Statistical Analysis

Data analysed by SPSS version 16. The primary outcome variable is expressed as number (proportion) and chi square test was done to

compare the result. Other study variables were expressed as mean or median and t test or Mannwhitney U test were used as statistical tests. P value <0.05 was considered statistically significant.

**Results**

Of the total 170 patients who satisfied the inclusion and exclusion criteria 85 belongs to controlled group and 85 belongs to uncontrolled group.

**Table1:** Distribution of age, weight, height, BMI, duration of surgery among the two groups

	Controlled (N=85)		Uncontrolled (N=85)		t	p
	Mean	SD	Mean	SD		
Age (yr)	40.4	11.2	40.4	10.5	0.042	0.966
Weight(Kg)	61.6	9	61.9	7.6	-0.268	0.789
Height(cm)	160.9	8	162.2	7.1	-1.131	0.26
BMI(Kg/m2)	23.7	2.9	23.5	2	0.714	0.476
Duration(mts)	159.3	44.4	147.1	36.9	1.953	0.053

Here 2 groups are comparable with respect to age, weight, height, BMI, duration of surgery.

**Table 2:** Comparison of two groups based on the incidence and severity of post operative sore throat at 0 hour

Post operative sore throat - at 0 hour	Group		$\chi^2$	p
	Controlled	Uncontrolled		
No complaints	84	85	1.006	0.316
Minimal	0	0		
Moderate	1	0		
Severe	0	0		

**Table 3:** Comparison of two groups based on the incidence and severity of post operative sore throat at 12 hour

Post operative sore throat - at 12 hour	Group		$\chi^2$	p
	Controlled	Uncontrolled		
No complaints	55	39	14.026	0.003
Minimal	11	6		
Moderate	17	28		
Severe	2	12		

**Table 4:** Comparison of two groups based on the incidence and severity of post operative sore throat at 24 hour

Post operative sore throat - at 24 hour	Group		$\chi^2$	p
	Controlled	Uncontrolled		
No complaints	63	43	15.583	0.001
Minimal	8	6		
Moderate	12	23		
Severe	2	13		

**Table 5:** Comparison of incidence of post operative sore throat among the two groups

Time since extubation	Controlled (%)	Uncontrolled (%)	p
0 hour	1.1	0	0.316
12 hour	35.3	54.1	0.003
24 hour	25.9	49.5	0.001

**Discussion**

Post operative sore throat (POST) though a minor complication, still remains unresolved in patients undergoing endotracheal intubation. The purpose of endotracheal intubation is to control respiration and to protect airway. After tracheal intubation the incidence of sore throat varies from 14.4% to 50%.<sup>2,3,4,5</sup>

The method used for airway management has the strongest influence on the incidence of POST but several patient and operative factors may be involved. By knowing these factors, awareness of the problem will increase and this will help the anaesthesiologists in avoiding combinations of the predictive factors, thus decreasing the incidence of POST and improving patient satisfaction.

A multimodal approach which consists of pharmacological and non pharmacological interventions has been advocated to decrease the incidence of post operative sore throat. The endotracheal tube cuff pressure has been implicated as a risk factor for sore throat after general anaesthesia. The purpose of cuff inflation after endotracheal intubation is to prevent air leakage, thus ensuring the effect of ventilation and reducing the leakage of inhalation anaesthetics.

The present study was undertaken to determine the incidence and severity of post operative sore throat

after controlling the endotracheal tube cuff pressure within the range of 18-25mmHg of Hg/25-34cmH<sub>2</sub>O throughout anaesthesia and to compare it with that of uncontrolled cuff pressure where the cuff is inflated soon after intubation until there is no audible leak. No pressure adjustment thereafter.

A multi centre study by Liu J,Zhang X, Gong W, LiS, Wang F,et al in 2010 in 509 patients from four tertiary care university hospitals in Shanghai, China scheduled for elective surgery under general anaesthesia were assigned to a control group without measuring ETT cuff pressure, and a study group with ETT cuff pressure measured and adjusted. Their study showed that the incidence of postprocedural sore throat, hoarseness, and blood-streaked expectoration in the control group was significantly higher than in the study group<sup>13</sup>. When the duration of endotracheal intubation increased, the incidence of sore throat and blood-streaked expectoration in the control group increased. The incidence of sore throat in the study group also increased with increasing duration of endotracheal intubation. Fiberoptic bronchoscopy in the 20 patients showed that the tracheal mucosa was injured in varying degrees in both groups, but the injury was more severe in the control group than in the study group. But in our study there was no association of POST with duration of Surgery.

ETT cuff pressure estimated by palpation with personal experience is often much higher than measured or what may be optimal. Proper control of ETTc pressure by a manometer helped reduce ETT-related post procedural respiratory complications such as cough, sore throat, hoarseness, and blood-streaked expectoration even in procedures of short duration (1–3 hours).

Severe over inflation of the endotracheal tube cuff (ETTc) imparts risk for serious or even fatal injury and affects blood flow supply to the tracheal mucosa, resulting in tracheal mucosal ischemia, ulceration, necrosis, tracheoesophageal fistula<sup>8,9</sup>, or tracheal rupture<sup>10,11</sup>. This has been shown primarily for patients with prolonged (days) endotracheal intubation. For brief procedures lasting only a few hours, most clinicians give little attention to

inflation pressure of the ETTc, and simply determine the pressure by pilot balloon palpation according to their experience. Studies by faculty anesthesiologists, anesthesia residents and critical care unit staff<sup>15,16</sup>, have demonstrated a prevalent inability of these clinicians to accurately determine ETTc pressure by pilot balloon palpation.

A study by Suzuki N, Kooguchi et al in 1999, studied about Postoperative hoarseness and sore throat after tracheal intubation: effect of a low intra cuff pressure of endotracheal tube and the usefulness of cuff pressure indicator<sup>12</sup>. In this study, one hundred and ninety patients of ASA classes I or II were allocated randomly to two groups, low cuff pressure group (< 15 mmHg) or high cuff pressure group (15-25 mmHg), using continuous monitoring with a cuff pressure gauge. The incidence of postoperative hoarseness and sore throat at 24 hours after intubation and on the seventh postoperative day was measured. The incidence of postoperative hoarseness and sore throat was significantly decreased in the low pressure group at 24 hours after intubation as compared with the high pressure group, but there was no significant difference between the two groups on the seventh postoperative day. These results suggest that keeping the cuff pressure under 15 mmHg can prevent postoperative hoarseness or sore throat at 24 hours after intubation, and that a cuff pressure gauge is thought to be one of the indispensable monitors during anaesthesia.

In a cross sectional study by Hamed-Basir Ghafouri, Hossein Saeediet al<sup>17</sup> in 2012, the cuff pressure of 100 patients in emergency department and intensive care units of 2 university hospitals was evaluated by using a sensitive and accurate analogue standard manometer after insertion of the ETT and checking the pilot balloon by the provider. In their study they concluded that the estimation of cuff pressure using palpation techniques is not accurate and in order to prevent adverse effects of cuff over inflation, it is better to recheck the pressure using a manometer, regardless of place, time and the inserter of the endotracheal tube. Previous studies have shown that cuff palpation is not sufficient to detect high cuff

pressures.<sup>18,19</sup> Even after manual control of the cuff pressure by feeling the pilot balloon, over inflation of the endotracheal cuff is commonly reported in ICU patients. Over inflation of the ETT cuff is an avoidable risk factor for tracheal ischemia and subsequent complications.

In our study the incidence of post operative sore throat at 12 hour in the group with controlled ETT cuff pressure was 35.3% which was significantly lower (p value 0.003) than 54.1% in the group with uncontrolled ETT cuff pressure. Only 2 patients in the controlled group had severe post operative sore throat when compared to 12 patients in the uncontrolled group. The incidence of post operative sore throat at 24 hour in the group with controlled ETT cuff pressure was 25.9% which was significantly lower (p value 0.001) than 49.5% in the group with uncontrolled ETT cuff pressure. Only 2 patients in the controlled group had severe post operative sore throat when compared to 13 patients in the uncontrolled group.

In our study there was no significant difference in the incidence of POST at 0 hour between the 2 groups.

Limitation in our study is fiberoptic bronchoscopy is not done to confirm the severity of injury. The incidence of coughing or bucking on the endotracheal tube at the time of extubation was not recorded in both groups. The correlation between coughing or bucking at the time of extubation and the incidence of sore throat, cough and hoarseness could not be evaluated in this study. No large prospective study assessing short term benefits of measuring ETT cuff pressure has been reported.

The present study confirms the findings of studies by the above mentioned authors proving that proper control of ETT cuff pressure with the help of a manometer significantly reduces the incidence of POST, cough and hoarseness of voice.

#### **The major findings of this study are:**

The incidence of post operative sore throat at 12 hr and 24 hr in the group with controlled ETT cuff pressure was 35.3% and 25.9% respectively. This was significantly lower than 54.1% and 49.5%

respectively of the group with uncontrolled ETT cuff pressure.

There was no significant difference in the incidence of post operative sore throat at 0 hour between the 2 groups.

#### **Conclusion**

During general anaesthesia, control of endotracheal tube cuff pressure within 18-25 mms of Hg/25-34cms of H<sub>2</sub>O with the help of a manometer can significantly reduce the incidence and severity of post operative sore throat.

**Sources of support:** Nil

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