

Evaluation of early and late percutaneous tracheostomy in geriatric patients in the intensive care unit

Early and late percutaneous tracheostomy in geriatric patient

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Abstract

Aim: Percutaneous tracheostomy is a method frequently used in intensive care because of ease of implementation, can be open at the bedside and has a low complication rate. Early tracheostomy was defined in 3-10 days of mechanical ventilation, late tracheostomy was defined at any time except the early period. Mortality risk rises with prolonged ventilation in the geriatric population. The first aim of this study is to search for the duration of hospital stay for the geriatric patients who underwent early and late percutaneous tracheostomy in the intensive care unit and its effect on 30-day mortality; and the second aim is to evaluate the complications of early and late tracheostomy.

Material and Methods: Forty-six patients over 65 years of age who underwent percutaneous tracheostomy in the intensive care unit divided into two groups: within 3-10 days were grouped as "early tracheostomy", and after 10 days as "late tracheostomy". APACHE II scores, demographical data, indications, length of stay, discharge, 30-day mortality and complications during the procedure were recorded.

Results: In late tracheostomies, the incidence of minor bleeding was less than in early tracheostomies, but the incidence of major complications such as subcutaneous emphysema, pneumothorax, and hypotension was higher. Hospital stay and intensive care durations were found to be shorter in patients who underwent early tracheostomy.

Discussion: An early tracheostomy reduces the duration of hospital stay and has no effect on mortality and complications. Major complications after early tracheostomies were less common than in the late period. However, we think that this result should be investigated using randomized controlled studies with higher patient numbers.

Keywords

Percutaneous Tracheostomy; Early; Late; Length of Stay; Complication

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Introduction

Percutaneous tracheostomy is a method frequently used in intensive care because of ease of implementation, can be open at the bedside and has a low complication rate [1,2]. The tracheostomy procedure is performed for prolonged intubation, failure in extubating attempts, the need for a long-term mechanical ventilator, protection of the respiratory tract and prevention of aspiration in patients with severe brain damage, facial and neck traumas, and to by-pass upper airway obstruction [3].

Geriatric patients who are followed up in the intensive care have prolonged adherence to a mechanical ventilator, and an unsuccessful weaning process occurs [4]. Mortality risk rises with prolonged ventilation in the geriatric population [5].

Despite the advantages of tracheostomy in prolonged mechanical ventilation, optimal timing for tracheostomy remains controversial. In the articles published in the last years, while early tracheostomy was defined in 3-10 days of mechanical ventilation, late tracheostomy was defined at any time except the early period [6]. However, tracheostomy opening time does not depend on the physician's choice only, and the time for family decision and hesitation also affects the time for opening the tracheostomy. Airway safety, improved patient comfort, easier and more efficient secretion clearance are among the advantages of ventilation with a tracheostomy tube [7]. However, complications such as minor/major bleeding, wound infection, subcutaneous emphysema, pneumothorax/mediastinum, tracheal stenosis, tracheoesophageal fistula occurrence, tracheomalacia, cardiac arrest can be seen also [8]. The first aim of this study is to search for the duration of hospital stay for the geriatric patients who underwent early and late percutaneous tracheostomy in the intensive care unit and its effect on 30-day mortality; and the second aim is to evaluate the complications of early and late tracheostomy.

Material and Methods

The patients over 65 years age who underwent percutaneous tracheostomy between January 2015 and April 2020 were included in the study. After the ethical committee approval obtained from Uludag University Ethical Committee (no: 2021-5/2, date: 03.03.2021), patients over 65 years of age who underwent percutaneous tracheostomy in the intensive care unit of our hospital between January 2015 and April 2020 were evaluated retrospectively. The patients were divided into two groups according to the time from intubation to the opening of tracheostomy. Patients who underwent tracheostomy within 3-10 days were grouped as "early tracheostomy", and patients who underwent tracheostomy after 10 days as "late tracheostomy". Percutaneous dilatational tracheostomy has not been performed in patients without the permission of themselves and/or their families, and patients who have bleeding diathesis presence (thrombocyte count $<60,000 \text{ mm}^3/\text{L}$, international normalized ratio > 1.5), requiring high oxygenation support (positive expiratory pressure $> 10 \text{ mmHg}$; $\text{fiO}_2 > \%80$) and presence of cervical trauma.

The patients were given fentanyl $1-2 \text{ mg kg}^{-1}$, midazolam 0.2 mg kg^{-1} and rocuronium $0.5-1 \text{ mg kg}^{-1}$ for sedation and muscle relaxation. Thereafter, for the position, the armpit

support was placed with the head in extension while the patient was in the supine position. After cleaning the mouth with antiseptic solutions, the endotracheal tube balloon was lowered and retracted to the vocal cord level and inflated. Percutaneous tracheostomy was opened via the Griggs technique. After the neck area was sterilized by povidone iodine in the surgical area, a local anesthetic was applied to the incision area. Skin and subcutaneous incisions were made over 2-3 tracheal rings, after the neck area was sterilized by povidone iodine in the surgical area, a local anesthetic was applied to the incision area. A guidewire was inserted into the lumen of the trachea through the needle. The area was enlarged with the help of an 8F dilatator passed over the guidewire. After removing the dilatator, expanding the skin, subcutaneous and trachea with the help of forceps and guiding the guide wire to the tracheal lumen, the appropriate tracheostomy cannula was inserted, the cuff was inflated. After the endotracheal tube was removed, ventilation of both lungs was controlled by listening. It was evaluated with chest radiography after the procedure. Close observation and monitoring were performed for 24 hours for early complications.

Patients' Acute Physiology, Assessment and Chronic Health Evaluation II (APACHE II) scores, age, gender, additional diseases, intensive care hospitalization indications, time of opening of tracheostomy, intensive care stay, intensive care discharge, 30-day mortality, and complications during the procedure (bleeding, pneumothorax, subcutaneous emphysema, hypotension, hypoxia, mortality) were recorded. The bleeding was classified as minor bleeding (bleeding that stops for a short time with the sponge wrapped around the stoma), moderate bleeding (continuation of bleeding from the trachea with stoma/aspiration despite compression) and abundant bleeding (bleeding that was taken to the operating room and intervened).

Statistical analysis

Data were analyzed using Statistical Package for the Social Sciences software for Windows (version 22.0; SPSS Inc., Chicago, IL, USA). Whether continuous variables were normally distributed was determined using the Kolmogorov-Smirnov test. The Levene test was used to evaluate the variance homogeneity. Continuous data are presented as mean \pm standard deviation (sd). Median (range) was used for skewed distributions. Categorical data were previously sent as the number of cases (%).

Results

Forty-six patients were included in the study. There were 20 patients in the early tracheostomy group and 26 patients in the late tracheostomy group. There was no statistically significant difference between the groups in terms of age, comorbidity, hospitalization indications, APACHE II scores, discharge, and 30-day mortality (Tables 1 and 2). The time to open tracheostomy in the early tracheostomy group was 6.2 ± 2.6 days, and in the late tracheostomy group it was 21.42 ± 10.02 days. The hospitalization duration of patients who underwent early tracheostomy was 20.35 ± 5.14 days, and for patients who underwent late tracheostomy was 43.11 ± 15.18 days (Table 2). The hospital stay after tracheostomy was shorter in early

Table 1. Demographic data, clinical characteristics and complications

	Early Tracheostomy	Late Tracheostomy	P- value
Gender			
Female	11(%)	7	0.052
Male	9(%)	19	
APACHE II	24.25±4.81	25.15±4.83	0.532
Age (years)	71.65±13.85	72.53± 13.06	0.825
Complications			
Minor bleeding	4(%)	1	0.052
Subcutaneous emphysema	0	1(%)	
Pneumothorax	0	1(%)	
Hypotension	0	1(%)	
Admission Indication			
Cerebrovascular hemorrhage	9(%)	3	0.532
Cerebrovascular ischemia	2(%)	7	
Aspiration pneumonia	6(%)	6	
Pneumonia	2(%)	7	
Urosepsis	0(%)	1	
Post CPR	1(%)	2	
Comorbidities			
Hypertension	24(%)	20	0.879
Diabetes Mellitus	13(%)	11	
Stroke	3(%)	2	
CHF	4(%)	3	
ALS	2(%)	1	
malignancy	1(%)	0	
COPD	3(%)	4	
Dementia	2(%)	1	

n: number of patients, COPD: Chronic Obstructive Pulmonary Disease, CHF: Chronic Heart Failure, CPR: Cardiopulmonary Resuscitation, ALS: Amyotrophic Lateral Sclerosis

Table 2. Length of stay (LOS), discharge and mortality

	Early Tracheostomy	Late Tracheostomy	P- value
Timing of Tracheostomy	6.2±2.6	21.42±10.02	<0.001*
Length of stay (LOS)	20.35±5.14	43.11±15.18	<0.001*
30-day mortality	1	4	0.60
LOS after tracheostomy	14.15±3.92	21.69±13.55	0.021*
Discharge Status			
Discharged	6(%)	11	0.540
Exitus	14(%)	15	

tracheostomies than in late tracheostomies (p<0.05, Table 2). Minor bleeding was observed in 10% (n = 5) of the patients, subcutaneous emphysema in 2% (n = 1), pneumothorax in 2% (n = 1), hypotension in 2% (n = 1). In early tracheostomies, minor bleeding was observed in 4 patients, and in addition to minor bleeding in late tracheostomies, subcutaneous emphysema, pneumothorax and hypotension were observed.

Discussion

In late tracheostomies, the incidence of minor bleeding was less than in early tracheostomies, but the incidence of major complications such as subcutaneous emphysema, pneumothorax, and hypotension was higher. Hospital stay and intensive care durations were found to be shorter in patients

who underwent early tracheostomy.

In meta-analyses comparing early tracheostomy and late tracheostomies in intensive care, it has been shown that the duration of hospital stay and in-hospital mortality are less with early tracheostomies [9, 10]. Jeon et al.'s study in the neurological intensive care unit showed that early tracheostomies shorten the length of hospital stay and do not affect mortality in the intensive care unit [11]. Chen et al.'s study on patients followed up for hemorrhagic stroke showed that early tracheostomies reduce the length of hospital stay and have no effect on mortality in intensive care [12]. In the monocenter study by Affronti et al. comparing early and late tracheostomies after cardiac surgery, showed that early tracheostomy decreases the duration of hospital stay and does not affect mortality in intensive care [13]. In the study by Schneider et al. on elderly patients hospitalized in the intensive care unit, it was shown that the duration of intensive care stay was short in patients who underwent early tracheostomy [14]. In our study, it was also observed that the duration of hospital stay was less in early tracheostomies, but there was no difference in terms of mortality in the intensive care unit.

In addition to studies showing that early tracheostomy is short in intensive care, there are also studies showing that it does not affect the duration of hospital stay [15,16]. In the randomized controlled study by Bösel et al., it was shown that early tracheostomy did not reduce the length of stay in the hospital [17]. Day 3 was taken as the limit for early tracheostomy in this study. In the late tracheostomy group, the mean time to open tracheostomy is 10.5 days. In our study, the time to open tracheostomy in the late tracheostomy group was found to be 21.42 ± 10.02 days. We think that the reason for the discrepancy with the literature cited is the difference between the average tracheostomy opening days. Bergquist et al.'s study showed that early tracheostomy does not reduce the duration of hospital stay [18]. The patients included in the study were over the age of 15, and the average age was below 65. We think this is the reason why it differs from our study.

In addition, many studies do not specify whether the total length of hospital stay or only the duration after tracheotomy is calculated. In the study by Young et al., it was shown that there was no correlation between the intubation time before tracheostomy and the duration of hospital stay. In the study by Türkovic et al., it was shown that there was no difference between the duration of hospital stay after tracheostomy between early and late tracheostomy [19,20]. In our study, the duration of hospital stay was found to be shorter in patients who underwent early tracheostomy. We think that this difference from the literature is due to the fact that there are patients who underwent surgical operations in our patient population. Compared with surgical tracheostomy, less complications have been reported in percutaneous tracheostomy [6]. In patients who underwent percutaneous tracheostomy, minor bleeding was 1.4%, 5.5%, 28%, and major bleeding was 4.2%, 2.7% [7, 21,22]. In our study, the rate of minor bleeding was measured as 10%, and it was seen in accordance with the given literature. Post-procedure incidence of hypotension was reported as 3.8%, pneumothorax 0.5% and subcutaneous emphysema 1.1% [1, 2, 21, 22]. In our study, the incidence of hypotension,

pneumothorax, and subcutaneous emphysema was found to be 2% and in accordance with the literature. Complications of early and late tracheostomy application have not been compared much in the literature. In the study by Ülkümen et al., comparing post-procedural complications of early and late tracheostomies, no difference was observed [1]. In the same study, it was stated that minor bleeding was more common with early tracheostomies, but it was not statistically significant. In our study, there was no statistically significant difference between early and late tracheostomies, but in the early period, minor bleeding was seen more often, and the incidence of pneumothorax hypotension and subcutaneous emphysema in the late period was found to be higher than in the early period. As a result, we think that early tracheostomy reduces the duration of hospital stay and has no effect on mortality and complications. Major complications after early tracheostomies were less common than in the late period. However, we think that this result should be investigated in randomized controlled studies with higher patient numbers. The most important limitation of our study is that it had a retrospective design and that late complications after tracheostomy were not examined.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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