



## Bioscientia Medicina: Journal of Biomedicine & Translational Research

Journal Homepage: [www.bioscmed.com](http://www.bioscmed.com)

### Comparison of Outcomes in Critically Ill Patients Installed with Mechanical Ventilation Performed Early and Late Tracheostomy at Dr. M. Djamil General Hospital Padang

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#### ARTICLE INFO

##### Keywords:

Length of stay  
Mortality  
Outcome  
Tracheostomy

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All authors have reviewed and approved the final version of the manuscript.

<https://doi.org/10.37275/bsm.v6i16.701>

#### ABSTRACT

**Background:** Tracheostomy is an alternative that is widely used as airway access after the use of a ventilator in the care of critically ill patients. Several factors are known to influence the outcome in patients undergoing tracheostomy. This study aimed to compare the outcomes of critically ill patients installed with mechanical ventilation performed early and late tracheostomy in Dr. M Djamil General Hospital, Padang, Indonesia. **Methods:** This study was an analytical observational study with a cross-sectional approach. A total of 97 research subjects participated in this study. Data analysis was carried out with the help of SPSS software in a univariate and bivariate manner between tracheostomy time (early and late) with patient outcomes in the form of death and length of stay. **Results:** There was a statistical difference in the mortality rate in critically ill patients with mechanical ventilation performed early and late tracheostomy,  $p = 0.014$ . There is a statistical difference in the length of stay in the intensive care unit in critically ill patients with mechanical ventilation performed early and late tracheostomy with  $p = 0.000$ . **Conclusion:** There are differences in outcomes in the form of mortality and length of stay in critically ill patients who have tracheostomy installed at Dr. M. Djamil General Hospital Padang, Indonesia.

#### 1. Introduction

Tracheostomy is generally recommended for patients who are expected to require prolonged mechanical ventilation based on international consensus.<sup>1,2</sup> Tracheostomy is an alternative that is widely used as airway access after the use of a ventilator in the care of critically ill patients. Tracheostomy can be performed both at the bedside and in the operating room.<sup>2</sup> Several studies have varied in the timing of tracheostomy. Other studies divided tracheostomy time into 2 groups, namely  $\leq 7$  days after intubation for early tracheostomy and after 7 days for late tracheostomy.<sup>2</sup> From these studies, it was found that earlier tracheostomy placement can

provide benefits in patients who require prolonged mechanical ventilation.<sup>3-5</sup>

Several factors are known to influence the outcome in patients undergoing tracheostomy. Another study said that age and comorbidities affect the mortality rate in patients who underwent tracheostomy.<sup>6</sup> Another study reported a very high one-year mortality (37%) in patients with comorbidities who underwent tracheostomy.<sup>7</sup> Other studies suggest that under 44 years of age have a smaller risk of complications in patients undergoing tracheostomy.<sup>8</sup> Female sex is also said to have a lower risk of dysphagia due to tracheostomy due to the female anatomical structure,

which makes it easier for tracheostomy placement.<sup>9</sup> Obesity is also said to affect outcomes of tracheostomy, where obesity causes anatomical changes and a shortened neck.<sup>10,11</sup> Another factor that affects the outcome of patients in the ICU is the total APACHE II score which is a score that is often used in the ICU to predict the risk of death in patients. The higher this score, the worse the patient's outcome, regardless of the tracheostomy performed on the patient.<sup>12</sup> This study aims to compare outcomes in critically ill patients with mechanical ventilation who underwent early and late tracheostomy in the room at Dr. M. Djamil General Hospital, Padang, Indonesia.

## 2. Methods

This study was an analytic observational study with a cross-sectional approach. This study uses primary data obtained from direct observation of research subjects. A total of 97 research subjects were included in this study. The inclusion criteria were in the form of patients aged > 18 years, patients who underwent tracheostomy while being treated in the intensive care unit of Dr. M Djamil General Hospital, Padang, Indonesia, and patients who underwent tracheostomy using surgical tracheostomy techniques. This study was approved by the medical and health research ethics committee at Dr. M Djamil General Hospital, Padang, Indonesia (LB.02.02/5.7/495/2022).

The test variable in this study was tracheostomy. Tracheostomy is a surgical procedure by making a hole in the anterior trachea and placing a cannula in the lumen of the trachea to treat respiratory failure due to upper airway obstruction or prolonged intubation to make it easier for oxygen to enter the lungs. In this study, tracheostomy procedures were grouped into early tracheostomy (tracheostomy performed  $\leq 7$  days) and late tracheostomy (tracheostomy > 7 days). The outcome variables assessed in this study were death and length of stay in the intensive care unit. Data analysis was performed with the help of SPSS software

version 25. Univariate analysis was performed to present the frequency distribution of each variable. Bivariate analysis was carried out to present the relationship between the test variables, with a p-value <0.05.

## 3. Results

Table 1 shows that the majority of patients who underwent an early tracheostomy had an average age of 50.1 years, male (81%), normoweight (47.6%), an average length of stay of 11.2 days, APACHE II score of 21.4 with an highest mortality rate in the ICU of 42.9% and a total mortality rate of 64.3%. While the majority of patients who underwent late tracheostomy were also male (54.5%), with an average age of 54.1 years, BMI normoweight (47.3%), average hospitalization of 17 days, APACHE II score of 23.8 with the highest mortality rate in ICU of (69.1%) and a total mortality rate of 87.3%. Table 2 shows that there is a statistical difference in the mortality rate in critically ill patients with mechanical ventilation who underwent early and late tracheostomy with a p-value  $\leq 0.05$ , which is 0.014. Table 3 shows that there is a statistical difference in the length of stay in the intensive care unit in critically ill patients with mechanical ventilation who underwent early and late tracheostomy with a p-value <0.05, which is 0.000.

## 4. Discussion

There are several benefits of tracheostomy, including reduced use of analgesics and sedatives due to reduced pain and discomfort in the pharynx or mouth and accelerated rehabilitation due to reduced use of drugs. In this context, early tracheostomy may have beneficial outcomes, such as reduced ventilator-acquired pneumonia (VAP), shorter hospital stays, and reduced mortality. This supports the findings in this study, where there is a difference in mortality in critically ill patients with mechanical ventilation who underwent early and late tracheostomy, with a lower mortality rate in early tracheostomy.

Table 1. Baseline characteristics of research subjects.

Characteristics	Early tracheostomy	Late tracheostomy
<b>Age (Mean ± SD)</b>	50.1±15.8	54.1±16.7
<b>Gender (frequency (%))</b>		
Male	34(81.0)	30(54.5)
Female	8 (19.0)	25(45.5)
<b>BMI (frequency (%))</b>		
Underweight	2(4.8)	3(5.5)
Normoweight	20(47.6)	26(47.3)
Overweight	10(23.8)	8(14.5)
Obesity	10(23.8)	18(32.7)
<b>Length of stay (Mean ± SD)</b>	11.2±4.1	17±7.7
<b>APACHE II Score (Mean ± SD)</b>	21.4±4.5	23.8±4.1
<b>Outcome (frequency (%))</b>		
Mortality in ICU	18(42.9)	38(69.1)
Mortality in hospital	9(21.4)	10(18,2)
Total of mortality	27(64.3)	48(87,3)
Alive	15(35,7)	7(12,7)

Table 2. Relationship between tracheostomy and patient mortality.

Tracheostomy	Alive frequency (%)	ICU mortality frequency (%)	Out of ICU mortality frequency (%)	*P-value
Early tracheostomy	15(35.7)	18(42.9)	9(21.4)	0.014
Late tracheostomy	7(12.7)	38(69.1)	10(18,	

\*Chi-Square test, p<0.05.

Table 3. Relationship between tracheostomy and length of stay.

Tracheostomy	Length of stay (mean, SD)	*P-value
Early tracheostomy	11.2 ± 4.1	0.000
Late tracheostomy	17 ± 7.7	

\*Mann Whitney U test, p<0.05.

Another study found similar support for early tracheostomy in three groups of adults and children because early tracheostomy was superior in terms of lower mortality rates. Early tracheostomy reduces rates of aspiration pneumonia, bacteraemia, septic shock, ARDS, and multisystem organ failure. Because an early tracheostomy reduces the length of stay in the ICU (Intensive Care Unit), it will reduce the incidence of ICU-related complications (which can lead to multisystem organ failure), resulting in a reduced mortality rate when compared to late tracheostomy in adults. Another study reported that each 1-day increase in tracheostomy time was significantly associated with a 4% increase in the risk of an unfavorable outcome with a 6% increase in the risk of death. Another reason for the poor outcome in late tracheostomy patients is that patients with more

severe injuries may have a longer need for therapy to limit the evolution of intracranial damage (thereby delaying the tracheostomy) or may have a poorer outcome, to begin with (resulting in a higher number of attempts). Higher to delay tracheostomy). Different things were conveyed by other studies where patients who underwent early tracheostomy had a higher risk of death in the hospital compared to standard tracheostomy. In this study, all patients came from the head injury group, where most of the patients had a high degree of pulmonary insufficiency due to the trauma that occurred, so the high mortality rate in early tracheostomy could be due to the higher proportion of patients who died at the initial ICU admission. In the theory of the early phase of head injury, the goal of therapy is to manage an intracranial emergency, and a tracheostomy at this stage could

increase intracranial pressure and influence the outcome. After this phase is completed, cessation of sedation, weaning from ventilator support, and initiation of new rehabilitation are the main treatment targets. Another reason for delaying tracheostomy in patients is to prevent the use of the procedure in patients with lesser injuries, who may be able to extubate successfully, and in those who have a rapidly progressive course of the disease and die early from their injuries.<sup>13-17</sup>

In this study, there were differences in the length of stay in the intensive care unit for critically ill patients with mechanical ventilation who underwent early and late tracheostomy, where the length of stay was longer in the late tracheostomy group. This is consistent with studies that state that early tracheostomy is associated with a shorter average hospital stay (27 days) compared to standard tracheostomy (36 days) and late tracheostomy (48 days). Another study also found that there was a significant difference in the shorter duration of ICU stay related to early tracheostomy in three groups of adults and children. Similar results were also obtained by other studies, which also stated that early tracheostomy reduced the duration of hospitalization in ICU patients. A shorter duration of hospitalization in early tracheostomy is associated with higher VAP complications in late tracheostomy. However, different results were found by other studies, which stated that early tracheostomy was not associated with VAP complications in patients with head injuries under 8 GCS who were not assessed in this study.<sup>18-20</sup>

## 5. Conclusion

There are differences in outcomes in the form of mortality and length of stay in critically ill patients who have tracheostomy installed at Dr. M. Djamil General Hospital Padang, Indonesia.

## 6. References

1. Ambrosino N, Vitacca M. The patient needing prolonged mechanical ventilation: A narrative review. *Multidiscip Respir Med.* 2018; 13(1): 1–10.
2. Tanaka A, Uchiyama A, Kitamura T, Sakaguchi R, Komukai S, et al. Association between early tracheotomy and patient outcomes in critically ill patients on mechanical ventilation: a multicenter cohort study. *J Intensive Care.* 2022; 10(1): 1–10.
3. Kang HT, Kim SY, Lee MK, Lee SW, Baek A, et al. Comparison between real-time ultrasound-guided percutaneous tracheotomy and surgical tracheostomy in critically ill patients. *Crit Care Res Pract.* 2022; 2022: 1–6.
4. Guia M, Ciobanu LD, Sreedharan JK, Abdelrahim ME, Gonçalves G, et al. The role of non-invasive ventilation in weaning and decannulating critically ill patients with tracheostomy: A narrative review of the literature. *Pulmonology.* 2021; 27(1): 43–51.
5. Ull C, Weckwerth C, Hamsen U, Jansen O, Spieckermann A, et al. Development of the tracheotomy well-being score in critically ill patients. *European Journal of Trauma and Emergency Surgery.* 2022.
6. Mussa CC, Gomaa D, Rowley DD, Schmidt U, Ginier E, et al. AARC clinical practice guideline: Management of adult patients with tracheostomy in the acute care setting. *Respir Care.* 2021; 66(1): 156–69.
7. Chorath K, Hoang A, Rajasekaran K, Moreira A. Association of early vs late tracheostomy placement with pneumonia and ventilator days in critically ill patients: a meta-analysis. *JAMA Otolaryngol Head Neck Surg.* 2021; 147(5): 450–9.
8. Levy L, Smiley A, Latifi R. Mortality Risk factors in patients admitted with the primary diagnosis of tracheostomy complications: an analysis of 8026 patients. *Int J Environ Res Public Health.* 2022; 19(15).
9. Franco-Jiménez JA, Ceja-Espinosa A, Álvarez-Vázquez L, Vaca-Ruiz MA. Associated factors for tracheotomy in adults with severe

- traumatic brain injury. Score proposals. *Cirurgia y Cirujanos (English Edition)*. 2020; 88(2): 200–5.
10. Zuleika P, Mariance, Bahar E. Factors related to the incidence of dysphagia in patients using tracheal cannula at Dr. Mohammad Hoesin General Hospital Palembang. *Bioscientia Medicina: Journal of Biomedicine and Translational Research*. 2022; 6(9): 2165–72.
  11. Hwang SM, Jang JS, Yoo JI, Kwon HK, Lee SK, et al. Difficult tracheostomy tube placement in an obese patient with a short neck -A case report-. *Korean J Anesthesiol*. 2011; 60(6): 434–6.
  12. Sutiono AB, Arifin MZ, Adhipratama H, Hermanto Y. The utilization of APACHE II score to predict the incidence of ventilator-associated pneumonia in patients with severe traumatic brain injury: A single-center study. *Interdiscip Neurosurg*. 2022; 28.
  13. Deng H, Fang Q, Chen K, Zhang X. Early versus late tracheotomy in ICU patients: A meta-analysis of randomized controlled trials. *Medicine*. 2021; 100(3): e24329.
  14. Wang R, Pan C, Wang X, Xu F, Jiang S, et al. The impact of tracheotomy timing in critically ill patients undergoing mechanical ventilation: A meta-analysis of randomized controlled clinical trials with trial sequential analysis. *Heart and Lung*. 2019; 48(1): 46–54.
  15. Kayambankadzanja RK, Schell CO, Wörnberg MG, Tamras T, Mollazadegan H, et al. Toward definitions of critical illness and critical care using concept analysis. *BMJ Open*. 2022; 12(9): e060972.
  16. Lilian TM, Halima M. Caring critically ill patients in the general wards in Tanzania: experience of nurses and physicians. *International Journal of Critical Care and Emergency Medicine*. 2018; 4(2).
  17. Vaporidi K, Akoumianaki E, Telias I, Goligher EC, et al. Respiratory drive in critically ill patients pathophysiology and clinical implications. *Am J Respir Crit Care Med*. 2020; 201(1): 20–32.
  18. Ostermann, M; Spring D. Presentations in acute medicine. *Acute medicine: A practical guide to the management of medical emergencies*, 5<sup>th</sup> ed. WILEY Blackwell. 2017; 1–8.
  19. Admass BA, Endalew NS, Tawye HY, Melesse DY, Workie MM, et al. Evidence-based airway management protocol for a critically ill patient in a medical intensive care unit: Systematic review. *Annals of Medicine and Surgery*. 2022; 80: 104284.
  20. Vargas M, Buonanno P, Giorgiano L, Sorriento G, Iacovazzo C, et al. Comparison between surgical and percutaneous tracheostomy effects on procalcitonin kinetics in critically ill patients. *Crit Care*. 2018; 22(1): 22–4.