

(RESEARCH ARTICLE)



## Determining the epidemiological status of patients with tracheal stenosis

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### Abstract

**Introduction:** Tracheal stenosis is a rare, but serious complication that often occurs following tracheal intubation or tracheostomy. This study aimed to evaluate the causes, symptoms, and complications of therapeutic methods in patients with treated tracheal stenosis Analysis.

**Material and methods:** In this descriptive retrospective study, patients who had undergone tracheal stenosis were evaluated for its cause, the cause of endotracheal intubation, the duration of intubation, types of treatment, length of hospital stay, and postoperative complications. 80 patients were included in the study.

**Result and Discussion:** The most common cause of tracheal stenosis was endotracheal intubation (57.5%). Among 41 patients with a history of tracheostomy, 34 patients underwent late tracheostomy and 7 patients underwent early tracheostomy. Recurrence of stenosis was the most common complication of tracheal stenosis treatment (surgery), respectively.

**Conclusion:** The prolonged endotracheal intubation is the most common cause of endotracheal stenosis, therefore, early tracheostomy is recommended to be done on patients with predicted long-term endotracheal intubation.

**Keywords:** Endotracheal Intubation; Tracheostomy; Tracheal Stenosis; Mechanical ventilation; Tracheal

### 1. Introduction

Intubation is one of the primary procedures that is usually operated on patients who are critically ill with respiratory problems; therefore, it can cause changes in the structure of the trachea and in some cases stenosis of the trachea (1). Trauma is one of the most common causes of endotracheal intubation in young and middle-aged people. Various causes such as trauma, infection, benign and malignant tracheal tumors, and prolonged intubation or tracheostomy are involved in the development of tracheal stenosis (2). Various causes such as trauma, infection, benign and malignant tumors of the trachea, and prolonged intubation or tracheostomy are involved in the development of tracheal stenosis (3). The main pathophysiology of endotracheal stenosis is endotracheal intubation, endotracheal tube cuff pressure, chronic inflammation and subsequent fibrosis (4). The best treatment for severe tracheal stenosis is resection and

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tracheal repair (5), but the most important complication of tracheal surgery is postoperative stenosis, the best treatment of which is repeating tracheal resection (6, 7). However, sometimes for various reasons the patient cannot be a suitable candidate to undergo surgery and may need other treatments.

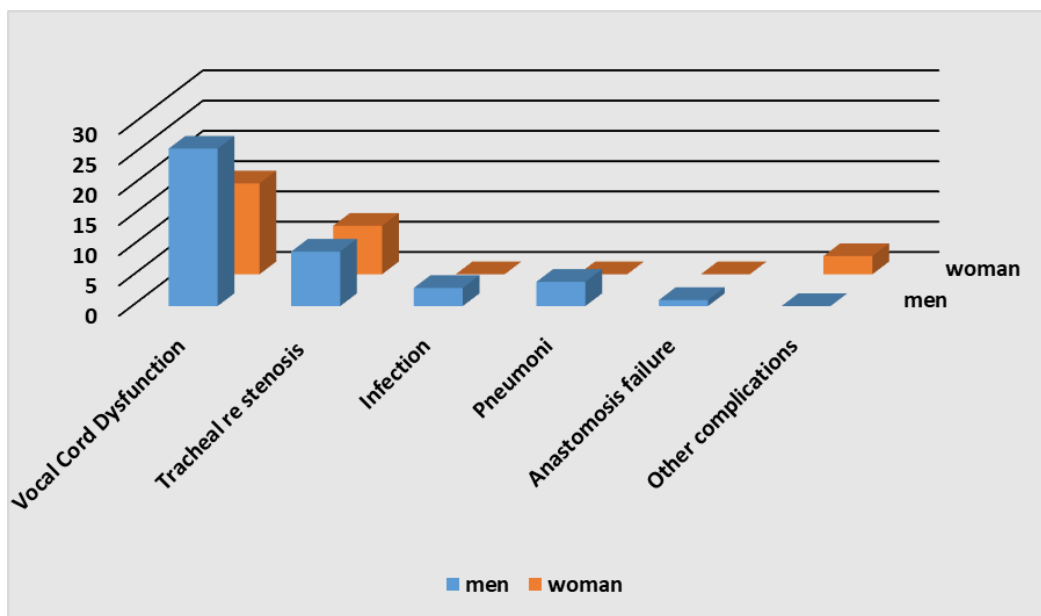
In such cases, several treatments as alternative therapies are recommended, including tracheal stenting (8, 9). Understanding the causes and the treatment complications can surely be effective in controlling and reducing the incidence of tracheal stenosis. The aim of this study was to Determining the epidemiological status of patients with tracheal stenosis.

## 2. Methods and Materials/Patients

In this descriptive retrospective study, the records of 80 patients in 2013 to 2015 who underwent tracheal stenosis treatment in the surgical wards were reviewed. The degree of tracheal stenosis was classified according to Cotton: grade 1, luminal narrowing <50%; grade 2, luminal narrowing 51-70%; grade 3, luminal narrowing 71-99% and grade 4, luminal narrowing 100%. Exclusion criteria were incomplete patient records and inability to follow up on patients who underwent surgery.

**Table 1** Frequency of various treatments performed in 80 patients with tracheal stenosis

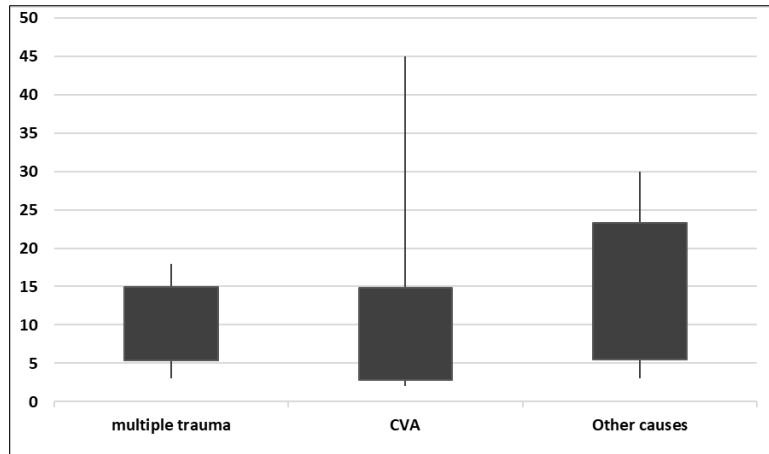
Treatment methods	Number (persons)	Percent%
Bronchoscopy and dilatation	23	28.75
Tracheal resection and anastomosis	52	65
Tracheal resection and anastomosis & re-tracheostomy	3	3.75
Bronchoscopy and dilatation & re-tracheostomy	2	2.5



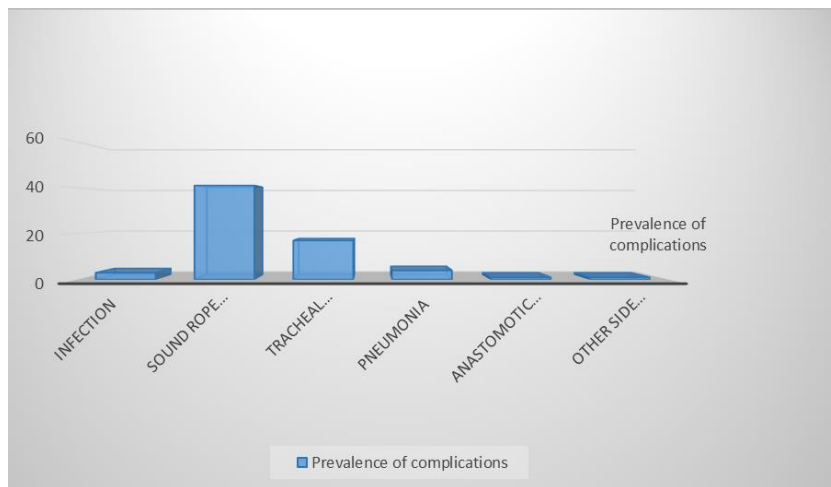
**Figure 1** The frequency of the complications of gender -based treatment

The variables studied in this study include age, gender, cause of tracheal stenosis, cause and duration of endotracheal intubation, history of tracheostomy at the time of referral, time of tracheostomy after intubation, clinical signs of tracheal stenosis, types of treatment, post-operation complications and the general condition of the patient at the time of discharge, which was extracted from the patients' records. This information, as well as their names remained confidential. In this study, data were collected, coded and entered into SPSS 22 software. Mean and standard deviation

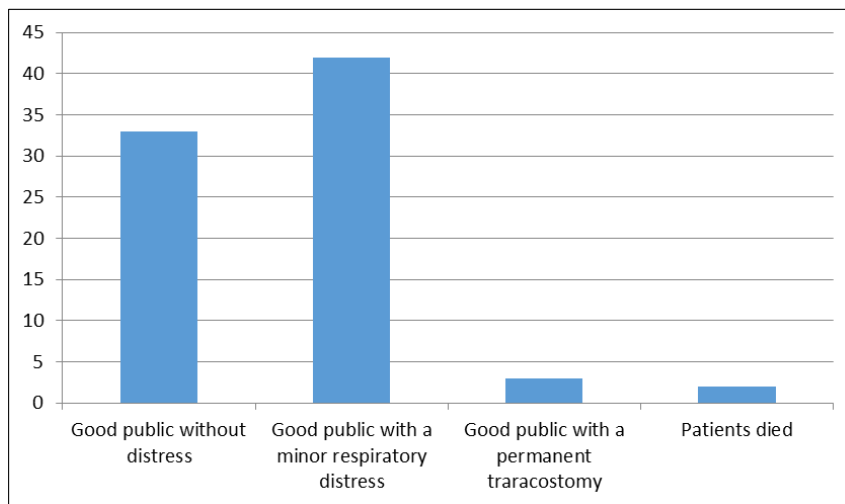
were used to describe quantitative variables with normal distribution and mean and amplitude were used for quantitative variables with abnormal distribution. Qualitative variables were also described based on numbers and percentages. The normal distribution of the study's quantitative variables was also measured using the Kolmogorov-Smirnov test. If necessary, Chi Square and t-test were used to analyze the collected data.



**Figure 2** Duration of hospitalization for the treatment of tracheal stenosis according to the cause of tracheal stenosis



**Figure 3** Frequency of complications after treatment of tracheal stenosis



**Figure 4** Distribution of patients' respiratory status during discharge

### 3. Results

In the present study, 80 patients were included, with 44 (U) male and 36 (E) female. The participants' mean age was  $44.91 \pm 4.06$  years with the younger participant 20 years old and the oldest participant of 79 years. Regarding the causes of tracheal stenosis, 46 patients (57.5%) due to tracheal intubation, 14 patients (17.5%) due to various types of thyroid malignancies and 10 patients (12.5%) due to retrosternal thyroid and goiter, 8 patients (10%) also had tracheal stenosis due to a mass in the trachea or esophagus or mediastinum, two patients (2.5%) due to stenosis due to previous thyroid surgery. In the present study, out of 41 patients who underwent tracheostomy, 34 patients (82.9%) underwent late tracheostomy which was more than 7 days after intubation, and 7 patients (17.1%) underwent early tracheostomy within 7 days. In our study, shortness of breath was the most common symptom of tracheal stenosis (90%), followed by Stridor and Tachypnea with a prevalence of 83.3% and 75%, respectively, which were the most common symptoms in patients with tracheal stenosis. 52 patients (65%) underwent tracheal resection and anastomosis, 23 patients (28.75%) underwent bronchoscopy and dilatation, and 3 patients (3.75%) received bronchoscopy and dilatation procedures, resection and anastomosis and re-tracheostomy. Finally, 2 patients (2.5%) underwent bronchoscopy, dilatation and re-tracheostomy combined (Table 1).

The mean length of hospital stays in patients who were intubated due to multiple trauma was  $10.50 \pm 49.69$  days and this number was  $8.50 \pm 83.98$  days for patients who were intubated due to CVA (Figure 1). The highest treatment complication in patients with vocal cord dysfunction participated was of 41 patients, followed by recurrence of tracheal re stenosis (Figure 2). The most common complication of endotracheal stenosis in the present study was vocal cord dysfunction with a frequency of 51.3% (41 patients), followed by endotracheal stenosis and pneumonia with a frequency of 21.3% and 5% (17 and 4 patients, respectively). They have been the most common side effects of treatment (Figure 3). At the end of the study, 33 patients (40%) were discharged without respiratory distress, 42 patients (52.5%) had slight respiratory distress at discharge. Two patients died of respiratory complications following tracheal resection and 3 patients were discharged with permanent tracheostomy due to continued shortness of breath due to recurrence of tracheal stenosis and impossibility of reconstruction and re-anastomosis of the stenotic area (Figure 4).

### 4. Discussion

The aim of this study was to evaluate the symptoms, causes, complications and therapeutic methods in patients with treated tracheal stenosis. Tracheal stenosis may occur mainly due to internal causes such as stenosis after prolonged intubation or because of external causes like pressure on the trachea by a tumor or thyroid gland (10). In the present study, prolonged intubation with a prevalence of 57/ 5% was the most common cause of stenosis. In the study of Pino et al., the prevalence of tracheal stenosis due to intubation was mentioned as 42.85 (11), but in the study of Ozkol et al., this ratio was mentioned as 85.71% (12). Although both these studies had small sample populations which were in line with various studies, they clearly demonstrated that endotracheal stenosis was the most common cause of endotracheal stenosis after intubation (13). In the present study, shortness of breath was endotracheal stenosis's most common symptom, followed by stridor and tachypnea, respectively. They were the most common symptoms in patients with endotracheal stenosis. In the study of Khosh Sirat, 73.3% of patients with dyspnea, 1.5% with stridor, 1.3% with hoarseness, 1.2% with cyanosis, and 1.5% with cough referred to the hospital (14). Out of 80 patients in our study, 41 patients with history of tracheostomy referred to the hospital. Tracheostomy was done on 34 patients (82.5) seven days after tracheal intubation which was late tracheostomy. Tracheostomy was performed on 7 patients (17.1%) seven days earlier (Early Tracheostomy), which indicates this issue that patients who were tracheostomy candidates for long-term intubation, the frequency of tracheal stenosis in patients with late tracheostomy was higher than patients with early tracheostomy. Previous studies (15, 16) have shown that patients admitted to the ICU who underwent early tracheostomy during the first week of hospitalization compared with patients who underwent late tracheostomy from the eighth day onwards. Cases of pneumonia, duration of mechanical ventilation, duration of hospitalization in the ICU were significantly lower. According to the above findings, the reason for the low frequency of tracheal stenosis in our patients who had premature tracheostomy is related to faster removal of the endotracheal tube, their faster separation from mechanical ventilation and reducing the length of hospital stay in the ICU and consequently it was their faster decanulation of their tracheostomy. For the treatment of tracheal stenosis in cases that cannot be treated with bronchoscopy and dilatation, the best treatment is resection of the affected part and residual anastomosis of the trachea (17) In our study, 23 patients (28.75%) were successfully treated with bronchoscopy and dilatation, and 52 patients (e) were treated with resection and anastomosis, tracheal stenosis. One of the problems of tracheal surgery is postoperative restenosis, the best treatment of which is reoperation and resection and tracheal anastomosis (6, 7) and in our study 3 patients (3.75%) after resection surgery and anastomoses suffered from recurrent stenosis, which underwent re-tracheostomy due to inoperability. Sometimes tracheal surgery and reconstruction are not possible, such as in cases where previous surgery has been associated with a complication and due to insufficient length or tracheomalacia,

tracheal reconstruction is not possible or in patients who for various reasons cannot tolerate major surgery, or In patients with tracheal malignancy and inoperable due to surrounding tissue involvement or distant metastasis. In such cases, various recommended treatment methods, one of which is tracheal stenting(17, 18) .Among our patients, 2 patients (2.5%) underwent tracheostomy to perform the problem of tracheal stenosis after bronchoscopy and unsuccessful dilatation and diagnosis of inoperability. In the present study, the most common treatment complication in patients with vocal cord dysfunction was 51.3% prevalence (41 patients), followed by recurrence of stenosis and pneumonia with a prevalence of 21.3% and 5% (17 and 4 patients, respectively). They had numerous studies performed by physicians have discussed the beneficial effects and complications of tracheal stent in non-malignant tracheal stenosis(19) .

The most extensive study by Oman et al. With 7 years of study on about 200 cases of stenting in benign stenosis using silicone polyfix stents, which due to the complications of this method (granulation tissue - stent displacement - accumulation of secretions and Occurrence of stenosis after stent removal) He considered this method with few complications and recommended for benign stenosis in special cases (20).

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## 5. Conclusion

Prolonged endotracheal intubation is the main cause of endotracheal stenosis. The incidence of tracheal stenosis can be reduced if tracheal tube cuff pressure is controlled, an early tracheostomy is preformed, extubation is done in time, and decanulation of tracheostomy is done in time.

Our retrospective study also shows that the late tracheostomy approach increases the incidence of tracheal stenosis in patients who have long required tracheal intubation, however, for more accurate conclusions, future prospective studies on groups of patients who will have undergone early and late tracheostomy based on the incidence of tracheal stenosis is recommended.

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## Compliance with ethical standards

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### *Disclosure of conflict of interest*

There are no conflicts of interest.

### *Statement of ethical approval*

The study was performed in accordance with the declaration of Helsinki and approved by the Ethics Committee of Guilan

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