Research Article / Araştırma Makalesi
doi: 10.18678/dtfd.1350474

Duzce Med J, 2023;25(3):273-278
Düzce Tıp Fak Derg, 2023;25(3):273-278

Classical Blind Percutaneous Dilatational Tracheostomy vs Fiberoptic Bronchoscopy Guided Percutaneous Dilatational Tracheostomy in the Intensive Care Unit: Complications, Mortality, and Outcomes

Yoğun Bakım Ünitesinde Fiberoptik Bronkoskopi Kılavuzluğunda Perkütan Dilatasyonel Trakeostomiye Karşı Klasik Kör Perkütan Dilatasyonel Trakeostomi: Komplikasyonlar, Mortalite ve Sonuçlar

Kadir ARSLAN
0000-0003-4061-0746
Ebru KAYA
0000-0002-9506-0756
Ayça Sultan ŞAHİN
0000-0002-7765-5297

Anesthesiology and Reanimation Clinic, University of Health Sciences Kanuni Sultan Süleyman Training and Research Hospital, İstanbul, Türkiye

Corresponding Author
Sorumlu Yazar
Kadir ARSLAN
kadir.arslan@sbu.edu.tr

Received / Geliş Tarihi : 29.08.2023
Accepted / Kabul Tarihi : 10.11.2023
Available Online / Çevrimiçi Yayın Tarihi : 30.11.2023

ABSTRACT

Aim: This study aimed to compare percutaneous dilatational tracheostomy (PDT) procedures performed with fiberoptic bronchoscopy (FOB) guidance and classical blind technique regarding complications, mortality, and patient outcomes.

Material and Methods: This study included 62 patients receiving mechanical ventilator support in the intensive care unit (ICU) between October 2022 and June 2023. Patients were randomized into two groups: those who underwent FOB-guided PDT (group FOB, n=31) and those who underwent PDT with the classical blind technique (group C, n=31). Demographic data, clinical characteristics, PDT procedure times, complications, and mortalities were analyzed.

Results: The median age was 64 (range, 19-94) years, and 67.7% (n=42) of the patients were male. Demographic data were found similar between groups. The most common primary diagnosis in patients who underwent PDT was intracranial hemorrhages (32.3%, n=20). While the median tracheostomy opening time in the entire study group was 13 (range, 3-31) days, there was no significant difference between the groups (p=0.637). The mean PDT procedure time (9.6±3.8 vs 12.6±5.4 min, p=0.015), median ICU stay (26 vs 37 days, p=0.004), and complication rate (6.4% vs 25.8%, p=0.038) were found to be significantly lower in group FOB. While the 28-day mortality in the entire study group was 17.7% (n=11), there was no significant difference between the groups (p=0.740).

Conclusion: In PDT procedures performed under FOB guidance, procedure time, length of stay in the ICU, and procedure-related complication rates were significantly lower, while no significant difference was observed in terms of mortality.

Keywords: Tracheostomy; bronchoscopy; intensive care unit; mechanical ventilation; ventilator weaning.

ÖZ

Amaç: Bu çalışmanın amacı, fiberoptik bronkoskopi (FOB) kılavuzluğu ile klasik kör teknikle gerçekleştirilen perkütan dilatasyonel trakeostomi (PDT) işlemlerinin komplikasyonlar, mortalite ve hasta sonuçları açısından karşılaştırılmasıdır.

Gereç ve Yöntemler: Bu çalışmaya Ekim 2022 ile Haziran 2023 tarihleri arasında yoğun bakım ünitesinde (YBÜ) mekanik ventilatör desteği alan 62 hasta dahil edildi. Hastalar FOB kılavuzluğunda PDT gerçekleştirilenler (grup FOB, n=31) ve klasik kör teknikle PDT gerçekleştirilenler (grup C, n=31) olarak iki gruba randomize edildi. Demografik veriler, klinik özellikler, PDT işlem süreleri, komplikasyonlar ve mortaliteler analiz edildi.

Bulgular: Ortanca yaş 64 (aralık, 19-94) yıl ve hastaların %67,7'si (n=42) erkek idi. Gruplar arasında demografik verilerin benzer olduğu saptandı. PDT işlemi gerçekleştirilen hastalarda en sık primer tanı intrakranyal hemorajiler (%32,3; n=20) idi. Tüm çalışma grubunda medyan trakeostomi açılma zamanı 13 (aralık, 3-31) gün iken gruplar arasında anlamlı bir farklılık yoktu (p=0,637). Ortalama PDT işlem süresi (9,6±3,8'e karşı 12,6±5,4 dakika, p=0,015), ortanca YBÜ kalış süresi (26'ya karşı 37 gün, p=0,004) ve komplikasyon oranı (%6,4'e karşı %25,8; p=0,038) grup FOB'da anlamlı olarak daha düşük saptandı. Tüm çalışma grubunda 28 günlük mortalite %17,7 (n=11) iken gruplar arasında anlamlı bir farklılık yoktu (p=0,740).

Sonuç: FOB kılavuzluğunda gerçekleştirilen PDT işlemlerinde, işlem süresi, YBÜ kalış süresi ve işleme bağlı görülen komplikasyon oranları anlamlı olarak düşük saptanırken, mortalite açısından anlamlı bir farklılık görülmedi.

Anahtar kelimeler: Trakeostomi; bronkoskopi; yoğun bakım ünitesi; mekanik ventilasyon; ventilatörden ayırma.

INTRODUCTION

Percutaneous dilatational tracheostomy (PDT) is frequently performed in patients who need prolonged mechanical ventilator follow-up in the intensive care unit (ICU). PDT has become a standard method, preferred over surgical tracheotomy due to its advantages, such as being able to be performed at the bedside in patients followed in ICU, avoiding complications during transport to the operating room, and limited tissue incision and damage (1). It has been reported that PDT is beneficial in avoiding complications related to prolonged intubation, ensuring airway safety, reducing work of breathing, clearing secretions in the airway more efficiently, reducing the need for sedation, increasing the comfort of the patient by enabling speech, and shortening the length of stay in ICU (2,3).

The development of PDT techniques has facilitated the spread and implementation of the procedure in ICUs. Thus, the PDT procedure has become one of the most frequently performed surgical procedures in patients receiving mechanical ventilator support (4). Various PDT methods are available. Although there are methods such as multiple dilatation (Ciaglia technique) and one-step dilatation (Ciaglia Blue Rhino), the Griggs method using forceps dilatation is one of the most frequently used methods (5). In the Griggs technique, tracheal dilatation is performed with specially designed forceps, and the cannula is placed in the trachea. Recently, fiberoptic bronchoscopy (FOB) in PDT procedures has become common. Thus, the trachea can be visualized, and the airway and the posterior tracheal wall can be seen during the placement of the tracheal cannula, thus ensuring the procedure's safety. Although it is reported in the literature that FOB reduces early complications, there needs to be more studies on its effect on late complications and mortality.

This study aimed to compare FOB-guided PDT and classical blinded PDT procedures regarding early and late complications, mortality, and patient outcomes in patients followed up in the ICU.

MATERIAL AND METHODS

This prospective randomized study was conducted following the principles of the Declaration of Helsinki after the approval of the local Clinical Research Ethics Committee (date: 12.10.2022, no: 208). Sixty-two patients who underwent elective PDT procedures between October 2022 and June 2023 at the University of Health Sciences Türkiye, İstanbul Kanuni Sultan Süleyman Training and Research Hospital ICU, were included in the study. Informed consent was obtained from the relatives of all patients included in the study. The patients were randomized into two groups of 31 using the sequentially closed envelope method. Randomization was performed by a healthcare professional other than those performing the tracheostomy (Figure 1). In the ICU of our hospital, PDT is performed both with the classical blind technique and under FOB guidance. The patients who underwent PDT with the blind technique were classified as group C (n=31), and those who underwent PDT with FOB accompaniment were classified as group FOB (n=31).

Inclusion criteria: Patients who were endobronchial intubated and received mechanical ventilator support, were 18 years or older, were not expected to be extubated soon, did not have complex neck anatomy, and had normal coagulation parameters regarding the procedure.

Exclusion criteria: They were patients under 18 years of age who needed urgent tracheostomy, had complicated neck anatomy (past neck surgery, abnormally large thyroid tissue, mass in the trachea or neck, or suspected infection), and abnormal coagulation parameters (INR>1.5 and platelet count <50,000 /µL). All PDT procedures were performed by two experienced Anesthesiology and Reanimation and Intensive care specialists (who had at least 5 PDT experience and performed tracheostomy with both methods) accompanied by two experienced (>5 years of ICU and tracheostomy experience).

Before the PDT procedure, the patients in both groups were placed on volume-controlled ventilation and ventilated with 100% oxygen for 5 minutes. Considering the vital signs of all patients, before the procedure, 1 µg/kg fentanyl (Talinat, Vem Pharma, Türkiye), 1-2 mg/kg propofol (Propofol-PF 1%, Polifarma, Türkiye), and 0.3 mg/kg rocuronium (Muscuron, Kocak Pharma, Türkiye) was given intravenously and 0.9% isotonic fluid resuscitation was performed. All patients were followed up with electrocardiogram, pulse oximetry, oxygen saturation, non-invasive blood pressure, or invasive arterial pressure monitoring during the PDT procedure. The patients were placed in the ideal position with the head slightly extended by placing support under their shoulders.

Classical Blind Percutaneous Dilatational Tracheostomy

The tracheostomy application site was sterilized with 10% povidone-iodine and covered with a perforated drape. To reduce bleeding with its vasoconstrictor effect and to facilitate the procedure, 2-3 mL of 2% lidocaine (Aritmal, Osel Pharma, Türkiye) with epinephrine diluted 1:100,000 was applied subcutaneously at the application site. All tracheostomy procedures were performed with the Grigss technique. The endotracheal tube cuff was deflated and retracted to remain between the vocal cords and allow ventilation. The cricoid process was palpated and advanced

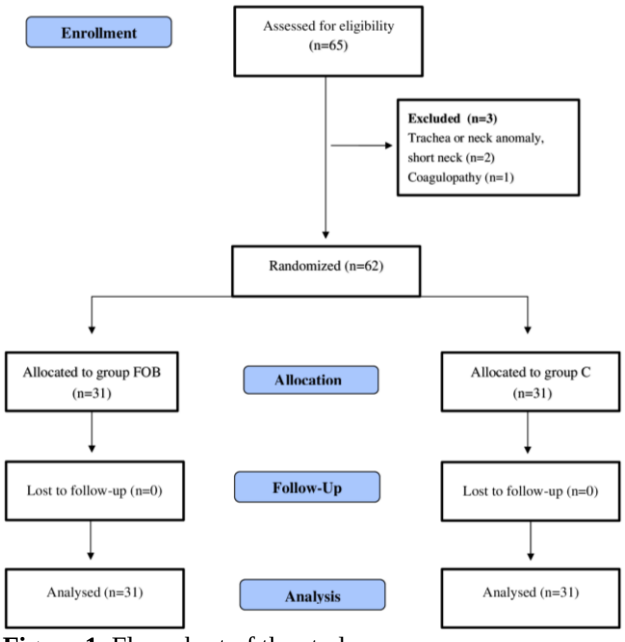

Figure 1. Flow chart of the study

approximately 1.5-2 cm below the second and third tracheal cartilages with a 14G cannula until air was aspirated and the tracheal lumen was entered. A horizontal incision of approximately 1-2 cm in diameter was created in the skin of the puncture site. After the guide wire was placed, the cannula was withdrawn, the 8F dilator was inserted over the guide wire, and the skin and tracheal rings were widened with forceps. Tracheostomy cannula 7F or 8F was inserted according to the patient's height and weight. After confirming the location of the cannula with chest movements and auscultation, the endotracheal tube was removed. Ventilation was started at volume-controlled Mv settings before the procedure. A bedside chest X-ray was taken 2-4 hours after the procedure, and possible complications were checked.

Fiberoptic Bronchoscopy Guided Percutaneous Dilatational Tracheostomy

As in the classical blind technique, the application area was sterilized with povidone-iodine, and a perforated cover was placed. Due to its vasoconstrictor and local anesthetic effect, 2-3 mL of 2% lidocaine with epinephrine was applied to the area where the tracheostomy was performed. A fiberoptic bronchoscope was inserted through a small hole by making a cross-shaped incision on the lid of the oral endotracheal tube. Thus, it was ensured that both followed the tracheostomy procedure, continued the procedure safely, and ventilated the patient mechanically. With FOB, the endotracheal tube was pulled up to the level of the vocal cords. The tip of the bronchoscope was left approximately 1 cm away from the end of the endotracheal tube to provide optimum view. As in the blind technique, the second and third tracheal cartilages were palpated 1.5-2 cm below the cricoid process. Simultaneously, the entry site was confirmed by transillumination of the FOB light by applying gentle pressure on the skin. As in the blind technique, air puncture and guide wire were placed under FOB guidance. A horizontal incision of approximately 1-2 cm diameter was created at the puncture site. After the guide wire was placed, the cannula was withdrawn, the 8F dilator was inserted over the guide wire, and the skin and tracheal rings were widened with forceps. Considering the patient's height, weight, and neck anatomy, a tracheostomy cannula 7F or 8F was inserted. After confirming the location of the cannula with chest movements and auscultation, the endotracheal tube was removed. Ventilation was started at volume-controlled Mv settings before the procedure. A bedside chest X-ray was taken 2-4 hours after the procedure, and possible complications were checked.

Demographic characteristics of the patients in both groups, time from ICU admission to tracheostomy, Glasgow coma scale (GCS) and acute physiology and chronic health evaluation II (APACHE-2) scores, duration of PDT, minor (small hemorrhages that stop with <10 mL pressure, hypoxemia; <88% SpO_2 in pulse oximetry) and major (>50 mL or major bleeding requiring suturing, paratracheal placement of the tracheostomy cannula; wrong lumen, pneumothorax, tracheoesophageal fistula, tracheal posterior wall injury) complications were analyzed by recording mortality and patient outcomes. In both groups, the procedure duration was determined as the time between starting the skin incision, inflating the cuff of the cannula, and seeing chest movements.

G*Power 3.1 program was used to calculate the sample size. The study's primary outcome is comparing 28-day mortality between groups. Secondary outcomes were determined as complication rates and procedure time. In this context, it was calculated that at least 31 patients in each group should be included in the 95% confidence interval when the effect size of 0.7 for the t-tests, and the power of the study was 85%. This sample size also includes other analyses within the scope of the study.

Statistical Analysis

IBM SPSS v.26.0 (IBM Corp., Armonk, NY) program was used to analyze the data. Descriptive statistics were expressed as mean±standard deviation, median, interquartile range (IQR=Q3-Q1), minimum-maximum, number of patients, and percentage. The conformity of the variables to the normal distribution was evaluated analytically (Shapiro-Wilk test) and visually (histogram). Independent sample t-test was used to analyze data with normal distribution, and the Mann-Whitney U test was used to analyze data that did not show normal distribution among the groups. The chi-square and Fisher's exact tests were used to evaluate qualitative data. The statistical significance limit was accepted as $p<0.05$.

RESULTS

A total of 62 patients, 31 in group FOB and 31 in group C were included in the study. The median age of the patients was 58 (range, 21-94) years in group FOB and 67 (range, 19-88) years in group C. Of the entire study group, 67.7% (n=42) were male. There was no significant difference between the groups regarding age (p=0.375), gender (p=0.587), and BMI (p=0.966). While 71% (n=44) of the entire study group had at least one comorbid disease, the most common comorbid diseases were hypertension (27.4%, n=17), diabetes mellitus (25.8%, n=16), and coronary artery disease/heart failure (17.7%, n=11). While the GCS score at the time of admission to the ICU was 7 (range, 3-12) in group FOB and 7 (range, 3-13) in group C, no significant difference was found between the groups (p=0.579). Similarly, APACHE-2 scores were similar between groups (21.6±6.5 vs 21.5±6.5, p=0.899). The median tracheostomy opening time after ICU admission was 13 (range, 5-31) days in group FOB and 13 (range, 3-28) days in group C (p=0.637). It was determined that the tracheostomy procedure was performed in a significantly shorter time in group FOB than in group C (9.6±3.8 vs 12.6±5.4 minutes, p=0.015). The median length of stay in the ICU was 26 (range, 6-74) days in group FOB and 37 (range, 14-100) days in group C. In group FOB, the length of ICU stay was significantly shorter (p=0.004). While 28-day mortality was 17.7% (n=11) and 90-day mortality was 40.3% (n=25) in the whole study group, there was no significant difference between the groups in terms of 28- and 90-day mortality (p=0.740 and p=0.796, respectively, Table 1).

Considering the primary admission diagnoses of patients who underwent tracheostomy in the ICU, 32.3% (n=20) of the entire group had intracranial hemorrhages (intraparenchymal, intraventricular, subdural, and subarachnoid hemorrhage) and 19.4% (n=12) of the acute ischemic strokes were hospitalized most frequently (Table 2).

Considering the complications between the groups during and after the tracheostomy procedure, complications were

Table 1. Demographic data and some clinical characteristics of the patients

	Group FOB (n=31)	Group C (n=31)	p	Overall (n=62)
Age (years)	58 (74-44) [21-94]	67 (76-55) [19-88]	0.375	64 (76-49) [19-94]
Gender, n (%)				
Female	11 (35.5)	9 (29)	0.587	20 (32.3)
Male	20 (64.5)	22 (71)		42 (67.7)
BMI (kg/m^2)	26.1 (27-23) [19.5-38.8]	25.7 (27-24) [19.1-39.1]	0.966	25.7 (27-23) [19.1-39.1]
Comorbidity, n (%)	21 (67.7)	23 (74.2)	0.576	44 (71)
GCS score	7 (11-5) [3-12]	7 (10-4) [3-13]	0.579	7 (11-5) [3-13]
APACHE-2 score	21.6±6.5	21.4±6.5	0.899	21.5±6.5
Tracheostomy time (days)	13 (17-9) [5-31]	13 (21-8) [3-28]	0.637	13 (21-8) [3-31]
Processing time (min)	9.6±3.8	12.6±5.4	**0.015**	11.1±4.9
Duration of ICU (days)	26 (35-22) [6-74]	37 (51-28) [14-100]	**0.004**	30 (46-25) [6-100]
Mortality (28-day)	6 (19.4)	5 (16.1)	0.740	11 (17.7)
Mortality (90-day)	13 (41.9)	12 (38.7)	0.796	25 (40.3)

Group FOB: fiberoptic bronchoscopy guided percutaneous dilatational tracheostomy, Group C: classical blind percutaneous dilatational tracheostomy, BMI: body mass index, GCS: Glasgow coma scale, APACHE-2: acute physiology and chronic health evaluation II, ICU: intensive care unit, descriptive statistics were reported as mean±standard deviation or median (interquartile range, IQR=75th-25th percentile) [minimum-maximum] for numerical variables, and number of patients and percentage for categorical variables

Table 2. Primary diagnosis of patients with tracheostomy

	Group FOB (n=31)	Group C (n=31)	p	Overall (n=62)
Primary diagnosis, n (%)				
Intracranial hemorrhages*	10 (32.3)	10 (32.3)		20 (32.3)
Acute ischemic strokes	5 (16.1)	7 (22.6)		12 (19.4)
Sepsis/septic shock	3 (9.7)	6 (19.4)		9 (14.5)
Pneumonia, respiratory failure	5 (16.1)	4 (12.9)	0.317	9 (14.5)
Multi-trauma	4 (12.9)	1 (3.2)		5 (8.1)
Post-CPR	4 (12.9)	1 (3.2)		5 (8.1)
Other**	0 (0.0)	2 (6.4)		2 (3.2)

Group FOB: fiberoptic bronchoscopy guided percutaneous dilatational tracheostomy, Group C: classical blind percutaneous dilatational tracheostomy, CPR: cardiopulmonary resuscitation, *: intraparenchymal, intraventricular, subdural, epidural, and subarachnoid hemorrhage, **: preeclampsia and ileus

observed in 6.4% (n=2) of the patients in group FOB. In comparison, minor and major complications were observed in 25.8% (n=8) of the patients in group C. The complication rate in group C was found to be significantly higher (p=0.038). While subcutaneous emphysema was seen in only 1 (3.2%) patient among major complications in group FOB, in group C, subcutaneous emphysema, which is one of the major complications, tracheostomy cannula placement in the wrong lumen, pneumothorax and tracheoesophageal fistula, which is one of the late complications, were detected in a total of 5 (16.1%) patients (Table 3).

Table 3. Complications seen in patients with tracheostomy

	Group FOB (n=31)	Group C (n=31)	p
Complication (total), n (%)	2 (6.4)	8 (25.8)	**0.038**
Minor complication, n (%)			
Minor bleeding (<10 mL)	1 (3.2)	2 (6.4)	
Hypoxemia	0 (0.0)	1 (3.2)	
Major complication, n (%)			
Subcutaneous emphysema	1 (3.2)	1 (3.2)	
Placement in wrong lumen	0 (0.0)	2 (6.4)	
Pneumothorax	0 (0.0)	1 (3.2)	
Tracheoesophageal fistula	0 (0.0)	1 (3.2)	

Group FOB: fiberoptic bronchoscopy guided percutaneous dilatational tracheostomy, Group C: classical blind percutaneous dilatational tracheostomy

DISCUSSION

In this prospective study in which FOB guidance and classical percutaneous tracheostomy procedures were analyzed in the ICU, it was determined that more tracheostomy was required in the male gender in the entire study group. In FOB-guided PDT, the duration of the procedure after skin sterilization and the rate of complications during and after the procedure were significantly reduced, and the duration of stay in the ICU was shorter in these patients. However, no significant difference was found in 28- and 90-day mortality rates in patients who underwent tracheostomy with both methods. Tracheostomy is one of the most frequently performed surgical procedures in the ICU, and its application rates may vary depending on the specialized structure of ICU and the characteristics of the patients followed. The rate of performing tracheostomy in an ICU where patients with neurological problems are followed has been reported as 28.6% (6). It has been reported that tracheostomy was performed in 6% of trauma patients in an ICU where a significant number of trauma patients were followed (7). There has yet to be a definite consensus on the indications, timing, method, and subject. In a multicenter survey study from Türkiye, it was reported that 70.4% of ICU physicians performed PDT with the Grigss method, and the most common indication for tracheostomy was prolonged mechanical ventilation (76.9%) and coma (14.8%) (8). FOB-guided PDT has become a frequently used method today because it reduces complications and provides

procedural safety (9). The application time may vary depending on the decision of the ICU specialist physicians to evaluate the patient's clinical condition daily. However, the process may be prolonged due to bleeding diathesis, the instability of the patient's clinical condition, and the indecision of the patient's relatives about the procedure. Although early tracheostomy applications may be associated with improvement in some clinical outcomes, it has been reported that an unnecessary tracheostomy procedure may lead to various complications and risks (10,11) and also reported that it is generally performed seven days after orotracheal intubation (11). Romero et al. (13) reported that approximately 60% of patients who underwent FOB-guided PDT were male, with a mean age of 64±18 years and a mean tracheostomy opening time of 11±3 days. In another study, it was reported that 70% of the patients who underwent tracheostomy were male, the mean age was 56.6±18 years, and all tracheostomies were opened due to the need for a prolonged mechanical ventilator (14). Consistent with the literature, in our study, while more tracheostomies were performed in males (67.7% of the entire study group), the median age was found to be 64 (range, 19-94) years in the entire group. The median duration of mechanical ventilation was 13 (range, 3-31) days, similar in both groups. While all PDT procedures were performed with the Griggs method, the need for prolonged mechanical ventilation and coma were the most common indications for tracheostomy. Considering that prolonged mechanical ventilation and coma are effective in opening tracheostomy in some of the patients followed in the ICU, it is difficult to state the indications clearly.

The duration of the tracheostomy procedure may be crucial in critically ill patients followed in the ICU. FOB-guided PDT procedure may increase the cost and prolong the procedure depending on the physician's experience using the bronchoscopy. Shen et al. (15) reported an average time of 9.8±1.2 minutes to perform FOB-guided tracheostomy. In another study, ultrasound-guided and FOB-guided tracheostomy was investigated, and the mean time to perform FOB-guided tracheostomy was 16.3±1.6 minutes (16). Batcik et al. (14) reported that the duration of tracheostomy procedures performed under FOB guidance was significantly higher than the classical technique (13.4±4.9 vs 8.1±6.1 minutes). In our study, the procedure times were similar to the literature. However, the procedure time was significantly lower in the FOB group compared to the classical blind technique (9.6±3.8 vs 12.6±5.4 minutes). The physician's experience using bronchoscopy, the type of bronchoscopy (rigid or flexible bronchoscopy), or how the duration is calculated may affect this situation. In our study, all bronchoscope procedures were performed by an experienced ICU or anesthesiology and reanimation specialist, and the starting time of the procedure was started by opening the plus sign at the end of the endotracheal tube after skin disinfection and placing the flexible bronchoscopy. All tracheostomy procedures were performed by senior assistants with experience in tracheostomy at least five times under the guidance of an expert. Confirming the place where the procedure is performed and guiding the people who perform the procedure, thanks to the translumination of the light on the fiberoptic bronchoscope tip, may be effective in shortening the procedure time.

Although PDT is a generally safe procedure, it has some complications. Major complications such as subcutaneous emphysema, pneumomediastinum, pneumothorax, paratracheal placement of the cannula (cannula in the wrong lumen), perforation of the tracheal posterior wall and tracheoesophageal fistula that may occur in the late period can be seen among minor complications such as minor bleeding that can stop with compression and hypoxemia. In studies comparing percutaneous and surgical tracheostomy, it was reported that complications such as hemorrhage, subcutaneous emphysema, pneumothorax, and tracheal stenosis were significantly less common in percutaneous techniques compared to the surgical technique (3,17). In a study comparing FOB guidance and standard blind PDT, it was reported that major complications, including tracheal posterior wall damage, were observed in the blind technique, and the use of FOB reduced both major and minor complications (18). Another study reported that FOB guidance in PDT did not make a difference in complications compared to the blind technique (19). A meta-analysis examining FOB-guided PDT procedures reported that the rates of serious complications could reach 35%, and the rates of minor complications could reach 65% (20). In our study, both minor and major complication rates were found to be low in the FOB-guided PDT group, consistent with the literature. One (3.2%) patient had minor bleeding, and one patient had subcutaneous emphysema, which could be classified as a major complication. In the classical blind technique group, major complications (subcutaneous emphysema, paratracheal placement of the cannula, pneumothorax, and tracheoesophageal fistula) were found in 5 (16.1%) patients. Following the literature, FOB guidance reduces complications. However, sufficient experience in using bronchoscopy is essential in not prolonging the procedure time and preventing complications related to bronchoscopy.

In the literature, auxiliary methods such as bronchoscopy and ultrasonography have been investigated regarding guiding surgical methods, bedside percutaneous techniques, or percutaneous techniques in patients who have undergone tracheostomy (14,18,21,22). In these studies, the early complications and the duration of the procedure were investigated, and the effects of the methods on mortality were not evaluated. Shen et al. (15) reported no significant difference in 28-day mortality between the groups in PDTs opened with FOB guidance and the classical blind technique, and the mortality was 20% in the whole population. The authors stated that the APACHE-2 scores of the patients in both groups in the study were similar, and 23±7 in their entire study group. In our study, consistent with the literature, APACHE-2 scores were similar between the groups and were found to be 21.5±6.5 in the entire study group. GCS scores also did not differ significantly; the median was 7 (range, 3-13) in whole patients. From this point of view, we can say that our patient groups consist of patients with similar characteristics. Our mortality rates did not differ significantly between the groups (28-day mortality rates were 19.4% in group FOB, and 16.1% in group C), consistent with the literature.

The main limitations of our study are the small sample size and its single-center design. In addition, although all

tracheostomy procedures were performed by the same intensive care or senior assistant physicians with tracheostomy experience, accompanied by an anesthesiology and reanimation specialist, not all tracheostomy procedures were performed by the same person.

CONCLUSION

FOB-guided percutaneous tracheostomy procedures, which are frequently performed in patients followed up in the ICU, may be beneficial in shortening the procedure time and reducing complication rates and length of stay in the ICU, although it does not affect mortality.

Ethics Committee Approval: The study was approved by the Ethics Committee of İstanbul Kanuni Sultan Süleyman Training and Research Hospital (12.10.2022, 208).

Conflict of Interest: None declared by the authors.

Financial Disclosure: None declared by the authors.

Acknowledgments: None declared by the authors.

Author Contributions: Idea/Concept: KA, EK, ASŞ; Design: KA, EK, ASŞ; Data Collection/Processing: KA, EK; Analysis/Interpretation: KA, ASŞ; Literature Review: KA; Drafting/Writing: KA, EK, ASŞ; Critical Review: KA, EK, ASŞ.

REFERENCES

1. Griggs WM, Myburgh JA, Worthley LI. A prospective comparison of a percutaneous tracheostomy technique with standard surgical tracheostomy. Intensive Care Med. 1991;17(5):261-3.
2. Durbin CG Jr. Tracheostomy: why, when, and how? Respir Care. 2010;55(8):1056-68.
3. Düger C, İsbir AC, Uysal İÖ, Özdemir Kol İ, Kaygusuz K, Gürsoy S, et al. The evaluation of the complications of surgical and percutaneous tracheostomies in intensive care unit. Turk J Anaesthesiol Reanim. 2013;41(3):84-7. Turkish.
4. Al-Ansari MA, Hijazi MH. Clinical review: percutaneous dilatational tracheostomy. Crit Care. 2006;10(1):202.
5. Yıldırım F, Güllü YT, Demirel CB. Percutaneous tracheostomy in the intensive care unit. Eurasian J Pulmonol. 2015;17(3):136-41.
6. Memmedova F, Ger Akarsu F, Mehdiyev Z, Aykaç Ö, Pınarbaşlı MÖ, Gürbüz MK, et al. Evaluation of percutaneous and surgical tracheostomy results in neurocritical care unit. Turk J Neurol. 2022;28(1):31-7.
7. Arslan K, Sahin AS, Yalcın N, Kaya E. Evaluation of trauma patients followed up and treated in intensive care unit: the sample of Istanbul province training and research hospital. Turk J Intensive Care. 2023;21(1):41-7.
8. Gucyetmez B, Atalan HK, Cakar N; Turkish Tracheotomy Survey Group. Elective tracheotomy practices in Turkey. PLoS One. 2016:11(11):e0166097.
9. Decker S, Gottlieb J, Cruz DL, Müller CW, Wilhelmi M, Krettek C, et al. Percutaneous dilatational tracheostomy (PDT) in trauma patients: a safe procedure. Eur J Trauma Emerg Surg. 2016;42(5):605-10.
10. Terragni PP, Antonelli M, Fumagalli R, Faggiano C, Berardino M, Pallavicini FB, et al. Early vs late tracheotomy for prevention of pneumonia in mechanically ventilated adult ICU patients: a randomized controlled trial. JAMA. 2010;303(15):1483-9.
11. Young D, Harrison DA, Cuthbertson BH, Rowan K; TracMan Collaborators. Effect of early vs late tracheostomy placement on survival in patients receiving mechanical ventilation: the TracMan randomized trial. JAMA. 2013;309(20):2121-9.
12. Gupta S, Tomar DS, Dixit S, Zirpe K, Choudhry D, Govil D, et al. Dilatational percutaneous vs surgical tracheostomy in intensive care unit: a practice pattern observational multicenter study (DISSECT). Indian J Crit Care Med. 2020;24(7):514-26.
13. Romero CM, Cornejo R, Tobar E, Galvez R, Luengo C, Estuardo N, et al. Fiber optic bronchoscopy-assisted percutaneous tracheostomy: a decade of experience at a university hospital. Rev Bras Ter Intensiva. 2015;27(2):119-24.
14. Batcik S, Süren M, Cömlekci M, Özdamar M, Özdemir H, Fadıllıoğlu S, et al. Comparison of patients undergoing tracheostomy with and without fiberoptic bronchoscopy. Ann Clin Anal Med. 2021;12(Suppl 3):S333-7.
15. Shen G, Yin H, Cao Y, Zhang M, Wu J, Jiang X, et al. Percutaneous dilatational tracheostomy versus fibreoptic bronchoscopy-guided percutaneous dilatational tracheostomy in critically ill patients: a randomised controlled trial. Ir J Med Sci. 2019;188(2):675-81.
16. Ravi PR, Vijay MN. Real time ultrasound-guided percutaneous tracheostomy: is it a better option than bronchoscopic guided percutaneous tracheostomy? Med J Armed Forces India. 2015;71(2):158-64.
17. Karvandian K, Mahmoodpoor A, Beigmohammadi M, Sanaie S. Complications and safety of percutaneous dilatational tracheostomy with Griggs method versus surgical tracheostomy: A prospective trial with six months follow-up. Pak J Med Sci. 2009;25(1):41-5.
18. Saritas A, Saritas PU, Kurnaz MM, Beyaz SG, Ergonenc T. The role of fiberoptic bronchoscopy monitoring during percutaneous dilatational tracheostomy and its routine use into tracheotomy practice. J Pak Med Assoc. 2016;66(1):83-9.
19. Dennis BM, Eckert MJ, Gunter OL, Morris JA Jr, May AK. Safety of bedside percutaneous tracheostomy in the critically ill: Evaluation of more than 3,000 procedures. J Am Coll Surg. 2013;216(4):858-65.
20. Cabrini L, Monti G, Landoni G, Biondi-Zoccai G, Boroli F, Mamo D, et al. Percutaneous tracheostomy, a systematic review. Acta Anaesthesiol Scand. 2012;56(3):270-81.
21. Eminoğlu S, Özgünay ŞE. Comparison of percutaneous dilatational tracheostomy via fiberoptic bronchoscopy with standard percutaneous dilatational tracheostomy: a prospective randomized trial. Med Bull Haseki. 2020;58(1):78-83. Turkish.
22. Karaca Ü, Onur T, Eminoğlu S, Özgünay SE, Ata F. The comparison of ultrasonography-guided percutaneous tracheostomy with fiberoptic bronchoscopy-guided percutaneous tracheostomy: clinical experimental research. Turkiye Klinikleri J Anest Reanim. 2022;20(1):16-22. Turkish.