

COMPARATIVE EVALUATION OF INCIDENCE, SEVERITY, AND RELATION OF SORE THROAT AFTER ENDOTRACHEAL INTUBATION AT DIFFERENT CUFF PRESSURES

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ABSTRACT

Objective: The primary objective of the study was to evaluate and compare the incidence, severity, and relation of sore throat after endotracheal intubation at different cuff pressures. The secondary objective of the present study was to evaluate whether regular monitoring of cuff pressure has any additional advantage during surgical procedures.

Methods: Study design – A prospective, comparative, and randomized study. Group A – 25 female patients of age 20–35 where cuff pressure was kept at 15 cm H₂O. Group B – 25 female patients of age 20–35 where cuff pressure was kept at 20 cm H₂O. Group C – 25 female patients of age 20–35 where cuff pressure was kept at 25 cm H₂O. Group D – 25 female patients of age 20–35 where cuff pressure was kept at 30 cm H₂O. The patient was visited at 24 h, 48 h, and 72 h following extubation and enquired about the incidence of sore throat.

Results: The incidence and severity of sore throat ranged from as low as 16% in group A to as high as 60% in group D at 24 h. Groups B and C showed incidences of 28% and 40%, respectively. The incidence of sore throat was found to be 12% in group A to as high as 40% in group D at 48 h postoperatively, which was further decreased to just one patient with a scratchy feeling in group A and three patients in group D at 72 h with incidence ranging from 4% to 12% only.

Conclusion: As the cuff pressure goes on increasing, the incidence and severity of sore throat also increase, and cuff pressure should be monitored and regulated continuously. Moreover, the cuff pressure should not exceed 25 cm of H₂O to minimize post-operative sore throat.

Keywords: Cuff pressure, Post-operative sore throat, Post-operative anesthetic complication, Hoarseness, Duration of intubation.

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INTRODUCTION

Endotracheal intubation is a common and frequent procedure in anesthetic practice because the maintenance of a patent and protective airway is the first and foremost duty of an anesthesiologist. One of the major responsibilities of an anesthesiologist is providing adequate respiration. No anesthesia is safe unless diligent efforts are made to maintain an intact airway. Numerous advantages of endotracheal intubation have been recognized. In addition to providing and securing a clear airway, it also facilitates control of respiration, aids in removing tracheobronchial secretions, and acts as a safeguard against aspiration.

However, the procedure is associated with a complication of sore throat, as noticed from time to time during busy anesthetic practices. Even though, it is not incapacitating, it can be very uncomfortable. While a sore throat is a subjective feeling, hoarseness can be appreciated by an observer as the voice changes. It appears soon after extubation, usually within 6 h and if not severe, heals within 48 h. Various factors have been identified as causing sore throat [1,2]:

1. High pressure exerted by the cuff against the tracheal wall
2. Intubation trauma
3. Succinylcholine
4. Xylocaine jelly is used as a lubricant
5. Post-intubation neck movements
6. Presence of N-G tube
7. Occurrence of regurgitation and vomiting of gastric contents
8. Presence of blood in the throat
9. Prone position
10. Straining on the tube
11. Type of cuff
12. Common in females.

The aim of the present study was to evaluate and compare the incidence, severity, and relation of sore throat after endotracheal intubation at different cuff pressures.

METHODS

Study design

The present study was a prospective, comparative, and randomized study. With the approval from the institutional ethics committee, IRB approval, and written informed consent from the patients, the present study was conducted on 100 ASA-1 young adult female patients in the age group of 20–35 years undergoing various elective surgical procedures requiring general anesthesia and intubation in gynecology, orthopedics, and general surgery departments.

The sample size was taken as 100 in four groups of 25 each as per convenience sampling.

The patients were randomly assigned to four groups as follows:

- Group A – 25 female patients of age 20–35 where cuff pressure was kept at 15 cm H₂O
- Group B – 25 female patients of age 20–35 where cuff pressure was kept at 20 cm H₂O
- Group C – 25 female patients of age 20–35 where cuff pressure was kept at 25 cm H₂O
- Group D – 25 female patients of age 20–35 where cuff pressure was kept at 30 cm H₂O.

Exclusion criteria

Patients with diabetes, patients undergoing head-and-neck surgery, patients with lower or upper respiratory infections or airway irritation,

where intubation could not be achieved on the first attempt, *in vivo* N-G tube, post-operative nausea, and vomiting.

Pre-anesthetic check-up

One day before surgery, a pre-operative visit was made and a detailed history was taken. A thorough clinical examination was conducted in each case. The patients were informed about the intubation and its necessity for general anesthesia. The purpose of the study was also explained. The necessary investigations were reviewed and patients fit for anesthesia with physical status ASA-1 were included in the study. Apart from necessary investigations, a pre-operative throat examination was done as a compulsory part of the study in all patients.

Pre-medication

All the patients were asked to remain fasting for at least 8 h before surgery. On the day of surgery, patients were given an injection of glycopyrrolate 0.2 mg and an injection of midazolam 5 mg intramuscularly 45 min before the proposed surgery.

Anesthetic technique

After the patients were brought into the operating room, the monitors were connected and an intravenous line was established. The patients were pre-oxygenated with 100% oxygen and G.A was induced with an injection of propofol 1% (2 mg/kg body weight) along with N₂O and halothane. This was followed by an injection of vecuronium (0.1 mg/kg body weight) as a relaxant and patients were ventilated with a bag and mask for 3 min. After 3 min, laryngoscopy was performed using a Macintosh laryngoscope (MCL) blade (adult size). A new 7.5 mm disposable polyvinyl chloride endotracheal tube (ETT) was used in all the patients, followed by inflation of the cuff at 15 cm, 20 cm, 25 cm, and 30 cm of H₂O using a cuff pressure monitor. The pressure of the cuff was checked and corrected every 10 min.

Maintenance of anesthesia was done with N₂O, O₂, and halothane and muscle relaxation with incremental doses of vecuronium.

Table 1: Duration of intubation

Group	Duration	Mean
A	30-190 min	84.6 min±35.35
B	30-165 min	75.0 min±34.20
C	30-170 min	72.0 min±33.32
D	35-170 min	72.6 min±26.28

Table 2: Post-operative sore throat at 24 h in the four groups

Group	Incidence	Score 0	Score 1	Score 2	Score 3	Total	χ^2	p-value
A	4 (16%)	21	3	1	0	25	1.064	>0.05
B	7 (28%)	18	5	2	0	25		
B	7 (28%)	18	5	2	0	25	0.545	>0.05
C	10 (40%)	15	8	2	0	25		
C	10 (40%)	15	8	2	0	25	3.776	>0.05
D	15 (60%)	10	8	7	0	25		
D	15 (60%)	10	8	7	0	25	10.674	<0.05
A	4 (16%)	21	3	1	0	25		

Table 3: Post-operative sore throat at 48 h in the four groups

Group	Incidence	Score 0	Score 1	Score 2	Score 3	Total	χ^2	P-value
A	3 (12%)	22	3	0	0	25	2	>0.05
B	7 (28%)	18	7	0	0	25		
B	7 (28%)	18	7	0	0	25	0	>0.05
C	7 (28%)	18	7	0	0	25		
C	7 (28%)	18	7	0	0	25	1.522	>0.05
D	10 (40%)	15	9	1	0	25		
D	10 (40%)	15	9	1	0	25	5.324	>0.05
A	3 (12%)	22	3	0	0	25		

At the end of the surgery, the neuromuscular block was reversed with an injection of neostigmine 2.5 mg and glycopyrrolate 0.2 mg. Suction was done with utmost care to avoid any injury and extubation was done gently after deflating the cuff.

Any incidence of coughing, laryngospasm, nausea, and vomiting was noted with a total duration of intubation, and the patient was shifted to the recovery room.

Post-operative period

The patient was visited at 24 h, 48 h, and 72 h following extubation and enquired about the sore throat and grading of severity was done as follows:

- Grade 0: No complaints
- Grade 1: Minimal scratchy or sore throat with no hoarseness
- Grade 2: Moderate sore throat or slight hoarseness
- Grade 3: Severe sore throat or obvious hoarseness.

RESULTS

The patients were well matched with regard to age and surgical procedure in all four groups ($p>0.05$). The CONSORT flow diagram is shown in Fig. 1.

The following data were collected:

After recording the observations, data were analyzed (using the Chi-square test), compiled, and compared with that available in the literature.

The following points were noted:

1. The cuff pressure increased from the preset value during the surgery and had to be brought down to the original value using a pressure regulating valve every 10 min
2. The cuff pressure increased rapidly initially but slowly afterward so that initial cuff pressure had a bearing on maximum cuff pressure
3. The incidence and severity of sore throat ranged from as low as 16% in group A to as high as 60% in group D at 24 h with only four patients complaining of sore throat in group A and 15 patients in group D. The group B and C showed an incidence of 28% and 40%, respectively
4. The incidence of sore throat was found to be 12% in group A to as high as 40% in group D at 48 h postoperatively, which was further decreased to just one patient with a scratchy feeling in group A and

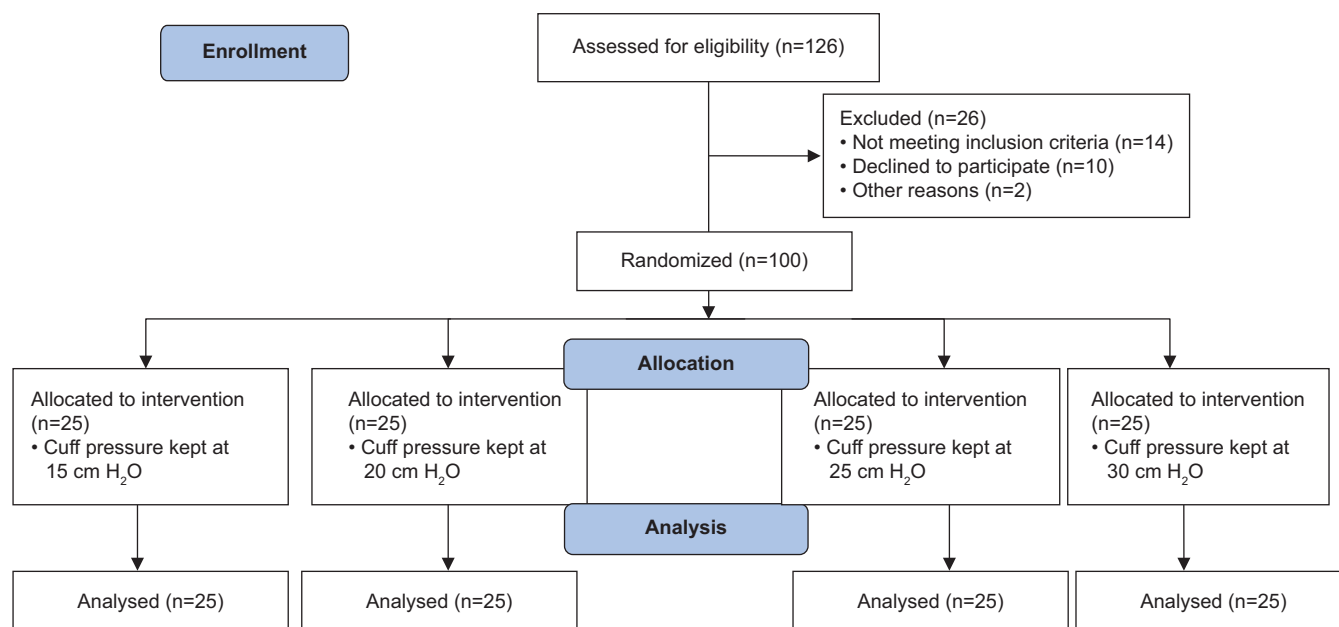


Fig. 1: CONSORT 2010 flow diagram

Table 4: Post-operative sore throat at 72 h in the four groups

Group	Incidence	Score 0	Score 1	Score 2	Score 3
A	1 (4%)	24	1	0	0
B	1 (4%)	24	1	0	0
C	0	25	0	0	0
D	3 (12%)	22	3	0	0

p>0.05

three patients in group D at 72 h with incidence ranging from 4% to 12% only

- The patients in group A were intubated for a longer time than the patients in the other three groups (p<0.05). No positive correlation was found between the severity of sore throat and with duration of intubation, as the mean duration of intubation was more in group A (84.6 min) than the mean duration in group D (72.6 min).

DISCUSSION

There is a large variation in the reported incidence of sore throat and it ranges from as low as 24% to as high as 90% [3]. Various factors have been attributed to affect the incidence of sore throat:

- High cuff pressure is exerted against the wall of the trachea [4]
- Succinylcholine [5]
- Lignocaine jelly [6]
- Post-intubation neck movements
- Presence of N-G tube
- Intubation trauma.

Saarnivaara and Grahne [7] studied the incidence of sore throat and hoarseness when cuff pressure was maintained at minimal occlusion pressure versus when cuff pressure was allowed to increase freely. They observed hoarseness and sore throats as separate entities. Jensen *et al.* [8] observed post-operative sore throat (POST) occurring more frequently in females as compared to males.

Capan *et al.* [5] identified succinylcholine as a factor contributing to POST probably as a result of myalgia due to fasciculations of pharyngeal muscles.

Loeser *et al.* [6] demonstrated a low incidence of sore throat when no lubricant jelly was used on ETT.

Seeglobin and VanHasselt [9] recommended a cuff pressure of 30 cm H₂O should not be exceeded as the tracheal mucosal blood flow is occluded at and above this pressure.

Raeder *et al.* [10] studied the changes in cuff pressure and volume of ETT under GA with N₂O and O₂ as an anesthetic gas mixture. They observed significantly higher cuff pressure using air than the anesthetic gas group.

Sprague and Archer [4] compared the incidence of POST following intubation with high-pressure low-volume cuffed tubes (MAGILL) versus low-pressure high-volume cuffed tubes (MALLINCKRODT). They observed a sore throat incidence of 50% with Magill tube as against 28% with Mallinckrodt tubes.

Aqil *et al.* [11] studied the incidence and severity of POST with glidescope laryngoscope (GL) compared with MCL. The authors found that routine use of GL for ETT placement resulted in a reduction in the incidence and severity of POST compared to MCL.

Lee *et al.* [2] studied the incidence and risk factors of POST after endotracheal intubation in Korean patients. The authors found that an intracuff pressure ≥ 17 cm H₂O and a cough at emergence were risk factors for POST in Korean patients. Intracuff monitoring during anesthesia and a smooth emergence were needed to prevent POST. Similar results were seen in the present study in which the authors found that as the cuff pressure increased, the incidence and severity of sore throat increased in the Indian population. However, the margin of safety for cuff pressure in the present study was up to 25 cm of H₂O to minimize the incidence of POST. This could probably be attributed to anatomical differences between the two ethnic groups. This could also be probably due to different compliances and receptor sensitivity of airways in Korean and Indian populations.

Shrestha *et al.* [12] studied the incidence and associated risk factors of POST in a tertiary care hospital in Nepalese population. The authors found that ETT, female patients, and increased duration of anesthesia were associated with increased POST rates. However, there was no positive correlation between the increased duration of anesthesia and the incidence of POST in the present study. This could be attributed to the fact that the intracuff pressure was regularly monitored and was regularly reduced to maintain a certain pressure in the present study. This highlights the importance of regular cuff monitoring during prolonged surgeries to decrease the incidence of POST.

CONCLUSION

From the above findings, we conclude that as the cuff pressure goes on increasing, the incidence and severity of sore throat also increase, and cuff pressure should be monitored and regulated continuously. Moreover, the cuff pressure should not exceed 25 cm of H₂O to minimize POST.

CONFLICTS OF INTEREST

Nil.

AUTHORS CONTRIBUTIONS

Tanveer Singh Kundra - Writing the manuscript; Deepak Berry - Planning the study, collecting data, and analyzing data.

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