Tracheostomy Applications in a Medical Intensive Care Unit: Timing, Indications, and Outcomes

Bir Dahili Yoğun Bakım Ünitesinde Trakeostomi Uygulamaları: Zamanlama, Endikasyonlar ve Sonuçlar

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ABSTRACT

Background: This study aimed to determine the timing, indications, and mortality associated with tracheostomy through the evaluation of the data obtained from a medical ICU.
Materials and Methods: We retrospectively evaluated the data of the patients who underwent tracheostomy at an internal medicine ICU of a university hospital between January 01, 2012, and December 31, 2015. After determining the general characteristics of the patients, we compared the data of the patients who survived or died, underwent percutaneous (PT) or a surgical tracheostomy (ST) and early (ET) or a late tracheostomy (LT).
Findings: A total of 91 patients were included in the study. The median age of the patients was 72 years, tracheostomy was performed on the median 16th day after the ICU admission. Tracheostomy was most commonly performed due to prolonged mechanical ventilation (93.4%). The surgical method was the most commonly preferred tracheostomy technique (79.1%). When the 16 patients (17.6%) who survived tracheostomy were evaluated, they were found to be younger and there was a shorter time between the ICU admission and tracheostomy procedure. This study also demonstrated that the preferred tracheostomy technique (PT or ST) did not affect early or late tracheostomy complications, the length of ICU stay, infection rate, and ICU mortality. Additionally, ET or LT had no effect on ICU mortality, however; patients who underwent ET had a shorter ICU stay.
Conclusions: Tracheostomy is the most common invasive procedure performed in ICUs. However, there is still no consensus regarding the timing and method. An ICU specialist should decide the necessity of tracheostomy based on the patients' needs.

Keywords: Tracheostomy, intensive care unit, timing, method, mortality.

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ÖZET

Amaç: Bu çalışmanın amacı, bir iç hastalıkları yoğun bakım ünitesinin verilerini değerlendirerek trakeostomi ile ilişkili zamanlamayı, endikasyonları ve mortaliteyi belirlemektir.
Gereç ve Yöntem: 01 Ocak 2012 ve 31 Aralık 2015 tarihleri arasında bir üniversite hastanesi iç hastalıkları yoğun bakım ünitesinde (YBÜ) trakeostomi açılan hastaların verileri retrospektif olarak değerlendirildi. Hastaların genel özelliklerini belirledikten sonra hastalar hayatta kalan veya ölen, perkütan (PT) veya cerrahi trakeostomi (CT) açılan ve erken (ET) veya geç trakeostomi (GT) uygulanan hastalar olarak gruplandırılarak karşılaştırıldı.
Bulgular: Çalışmaya toplam 91 hasta dahil edildi. Hastaların ortanca yaşı 72 idi. Trakeostomi YBÜ'ye kabul edildikten sonra medyan 16. günde açıldı. Trakeostomi en sık uzamış mekanik ventilasyon (% 93.4) nedeniyle açıldı. Cerrahi yöntem en sık tercih edilen trakeostomi tekniğiydi (%79.1). Hayatta kalan 16 trakeostomi hastası (% 17.6) değerlendirildiğinde, bu hastalar daha gençti ve YBÜ'ye kabul ile trakeostomi arasındaki süre daha kısa idi. Bu çalışmada ayrıca tercih edilen trakeostomi tekniğinin (PT veya CT) erken veya geç trakeostomi komplikasyonlarına, YBÜ'de kalış süresine, enfeksiyon oranına ve YBÜ mortalitesine etkisi yoktu. Ek olarak, ET veya GT'nin YBÜ mortalitesi üzerinde hiçbir etkisi olmadığı, ancak ET yapılan hastaların daha kısa YBÜ kalışları olduğu gözlendi.
Sonuç: Trakeostomi YBÜ'lerde sık uygulanan bir invaziv prosedürdür. Bununla birlikte, zamanlama ve yöntem hakkında kesin bir fikir birliği yoktur. Trakeostomi kararının YBÜ uzmanı tarafından hasta bazında alınması gerekir.

Anahtar Sözcükler: Trakeostomi, yoğun bakım ünitesi, zamanlama, metod, mortalite

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INTRODUCTION

Tracheostomy is a surgical procedure in which a temporary or permanent opening into the trachea through the anterior surface of the neck is performed so that a special cannula or intubation tube can be placed to maintain the airway opening. Tracheostomy is basically indicated for the by-passing upper airway to maintain the airway patency, shortening the airway length and cleaning the secretions, and hence reducing the airway resistance, dead space, and work of breathing (1). Additionally, tracheostomy is opened in patients who require prolonged invasive mechanical ventilation support to avoid the destructive effects of intubation tubes on the vocal cords, tracheal walls, and even mouth and facial dermal tissue, and to help nursing care. Tracheostomy decreases risks of self-extubation and malposition of endotracheal tubes, and sedation requirements, and facilitates nursing care, aspiration of the respiratory tract and oral feeding (1,2). A tracheostomy provides better oral hygiene and early mobilization of the patient with a secure airway, helps restore speech early, facilitates liberation from mechanical ventilation, reduces the incidence of ventilator-associated pneumonia (VAP), and shortens the length of ICU stay (1-3).

Surgical tracheostomy (ST) is mostly performed by surgeons, particularly otolaryngologists, while percutaneous tracheostomy (PT) is performed by the departments of anesthesiology and reanimation or ICU specialists. PT is a less time-consuming bedside procedure and more cost-effective. Better scar tissue and less bleeding are among other expected positive outcomes (4,5). PT techniques that are currently used are the classical Ciaglia (sequential dilatation), the Griggs (forceps dilatation) (GFD), the Ciaglia Blue Rhino (CBR) (one-step dilatation) and the PercuTwist (controlled rotating dilatation) methods, etc., however, it is still not determined which one is superior to the others for routine use (6,7). Early and late complications for tracheostomy are common in both ST and PT. These are pneumothorax, pneumomediastinum, subcutaneous emphysema; tube malposition, obstruction or dislocation of the tube or cuff, infection; tracheoesophageal fistula, tracheo-cutaneous fistula, tracheomalacia; dysphagia and difficult decannulation (3,8).

This study aimed to evaluate the timing, indications, methods, complications, and outcomes in patients who underwent tracheostomy in an internal medicine ICU of a university hospital.

MATERIALS and METHODS

In this study, the retrospective data of patients who underwent tracheostomy in the internal medicine ICU of Gazi University hospital between January 01, 2012, and December 31, 2015, were evaluated. Data were obtained from the patients' epicrisis, daily follow-up forms, and the hospital information management system.

We evaluated the patients' demographic data (age, sex, etc.), co-morbidities, reasons for ICU admission; disease severity scores (Acute Physiology and Chronic Health Evaluation-APACHE II, Glasgow Coma Scale-GCS, and Sequential Organ Failure Assessment-SOFA), length of ICU stay; and the data of tracheostomy procedure (timing-early or late; location-performed at the bedside or in the operation room; method-surgical or percutaneous; indications; complications-early or late, and outcomes -weaning from mechanical ventilation, development of sepsis or pneumonia, ICU mortality, etc.).

The study was approved by the Clinical Research Ethics Committee of Gazi University (Date: December 28, 2015, and Decision Number: 172) and was conducted according to the Declaration of Helsinki and Good Clinical Practice.

Statistical Analysis

Data were analyzed using the SPSS software package program version 22.0. All data were initially analyzed using descriptive statistics. Continuous variables were presented as median and interquartile ranges, and categorical variables were expressed in frequencies and percentages. Later, the tracheostomy patients were divided into subgroups according to the technique (surgical or percutaneous), timing (early or late), and outcome (survived and died), and the variables were compared between the subgroups. The Mann-Whitney U-test was used for the pairwise comparison of continuous variables and the Chi-square test for the comparison of categorical variables. A p-value < 0.05 was accepted as statistically significant.

RESULTS

The study included 91 patients who underwent tracheostomy. The median age of the patients was 72 (IQR 58-80) years. Of them, 50.5% (46) were male. The patients were most commonly admitted to our ICU due to respiratory failure (79.1%) and sepsis/septic shock (64.8%). Tracheostomy was performed in a median 16 days (IQR 12-24) after the ICU admission and median 15 days (IQR 12-21) after invasive mechanical ventilation. Seventy-two patients (79%) underwent ST performed by the otolaryngologists and 19 patients underwent PT performed by the ICU physicians. All PTs were performed using the Griggs (forceps dilatation) method. The most common indication for tracheostomy was prolonged mechanical ventilation (93.4%). Tracheostomy was performed at the bedside for 70 patients (76.9%), while it was performed in the operation room for 20 patients (22%). The most common early complication after tracheostomy was bleeding (21 patients, 23.1%), while the most common late complication was stoma infection (8 patients, 8.8%).

When the patients were evaluated regarding the tracheostomy techniques, it was observed that the patients in the PT group had more central nervous system (CNS) pathologies (36.8% vs. 13.9%, p= 0.042) than those in the ST group. All PTs were performed at the bedside in ICU. These two groups did not have significant differences in terms of the timing of tracheostomy, the early or late complications, and ICU mortality (Table 1).

Table 1: General characteristics of the ICU patients who underwent surgical or percutaneous tracheostomy

Parameters	All study patients (n:91)	Surgical tracheostomy (ST) (n:72)	Percutaneous tracheostomy (PT) (n:19)	p values
Gender (Male) (n,%)	46 (50.5)	34 (47.2)	12 (63.2)	0.217
Age (year) Median [interquartile range]	72 [58-80]	72 [60-79.5]	69 [54-81]	0.491
APACHE II score at ICU admission Median [interquartile range]	25 [21-30]	26 [21-30]	23 [17-31]	0.376
GCS at ICU admission Median [interquartile range]	9 [7-13]	9 [7-13]	9 [6-11]	0.202
SOFA score at ICU admission Median [interquartile range]	8 [6-11]	9 [6-12]	7 [6-10]	0.075
Duration between ICU admission and tracheostomy procedure (day) Median [interquartile range]	16 [12-24]	15.5 [12.25-25.75]	16 [12-26]	0.984
Duration between IMV initiation and tracheostomy procedure (day) Median [interquartile range]	15 [12-21]	15 [12-21.75]	15.5 [11-19]	0.642
Length of ICU stay (day) Median [interquartile range]	39 [28-62]	39.5 [28-63.5]	37 [24-51]	0.615
Co-morbidities (n,%)				
Diabetes Mellitus	38 (41.8)	32 (44.4)	6 (31.6)	0.312
Hypertension	56 (61.5)	45 (62.5)	11 (57.9)	0.714
CAD/CHF	39 (42.9)	32 (44.4)	7 (36.8)	0.551
Cancer	29 (31.9)	24 (33.3)	5 (26.3)	0.559
Reason for ICU admission (n,%)				
Respiratory failure	72 (79.1)	56 (77.8)	16 (84.2)	0.753
Sepsis/septic shock	59 (64.8)	47 (65.3)	12 (63.2)	0.863
CNS pathology	17 (18.7)	10 (13.9)	7 (36.8)	**0.042**
Opening place of tracheostomy (n,%)				
Operation room	20 (22)	20 (27.8)	0 (0)	**0.005**
At the bedside in ICU	70 (76.9)	51 (70.8)	19 (100)	
Tracheostomy indication (n,%)				
Prolonged IMV	85 (93.4)	68 (94.4)	17 (89.5)	0.601
Security of airway	6 (6.6)	4 (5.6)	2 (10.5)	
Complications of the tracheostomy (n,%)				
Early complication	25 (27.5)	22 (30.6)	3 (15.8)	0.460
Late complication	9 (9.9)	8 (11.1)	1 (5.3)	1
VAP after tracheostomy (n,%)	55 (60.4)	41 (56.9)	14 (73.7)	0.454
Sepsis/septic shock after tracheostomy (n,%)	47 (51.6)	36 (50)	11 (57.9)	0.540
ICU mortality (n,%)	75 (82.4)	59 (81.9)	16 (84.2)	0.886

APACHE: Acute Physiology and Chronic Health Evaluation; GCS: Glasgow Coma Scale; SOFA: Sequential Organ Failure Assessment; ICU: Intensive Care Unit; IMV: Invasive mechanical ventilation; CAD/CHF: Coronary artery disease / Congestive Heart Failure; CNS: Central Nervous System; VAP: Ventilator associated pneumonia; n: number

When the patients' timing of tracheostomy was evaluated, it was revealed that the length of ICU stay was shorter in the early tracheostomy group (median 33.5 days vs. 48 days, p= 0.01) than the late ones.

The early and late tracheostomy groups did not have significant differences in terms of demographic data, the tracheostomy technique, complication rate, and ICU mortality (Table 2).

Table 2: General characteristics of the patients who were performed early (within the 14 days after ICU admission) or late (15 days or later after ICU admission) tracheostomy

Parameters	All study patients (n:91)	Early tracheostomy group (n:42)	Late tracheostomy group (n:49)	p values
Gender (Male) (n,%)	46 (50.5)	24 (57.1)	22 (44.9)	0.244
Age (year) Median [interquartile range]	72 [58-80]	71 [57.5-78]	73 [60-81]	0.527
APACHE II score at ICU admission Median [interquartile range]	25 [21-30]	26 [21-32.25]	25 [19-30]	0.229
GCS at ICU admission Median [interquartile range]	9 [7-13]	9 [7-14]	9 [7-12]	0.974
SOFA score at ICU admission Median [interquartile range]	8 [6-11]	8 [6-11.25]	9 [6-11.5]	0.551
Duration between ICU admission and tracheostomy procedure (day) Median [interquartile range]	16 [12-24]	13 [9.75-15]	22 [16-29.5]	**0.0001**
Duration between IMV initiation and tracheostomy procedure (day) Median [interquartile range]	15 [12-21]	11 [8-13]	21 [17-26.5]	**0.0001**
Length of ICU stay (day) Median [interquartile range]	39 [28-62]	33.5 [23-53.25]	48 [30-71.5]	**0.01**
Co-morbidities (n,%)				
Diabetes Mellitus	38 (41.8)	20 (47.6)	18 (36.7)	0.294
Hypertension	56 (61.5)	26 (61.9)	30 (61.2)	0.947
CAD/CHF	39 (42.9)	20 (47.6)	19 (38.8)	0.395
Cancer	29 (31.9)	16 (38.1)	13 (26.5)	0.238
Reason for ICU admission (n,%)				
Respiratory failure	72 (79.1)	32 (76.2)	40 (81.6)	0.524
Sepsis/septic shock	59 (64.8)	28 (66.7)	31 (63.3)	0.735
CNS pathology	17 (18.7)	10 (23.8)	7 (14.3)	0.245
Method of tracheostomy (n,%)				
Surgical	72 (79.1)	33 (78.6)	39 (79.6)	0.905
Percutaneous	19 (20.9)	9 (21.4)	10 (20.4)	
Opening place of tracheostomy (n,%)				
Operation room	20 (22)	11 (26.2)	9 (18.4)	0.336
At the bedside in ICU	70 (76.9)	30 (71.4)	40 (81.6)	
Tracheostomy indication (n,%)				
Prolonged IMV	85 (93.4)	37 (88.1)	48 (98)	0.091
Security of airway	6 (6.6)	5 (11.9)	1 (2.0)	
Complications of the tracheostomy (n,%)				
Early complication	25 (27.5)	10 (23.8)	15 (30.6)	0.452
Late complication	9 (9.9)	4 (9.5)	5 (10.2)	0.444
VAP after tracheostomy (n,%)	55 (60.4)	25 (59.5)	30 (61.2)	0.869
Sepsis/septic shock after tracheostomy (n,%)	47 (51.6)	20 (47.6)	27 (55.1)	0.476
ICU mortality (n,%)	75 (82.4)	32 (76.2)	43 (87.8)	0.149

APACHE: Acute Physiology and Chronic Health Evaluation; GCS: Glasgow Coma Scale; SOFA: Sequential Organ Failure Assessment; ICU: Intensive Care Unit; IMV: Invasive mechanical ventilation; CAD/CHF Coronary artery disease / Congestive Heart Failure; CNS: Central Nervous System; VAP: Ventilator associated pneumonia; n: number

Of the patients, 75 (82.4%) died in median 39 days (IQR 28-62) after the ICU admission. The comparison of surviving and deceased tracheostomy patients revealed that the surviving patients were younger (61 years vs. 73 years, p= 0.017). Additionally, the time between ICU admission and tracheostomy procedure was shorter in the patients who survived (12.5 days vs. 16 days, p= 0.01). The surviving tracheostomy patients were more likely to have an underlying CNS pathology (CVA, trauma, intracranial mass, brain hypoxia, etc.) compared to the patients who died (43.8% vs. 13.3%, p= 0.01). Tracheostomy was more commonly performed to secure the airway (25% vs. 2.7%, p= 0.008) in those who survived. Also, the rate of sepsis after tracheostomy was lower in the surviving patients (25% vs. 57.3%, p= 0.019). However, the surviving and deceased tracheostomy patients were not statistically different in terms of the preferred tracheostomy technique or the associated complications (Table 3).

Table 3: General characteristics of the surviving or deceased ICU patients who underwent tracheostomy

Parameters	All study patients (n:91)	Survivors (n:16)	Non-survivors (n:75)	p values
Gender (Male) (n,%)	46 (50.5)	8 (50)	38 (50.7)	0.961
Age (year) Median [interquartile range]	72 [58-80]	61 [42.25-76.5]	73 [60-81]	**0.017**
APACHE II score at ICU admission Median [interquartile range]	25 [21-30]	23.50 [19.5-27.75]	26 [21-31]	0.337
GCS at ICU admission Median [interquartile range]	9 [7-13]	7 [6-10.5]	9 [8-13]	0.106
SOFA score at ICU admission Median [interquartile range]	8 [6-11]	6.5 [6-9]	9 [6-12]	0.150
Duration between ICU admission and tracheostomy procedure (day) Median [interquartile range]	16 [12-24]	12.5 [9.25-17.75]	16 [13-26]	**0.010**
Duration between IMV initiation and tracheostomy procedure (day) Median [interquartile range]	15 [12-21]	13 [10.25-17.5]	16 [12-22.25]	0.081
Length of ICU stay (day) Median [interquartile range]	39 [28-62]	36.5 [23.25-82]	39 [29-61]	0.839
Co-morbidities (n,%)				
Diabetes Mellitus	38 (41.8)	5 (31.3)	33 (44)	0.348
Hypertension	56 (61.5)	7 (43.8)	49 (65.3)	0.107
CAD/CHF	39 (42.9)	5 (31.3)	34 (45.3)	0.301
Cancer	29 (31.9)	6 (37.5)	23 (30.7)	0.571
Reason for ICU admission (n,%)				
Respiratory failure	72 (79.1)	13 (81.8)	59 (78.7)	1
Sepsis/septic shock	59 (64.8)	9 (56.3)	50 (66.7)	0.614
CNS pathology	17 (18.7)	7 (43.8)	10 (13.3)	**0.010**
Method of tracheostomy (n,%)				
Surgical	72 (79.1)	13 (81.3)	59 (78.7)	1
Percutaneous	19 (20.9)	3 (18.8)	16 (21.3)	
Opening place of tracheostomy (n,%)				
Operation room	20 (22)	4 (25)	16 (21.3)	0.735
At the bedside in ICU	70 (76.9)	11 (68.8)	59 (78.7)	
Tracheostomy indication (n,%)				
Prolonged IMV	85 (93.4)	12 (75)	73 (97.3)	**0.008**
Security of airway	6 (6.6)	4 (25)	2 (2.7)	
Complications of the tracheostomy (n,%)				
Early complication	25 (27.5)	2 (12.6)	23 (30.7)	0.376
Late complication	9 (9.9)	2 (12.6)	7 (9.3)	1
VAP after tracheostomy (n,%)	55 (60.4)	11 (68.8)	44 (58.7)	0.454
Sepsis/septic shock after tracheostomy (n,%)	47 (51.6)	4 (25)	43 (57.3)	**0.019**

APACHE: Acute Physiology and Chronic Health Evaluation; GCS: Glasgow Coma Scale; SOFA: Sequential Organ Failure Assessment; ICU: Intensive Care Unit; IMV: Invasive mechanical ventilation; CAD/CHF: Coronary artery disease / Congestive Heart Failure; CNS: Central Nervous System; VAP: Ventilator associated pneumonia; n: number

Of the surviving 16 patients, six were liberated from mechanical ventilation, and four were discharged after closing the tracheostomy stoma. Eight patients with tracheostomy were transferred to palliative care centers.

The remaining four patients were discharged to their homes with tracheostomy and home mechanical ventilation.

DISCUSSION

The general indications of tracheostomy include overcoming upper airway obstructions, maintaining pulmonary hygiene and tracheal access for long-term positive-pressure ventilation, improving the respiratory mechanism of the patients, helping to liberate from mechanical ventilation, and securing the airway of the patients with prolonged coma after neurological trauma or surgery (1-3).

The main indication of tracheostomy is particularly prolonged mechanical ventilation in ICU patients. Vargas et al. found that the most common indication of tracheostomy was prolonged mechanical ventilation (53.7%) and 4.3% of the patients underwent tracheostomy to secure the airway (9). In their study, Fischler et al. reported that in 90% of cases, prolonged mechanical ventilation was an indication for tracheostomy (10). In the present study, 85 patients (93.4%) underwent tracheostomy due to prolonged ventilation, while it was performed to secure the airway in six patients (6.6%). Our study findings were in line with the literature.

Today, PT techniques are the preferred procedures for tracheostomy applications due to their many advantages such as lower stoma infection, less bleeding, superior fitting of the tube due to the presence of soft tissue around the tube; being applicable at the bedside, and the reduced cost (5-7,11). In their study conducted in England, Krishnan et al. found that the rate of PT was 95% for all tracheostomies, and the most commonly used PT technique was the one-step dilatation method (12). Marchese et al. evaluated data from numerous respiratory ICUs in Italy and found that PT was more commonly preferred than ST (13). One study concerning tracheostomy applications in the ICUs in the Netherlands found that ST used to be more common (65.5%) but was recently replaced by percutaneous techniques (61.8%) and that the most commonly used percutaneous technique was the multiple dilatation method (14). In our study, PT was performed in 19 of 91 patients (20.9%). Our choice of the percutaneous technique was the Griggs method. Despite the many advantages of PT demonstrated by numerous studies, PT was less used in our ICU. The preference of ICU physicians, their experiences in PT, the characteristics of the patients (overweight, short neck, a history of neck surgery, etc.) could have caused the less use of PT in our study. However, as intensive care subspecialty residents started to train in our ICU since 2013, the use of PT became more common.

There is no consensus on the optimal timing of tracheostomy in the literature. Blot et al. indicated that the median time of tracheostomy was 20 [14-30] days (15). Vargas et al. stated that tracheostomy was most commonly applied between the days 7-15 (54.4%) (9). Veenith et al. reported that 71% of the patients underwent tracheostomy in the 6th-10th days (16). Cheung et al. found that the median timing of tracheostomy was 9 days [5-14] (17). Yeniaras et al. reported that 64.6% of tracheostomy patients underwent tracheostomy 4-10 days after intubation (18). In our study, the median timing of tracheostomy was 16 days [12-24] after ICU admission and 15 days [12-21] after the initiation of invasive mechanical ventilation. Compared to other studies, the timing of the tracheostomy in our study was in line with the literature.

Although there is still no conclusive evidence regarding the optimal timing of tracheostomy in the literature, some studies show that early tracheostomy reduced the mortality of the patients, while several other studies demonstrate that it was ineffective. Rumbak et al. found that the mortality rate was lower in the group who underwent early tracheostomy (first 48 hours) compared to the group who underwent late (14-16 days, prolonged intubation) tracheostomy (19). The SETPOINT study reported that among the patients who were treated in the neurology/neurosurgery ICU, those who underwent early tracheostomy (1-3 days after intubation) had significantly less ICU and six-month mortality rates compared to patients who underwent late tracheostomy (7-14 days after intubation) (20). The TracMan randomized trial by Young et al. found that early (within 4 days) or late (after 10 days) tracheostomy did not significantly affect 30-day, one-year, and two-year mortality rates (21). Gomes Silva et al. indicated that there was no evidence suggesting early (2-10 days after intubation) or late (>10 days after intubation) tracheostomy changed mortality rates in the ICU patients under prolonged mechanical ventilation support (22).

Due to these and other similar studies, the tracheostomy guideline for ICU patients published in 2017 stated that despite decreasing short-term mortality, early tracheostomy was not effective in decreasing long-term mortality (23). In the present study, the median duration between ICU admission and tracheostomy was shorter in the surviving patients (12.5 [9.25-17.75] days vs.16 [13-26] days, p = 0.01) than those who died.

However, when we moved the timing threshold of tracheostomy to the second week and statistically evaluated the results, it was observed that the morbidity and mortality outcomes of the patients that underwent tracheostomy within the 14 days or on 15 days or later were not significantly different.

As in any invasive procedure, complications can be also observed in tracheostomy (4,8). Vargas et al. reported that 66.9% of their patients developed bleeding, 0.4% developed pneumothorax in the early post-tracheostomy period, and 33.1% developed stoma infections in the late post-tracheostomy period (9). Krishnan et al. reported bleeding in 70% of their patients, subcutaneous emphysema in 20%, and pneumothorax in 2% [12].

Fischler et al. reported that the early complication rate of the tracheostomy was 13% and that among these patients, 40% experienced bleeding, 9% pneumothorax, and 18% local infection (which was also considered an early complication) (10). Cheung et al. reported that the overall complication rate was 60.7% for 4776 patients that underwent tracheostomy (17). In our study, 34 patients (37.4%) who underwent tracheostomy developed complications. In the early post-tracheostomy period, 21 patients (23.1%) developed bleeding, and three patients (3.3%) pneumothorax. In the late post-tracheostomy period, 8 patients (8.8%) developed stoma infections. When compared to the literature, the complication rate was low in our tracheostomies. This might be related to the retrospective nature of the study, mild bleeding might have not been recorded by the doctors and nurses or because ST commonly was performed, bleeding control might have been better during this procedure. The reason for observing less late tracheostomy complications in our study might be due to our high ICU mortality rate or not following patients after ICU discharge.

Cheung et al. reported that the mean length of ICU stay of the patients with a tracheostomy was 24.3 ± 20.7 days (17). Dempsey et al. evaluated data from 589 patients from both surgical and medical ICUs and found that the average length of ICU stay was 18 days (3-68) for the patients that died and 20 days (4-92) for the patients that survived (24). In our study, the median length of ICU stay for tracheostomy patients was 39 days [28-62]. The length of ICU stay was not significantly different for patients that survived or died (36.5 days [23.25-82] vs. 39 days [29-61], p= 0.839). However, the length of ICU stay was significantly shorter in patients who underwent early tracheostomy compared to late ones (33.5 days [23-53.25] vs. 48 days [30-71.5], p= 0.01). The length of ICU stay was considerably long for our patients who underwent tracheostomy. Several reasons can explain such a finding. Firstly, medical care of these patients was difficult, hence they were not transferred to the ward or not discharged home because of the unwillingness of their relatives or medical staff. Secondly, because of the scarcity of palliative care centers, these patients could not be transferred to these centers or they experienced reinfection while waiting to transfer.

Some studies showed that tracheostomy was associated with a decreased risk of nosocomial pneumonia, while several studies supported that tracheostomy caused bacterial colonization in the tracheobronchial tree and increased the risk of pneumonia. Nseir et al. found that tracheostomy was associated with a low prevalence of VAP (25). Xie et al. suggested that tracheostomy was an independent risk factor for VAP development (26). Alp et al. demonstrated a seven-fold increase in the risk of developing nosocomial pneumonia in patients with tracheostomy (27). The most relevant factor for this disagreement in the literature is the timing difference for tracheostomy in the different centers. Moreover, this disagreement could be attributed to the variations of definitions of pneumonia, sepsis, septic shock, and the related diagnostic criteria in the studies. Of the patients in our study, 50 (60.4%) developed ventilator-associated pneumonia, and 47 (51.6%) sepsis/septic shock after tracheostomy. Sepsis/septic shock was significantly more common in tracheostomy patients who died (57.3% vs. 25%, p= 0.019). However, there was no relationship between the tracheostomy technique (ST vs PT) or the timing of tracheostomy and the frequency of VAP or sepsis/septic shock.

Marchese et al. reported that the ICU mortality rate was 10% in patients with tracheostomy, 49% of the patients were liberated from mechanical ventilation, and the tracheostomy stoma was closed in 22% (13).

Engoren et al. reported that 57% of their patients with tracheostomy were liberated from mechanical ventilators, the tracheostomy stoma was closed in 30% and the mortality rate was 19% (28). Cheung et al. reported that the mortality rate was 20.6% in their patients with tracheostomy (17). Taş et al. found that the rate of ICU mortality was 73.1% in patients with tracheostomy (29). In our study, the mortality rate in patients who underwent tracheostomy was 82.4%, and higher than the similar studies.

This higher mortality rate might be related to the characteristics of the patients (age, co-morbidities, the reason for ICU admission, etc.) and the extended duration of ICU stay (recurrent infections, ICU complications). In our study, 16 patients survived after tracheostomy and were discharged from ICU. Four of them were discharged to home after weaning from mechanical ventilation and closing the tracheostomy stoma. Eight patients with tracheostomy were transferred to palliative care centers. The remaining four patients were discharged to home with tracheostomy and home mechanical ventilation after their caregivers received the necessary training.

We would also like to mention two more important data about ICU mortality in our study. One of them is the relationship between the mortality of patients with tracheostomy and age.

As observed in the studies by Engoren et al. and by Kurek et al. (28,30), we reported in our study that mortality rate of the patients with tracheostomy increased with age (median age 61 years in the patients who survived vs. median age 73 years in the patients who died, p= 0.017). This result could be related to functional status, primary diagnosis, and concomitant diseases; apart from the tracheostomy procedure. Another data is that, as it was also reported in the study by Engoren et al. (28), we found that the patients who underwent tracheostomy and survived had more CNS pathology (43.8% vs 13.3%, p= 0.01). This result could be attributed to the fact that these patients were younger and healthy before they were hospitalized.

The present study had several limitations. The study was retrospective and single-center with few patients. The retrospective nature of this study might have caused an incomplete collection of data. The findings of this study cannot be generalized due to its single-centered design and a small number of patients. However, it could be a guide for other local or multicenter studies by presenting tracheostomy data of a medical ICU.

To conclude, tracheostomy is an invasive procedure frequently performed in ICUs. However, there is still no consensus about the timing and method of tracheostomy. The timing of tracheostomy should be decided by the ICU specialist after evaluating the patients and their clinical condition. Therefore, this application should be carried out by experienced physicians, followed up closely, and closed quickly when no longer needed.

Conflict of interest

No conflict of interest was declared by the authors.

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