ISSN: 1607-8322, e-ISSN: 2220-5799 **Anaesthesia, Pain & Intensive Care**
Vol 28(6); December 2024 DOI:10.35975/apic.v28i6.2620

ORIGINAL RESEARCH **INTENSIVE CARE**

Correlation between tracheostomy timing and length of stay in critically ill patients

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ABSTRACT

Background & objective: Tracheostomy is the most frequently performed operative procedure in the Intensive Care Unit (ICU). The most common indication for a tracheostomy is the need of prolonged mechanical ventilation (PMV). The benefits of tracheostomy over an endotracheal tube include the safer, more comfortable breathing support, better oral hygiene, less need for sedation, and faster weaning of mechanical ventilation. The most appropriate and optimal time to perform a tracheostomy procedure is still controversial. Therefore, we wanted to describe the relationship between tracheostomy timing and length of stay (LOS) in the ICU of Dr. Moewardi Hospital during 2019 - 2020.

Methodology: This study was an observational, analytical retrospective cohort study. We used consecutive sampling technique from 79 patients, based on inclusion and exclusion criteria. Tracheostomy timings were assigned into two groups; early tracheostomy (during first 8 days) and late tracheostomy groups (after 8 days) . To analyze the relationship between tracheostomy timing and LOS, chi-square test was performed.

Results: Of the 79 subjects, 52 samples were in early tracheostomy and 27 in late tracheostomy group. Chi-square test revealed a significant correlation between tracheostomy timing and length of stay (P = 0.000). Also, age, sex, did not correlate with LOS (P > 0.05). The only factor related to LOS significantly was severity with APACHE II score and initial indication of tracheostomy (P = 0.000). After making gradual adjustments to other variables that affect LOS, tracheostomy timing and APACHE II score, only tracheostomy timing had a significance value of 0.000 in the second stage of the multivariate analysis.

Conclusion: In conclusion, tracheostomy timing was significantly associated with LOS. Early tracheostomy significantly shortens length of hospitalization.

Keywords: Early Tracheostomy; Length of Stay; Intensive Care Unit.

Citation: Permana SA, Amelia A, Adithya B. Correlation between tracheostomy timing and length of stay in critically ill patients. Anaesth. pain intensive care 2024;28(6): 1004-1009; **DOI:** 10.35975/apic.v28i6.2620

Received: December 21, 2021; **Reviewed:** February 11, 2023; **Accepted:** February 12, 2023

1. INTRODUCTION

Tracheostomy is the most frequently performed surgical procedure in the Intensive Care Unit (ICU). The most common indication for a tracheostomy is prolonged mechanical ventilation (PMV). The benefits of tracheostomy compared to the use of endotracheal intubation are reducing the risk of laryngeal injury, increasing patient comfort and increasing activities of daily life such as mobility and eating. Another category

for tracheostomy is due to the patient's airway obstruction, such as in patients who have tumors in the airways, problematic vocal cords such as swelling, narrowing, or due to abnormal airway anatomy .[1]

The concept of early tracheostomy has emerged in the last 30 years. Other observational studies have shown better clinical outcomes in patients with early tracheostomy, although the definition of early tracheostomy varies from 3 days to 21 days.[2]

Many studies show considerable variation in the analysis of the relationship between tracheostomy timing and LOS in the ICU. The results of the study by Rumbak et al., showed that tracheotomy after 2 days of intubation could reduce the mortality rate, occurrence of pneumonia, and length of stay in the ICU compared to tracheostomy performed after 14 to 16 days of intubation. Meanwhile, Terragni et al., analyzed by comparing early tracheostomy performed after 6 to 8 days of endotracheal intubation and late tracheostomy performed after 13 to 15 days of endotracheal intubation. From this analysis, it was found that the early tracheostomy group was significantly associated with increased ICU-free days and successful weaning [3] In addition, another study also stated significant results between early tracheostomy performed less than 4 days and length of hospitalization (Bickenbach et al., 2011).

The tracheostomy procedure has shown various advantages over the use of an endotracheal tube in patients with Prolonged Mechanical Ventilation/PMV. Even so, the time limit or the most appropriate and optimal time to perform a tracheostomy procedure is still controversial. Therefore, the researcher wanted to know the description of the relationship between tracheostomy time and LOS in the ICU Dr. Moewardi Hospital in 2019 - 2020.

2. METHODOLOGY

This study was conducted in ICU of Dr. Moewardi General Hospital, Surakarta, by collecting patient data from January 2019 to December 2020. This is an observational analytical cohort prospective study to associate tracheostomy timing and length of stay in critically ill patients. Sampling calculated by consecutive sampling technique. Patients were consisting of 79 samples data was collected from the medical records of the research subjects and based on inclusion and exclusion criteria. Data analysis was performed using bivariate analysis with chi-square test and multivariate logistic regression analysis.

2.1. Subjects

The study samples were sepsis patients treated in the ICU of Dr. Moewardi General Hospital, Surakarta, from July to December 2020. The sampling was done by consecutive sampling technique. Patients were assigned into 2 groups, there are early tracheostomy (< 8 days after intubation) and late tracheostomy (≥ 8 days after intubation) We included patients aged over 18 years who had been intubated in the ICU. Patients who died before the end of hospitalization or patients with history previous tracheostomy were excluded.

1.1. Data collection

Primary data was Length of Stay (LOS) within 28 days. Patients who were discharged alive from the hospital before 28 days were considered to be short LOS and who were discharged after 28 days were considered to be prolonged LOS. Study personnel collected data by manual review of medical records. Patient-level data included baseline information on demographics, initial cause of tracheostomy and severity with APACHE II score. We followed the severity definition into 2 groups; low severe patient < 16 of APACHE II score and high severe patients who get > 16 of APACHE II score. Initial causes of tracheostomy were assigned into 3 groups; airway problems, neurological disease and intrathoracic disease.

1.2. Statistical Analysis

The data analysis was performed with SPSS ver. 22. Univariate analysis was done descriptively. *Chi-square* test was used for bivariate analysis and logistic regression was used for multivariate analysis.

3. RESULTS

3.1. Subject's description

Seventy-nine patients with tracheostomy history treated in the ICU of Dr. Moewardi General hospital, Surakarta were included in this study. Based on gender, male research subjects consisted of 38 (48.1%) in the early tracheostomy group and 17 (21.5%) in the late tracheostomy group; while the female subjects consisted of 14 (17.7%) in the early tracheostomy group and 10 (12.6%) in the late tracheostomy group.

Based on the results of data mapping, data obtained from 52 (65.8%) people in the early tracheostomy group and 5 (6.3%) people in the late tracheostomy group included in the short LOS, while there were data of 22 (27.8%) people in the case of late tracheostomy who included the criteria for the long LOS.

Airway problem (50%) is the most common cases requiring tracheostomy treatment, especially early tracheostomy group. While neurological disease (25%) is second and mostly done with late tracheostomy. The distribution of the main diagnosis of research subjects in early tracheostomy showed that the most cases were laryngeal cancer. The distribution of the main diagnosis

Table 1: Cross-tabulation between AKI and characteristics of samples. Data given as n (%).

Characteristics		Total	Early Tracheostomy (n = 48)	Late Tracheostomy (n = 34)	p- value*
Age, mean		55	55 □16.75	55 □ 14.9	0.075
Gender	Male	55 (70)	38 (48.1)	17 (21.5)	0.447
	Female	24 (30)	14 (17.7)	10 (12.6)	
Length of Stay (days)	Short	57 (54.9)	52 (65.8)	5 (6.3)	0.000
	Long	22 (45.1)	19 (46.3)	22 (22.8)	
APACHE II score	High	44 (55.7)	40 (50.6)	4 (5.1)	0.000
	Low	35 (44,3)	12 (15.2)	23 (29.1)	
Initial Cause of tracheostomy	Airway problems	45 (57)	40 (50)	5 (6.3)	0.000
	Intrathoracic disease	31 (40)	11 (14)	20 (25)	
	Neurological disease	3 (3)	1 (1.2)	2 (2.5)	

**Chi-square test. Significant at α = 5% (P < 0.05). Data given as n (%)*

of research subjects on late tracheostomy showed that the most cases were post craniotomy evacuation of epidural hemorrhage (EDH) and the majority of cases were dominated by diseases in the region of cerebral / neurological disease (25%).

3.2. Bivariate analysis

Table 2 presents the results of the analysis of the chi square test and crosstabulation between tracheostomy timing related to LOS. From the results of this study, it was found that the incidence of short LOS was more in the early tracheostomy group (65.8%) compared to the late tracheostomy group (6.3%). found a significant relationship between the time of tracheostomy and length of stay (p value: 0.000).

3.3. Multivariate analysis

Selection of covariates to be included in multivariate analysis through selection in bivariate analysis with simple logistic regression test. Candidates are selected based on variables that have a P value < 0.25. After a simple logistic regression test was performed, the variables that met the requirements for P < 0.25 were the tracheostomy time interval variable and the severity variable (APACHE II score) after being tested for multivariate logistic regression, the results can be seen in Table 3.

Table 2: Bivariate analysis between tracheostomy timing related to LOS

Tracheostomy Timing	Short LOS	Prolonged LOS	p*
Early Tracheostomy	52 (65,8)	0 (0%)	0.000
Late Tracheostomy	5 (6,3)	22 (27,8)	
Total	57 (72,2)	22 (27,8)	

**Chi-square test. Significant at α = 5% (p < 0.05). Data given as n (%)*

Table 3 shows the results that the tracheostomy time interval variable is a variable that passes up to the second stage of the logistic regression test. This shows that these variables affect the length of stay directly on the variable length of stay. The variable APACHE II score (p value: 0.306) is more than the 5% significance value, so it can be concluded that the APACHE II score in this study did not significantly affect the length of stay

4. DISCUSSION

Most of the main indications for intensive care in the early tracheostomy group were cases of airway problems due to mass/airway problems, then followed by trauma disease with clinical loss of consciousness mainly due to intracranial hemorrhage after head

Table 3: multivariate logistic regression analysis between LOS and tracheostomy timing with APACHE II score

	Variable	β coefficient	OR (IK 95%)	p*
Step 1	Tracheostomy timing	22.423	5.697	0.000
	APACHE II score	0.460	1.583	0. 306
Step 2	Tracheostomy Timing	0.000	3.430	0.000

**Chi-square test. Significant at α = 5% (p < 0.05). Data given as n (%)*

trauma/neurological disease followed by intrathoracic disease/pulmonary disease. . This is in accordance with the Critical Nurse Caring study regarding the benefits of tracheostomy four categories of tracheostomy, one of which is due to the patient's airway obstruction / airway problems, such as in patients who have tumors in the airways, problematic vocal cords such as swelling, narrowing, or swelling. because abnormal airway anatomy (Morris et al., 2013).

In the late tracheostomy group, neurological disease cases were found as the main indication, followed by airway obstruction due to masses and other medical cases. This is in accordance with the NHS Foundation Trust research on Trachostomy Care Guidelines 2017 tracheostomy can be performed in patients with decreased level of consciousness or neuromuscular disorders in breathing, airway obstruction, excessive secretions, and supports weaning in patients. (Guys, 2017). Several other studies found that cases of respiratory failure were the main indication for intensive care in both groups. (Young et al., 2013)

The difference in the indications for intensive care in the late tracheostomy group in this study may be because most of the neurological cases had a low GCS (GCS < 8) on admission and thus were expected to require long-term mechanical ventilation. Differences in indications for intensive care may also be possible because of the delay in assessing the presence of respiratory failure for transfer to the intensive care unit. (Lusiana et al., 2014)

In this study, the time limit for determining the early and late tracheostomy groups was 8 days using mechanical ventilation during intensive care. This is based on previous studies where the mean time to tracheostomy varied between 9-14 days and ACCP recommends that endotracheal intubation not exceed 10 days.(Lusiana et al., 2014)

The results of this study indicate that the tracheostomy time interval with a cut off of 8 days as a differentiator between early tracheostomy and late tracheostomy which was carried out by chi square analysis with length of hospitalization showed quite significant results. This is in accordance with other studies which stated significant results between early tracheostomy performed less than 4 days and length of hospitalization (Bickenbach et al., 2011). this is because performing the procedure in the first week after mechanical ventilation requires a lower dose of sedative drug and a shorter duration of sedative treatment. This could explain the decreased duration of mechanical ventilation and ICU LOS. (Zagli et al., 2010). In addition, this study also proves that the benefits of tracheostomy presented in Durbin's study comparing tracheostomy with an endotracheal tube are a safer, more comfortable form of rescue breaths, better oral hygiene, less need for sedation, and weaning from mechanical ventilation. fast. (Durbin, 2010).

In a study conducted by Bickenbach, the severity of illness of the research subjects was also found to be more severe in the intermediate and advanced groups. The results between the early tracheostomy and late tracheostomy groups had a statistically significant relationship, but not significant between the intermediate tracheostomy and late tracheostomy groups. This suggests that an earlier time limit for performing a tracheostomy may have a role in reducing medical and surgical UPI mortality or the severity of illness strongly influences mortality rates regardless of the time to perform a tracheostomy. (Bickenbach et al., 2011)

Multivariate analysis was performed for the tracheostomy group variables and confounding variables with p value <0.25, so that the adjusted OR for the tracheostomy group for intensive care LOS was obtained. After making adjustments gradually on other variables that affect LOS, namely the distance between tracheostomy and LOS, the relative risk (RR) is 0.2 in the cis square test analysis and has a significance value of 0.000 in the second stage of multivariate analysis. These results indicate that early tracheostomy is significantly related to length of stay and the RR value means that patients who underwent early tracheostomy 0.2 times had a shorter length of stay compared to patients who underwent late tracheostomy. APACHE II scores were significantly associated when chi-square analysis was performed with length of stay, but when multivariate analysis was performed between APACHE II scores and tracheostomy time interval with length of stay, it was found that APACHE II scores did not partially correlate with length of stay. This explains that there are many other factors that influence the length of stay. From the research, Rachmawati et al. stated that the APACHE II score could not predict the length of stay of a patient because the higher the severity of the APACHE II score, the higher the risk of mortality so that the length of stay was also shorter. (Rachmawati et al., 2013)

5. LIMITATIONS

This study has been carried out with maximum effort, but has not been presented because this study was carried out retrospectively.

6. CONCLUSION

Based on the results of data analysis that has been carried out in this study, it can be concluded that the early tracheostomy significantly shortens length of hospitalization.

7. CONFLICT OF INTERESTS

The study was supported by the Faculty of Medicine of Sebelas Maret University and Dr. Moewardi General Hospital Surakarta. No party other than those mentioned were involved in this study.

8. AUTHORS CONTRIBUTION

The idea, writing, research, and report making was done by the first author. The second and the third author assisted in drafting ideas, giving direction in research, as well as improving reports.

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