

Laryngeal Findings and Aspiration Risk after Prolonged Endotracheal Intubation in Adult Patients

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Abstract

Background: Prolonged endotracheal intubation (more than forty eight hours) is needed in critically ill patients after respiratory failure. Prolonged intubation are usually associated with different laryngeal injuries as vocal fold immobility, ulceration, granulomas and edema. **Objectives:** To determine the effects of prolonged endotracheal intubation on the larynx & to assess swallowing ability and presence of aspiration in selected patients. **Patients and Methods:** This study was conducted on 54 patients with endotracheal intubation admitted to adult Intensive Care Unit (ICU). When the patients were eligible for endotracheal extubation. The patients evaluated immediately after extubation or within 24 hours. The patients evaluated by flexible fibroptic-naso-laryngoscope with endoscopic video-recording for the presence of vocal fold lesions. Also, some patients assessed for swallowing ability and presence of aspiration. **Results:** Laryngeal abnormalities were seen in 85% of patients on the day of extubation. Majority of patients (42.6%) had posterior glottal contusions and laceration, followed by vocal fold immobility (25.9%) and subglottal edema (22.2%). Also subglottic web and stenosis were found in (14.8%). 30 patients were assessed for swallowing difficulty. Laryngeal spiration was detected in 66% of those patients. **Conclusion:** Prolonged laryngeal intubation was associated with different laryngeal injuries. Size of tubes and duration of intubation are correlated with the severity & number of laryngeal lesions. High risk of aspiration was observed after prolonged laryngeal intubation.

Keywords: Prolonged endotracheal intubation; Laryngeal; Fiberoptic endoscopic evaluation of swallowing (FEES)

Introduction

Prolonged endotracheal intubation (more than 48 hours) is needed in critically ill patients after respiratory failure [1]. Endotracheal intubation is one of the most common procedures performed in the operating theatre, intensive care unit or wards, either on an elective or emergency basis [2]. Rangachar et al. [1] mentioned that intensive care units have a significant number of patients who require intubation for prolonged periods of time. They claimed that the indications for intubation are varied; however it is commonly used for ventilatory assistance, relief of upper airway obstruction and to aid in tracheobronchial toileting.

Colton et al. and Matta et al. [2,3] reported that prolonged intubation are usually associated with different laryngeal injuries as vocal fold immobility, ulceration, granulomas and edema. They reported 63% to 94% of patients had laryngeal injuries following intubation. Also, they mentioned permanent sequelae were found to be a 10% to 22% in the studied group.

Panda et al. and Ellis et al. [4,5], claimed that, complications of endotracheal extubation include laryngospasm and inability to remove the tracheal tube because of failure to deflate the cuff caused by a damaged pilot tube, trauma to the larynx, cuff herniation, adhesion to the tracheal wall and surgical fixation of the tube to adjacent structures. Also, they mentioned laryngeal edema, hemorrhage, trauma and vocal fold paralysis/dysfunction can occur.

Rangachari et al., Hsu et al. and Lundy et al. [1,6,7], found relationship between the size of the endotracheal tube, duration of endotracheal intubation and the occurrence of laryngeal injuries. However, Colton et al., [2] did not find any correlation between the size of the tube, duration of insertion and laryngeal findings.

Dysphagia means difficulty, pain or discomfort during swallowing. Oropharyngeal dysphagia (affects the oral and pharyngeal phases of swallowing) in the form of aspiration of fluids and soft food has been

reported in 3% to 62% of adult patients after endotracheal tubes. Aspiration (passage of food or fluids in the upper airway below the vocal folds) may be caused by direct trauma and impairments in the anatomy and physiology of the pharynx and larynx that may be associated with subsequent swallowing disorders [8-11].

Sue et al. [12] mentioned that more severe post-extubation dysphagia occur in patients with tracheostomy and mechanical ventilators. Furthermore, dysphagia persists at the time of discharge in a large portion (66%) of those patients.

Several studies are available assessing the laryngeal complications and dysphagia after laryngeal extubation worldwide. To our knowledge no studies are carried out in Arabian countries to assess laryngeal findings after endotracheal extubation.

Aim of the work

To determine the effects of prolonged endotracheal intubation (more than 48 hours) on the larynx and to identify the types of laryngeal involvement.

To assess swallowing ability and presence of aspiration in selected patients after endotracheal extubation.

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Received: November 07, 2019; **Accepted:** November 22, 2019; **Published:** November 29, 2019

Citation: Hassan HE, Desouky HIEI, Saud ME (2019) Laryngeal Findings and Aspiration Risk after Prolonged Endotracheal Intubation in Adult Patients. Otolaryngol (Sunnyvale) 9: 386.

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Research design

Cross-sectional study.

The target is the adult intubated intensive care patients.

Inclusion criteria

Males and females.

Age: >18 years old.

Prolonged intubation (48 hours or more).

Exclusion criteria

Pediatric population.

Known patients with laryngeal disorders before admission.

Patients who had a history of cerebrovascular stroke or bulbar manifestations before intubation.

Patients and Methods

This study conducted on 54 patients with endotracheal intubation admitted to Adult Intensive care unit (AICU) at King Salman Armed Forces Hospital which is a tertiary health care Hospital. Written consent was taken from the patient or relatives. The duration of the study was conducted during September, 2017 to September, 2019.

The study had approval from Research & Research Ethics Committee at King Salman Armed Forces Hospital (R&REC2017-154).

When the patients were eligible for endotracheal extubation (the decision was taken by the AICU consultants). The patients evaluated immediately after extubation or within 24 hours. The patients evaluated by flexible fibroptic-naso-laryngoscope with endoscopic video-recording (Karl-storz, with diameter 2.9 CMOS, 11102 CMM). The patient's nose was anesthetized with 10% zylcaine spray. Then, the fiberoptic nasolaryngoscope was lubricated by zylcaine jelly 2%. The larynx was examined during quite respiration and during vocalization (when the patient can phonate) for mobility of the vocal folds and the presence of vocal fold lesions.

Also, some selected patients were assessed for swallowing ability and presence of aspiration at the same session by using Fiberoptic Endoscopic Evaluation of Swallowing (FEES). FEES is done for some selected patients who passed bedside swallowing tests. The patient was seated for FEES in sitting position (whenever possible). However, in some cases, this was not possible, instead, a semi-upright position on the bed was adopted. The flexible fibreoptic-naso-laryngoscope was inserted transnasally into the pharynx. It provided detailed information about the anatomy of the pharynx and larynx. Sensation could be tested by the tip of the endoscope touching various areas of the larynx and reflex adduction of the vocal folds or reflex cough was observed. Different food consistencies as fluids (water), semisolids (thick juice/yoghurt) and solids (piece of biscuits or bread), mixed with blue dye, were used to evaluate swallowing. The salient findings noted were residue, penetration and aspiration into the larynx.

Statistical analysis

Data were collected and statistical analysis has done using Statistical package for Social Sciences version 17 (manufacturer is SPSS Inc., 233 South Wacker Drive, 11th Floor, Chicago, IL. Released 2008. SPSS Statistics for Windows, Version 17.0. Chicago: SPSS Inc.)

Descriptive statistics were done for continuous variables by mean, standard deviation (\pm SD) and range; Univariate correlation between presence of laryngeal complications and parametric variables was done using Spearman's coefficient of correlation. For all tests a probability (P) value less than 0.05 was considered significant.

Results

The total no. of patients were 54 and the male to female ratio was 1.25:1. The age range of the patients was 18-96 years. Mean age of the patients was 54 ± 33 years. Different causes of admission to ICU illustrated in Figure 1.

Patients with Cerebrovascular Stroke (CVS) were 14 (25%), patients with Road Traffic Accident (RTA) were 11 (20%), patients with recurrent aspiration were 10 (18%), septicaemia 5 (9)%, complicated medical conditions 8 (14%) & others 6 (11%).

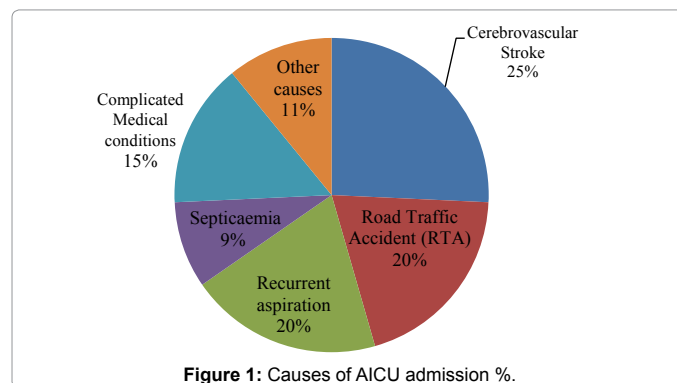


Figure 1: Causes of AICU admission %.

Laryngeal findings	No. of patients (Total=54)	%
Left VF immobility (partial or complete)	10	18.5
Right VF immobility (partial or complete)	4	7.4
Posterior glottis ulceration or Contusions	23	42.6
Subglottic rim or stenosis	8	14.8
Supraglottic edema	10	18.5
Subglottic edema	12	22.2
Glottal haemorrhage	4	7
Patients assessed for swallowing	30 out of 54	55.5
Decreased Laryngeal sensations	11 out of 30	20.3
Aspiration of fluids	20 out of 30	66
Penetration	24 out of 30	80
Residue	6 out of 30	20

Table 1: Laryngeal findings post extubation.

Variables	No. of patients	No. of laryngeal complications
Duration of intubation		
<2 days	12	8
03-5	19	14
06-8	12	11
>8 days	11	11
Tube size		
8.5	5	5
8	32	29
7.5	13	10
7	4	2

Table 2: Duration of intubation and size of tube vs. laryngeal complications.

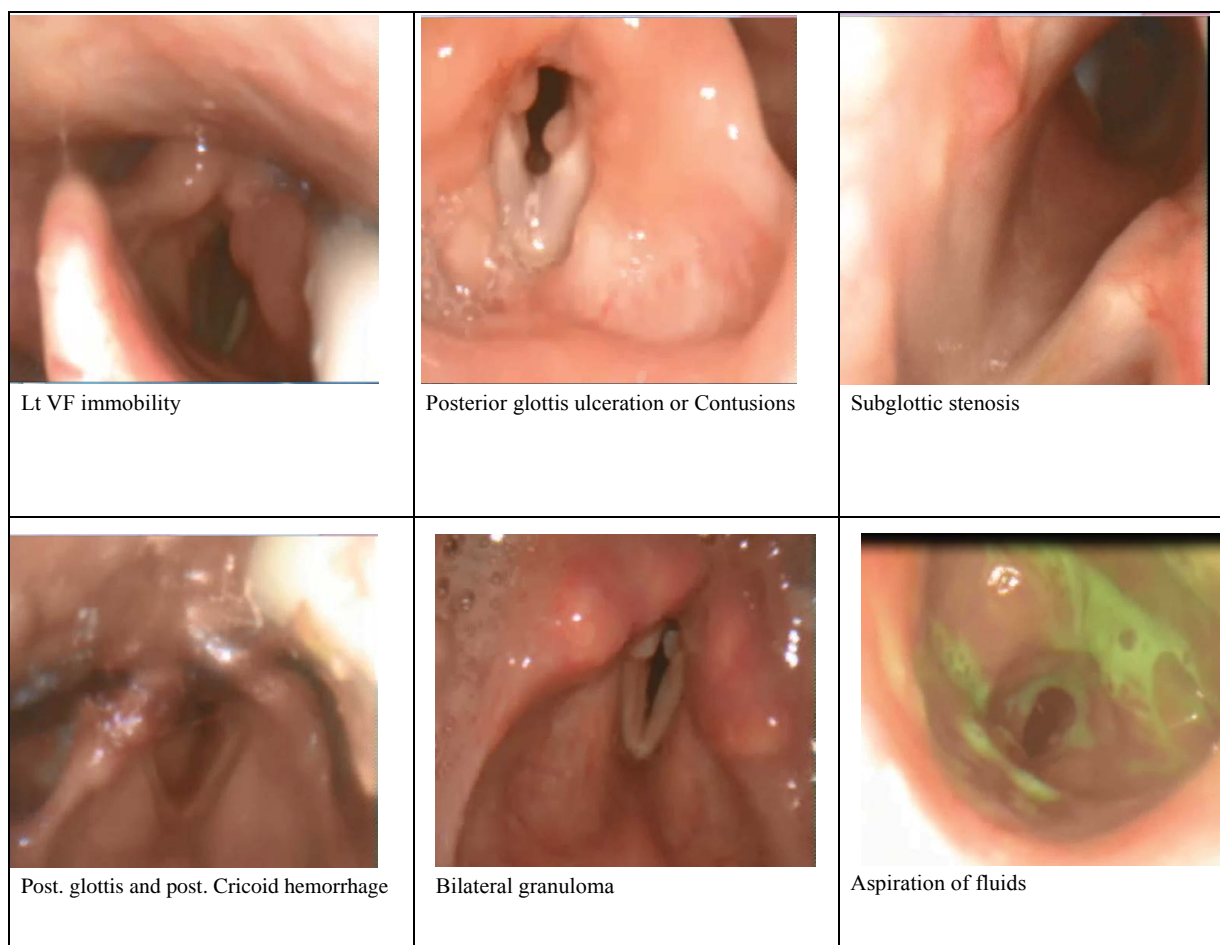


Figure 2: Laryngeal findings after endotracheal intubation.

Table 1 shows different laryngeal findings post extubation and percentage of patients affected. Table 2 shows the relation between duration of intubation and size of endotracheal tube versus laryngeal complications.

Discussion

Fifty four patients were included in the current study. Laryngeal abnormalities were seen in 85% of patients on the day of extubation. The majority of patients (42.6%) had posterior glottal contusions and laceration, followed by vocal fold immobility (25.9%) and subglottal edema (22.2%). Also, subglottic web and stenosis were found in (14.8%). These findings coincide with a study done by Colton et al. [2]. They found forty-one percent of their patients had some degree of vocal fold immobility, 65.6%, had vocal fold edema and 88.5%, and had vocal fold erythema. Subglottic edema/narrowing were found in 13.1 %, vocal process ulceration (34%), vocal process granulation tissue (52.5 %) and vocal fold immobility (39%) (Figure 2).

Also, Rangachari et al. [1] concluded that focal ulceration and/or inflammation can damage the vocal cords and cause granulation tissue and scarring. Arytenoid dislocation and subluxation can result in impaired glottic closure during swallowing.

In the current study, the size of the endotracheal tube was correlated with an increased number of vocal fold injuries compared with the small tube size. Large tubes may exert more compression on the vocal folds and cricoarytenoid joint causing more damage than small tubes. We assume that cricoarytenoid inflammation or dislocation may result in vocal fold immobility. Also, we found that duration of intubation was correlated with an increased number of vocal fold injury.

Various factors related to tube size, cuff pressure, and duration of intubation is postulated to be responsible for the increased incidence of vocal cord immobility. Santos et al. [13], found that patients intubated with tubes larger than 7.5 mm inner diameter had a greater incidence of vocal fold immobility than those with smaller diameters, Matta et al. [3], claimed that a possible etiology for vocal fold immobility resulting from intubation includes recurrent nerve injury from compression. Cavo et al. [14] found the recurrent laryngeal nerve vulnerable to compressive injury between the inflated cuff of the endotracheal tube and the thyroid cartilage.

However, Skoretz et al. [8] mentioned in this cohort duration of intubation, type of endotracheal tube, and size of endotracheal tube did not significantly correlate to the incidence of vocal fold mobility and degree of laryngeal injury noted after prolonged intubation.

In our study, 30 patients were assessed for swallowing difficulty within 24 hours after endotracheal extubation. 20% of the patient assessed for swallowing difficulty showed decreases laryngeal sensation notice by absent vocal folds adductor reflex during vocal folds stimulation. Also about 66% of those patients showed aspiration of fluids and/or soft food after extubation. 80% showed the penetration of food particles in the laryngeal inlet above the vocal folds and 20% of the selected patients showed residue in different laryngeal and pharyngeal areas. Aspiration and penetration were more frequent with thin & thick fluids than soft food. These findings may be attributed to a disturbed conscious level of the patients or due to trauma to the larynx that might disturb the anatomy and physiology of the laryngeal protective mechanisms.

Colton et al., Matta et al., Ellis et al. and Skoretz et al. [2,3,5,8] claimed that incidence of oropharyngeal dysphagia in the form of aspiration has been reported in 3% to 62% of adult patients after endotracheal tubes. They attributed the occurrence of aspiration to focal ulceration and/or inflammation that damage the vocal folds and cause granulation tissue, scarring, arytenoid dislocation and subluxation. The former lesions might resulted in impaired glottic closure during swallowing. Furthermore, impaired swallowing reflex was detected after extubation. Additionally, the recurrent laryngeal nerve can be compressed by the cuff, resulting in vocal fold paralysis [15].

In the current study, silent aspiration was observed in 40% of patients after extubation. The present finding may be explained by diminished laryngeal sensation due to prolonged intubation and the presence of vocal fold immobility in some patients.

Hafner et al. [16] found Silent aspiration or aspiration with acute symptoms (cough or choking as the bolus passed into the trachea) was detected in 69.3% of all patients.

Conclusion

Prolonged laryngeal intubation (more than 48 hours) was associated with different laryngeal injuries. The size of tubes and duration of intubation are correlated with the severity & number of laryngeal lesions. High risk of aspiration was observed after prolonged laryngeal intubation.

Conflict of Interest

None.

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