



# Retrospective Analysis of Our Experience with Percutaneous Tracheostomy in Our Intensive Care Unit

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## Abstract

**Aim:** Percutaneous tracheostomy (PT) application has advantages such as being able to be applied at the bedside in a short time and less bleeding. It is frequently preferred in intensive care units with indications such as prolonged artificial respiration requirement, facilitating weaning, and providing emergency airway. It is an alternative method to surgical tracheostomy. In this study, we aimed to retrospectively evaluate the percutaneous tracheostomy cases we performed in the Intensive Care Unit (ICU) in the last three years.

**Material and Methods:** Patients who underwent percutaneous tracheostomy in the 3rd Level our Hospital between January 2018 and December 2022 were examined. Demographic data of the patients, diagnosis of hospitalization, Acute Physiology and Chronic Health Evaluation II Score (APACHE II score), hospitalization time, intubation time, time from intubation to tracheostomy, early and late complications of tracheostomy were retrospectively analyzed.

**Results:** Ninety-seven patients were analyzed. The mean age of the patients was  $77.6 \pm 10.9$  (range, 41-100) years and the female-male ratio was 40/57. The most common hospitalization diagnosis was neurological reasons (54.6%). The patients were intubated for  $20.3 \pm 7.9$  (range, 7-48) days and the total length of stay in the ICU  $65.3 \pm 30.3$  (range, 17-175) days. The number of patients who developed complications related to the PT procedure was 17 (12.9%).

**Conclusion:** Percutaneous tracheotomy, which is performed in the ICU with indications such as the need for prolonged mechanical ventilation, facilitating weaning, and providing an emergency airway, is a simple, minimally invasive procedure with a low complication rate.

**Keywords:** Intensive care, tracheotomy, complication

## INTRODUCTION

Percutaneous tracheostomy (PT) is an interventional method that is frequently used in the treatment of upper airway obstructions and in intensive care patients who have undergone endotracheal intubation, which is thought to require long-term mechanical ventilation (MV) (1,2). The purpose of PT in intensive care unit (ICU) patients; protect the airway, prevent intubation-related complications, reduce laryngeal injury, facilitate nursing care and clearance of airway secretions, reduce dead space volume, facilitate patient transport from the intensive care unit to general services, increase patient comfort, assist and enable speech, improve airway resistance, counted as reducing the need for sedation, providing safer and faster weaning, shortening the length of stay in the ICU, and

facilitating oral feeding (3,4).

PT has been shown to be a viable method due to its key advantages including easy bedside application, low complication rates, and short application time. Moreover, PT is frequently used in ICU patients requiring elective tracheostomy (5). As PT is an invasive procedure, it may lead to both intraoperatif and postoperative complications. Tracheostomy can be performed with surgical and percutaneous methods. Percutaneous tracheostomy techniques are frequently preferred in intensive care patients because they can be applied at the bedside in a short time (6,7).

Although percutaneous tracheotomy has complications such as pneumothorax, emphysema and bleeding, it has advantages such as being simple, having a very low

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complication rate, not requiring operating room conditions, and being a method that can be applied at the bedside in a short time (8,9).

In this study, we aimed to retrospectively evaluate the percutaneous tracheostomy cases we performed in the ICU in the last three years.

## MATERIAL AND METHOD

After obtaining the ethics committee approval from the ethics committee of Karabük University (2023/1244), the patients who underwent PT between January 2018 and December 2022 in our hospital's intensive care units were evaluated retrospectively. Informed consent was not obtained as it was a retrospective study. Cases over the age of 18 who underwent PT between the dates we determined were included in the study. Surgical tracheostomy was performed in 21 patients. However, these patients were excluded from the study.

A total of 97 cases, 40 female and 57 male, who underwent percutaneous tracheostomy with the Griggs method, were retrospectively analyzed. Patients without bleeding disorders (platelet count greater than 50,000 (mm<sup>3</sup>)-1, activated partial thromboplastin time and prothrombin time less than 1.5 times the control value) were included. The procedure was applied to patients with normal trachea and neck structure (no previous neck surgery, goiter, soft tissue infection in the patient's neck). All tracheostomies were performed under elective conditions by an experienced specialist or an anesthesia assistant who has completed at least 2 years in the presence of a specialist. After intravenous administration of fentanyl 1 µg kg<sup>-1</sup>, propofol 3 mg kg<sup>-1</sup> and rocuronium 0.1 mg kg<sup>-1</sup> before the procedure, positive pressure mechanical ventilation (MV) with 100% oxygen was applied to the patients. After the patient was placed in a flat supine position, the head was extended with under-shoulder support. After the endotracheal tube cuff was lowered by the assistant standing on the head of the patient, the tube was pulled under the vocal cords, and the tube cuff was inflated again. Was dressed sterile for the procedure. The neck area was covered with perforated green after wiping with antiseptic solution. The first and second or second and third intervals of the tracheal cartilage were palpated and local anesthesia was administered with 2% lidocaine (2-3 ml) to the area to be treated. After local anesthesia, a vertical incision (8-10 mm) was made in the skin area with the help of a scalpel. With the help of an injector with a 14G needle at the withdrawn end of 3 ml of saline, aspiration was made from the determined area and the tracheal lumen was entered. When air was aspirated into the syringe, the syringe was separated from the needle and the guide wire passed through was placed in the lumen of the trachea. The area was enlarged with the help of an 8F dilator passed over the guide wire. After removing the dilator and expanding the skin, subcutaneous and trachea with the help of forceps, a 7.5, 8 or 8.5 tracheotomy tube was inserted into the trachea. The guide wire was pulled. The patient was connected to

the ventilator after in-tube aspiration was performed by inflating the tracheotomy tube cuff. After cleaning around the tracheotomy tube, sterile sponge was wrapped. After listening to the respiratory sounds, the patients had a chest X-ray in their bed.

Gender, age, diagnosis at the time of hospitalization, APACHE II scores, total length of stay (days), and discharge status (healthy/tracheotomy/death) of the cases were recorded. The number of days intubated, the anesthetic agents (All patients were given intravenous fentanyl 1 µg kg<sup>-1</sup>, propofol 3 mg kg<sup>-1</sup> and rocuronium 0.1 mg kg<sup>-1</sup> before the procedure; local anesthesia was administered with 2% lidocaine (2-3 ml) to the area to be treated) used during the procedure, and the complications that developed during and after the procedure were recorded.

Bleeding; minor bleeding (bleeding that can be stopped by wrapping sponge around the stoma in a short time) was classified as moderate bleeding (continuation of bleeding from the trachea with stoma/aspiration despite compresses) and bleeding from the appendix (bleeding that is intervened in the operating room).

## Statistical Analysis

In the descriptive statistics of the data, mean, standard deviation, median minimum, maximum, frequency and ratio values were used. SPSS 28.0 program was used in the analysis.

## RESULTS

There are three separate tertiary ICUs in our hospital. The number of patient beds varies between 24-28. Due to technical reasons, the number of beds decreased in some periods and some of the patient beds were reserved for the follow-up of patients infected with Covid-19 in certain periods due to the Covid-19 pandemic. Between January 2018 and December 2022, PT was performed to 104 patients. Seven cases whose data could not be accessed were excluded from the study.

Demographic data, diagnoses, early complications, late complications and discharge status of the cases are shown in Table 1. The mean age of the cases included in the study was 77.6±10.9 (41-100) years. 58.8% of these cases are male. The most common hospitalization reasons of the cases were due to neurological reasons (54.6%). Respiratory disease rate (28.9%), post-CPR rate (9.3%), cardiac disease rate (7.2%) were found. The duration of intubating the cases was 20.3±7.9 (7-48) days. The duration of follow-up in the intensive care unit was 65.3±30.3 (17-175) days.

All PT procedures were performed by specialist physicians. Forceps dilatation (Griggs) method was applied in all of them. 11.3% of our patients developed early complications and 2.1% developed late complications. Among the early complications, bleeding was the most common with 5.2%. One of our cases died due to paratracheal localization. Tracheoesophageal fistula and tracheal stenosis were seen in 1% of our cases as late complications.

The discharge status of our cases is also shown in Table 1. Intensive care treatments were completed in 30.9% of the cases. 10.3% of the cases were transferred to their homes

and 20.6% of them were transferred to the services. 62.9% of our cases died.

Table 1. Demographic data, diagnosis, complications, discharge status					
		Min-Max	Median	Mean±ss	n-%
Age		41.0-100.0	79.0	77.6±10.9	
Sex	Female			40	41.2%
	Male			57	58.8%
Diagnosis	Neurological disease			53	54.6%
	Respiratory disease			28	28.9%
	Post CPR			9	9.3%
	Cardiac disease			7	7.2%
Apache II score		6.0-47.0	21.0	22.1±7.5	
Early complication	None			86	88.7%
	Yes			11	11.3%
	Bleeding			5	5.2%
	Paratracheal placement			2	2.1%
	Subcutaneous emphysema			2	2.1%
	Death			1	1.0%
	Pneumothorax			1	1.0%
Late complications	None			95	97.9%
	Yes			2	2.1%
	Trachea-oesophageal fistula			1	1.0%
	Tracheal stenosis			1	1.0%
Intensive care hospitalization period		17.0-175.0	60.0	65.3±30.3	
Endotracheal intubation days		7.0-48.0	21.0	20.3±7.9	
Discharge status	Death			61	62.9%
	Clinic			20	20.6%
	Home			10	10.3%
	Currently in ICU			6	6.2%

## DISCUSSION

In order to simplify long-term airway management, tracheostomy is often needed in critically ill patients in the intensive care unit due to the need for long-term MV. Although this concept remains unchanged, its current timing is still a matter of debate. Continued research is needed as it depends primarily on physician's prediction of the need for long-term MV rather than evidence-based practice (10). The advantages of PT are that it can be done with a small skin incision, less damage to tissues, less risk of bleeding, reduction in tissue deformity, and less infection at the application site. In addition, the advantages of PT can be considered to be reduced transport risks and costs, shorter opening time, and reduced complication rates, since it can be performed at the bedside and therefore does not require an operating room. For these

reasons, PT is preferred more than surgical tracheostomy (11-15). Surgical tracheostomy was performed in 21 of 183 patients hospitalized in our ICU in the last 4 years, and PT was performed in 97.

Considering the diagnosis of hospitalization, it is seen that the most common cause is neurological. This is followed by respiratory causes (16,17). Similar results were obtained in our study.

In the study by Antonelli et al., the expected mortality rate according to the SAPS II score of the patients was approximately 34%. In the study by Destegul et al., the expected mortality rate according to the APACHE II score was approximately 95% (7,18). In another study, this rate was found to be %73 (19). In our study, the mean expected mortality rate was %38 according to the APACHE II score.

Since there are no proven guidelines, the appropriate timing to perform tracheostomy in the ICU in critically ill patients followed in MV varies according to the medical conditions of the patients, the foresight of the intensive care physician, and communication with the families of the patients (20). General view is that mechanical ventilation can be opened between 2-10 days (21). In some studies conducted in Turkey, the number of intubated days until tracheostomy is opened varies between a minimum of  $8.20 \pm 5.44$  days and a maximum of  $19.51 \pm 10.23$  days (13,16,17). In our study, the number of days to intubate was found to be  $20.3 \pm 7.9$  (7-48). This period is long. In fact, although the physicians in our intensive care unit decided to have a tracheostomy in accordance with the average, the main reason is that the families give their consent late in order to open a tracheostomy, which is obligatory. We observe that this situation is more evident especially in elderly patients. In another study, they reached the same results as ours (22).

Bleeding not requiring transfusion or surgery, subcutaneous emphysema, paratracheal insertion of the cannula, injury to the posterior tracheal wall, short-term hypoxia, and stoma infection are the most common complications in percutaneous techniques. In the percutaneous tracheotomy series of 827 cases, perioperative mortality was 0.6%, perioperative complication rate was 6%, and early postoperative complication rate was 5% (23). In our study, we had early complications in 11 patients and late complications in 2 patients.

There are studies reporting different results regarding bleeding from PT complications (8). Studies show that minor bleeding due to PT procedure is 1.5-5.2% and major bleeding is 0.75-2.6% (16,17,24). It has been reported that minor bleedings are seen in prolonged procedures and can be controlled with compression, ligation is required in major bleedings, and it has been shown that blood loss in the form of leakage from the stoma is 50-100 ml (8).

The main early complication of PT is bleeding in the anterior tracheal wall. It can be controlled by pressure or sewing. Major bleeding occurs in less than 5% of cases and is typically venous. Catastrophic bleeding is rarely seen and in most cases it is seen in the late period due to tracheo-innominate artery fistula. Tracheo-innominate artery fistula is a rare but life-threatening complication encountered during PT placement. The frequency rate is 0.3%. Fatal aortic arch laceration was reported as an early complication of PT in one case (25,26). These complications should be identified in the early period; emergency neck exploration and appropriate surgical intervention should be performed.

Opening the PT above the cricothyroid membrane increases the likelihood of tracheal stenosis, while opening it below the 4th tracheal ring increases bleeding complications (27). In a study, the rate of tracheal stenosis was reported as 5.7% (17). In our study, this rate was only 1%.

The incidence of mortality associated with PT procedure

varies between 0-8% in the literature (28,29). In our study, mortality was detected in 1 patient. We have developed hypoxia after pneumothorax due to the paratracheal location of the tracheostomy and lost the patient. Some authors recommend routine use of fiberoptic bronchoscopy to prevent paratracheal placement (30).

In the study of Karasu et al., 25.7% of the cases were discharged. 48.5% of them died (22). In our study, intensive care treatments were completed in 30.9% of our cases. 10.3% of the cases were transferred to their homes and 20.6% of them were transferred to the services. 62.9% of our cases died.

## CONCLUSION

It was observed that PT is a simple procedure that can be performed at the bedside and has low complication rates.

### Study Limitations

The main limitation of our study is that the people who performed the procedure were not the same, it was not known how many times these people performed the procedure, and the study was a retrospective study.

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**Conflict of Interest:** The authors have no conflicts of interest to declare.

**Ethical approval:** Ethics committee approval was obtained from the ethics committee of Karabuk University. (2023/1244).

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