Tracheostomy in Acute and Chronic Respiratory Failure – Efficacy and Patient Outcomes

Tawfiqur Rahman[a*], Mohammad Anwar Hossain[a], Abdullah-Al-Mamun[b]

ARTICLE INFO

Received: 2 Feb 2026
Accepted: 7 Feb 2026
Published Online: 16 Feb 2026

DOI: 10.5281/zenodo.18661837

Volume: 8, Number: 2, Page: 49-53

e-ISSN: 2789-5912
ISSN: 2617-0817

*Corresponding author

ABSTRACT

Background: In order to secure the airway, ease the transition from mechanical ventilation, and enhance patient comfort, tracheostomy is frequently performed in intensive care unit (ICU) patients with acute or chronic respiratory failure. However, there is still a lack of information from Bangladesh about patient outcomes and the best time to have a tracheostomy. The purpose of this study was to compare early versus late tracheostomy in this patient population and assess the efficacy, results, and problems of tracheostomy. **Methods & Materials:** This prospective observational study was conducted in the ICU and Otolaryngology-Head & Neck Surgery Department of a tertiary care hospital in Bangladesh from October 2024 to September 2025. This research involved forty adult patients needing tracheostomy for extended ventilation or airway safeguarding, gathering information on demographics, reasons, timing, complications, and results. Early tracheostomy was defined as a procedure performed within seven days of endotracheal intubation. **Results:** The average age was 58.4 ± 14.7 years, comprising 60% males. Acute respiratory failure and chronic respiratory failure comprised 57.5% and 42.5% of cases, respectively, with stroke (27.5%) and COPD (25%) being frequent underlying conditions. Extended ventilation was the primary reason (45%), and 65% had surgical tracheostomy performed. Following tracheostomy, the duration of mechanical breathing was reduced; 72.5% of patients were able to wean, 75% underwent decannulation, and the in-hospital mortality rate was 22.5%.Early tracheostomy was associated with shorter ICU stays, fewer days on ventilation, and higher rates of decannulation and weaning (all $p < 0.05$). **Conclusion:** Tracheostomy is a safe and beneficial procedure in critically ill patients, with early placement supporting quicker weaning and shorter ICU stays without added risk.

Keywords: *Tracheostomy, Respiratory Failure, ICU, Efficacy, Outcomes.*

[a.] *Associate Professor, Otolaryngology-Head & Neck Surgery Department, Bangladesh Medical University, Dhaka, Bangladesh (ORCID: 009-0005-6174-258X)*
[b.] *Assistant Professor, Otolaryngology-Head & Neck Surgery Department, Bangladesh Medical University, Dhaka, Bangladesh*

Introduction

Tracheostomy is frequently performed in ICU patients, with about 10% of those needing ≥3 days of mechanical ventilation requiring it, most commonly due to prolonged respiratory failure [1]. Compared with prolonged endotracheal intubation, it offers advantages such as improved comfort, enhanced secretion clearance, better airway stability, and reduced airway resistance. In certain patients, tracheostomy can be successfully conducted at the bedside using a percutaneous method [2]. Extended mechanical ventilation is the primary reason for ICU admission, minimizing airway damage and risks associated with long-term intubation and reintubation when performed promptly [3]. As a result, it is commonly utilized in cases of both acute and chronic respiratory failure [4].

Evidence from around the world suggests that patients who are effectively weaned after tracheostomy have better results than those who need on ventilation, even if long-term survival rates are usually low for those who need prolonged ventilation. [5]. However, in acute respiratory failure, one-year mortality after tracheostomy remains high, particularly among elderly patients. These patients frequently experience repeated hospital admissions, substantial healthcare utilization, and increased medical costs [6]. Although its impact on mortality and pneumonia is still unknown, early tracheostomy (within 7–10 days) may reduce mechanical ventilation and ICU stay, necessitating customized timing [7]. The best time to get a tracheostomy is debatable because recent research suggests that it may shorten ventilation times and ICU stays but does not consistently improve mortality[8]. Smaller studies similarly reported high rates of ventilator weaning and hospital discharge, indicating that tracheostomy is safe and can help manage ICU demand during peaks of respiratory illness [9].

Data from Bangladesh indicate the safety and advantages of tracheostomy, with head injuries being the primary reason and an overall complication rate of 10%, mainly due to surgical emphysema [10]. Another investigation at the same centers found that emergency tracheostomies had a significantly higher complication rate (33.3%) than elective procedures (9.9%), with laryngeal carcinoma being the main reason for emergency tracheostomy and cranial trauma or cerebral lesions for non-emergency situations [11]. However, most studies in Bangladesh are single-center and descriptive, Nonetheless, information regarding timing, weaning, and long-term results is still scarce, emphasizing the necessity for multicenter studies. With an emphasis on ventilator weaning, complication rates, overall clinical benefits, and factors impacting recovery and procedural safety, this study aims to evaluate the effectiveness and outcomes of tracheostomy in both acute and chronic respiratory failure.

Methods & Materials

Study Design and Setting

This was a prospective observational study conducted in the Intensive Care Unit (ICU) and Otolaryngology-Head & Neck Surgery Department of a tertiary care hospital in Bangladesh from October 2024 to September 2025.

Study Population

All adult patients admitted to the in the Otolaryngology-Head & Neck Surgery Department with acute or chronic respiratory failure who required tracheostomy for airway management or prolonged mechanical ventilation during the study period were eligible for inclusion.

Sample Size and Sampling

Forty eligible patients scheduled for tracheostomy were enrolled in succession

Inclusion Criteria:

- Age ≥18 years
- Sudden or long-term respiratory failure necessitating mechanical ventilation
- Tracheostomy is necessary for safeguarding the airway, extended ventilation, or unsuccessful extubation.

Exclusion Criteria

- Patients with head and neck malignancy
- Patients with previous tracheostomy
- Patients who died before tracheostomy
- Patients with incomplete clinical records

Operational Definitions

Early tracheostomy: Tracheostomy carried out within 7 days of starting mechanical ventilation. [12]

Late tracheostomy: Tracheostomy completed following 7 days of mechanical ventilation.[12]

Successful weaning: Successful weaning was characterized as the ability to be free from mechanical ventilation for a minimum of 48–72 hours without requiring re-intubation, indicating enduring independent respiratory capability. [13]

Decannulation: Decannulation was defined as the removal of the tracheostomy tube once the patient demonstrated adequate spontaneous breathing and airway patency without the need for invasive airway support through to discharge. [14]

Data Collection Procedure

A standardized case record form was used to gather information on sociodemographic traits, diagnosis, tracheostomy indication, procedure type and timing, ventilation duration, intensive care unit and hospital stay, complications, and clinical outcomes. From the time of tracheostomy until their release or death, patients were monitored.

Outcome Measures

The primary outcomes

- Duration of mechanical ventilation after tracheostomy
- ICU length of stay
- Successful ventilator weaning
- Decannulation
- In-hospital mortality

Secondary outcomes included tracheostomy-related complications such as bleeding, infection, tube blockage, subcutaneous emphysema, and tracheal stenosis.

Statistical Analysis

Data were analyzed using SPSS version 26. Continuous variables were expressed as mean ± standard deviation (SD) and categorical variables were expressed as frequency and percentage. Comparisons between acute and chronic respiratory failure groups and early vs late tracheostomy groups were performed using the independent t-test for continuous variables and Chi-square test for categorical variables. A p-value <0.05 was considered statistically significant

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of the study hospital. Written informed consent was obtained from the patients or their legal guardians prior to enrollment. Patient confidentiality and anonymity were maintained throughout the study.

Results

Table I shows this study included a total of 40 patients experiencing acute and chronic respiratory failure who had tracheostomy procedures. The average age of the patients was 58.4 ± 14.7 years, and almost half (45.0%) were 60 years old or above. Male patients were more prevalent (60.0%), leading to a male-to-female ratio of 1.5:1. Acute respiratory failure represented 57.5% of cases, whereas 42.5% experienced chronic respiratory failure. The most common primary diagnoses were stroke (27.5%), COPD (25%), pneumonia (22.5%), trauma (15%), and neuromuscular disorders (10%).

Table I
Socio-demographic and Baseline Clinical Characteristics (n = 40).

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	<40	6	15.0
	40–59	16	40.0
	≥60	18	45.0
Sex	Male	24	60.0
	Female	16	40.0
Type of respiratory failure	Acute	23	57.5
	Chronic	17	42.5
Primary diagnosis	Stroke	11	27.5
	COPD	10	25.0
	Pneumonia	9	22.5
	Trauma	6	15.0
	Neuromuscular disease	4	10.0

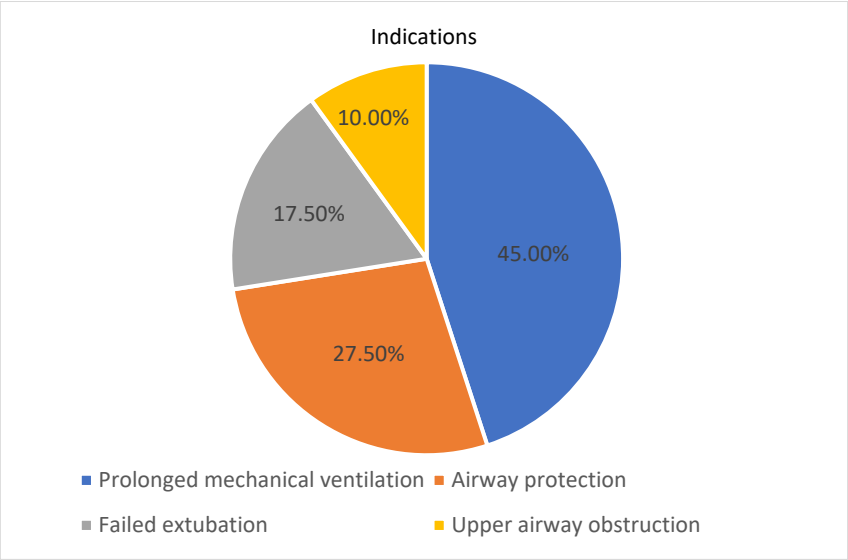

Figure 1 Indications for Tracheostomy.

Figure I primary reason for tracheostomy was prolonged mechanical ventilation (45.0%), followed by airway protection (27.5%), unsuccessful extubation (17.5%), and upper airway obstruction (10.0%)

Table II shows early tracheostomy (≤7 days) was performed in 42.5% of patients, whereas 57.5% underwent late tracheostomy (>7 days). The primary method used was surgical tracheostomy at 65.0%, whereas 35.0% of the procedures utilized the percutaneous technique.

Table II
Tracheostomy-Related Characteristics (n = 40).

Variable	Category	Frequency (n)	Percentage (%)
Timing of tracheostomy	Early (≤7 days)	17	42.5
	Late (>7 days)	23	57.5
Type of procedure	Surgical	26	65.0
	Percutaneous	14	35.0

Table III indicates the average duration of mechanical ventilation prior to tracheostomy was 8.9 ± 3.4 days, while the average duration following tracheostomy was 6.2 ± 2.9 days. The average duration of ICU stay was 14.6 ± 6.1 days, while the average overall hospital stay was 22.3 ± 8.4 days.

Table III
Ventilator and Hospital Outcomes.

Outcome	Mean ± SD
Duration of ventilation before tracheostomy (days)	8.9 ± 3.4
Duration of ventilation after tracheostomy (days)	6.2 ± 2.9
Total ICU stay (days)	14.6 ± 6.1
Total hospital stays (days)	22.3 ± 8.4

Table IV presents tracheostomy-related complications were relatively infrequent. Stomal infection was the most common complication (11.7%), followed by tube blockage (8.3%), bleeding (6.7%), subcutaneous emphysema (4.2%), and tracheal stenosis (3.3%). Remarkably, 65.8% of patients had no procedure-related complications.

Table IV
Tracheostomy-Related Complications (n = 40).

Complication	Frequency (n)	Percentage (%)
Stomal infection	5	12.5
Tube blockage	3	7.5
Bleeding	3	7.5
Subcutaneous emphysema	2	5.0
Tracheal stenosis	1	2.5
No complication	26	65.0

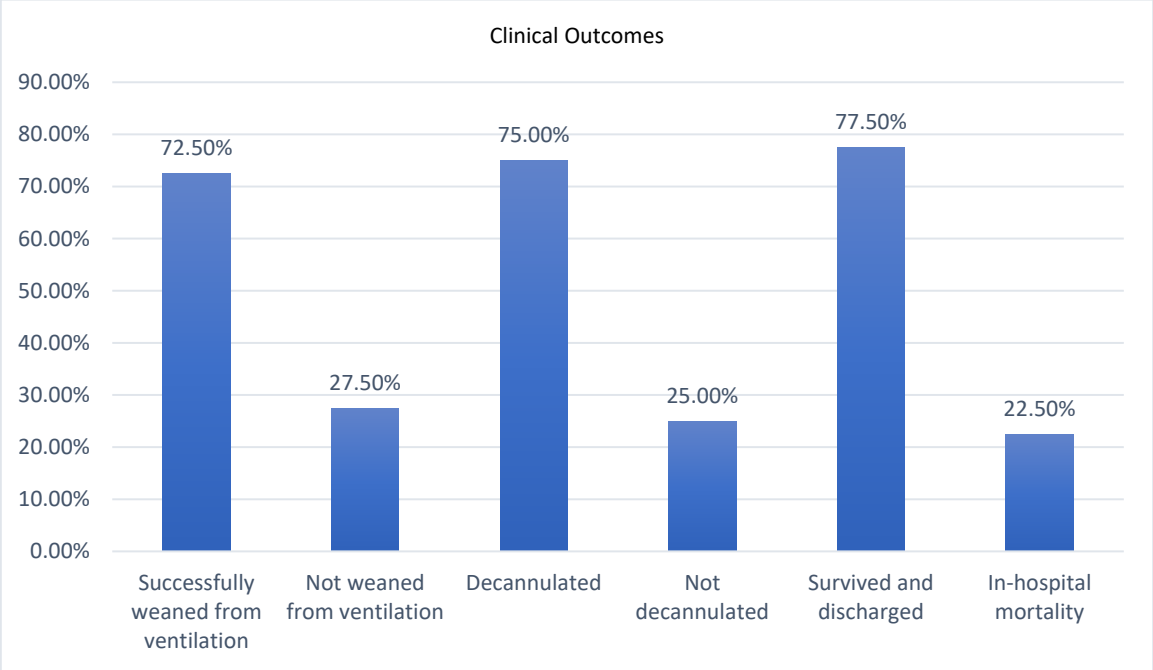

Figure 2 Overall Clinical Outcomes.

Figure 2 indicates that, in total, 72.5% of patients were effectively weaned off mechanical ventilation, and 75.0% underwent decannulation. The in-hospital death rate was 22.5%, whereas 77.5% of patients survived and left the hospital.

In *Table V* shows that there are no notable differences in results between acute and chronic respiratory failure. Successful weaning was a bit greater in acute cases (73.9% vs. 70.6%, p = 0.61), whereas decannulation occurred more often in chronic cases (82.4% vs. 69.6%, p = 0.22). The duration of ICU stays and mortality rates were comparable between the groups

Table V
Comparison of Outcomes Between Acute and Chronic Respiratory Failure.

Outcome	Acute RF (n=23)	Chronic RF (n=17)	p-value
Successful weaning	17 (73.9%)	12 (70.6%)	0.61
Decannulation	16 (69.6%)	14 (82.4%)	0.22
ICU stay (days)	15.0 ± 6.3	14.0 ± 5.7	0.48
Mortality	6 (26.1%)	3 (17.6%)	0.49

Table VI shows that early tracheostomy correlated with improved results, such as reduced ICU duration (12.2 ± 5.0 vs. 16.6 ± 6.7 days; p = 0.003), fewer days on the ventilator post-tracheostomy (5.0 ± 2.4 vs. 7.2 ± 3.1; p = 0.001), and increased rates of successful weaning (82.4% vs. 65.2%; p = 0.046) and decannulation (82.4% vs. 69.6%; p = 0.039). Mortality rates were reduced in the early group (17.6% compared to 26.1%) but did not reach statistical significance (p = 0.32).

Table VI
Comparison of Outcomes Between Early and Late Tracheostomy.

Outcome	Early (≤7 days) (n=17)	Late (>7 days) (n=23)	p-value
ICU stay (days)	12.2 ± 5.0	16.6 ± 6.7	0.003
Ventilator days after tracheostomy	5.0 ± 2.4	7.2 ± 3.1	0.001
Successful weaning	14 (82.4%)	15 (65.2%)	0.046
Decannulation	14 (82.4%)	16 (69.6%)	0.039
In-hospital mortality	3 (17.6%)	6 (26.1%)	0.32

Values are expressed as mean ± SD or n (%). p-values <0.05 indicate statistical significance.

Discussion

In this group of 40 patients receiving tracheostomy, most were elderly (45.0% aged ≥60 years) and male (60.0%), which aligns with earlier ICU studies that reported a median age of 65 years and 68.5% male [15]. Acute respiratory failure predominated (57.5%) over chronic respiratory failure (42.5%), reflecting the higher incidence of acute critical illness among ICU tracheostomy patients [16]. The most frequent primary diagnoses were stroke (27.5%) and chronic obstructive pulmonary disease (25.0%), aligning with previous findings that identify cerebrovascular disease and COPD as common indications [17].

Prolonged mechanical ventilation was the leading indication for tracheostomy (45.0%), followed by airway protection (27.5%), failed extubation (17.5%), and upper airway obstruction (10.0%) [18]. Early tracheostomy (≤7 days) was performed in 42.5% of patients, with surgical approaches more common than percutaneous ones [19]. After tracheostomy, the average length of mechanical ventilation reduced from 8.9 ± 3.4 to 6.2 ± 2.9 days. The average ICU and hospital durations were 14.6 ± 6.1 and 22.3 ± 8.4 days, respectively, in agreement with meta-analytic findings showing shortened ventilation times and ICU stays with prompt intervention [20,21].

Complications related to the procedure were rare, as 65.0% of patients reported having none. The most common complications were stomal infection (12.5%), tube blockage (7.5%), and bleeding (7.5%) [18]. Late complications, including tracheal stenosis, were rare (<5%), corroborating the reported safety profile of tracheostomy.

Overall, 72.5% of patients were successfully weaned from mechanical ventilation, 75.0% were decannulated, and 22.5% died during hospitalization, comparable to previously reported ventilator weaning rates of 60–80%, decannulation rates of 65–75%, and in-hospital mortality of 20–30% [1,18]. Outcomes were similar between acute and chronic respiratory failure, indicating comparable clinical benefits across etiologies [1,18].

Early tracheostomy (≤7 days) was associated with improved outcomes, including shorter ICU stay (12.2 ± 5.0 vs. 16.6 ± 6.7 days), fewer post-procedure ventilator days (5.0 ± 2.4 vs. 7.2 ± 3.1 days), and higher rates of successful weaning (82.4% vs. 65.2%) and decannulation (82.4% vs. 69.6%). In-hospital mortality was lower in the early group (17.6% vs. 26.1%), though not statistically significant. These findings are consistent with prior studies demonstrating that early tracheostomy facilitates ventilator liberation, reduces ICU stay, and improves overall clinical outcomes [12,13].

Conclusion

Tracheostomy is a reliable and effective treatment for patients with acute and chronic respiratory failure. Early tracheostomy (≤7 days) is associated with reduced ICU stay, fewer days on mechanical ventilation, and improved rates of weaning and decannulation, without a significant rise in complications or mortality. The procedure demonstrates comparable benefits across different types of respiratory failure and maintains low overall complication rates. These findings support early tracheostomy as a valuable strategy to optimize patient outcomes, enhance ventilator liberation, and improve ICU resource utilization.

References

1. Durbin Jr CG. Tracheostomy: why, when, and how? Respiratory care. 2010 Aug 1;55(8):1056-68.
2. Kollef MH. Tracheostomy for respiratory failure: we need more answers. Chest. 2004 Jan 1;125(1):7-9.
3. Boynton JH, Hawkins K, Eastridge BJ, O'Keefe GE. Tracheostomy timing and the duration of weaning in patients with acute respiratory failure. Critical care. 2004 Jun 24;8(4): R261.
4. Abe T, Madotto F, Pham T, Nagata I, Uchida M, Tamiya N, Kurahashi K, Bellani G, Laffey JG. Epidemiology and patterns of tracheostomy practice in patients with acute respiratory distress syndrome in ICUs across 50 countries. Critical care. 2018 Aug 17;22(1):195.
5. Huang C. The survival outcomes of patients requiring prolonged mechanical ventilation. Medicina. 2023 Mar 20;59(3):614.
6. Mehta AB, Walkey AJ, Curran-Everett D, Douglas IS. One-year outcomes following tracheostomy for acute respiratory failure. Critical care medicine. 2019 Nov 1;47(11):1572-81.
7. Adly A, Youssef TA, El-Begermy MM, Younis HM. Timing of tracheostomy in patients with prolonged endotracheal intubation: a systematic review. European Archives of Oto-Rhino-Laryngology. 2018 Mar;275(3):679-90.
8. Merola R, Iacovazzo C, Troise S, Marra A, Formichella A, Servillo G, Vargas M. Timing of tracheostomy in ICU patients: A systematic review and meta-analysis of randomized controlled trials. Life. 2024 Sep 14;14(9):1165Cardasis JJ, Rasamny JK, Berzofsky CE, Bello JA, Multz AS. Outcomes after tracheostomy for patients with respiratory failure due to COVID-19. Ear, Nose & Throat Journal. 2022 Jul;101(6):354-8.
9. Mahmud M, Hossain MA, Sarkar MZ, Hossain HM, Islam MO, Ahmed MU, Sattar MA. Tracheostomy in intensive care unit: indications, benefits and complications. Bangladesh Journal of Otorhinolaryngology. 2015 Jul 27;21(1):28-32.
10. Choudhury AA, Sultana T, Joarder MA, Tarafder KH. A comparative study of elective and emergency tracheostomy. Bangladesh journal of Otorhinolaryngology. 2008;14(2):57-62.
11. Tekin P, Bulut A. Tracheostomy Timing in Unselected Critically Ill Patients with Prolonged Intubation: A Prospective Cohort Study. Journal of Clinical Medicine. 2024 May 7;13(10):2729.
12. Shah NM, Hart N, Kaltsakas G. Prolonged weaning from mechanical ventilation: who, what, when and how? Breathe. 2024 Dec 10;20(3).
13. Bodenham A, Bell D, Bonner S, Branch F, Dawson D, Morgan P, McGrath B, Mackenzie S. Standards for the care of adult patients with a temporary tracheostomy; Standards and Guidelines. Intensive Care Society. 2014;2014:29-32.
14. El-Anwar MW, Nofal AA, El Shawadfy MA, Maaty A, Khazbak AO. Tracheostomy in the intensive care unit: a university hospital in a developing country study. International Archives of Otorhinolaryngology. 2017 Jan;21(01):33-7.
15. Colbert C, Streblow AD, Sherry SP, Dobbertin K, Cook M. Tracheostomies for respiratory failure are associated with a high inpatient mortality: a potential trigger to reconsider goals of care. Trauma Surgery & Acute Care Open. 2024 Jan 11;9(1).
16. Aksoy E, Ocaklı B. Long-term survival of patients with tracheostomy having different diseases followed up in the respiratory intensive care unit outpatient clinic: which patients are lucky? Turkish Thoracic Journal. 2019 Apr 1;20(3):182.
17. Cheung NH, Napolitano LM. Tracheostomy: epidemiology, indications, timing, technique, and outcomes. Respiratory care. 2014 Jun 1;59(6):895-919.
18. Khammas AH, Dawood MR. Timing of tracheostomy in intensive care unit patients. International archives of otorhinolaryngology. 2018;22(04):437-42.
19. Han R, Gao X, Gao Y, Zhang J, Ma X, Wang H, Ji Z. Effect of tracheotomy timing on patients receiving mechanical ventilation: A meta-analysis of randomized controlled trials. Plos one. 2024 Jul 23;19(7):e0307267.
20. Ji Y, Fang Y, Cheng B, Li L, Fang X. Tracheostomy timing and clinical outcomes in ventilated COVID-19 patients: a systematic review and meta-analysis. Critical Care. 2022 Feb 8;26(1):40.
21. Delaney A, Bagshaw SM, Nalos M. Percutaneous dilatational tracheostomy versus surgical tracheostomy in critically ill patients: a systematic review and meta-analysis. Critical care. 2006 Apr 7;10(2):R55.