

Retrospective evaluation of percutaneous tracheostomy cases performed by griggs method in intensive care unit

 Gulcin Patmano,  Tuba Bingol Tanriverdi,  Firdevs Tugba Bozkurt,  Mehmet Tercan

Department of Anaesthesiology and Reanimation, Mehmet Akif Inan Education and Research Hospital, Sanliurfa, Turkey

Copyright © 2020 by authors and Annals of Medical Research Publishing Inc.

Abstract

Aim: Tracheostomy is frequently performed after prolonged endotracheal intubation in intensive care units (ICU). Percutaneous tracheostomy (PT) is often preferred because it is a less invasive bedside applicable procedure and the complication rate is lower. The aim of this study is to present our experience of PT interventions in ICU.

Material and Methods: Between January 2016 and March 2019, patients who underwent PT by Griggs method were evaluated retrospectively. Age, gender, length of ICU stay, hospitalization diagnoses, timing for tracheostomy, complications related to the procedure and discharge / death status of the patients were recorded.

Results: Eighty-nine patients were examined. The mean age of the patients was 59.4 ± 19.5 years, and the mean length of ICU stay was 80.3 ± 10.2 days. Tracheostomy was most commonly performed for neurological disorders. Duration of intubation was 20.3 ± 4.5 days. Complications developed in 8 patients (8.9%). The most common complication was minor bleeding (3.3%). Mortality developed in 59 patients (66.2%); 9 patients (10.1%) were discharged to the palliative service and 8 patients (8.9%) were discharged home. The mean length of ICU stay was 80.3 ± 10.2 days in tracheostomized patients, 56.4 ± 8.9 days in discharged patients and 92.5 ± 12.5 days in patients who died.

Conclusion: In our study, performing day of tracheostomy was found to be higher. This may be due to patient relatives' ignorance of tracheostomy. By giving trainings to patients' relatives, tracheostomy may be performed earlier and complications due to late performed tracheostomy can be prevented.

Keywords: Complication; intensive care unit; mortality; percutaneous tracheostomy

INTRODUCTION

Tracheostomy is a procedure that is frequently applied to patients with prolonged duration of mechanical ventilation after endotracheal intubation in intensive care units (ICU) or to patients whom are predicted that this period will be extended (1). Tracheostomy should be considered in cases which intubation can last for more than 20 days to prevent complications such as laryngeal damage, tracheal damage (tracheo-malacia, tracheal dilatation and tracheal stenosis), glottic and subglottic stenosis, and vocal cord paralysis that may develop with prolongation of endotracheal intubation (2,3). However, tracheostomy has advantages such as providing the possibility of oral feeding of the patient, improving patient comfort, improving oral hygiene, reducing the rate of infection, reducing the need for sedation of the patient, improving communication with the patient, accelerating the weaning process and making it safer (4-6).

Tracheostomy can be performed in two ways: percutaneous and surgical method. Percutaneous tracheostomy (PT)

is performed more frequently today because it is a less invasive-bedside applicable procedure and the complication rate compared to the surgical method is lower (7). Many PT methods have been described in the literature. The most commonly used techniques are percutaneous 'guidewire' dilatational tracheostomy technique described in 1990 by Griggs et al. (8) and percutaneous dilatational tracheostomy technique described in 1985 by Ciaglia et al. (9). However, PT may also have serious complications such as bleeding, subcutaneous emphysema, wound infection and cardio-respiratory arrest (10).

The aim of this study is to present our experience of PT interventions performed in ICUs in the last 3 years, to determine the clinical characteristics of the patients and to investigate the complications in detail.

MATERIAL and METHODS

After obtaining approval from Harran University Ethics Committee for our study (number: E.39368, date: 18/09/19), patients who underwent PT by Griggs method

Received: 07.03.2020 **Accepted:** 29.09.2020 **Available online:** 22.10.2020

Corresponding Author: Gulcin Patmano, Department of Anaesthesiology and Reanimation, Mehmet Akif Inan Education and Research Hospital, Sanliurfa, Turkey **E-mail:** gulcinpatmano@gmail.com

between January 2016 and March 2019 in general intensive care and surgical intensive care units of our hospital were retrospectively evaluated. All patients over 18 years of age who underwent PT within the specified date range were included in the study. Patients whose clinical data were incomplete and patients who underwent surgical tracheostomy were excluded from the study. The characteristics of the patients were obtained from the hospital registry system and patient files. Age, sex, hospitalization diagnosis, length of stay in intensive care unit, performing day of tracheostomy and complications related to the procedure were recorded in all patients. All tracheostomies were performed by experienced anesthesiologists in elective conditions. All of the patients were intubated orotracheally and under mechanical ventilation support. All of the patients were monitored by electrocardiography, pulse oximetry and invasive arterial pressure during PT interventions. The procedure was performed with percutaneous tracheostomy kit (Portex, BlueLine Ultra Smiths Medical, North America). In our clinic, PT was performed by the forceps dilatation method (Griggs) as follows. Prior to the procedure, fentanyl 1 µg kg⁻¹, propofol 2 mg kg⁻¹ and rocuronium 0,6 mg kg⁻¹ were given intravenously and mechanical ventilation was performed in SIMV mode with 100% oxygen. The patient was laid flat in the supine position and the head was extended with sub-shoulder support. The endotracheal tube cuff was deflated by the assistant on the cranial side of the patient and the intubation tube was drawn to localization above the first tracheal interspace then the tube cuff was again inflated. The neck was wiped with antiseptic solution and covered with perforated sterile drape. Local anesthesia with 2% prilocaine (4-5 ml) was applied to the area between the first and second tracheal ring or the second and third ring based on the anatomical structure in each case. After local anesthesia, a horizontal incision (8-10 mm) was made to the skin area with the help of a lancet. Using the Seldinger method, a needle was inserted perpendicularly to airway through the 2 • 3 tracheal rings. When air was aspirated into the syringe, the syringe was separated from the needle and the guide wire was inserted into the trachea lumen. The area was enlarged with the help of an 8F dilator over the guide wire. After removing the dilator, the puncture area in the trachea was further enlarged with a special forceps (modified Howard Kelly) and the 7 or 8 numbered tracheostomy tube was passed through the guide wire and placed into the trachea. The tracheostomy tube cuff was inflated, intra-tube aspiration was performed and the patient was started to be mechanically ventilated. The area around the tracheostomy tube was cleaned and wrapped with sterile sponge. After listening breathing sounds, patient's chest X-ray was taken. Complications were recorded during and after the procedure. Bleeding was classified as minor hemorrhage (bleeding that stops in a short time with sponge wrapped around the stoma, or bleeding that stops by bedside procedures) or major hemorrhage (bleeding that was taken into the operating room and required blood transfusion). The duration of ICU stay and hospital discharge status (discharged / dead) were recorded.

Statistical analysis

SPSS 22 (Statistical Package for the Social Sciences, Chicago, IL, USA) was used for all statistical evaluations. Categorical variables were expressed as number and percentage, and continuous variables as mean ± standard deviation.

RESULTS

Eighty-nine patients who underwent PT between January 2016 and March 2019 were included in the study. A total of 587 patients were admitted to the ICU between these dates. Of these, 12 (2.0%) patients underwent surgical tracheostomy, while 89 (15.2%) patients underwent percutaneous tracheostomy. Baseline demographic characteristics of the patients, timing for PT, length of ICU stay and complications related to PT intervention are given in Table 1. The mean age of the patients was 59.4 ± 19.5 years and the majority of the patients were male (73%). The mean length of stay in ICU was 80.3 ± 10.2 days. The mean number of days in which the patients were endotracheally intubated before PT was 20.3 ± 4.5. PT was performed in 6 patients (6.7%) on the 7th day and before of admission to ICU, in 44 patients (49.4%) between 8.-20. day of admission to ICU and in 39 patients (43.8%) on the 21th day and after of admission to ICU. The mean length of ICU stay was 80.3 ± 10.2 days in tracheostomized patients, 56.4 ± 8.9 days in discharged patients and 92.5 ± 12.5 days in patients who died. Complications developed in 8 patients (8.9%). The most common complication was minor bleeding (3.3%). Other complications are posterior wall injury (2.2%) pneumotorax (2.2%) and subcutaneous emphysema (1.1%).

Table 1. Basal demographic characteristics of patients, timing for PT intervention, length of stay and complications prior to PT intervention

Variables	n = 89
Age (year)	59.5 ± 19.5
Gender	
Female (%)	24 (27)
Male (%)	65 (73)
Performing day of PT (day)	20.3 ± 4.5
Timing for PT according to days (%)	
7 th day and before	6 (6.7)
Between 8.-20. days	44 (49.4)
21 th day and after	39 (43.8)
Length of stay in ICU (day)	80.3 ± 10.2
Discharged patients (day)	56.4 ± 8.9
Patients who died (day)	92.5 ± 12.5
Complications prior to PT intervention	
Minor bleeding (%)	3 (3.3)
Posterior wall injury (%)	2 (2.2)
Pneumotorax (%)	2 (2.2)
Subcutaneous emphysema(%)	1 (1.1)
Total	8 (8.9)

ICU: Intensive Care Unit, PT: percutaneous tracheostomy

Table 2. Diagnosis of patients admitted to ICU

Variables	n = 89
Neurological Disorders (%)	56 (62.9)
Hypoxic ischemic encephalopathy	43 (48.3)
Cerebrovasculer diseases	3 (3.3)
Degenerative ve demialinating diseases	2 (2.2)
Intracranial lesions	4 (4.4)
Infections	2 (2.2)
Myastenia Gravis	1 (1.1)
Epilepsy	1 (1.1)
Respiratory diseases (%)	17 (19.1)
Trauma (%)	6 (6.7)
Cardiac diseases (%)	5 (5.6)
Chronic renal failure (%)	3 (3.3)
Acute renal failure (%)	3 (3.3)

ICU: Intensive care unit

The initial diagnoses of the patients during hospitalization are shown in Table 2. Tracheostomy was most often performed in patients with neurological disease (62.9%). The most common neurological disease was hypoxic ischemic encephalopathy (HIE) (48.3%).

Discharge and death status of the patients are presented in Table 3. Mortality occurred in 59 patients (66.2%) during intensive care unit stay. Nine patients (10.1%) were discharged to the palliative service, 4 of them were discharged decannulated and 5 of them were discharged tracheostomized. Eight patients (8.9%) were discharged home, 3 of them were discharged decannulated and 5 of them were discharged tracheostomized. Five patients (5.6%) were referred to another intensive care unit. All of these patients were referred to tracheostomized manner. Eight patients (8.9%) were still treated in ICU.

Table 3. Diagnosis of patients admitted to ICU

Variables	n = 89
Discharged to palliative service (%)	9 (10.1)
Tracheostomized	5
Decannulated	4
Discharged home (%)	8 (8.9)
Tracheostomized	5
Decannulated	3
Referred to another ICU (%)	5 (5.6)
Tracheostomized	5
Decannulated	0
Patienst still treated in ICU (%)	8 (8.9)
Patients who died (%)	59 (66.2)

ICU: Intensive care unit

DISCUSSION

In this study, 89 ICU patients who underwent PT by Griggs method in the last 3 years were examined retrospectively.

Tracheostomy is performed to minimize the complications of endotracheal intubation and mechanical ventilation and provide patient comfort who require long-term mechanical ventilation support in the ICU (1). PT is preferred to surgical tracheostomy because of its advantages such as less complication risks, low cost, bedside applicability (7,11). Of the 587 patients admitted to our intensive care unit in 3 years, 12 (2.0%) patients underwent surgical tracheostomy and 89 (15.2%) patients underwent percutaneous tracheostomy. Tracheostomy was performed in 17.2% of the patients due to the small number of patients who were followed up in the ICU for long-term intubation.

In our study, the mean performing day of tracheostomy was 20.3 ± 4.5 days. It was determined that the rate of patients who underwent tracheostomy on the 7th day or earlier of ICU admission was 6.7% and on 21th day or later of ICU admission was 43.8%. In a study evaluating the timing of tracheostomy procedure, it was found that tracheostomy was performed in the first week of ICU stay in 50% of patients in the UK. In the other half, it was found to be performed after the second week of ICU stay (12). In Akdeniz University, Kırca et al. (13) evaluated 444 patients with a 41% rate of tracheostomy performed before 7 days of admission to ICU and 4.7% rate of tracheostomy performed after 20 days of admission to ICU. There is no widely accepted recommendation regarding the timing of tracheostomy for all patient groups and diagnoses. Therefore, the time of tracheostomy is a decision of the responsible ICU specialist by evaluating the patient and the clinical situation. General practice is to perform tracheostomy as soon as possible after intubation and admission to ICU in the presence of pathology (neurological damage, progressive muscle diseases, medulla spinalis injuries, masses causing respiratory tract obstruction, etc.) that is not likely to be extubated in a short time. However, the clinical status of the patient and the decision of the physician are not the only factors determining the timing of tracheostomy. One of the most important factors here is the process of consent of the patient's relatives. After deciding to perform a tracheostomy in our clinic, the process of obtaining consent from the relatives of the patient is started. However, the process of giving consent of the patients' relatives in the Southeastern Anatolia region where our study was conducted is quite prolonged. This is because of low literacy rate in the region. Finding a literate patient relative and explaining the procedure leads to a delay of the procedure. In addition, due to the cultural characteristics of the region, the role of family elders in making these decisions is also very important. In our study, we conclude that the timing of tracheostomy is much longer than other studies because the tracheostomy consent cannot be obtained early. The socio-cultural level of the people of the region directly affected the results of the study.

In our study, length of ICU stay was found to be 80.3 ± 10.2 days in tracheostomized patients, 56.4 ± 8.9 days in discharged patients and 92.5 ± 12.5 days in patients who died. Dempsey et al. (14) evaluated 589 patients with a median ICU stay of 18 (3-68) days in patients who died and 20 (4-92) days of survivors. Díaz-Reganon et al. (15) reported that the median duration of ICU stay in tracheostomized patients was 21 (1-368) days. However, the hospitalization diagnoses of these patients are unknown. In our study, since the majority of the patients were hospitalized with the diagnosis of HIE, it was observed that the length of hospital stay in the ICU was very long. Another reason is legal and ethical reservations about making the end of life decisions in Turkey. It couldn't be possible to discontinue advanced and / or supportive treatment in patients that are not expected to benefit from treatment. For this reason, tracheostomy is performed to patients who are predicted to die and their treatment is continued in the ICU. Furthermore, it is very difficult to discharge patients as a home care patient in the region where the study was conducted. It is not easy to persuade relatives to take care of their patients at home or palliative service. The fact that none of our patients were discharged with a home-type ventilator supports this situation. The lack of rehabilitation centers and the lack of adequate social and economic assistance to families, and the low socio-economic and socio-cultural levels of the local population lead to prolonged ICU stay.

Flaaten et al. (16) examined 461 patients who underwent tracheostomy in the ICU within 7 years; 44 patients (9.54%) were discharged decannulated, 367 patients (79%) were discharged tracheostomized and 50 patients (10.8%) died. In a study conducted by Doğan et al. (17), 116 patients underwent tracheostomy in the intensive care unit in 2 years. It was observed that 83 (71%) patients died, 11 (9.4%) patients were discharged decannulated and 22 (18%) patients were discharged tracheostomized. In our study, 66.2% of the patients died in 3 years. Seven (7.8%) patients were discharged decannulated and 10 (11.2%) patients were discharged tracheostomized. Eight patients (8.9%) are still treated in the intensive care unit. The main reason for the low rate of discharge is that the relatives do not accept the discharge of their patients to home or palliative care centers. Low socio-cultural level came into play at this point.

In the studies performed, when the hospitalization diagnoses of the patients were examined, the most common cause was neurological disorders and respiratory problems (11,18). In our study, hospitalization diagnoses were found consistent with the literature. However, unlike the literature, HIE was the most common neurological cause.

Kirca et al. (13) reported that 31 (7%) of 442 patients who underwent tracheostomy for five years developed complications. The most common complication was early bleeding with a rate of 2.9%. Çiçek et al. (19) reported early bleeding as a complication of PT due to Griggs technique in 115 patients, minor bleeding in 3 patients, surgical bleeding in 1 patient, and false passage in 1 patient.

Serious problems that may occur during percutaneous dilatational tracheostomy include subcutaneous emphysema and pneumothorax (20). In our study, complications related to PT were seen in 8.9% of the patients. The most common complication was minor bleeding with 3 cases (3.3%). In these patients, bleeding control was achieved by compressive dressing, cauterization or stitching and tracheostomy was performed safely. None of the patients had major bleeding requiring surgery in the operating room. Subcutaneous emphysema developed in 1 patient and was determined as a result of cannula displacement. Subcutaneous emphysema regressed without any intervention. Two patients (2.2%) developed pneumothorax and underwater drainage was used for treatment. These patients were followed up with spontaneous respiration by tracheostomy cannula after removal of the thorax tube. Two patients (2.2%) developed posterior wall injuries. It has been reported that the use of fiberoptic bronchoscopes for PT interventions reduces major bleeding during tracheal dilatation and prevents posterior wall injuries during puncture of the trachea (21). There is no fiberoptic bronchoscope in our clinic and could not be used during the procedure. The high rate of posterior wall injury complication was attributed to this situation. The mortality rate associated with PT interventions ranges from 0-8% in the literature (22). Mortality due to PT interventions did not develop in any of our cases. It was found that the complication rates in our cases were consistent with the literature. In some studies, it is stated that assistant doctors also perform PT under the guidance of specialist doctors. Karasu et al. (18) included tracheostomy cases performed by assistant doctors to their study and reported the complication rate as 12.9%. Akıncı et al. (23) mostly attributed the incidence of complications to lack of experience. In our study, specialist physicians – not assistant doctors- performed the tracheostomy procedures. This situation may have ensured that our complication rate was not above the literature.

LIMITATIONS

The main limitation of our study was the retrospective design and the low number of patients. In addition, the tracheostomy procedures were not performed by the same doctors. The number of times the doctor performing the tracheostomy procedure and how long it took was not recorded. Moreover, the number of mechanically ventilated days after tracheostomy was not evaluated and patients were not followed for long-term outcomes.

CONCLUSION

In our study, performing day of tracheostomy was found to be higher than those in the literature. This is because the local people are ignorant of tracheostomy and afraid of tracheostomy. It is difficult to convince patients' relatives about the necessity of tracheostomy. By giving detailed trainings to the patients' relatives by the experts, performing day of tracheostomy can be reduced. Thus, complications that may arise as a result of late performed tracheostomy can be prevented. As a result, mortality rates and ICU hospitalization costs can be reduced.

Competing interests: The authors declare that they have no competing interest.

Financial Disclosure: There are no financial supports.

Ethical approval: Harran University Ethics Committee for our study (number: E.39368, date: 18/09/19).

REFERENCES

1. Duger C, Isbir AC, Uysal IO, et al. The evaluation of the complications of surgical and percutaneous tracheostomies in intensive care unit. *Turk J Anaesthesiol Reanim* 2013;41:84-7.
2. Whited RE. A prospective study of laryngotracheal sequelae in term intubation. *Laryngoscope* 1984; 94:367-77.
3. Marsh H, Gillespie D, Baumgartner A. Timing of tracheostomy in the critically ill patient. *Chest*1989; 96:190.
4. Freeman B, Morris P. Tracheostomy practise in adults with acute respiratory failure. *Crit Care Med* 2012; 40:2890-96.
5. Cortegiani A, Russotto V, Palmeri C, et al.. Previously undiagnosed Reinke edema as a cause of immediate post extubation inspiratory stridor. *A&A Case Rep* 2015; 4:1-3.
6. Mota LA, de Cavalho GB, Brito VA. Laryngeal complications by orotracheal intubation: Literature review. *Int Arch Otorhinolaryngol* 2012;16:236-45.
7. Totoz T, Turk HS, Sayin P, et al. Yoğun bakım ünitemizdeki (YBU) perkutan trakeotomi pratiğimiz. *Ş.E.E.A.H. Tıp Bulteni* 2013;47:11-5.
8. Griggs WM, Worley LI, Gilligan JE, et al. A simple percutaneous tracheostomy technique. *Surg Gynecol Obstet* 1990;170:543-5.
9. Ciaglia P, Firsching R, Syniec C. Elective percutaneous dilatational tracheostomy. A simple bedside procedure; Preliminary report. *Chest* 1985;87:715-9.
10. Friedman Y. Indications, timing, techniques and complications of tracheostomy in the critically ill patient. *Curr Op in Crit Care* 1996;2:47-53.
11. Canakci E, Sahin AE, Kilic K. Percutaneous tracheostomy with Griggs dilating forceps technique: Retrospective analysis of 60 intensive care patients. *Ege J Med* 2016; 55:184-9.
12. Krishnan K, Elliot SC, Mallick A. The current practice of tracheostomy in the United Kingdom: a postal survey. *Anaesthesia* 2005;60:360-4.
13. Kirca H, Cakin O, Cengiz M, et al. Yoğun Bakımda Trakeotomi: Endikasyonlar, Komplikasyonlar ve Prognoz. *J Turk Soc Intensive Care* 2018;16:17-25
14. Dempsey GA, Grant CA, Jones TM. Percutaneous tracheostomy: a 6 yr prospective evaluation of the single tapered dilator technique. *Br J Anaesth* 2010;105:782-88.
15. Díaz-Reganon G, Minambres E, Ruiz A, et al. Safety and complications of percutaneous tracheostomy in a cohort of 800 mixed ICU patients. *Anaesthesia* 2008; 63:1103-98.
16. Flaatiën H, Gjerde S, Heimdal JH, et al . The effect of tracheostomy on outcome in intensive care unit patients. *Acta Anaesthesiol Scand* 2006;50:92-8.
17. Dogan A, Avci O, Cevik BE, et al. Yoğun Bakım Ünitelerinde Takip Edilen Trakeotomi Olgularının Retrospektif Olarak Değerlendirilmesi. *GKDA Derg* 2017;23:139-45.
18. Karasu D, Yılmaz C, Baytar C, et al. Yoğun Bakım Ünitemizde Perkütan Yöntemle Açılan Trakeostomi Olgularının Retrospektif Analizi. *Turk J IntenseCare* 2018;16:83-7.
19. Cicek M, Gedik E, Yucel A, et al. Griggs tekniği ile açılan perkütan trakeostomi sonuçlarımız. İnönü Üniversitesi Tıp Fakültesi Derg 2007;14:17-20.
20. Kaiser E, Cantais E, Goutorbe P, et al. Prospective randomized comparison of progressive dilational vs forceps dilatational percutaneous tracheostomy. *Anaesth Intensive Care* 2006;34:51-4.
21. Peris A, Linden M, Pellegrini G, et al. Percutaneous dilatational tracheostomy: a self-drive control technique with video fiberoptic bronchoscopy reduces perioperative complications. *Minerva Anestesiol* 2009;75:21-5.
22. Durbin CG Jr. Early complications of tracheostomy. *Respir Care* 2005;50:511-5.
23. Akinci SB, Kanbak M, Aypar U. Perkütan trakeostomi. *Yoğun Bakım Dergisi* 2003;3:149-59.