

Original Research

Short-term Effects of Endotracheal Intubation on Larynx

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ABSTRACT:

Aims and Objectives:

1. Evaluate the immediate changes in voice and acoustic parameters following endotracheal intubation
2. Correlate these changes with the pressure of the endotracheal tube cuff.

Materials and Methods: A prospective study involving 75 patients examined before surgery, two hours after surgery, and 24 hours after surgery to assess vocal symptoms such as hoarseness, vocal fatigue, throat pain, throat clearing, globus sensation in the throat, and loss of voice. The study also measured maximum phonatory duration (MPD). Factors related to the endotracheal tube that were considered included the duration of anesthesia, number of intubation attempts, size of the endotracheal tube, and volume of the endotracheal cuff. **Results:** In our research, approximately 45% of patients reported voice hoarseness, 60% experienced throat pain, 61% had throat clearing, 33% felt a globus sensation in the throat, and 8% suffered from vocal fatigue two hours after surgery. These percentages decreased to 19%, 27%, 40%, 24%, and 4% respectively after 24 hours. The number of intubation attempts was found to be associated with vocal fatigue (p-value 0.032), and the volume of the endotracheal cuff was also linked to vocal fatigue (p-value 0.028). However, there was no significant change observed in maximum phonatory duration. **Conclusion:** The endotracheal tube parameters, mean cuff pressure, and ET cuff volume are the most important variables that are associated with the increase in vocal symptoms. An increase in the value of these parameters is associated with more postoperative discomfort.

Keywords: Endotracheal intubation, hoarseness, postoperative voice change, Larynx, Voice, Endotracheal tube, MPD, Maximum phonatory duration

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INTRODUCTION

Most ENT surgical procedures require endotracheal intubation to administer general anesthesia (GA). Post-intubation voice changes are common and can lead to an unpleasant postoperative experience for patients. However, selecting appropriate endotracheal tube (ET) parameters can significantly reduce these issues. Typically, voice changes and laryngeal symptoms are temporary and resolve within 24 hours without long-term effects for most patients.[1-2] Research has explored the morphological and histological changes in the laryngotracheal area associated with prolonged intubation.[1-3]

This study aims to

- (1) evaluate the immediate changes in voice and acoustic parameters following endotracheal intubation
- (2) correlate these changes with the pressure of the endotracheal tube cuff.

MATERIALS AND METHODS

A prospective analysis was carried out on patients admitted for routine ENT surgeries at our tertiary care teaching hospital. The study included 75 patients who provided written, informed consent. Of these, 46 were male (61%) and 29 were female (39%), with ages ranging from 19 to 68 years with a mean age of 34 years. All patients underwent laryngoscopic examination prior to intubation to rule out any vocal fold lesions or morphological abnormalities. Surgeries involving the vocal folds and neck surgeries near the recurrent laryngeal nerves, such as thyroid and parathyroid procedures, were excluded. To minimize injury, all intubations were performed by anesthetists with the rank of associate professor or higher. These anesthetists also preoperatively assessed patients for potential difficulties in laryngeal exposure using the modified Mallampati classification (MMC).[4] All patients were assessed preoperatively on the morning

of their surgery, two hours post-surgery, and 24 hours post-surgery. They were asked about vocal complaints such as hoarseness, throat pain, vocal fatigue, loss of voice, throat clearing, and globus pharyngeus (a sensation of a foreign body in the throat). To measure the maximum phonatory duration (MPD), patients were instructed to sustain the vowel /e/ for as long as

possible after a maximal inhalation. All patients received general anesthesia, with an endotracheal tube (ET) inserted through the oral cavity. The following parameters were recorded: size of the endotracheal tube, number of intubation attempts, duration of anesthesia, and ET cuff volume. (Table 1).

Table: 1 Parameters assessed for the study

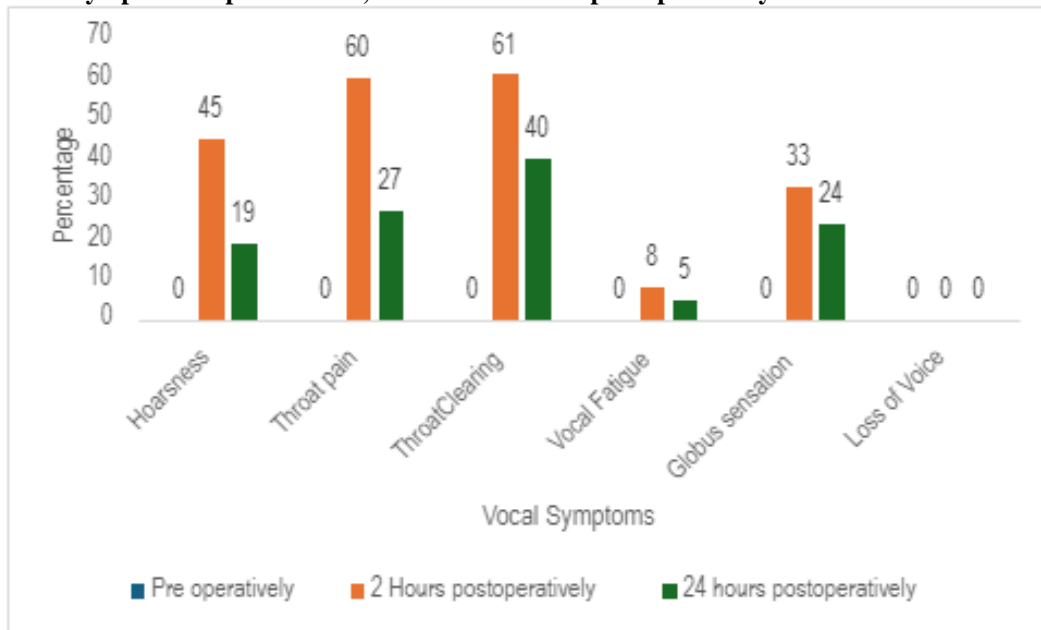
Vocal Symptoms	Endotracheal tube Parameters
Hoarsness	Size of Endotracheal tube
Throat Pain	Number of attempts of intubation
Vocal Fatigue	ET Cuff volume in cc
Throat Clearing	Duration of Anaesthesia (hrs)
Globus Sensation	
Loss of voice	

RESULTS

Seventy-five patients participated in the study, with ages ranging from 18 to 72 years and an average age of 39.2 years. The group consisted of 61.33% males (46) and 38.67% females (29). The duration of anesthesia varied between 100 and 240 minutes. Endotracheal tube (ET) sizes used for intubation were 6 to 7.5 for females and 7 to 8.5 for males. There was a notable increase in the incidence of vocal symptoms namely; hoarseness, throat pain, vocal fatigue, throat clearing, and globus pharyngeus, two hours after general anesthesia. These symptoms decreased within

24 hours. None of the patients had vocal complaints before surgery. Two hours postoperatively, 45% (34 patients) experienced hoarseness, which reduced to 19% (14 patients) after 24 hours. Throat pain affected 60% (45 patients) initially but decreased to 27% (20 patients) after 24 hours. Similarly, throat clearing was reported by 61% (46 patients) and globus pharyngeus by 33% (25 patients), with vocal fatigue affecting 8% (6 patients) immediately post-surgery. These symptoms reduced to 40%, 24%, and 4%, respectively, after 24 hours. (Fig 1)

Fig 1: Vocal Symptoms of patients Pre, 2 hr Post & 24 hrs post operatively



Vocal symptoms two hours post-surgery were also linked to the number of intubation attempts, ET cuff volume, tube size, duration of anesthesia, and extubation quality. Among ET-related parameters, the number of intubation attempts was associated with

vocal fatigue (p-value 0.032) (Table 2), and ET cuff volume was linked to vocal fatigue (p-value 0.028) (Table 3). The maximum phonatory duration did not significantly change over the 24-hour period (Table 4).

Table 2: Relation of vocal fatigue vs no of intubation attempts

Intubation attempts	2 hrs Post operatively % of patients (Numbers)	24 hrs post operatively % of patients (Numbers)	Total patients N=75
1	2.2% (1)	0 (0)	45
2	12.5% (2)	0 (0)	16
3	75% (6)	25% (2)	8
4	100% (5)	40% (2)	5
5	100% (1)	100% (1)	1

Table 3: Relationship of Vocal Fatigue with Cuff Pressure

ET cuff Volume (cc)	2 hrs Post operatively % of patients (Numbers)	24 hrs post operatively % of patients (Numbers)	Total patients N=75
3	25.8% (15)	5.1 (3)	58
4	62.5 % (10)	18.75 (3)	16
5	100% (1)	100% (1)	1

Table 4: Mean value of MPD

	Preoperatively	2 hrs Post operatively	24 hrs post operatively
Maximum Phonatory Duration (MPD) in seconds	14	12.8	13.1

DISCUSSION

Voice production in humans involves the lungs serving as a reservoir, the vocal folds functioning as a vibrator, and the supraglottic area, along with the sinuses and oral cavity, acting as resonators. Orotracheal intubation can cause physical and structural changes in the vocal folds and supraglottic tract, which can subsequently affect voice and phonatory behavior. [5]Anesthetic inhalational drugs and intubation can lead to dehydration of the laryngeal mucosa, increasing vocal fold viscosity and impairing their vibration.[6–7]The incidence of laryngeal trauma varied from 6.3% to 80%. [8-9]The extent of trauma can vary from minor vocal fold edema to more severe conditions such as vocal fold paresis, hematoma, lacerations, and granuloma formation. This trauma can occur during the insertion of the endotracheal tube, the intubation process, or during extubation. [10–14]Consequently, factors such as the size of the tube, the size of the larynx, cuff pressure, and the duration of anesthesia are crucial for interpreting postoperative vocal symptoms. Vocal fatigue increased with higher cuff volumes and more intubation attempts. Changes in the respiratory and neuromuscular systems, like musculoskeletal tenderness of intercostal muscles causing pain during phonation, can affect voice quality. In our study, the most common vocal symptoms post-extubation were throat pain and hoarseness, followed by throat clearing, globus pharyngeus, and vocal fatigue. Our findings showed a significant association between ET cuff volume and the number of intubation attempts with vocal fatigue.

CONCLUSION

The endotracheal tube parameters, mean cuff pressure, and ET cuff volume are the most important variables

that are associated with the increase in vocal symptoms. An increase in the value of these parameters is associated with more postoperative discomfort.

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