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ORIGINAL ARTICLE

Early versus Late Tracheostomy in a Suburban Population: Clinical Profile, Complications, and Outcomes

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Abstract

Background: Tracheostomy is one of the most frequently performed procedures in intensive care units (ICUs). Despite its common use, the optimal timing, patient selection, and impact on outcomes remain debated. There is limited data on tracheostomy practices in suburban Indian populations. m

Aim: To study the clinical profile, indications, complications, and outcomes of tracheostomised patients in a suburban population.

Materials and Methods: This observational study included 50 patients who underwent surgical tracheostomy between January 2023 and January 2026 at Rajalakshmi Medical College, Sriperumbudur, Tamil Nadu, India. Data were collected on demographic profile, primary diagnosis, indication for tracheostomy, type and timing of procedure, duration of mechanical ventilation, ICU and hospital stay, complications, and outcomes at discharge and three months. Statistical analysis was performed using chi-square test, Student's t‑test, and ANOVA; $p<0.05$ was considered significant.

Results: The mean age was 44.22±19.83 years, with male predominance (76%). Head trauma was the most common indication (58%). Early tracheostomy (≤7 days) was performed in 74% of patients and was associated with significantly shorter duration of mechanical ventilation (3.35±2.08 vs. 14.61±7.03 days), ICU stay (7.2±5.3 vs. 24.3±4.2 days), and hospital stay (24.97±19.59 vs. 41±15.36 days) compared to late tracheostomy (>7 days). Complication rates were lower in the early group (8.10% vs. 46.15%). At three months, 64.86% of early tracheostomy patients improved, whereas 61.53% of late tracheostomy patients expired (p=0.0001).

Conclusion: Early tracheostomy (≤7 days) is associated with reduced mechanical ventilation duration, shorter ICU and hospital stays, fewer complications, and improved three-month survival compared to late tracheostomy. In patients with an established need for prolonged airway support, earlier intervention is more rewarding than delayed management.

Key words: Surgical tracheostomy, early tracheostomy, late tracheostomy, head trauma, mortality

1 | INTRODUCTION

Tracheostomy is one of the most frequently performed procedures in the Intensive Care Unit (ICU) (1, 2). It involves creating a surgical opening into the trachea to establish a more permanent airway, facilitating prolonged mechanical ventilation, airway protection, and pulmonary toileting (3). Despite its widespread use, the decision regarding when and how to perform a tracheostomy remains highly subjective, often individualized to the patient, and continues to be a topic of debate (1, 2). The timing of the procedure, in particular, has been a focus of controversy, with varying practices across institutions (1, 2).

The historical roots of tracheostomy date back

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to ancient times, with descriptions on Egyptian tablets from 3600 BC (4). The first successful and well documented tracheostomy was performed by Antonio Musa Brasavola in 1546 to relieve airway obstruction (5). The procedure became safer with the introduction of antisepsis and anesthesia in the late 19th century, and further refinements by Chevalier Jackson in the early 20th century established modern surgical techniques (6). In contemporary practice, the most common indication for tracheostomy has shifted from upper airway obstruction to prolonged assisted ventilation, particularly in patients with acute respiratory failure, neurological impairment, or inability to wean from mechanical ventilation (7, 8).

Indications for tracheostomy include acute respiratory failure with anticipated need for prolonged ventilation, upper airway obstruction, difficult airway management, failure to wean from mechanical ventilation, and copious secretions (7, 8). Patients with multiple trauma often require assisted ventilation for extended periods due to inability to protect the airway, persistent secretions, and inadequate spontaneous ventilation (7, 8). In these settings, tracheostomy plays an integral role, yet the timing of intervention is highly subjective and remains a critical determinant of outcomes (9, 10).

Complications of tracheostomy can be categorized as immediate (e.g., hemorrhage, recurrent laryngeal nerve injury, pneumothorax), intermediate (e.g., tube obstruction, surgical emphysema, tracheo oesophageal fistula), and long term (e.g., tracheal stenosis, difficult decannulation, disfiguring scar). Mortality rates among tracheostomised patients are often high, reflecting the severity of underlying illness rather than the procedure itself. Patients undergoing tracheostomy typically have prolonged ICU and hospital stays, incur higher costs, and often require long term care and rehabilitation.

Given the limited data on tracheostomy practices in suburban Indian populations, this study was undertaken to evaluate the clinical profile, indications, complications, and outcomes of tracheostomised patients, with a focus on the impact of timing of intervention on patient prognosis.

2 | MATERIALS AND METHODS

Study Design and Setting

This observational study was conducted at Rajalakshmi Medical College and Hospital, Sriperumbudur, Tamil Nadu, India, over three years from January 2023 to January 2026. Institutional Ethics Committee approval was obtained before commencement, and all procedures adhered to the ethical principles of the Declaration of Helsinki. The study conforms to STROBE reporting guidelines for observational research.

Study Population

Patients requiring surgical tracheostomy were enrolled by consecutive sampling. Inclusion required an anticipated need for prolonged mechanical ventilation ($\geq$2 weeks) with a normal coagulation profile. Patients were excluded if prothrombin time or activated partial thromboplastin time exceeded 1.5 times the normal control value, platelet count fell below 50,000/mm^3, a pre-existing tracheostomy was present, or if the planned procedure was percutaneous dilatational tracheostomy. A total of 50 patients were enrolled (Figure 1).

Procedure

Written informed consent was obtained from patients or their legally authorized representatives prior to enrollment. All surgical tracheostomies were performed by qualified surgeons under appropriate anaesthesia. A vertical midline skin incision was used in most cases; the strap muscles were separated, the thyroid isthmus retracted or divided, and the trachea entered between the second and fourth rings. A cuffed polyvinyl chloride (PVC) tracheostomy tube of appropriate size was inserted and secured. Paediatric cases were managed with size-specific modifications. Post-operatively, all patients received standardized ICU nursing care including regular suctioning, cuff pressure monitoring (maintained at 20–25 cmH_2O), stoma hygiene, and heated humidification.

Grouping and Data Collection

Patients were classified by procedure type (emergency vs. elective) and timing of intervention: early tracheostomy ($\leq$7 days of admission) and late tracheostomy (>7 days), based on definitions from established literature. Data were prospectively recorded onto a structured proforma from ICU reg-

isters, operative notes, and ward records. Variables captured included age, sex, primary diagnosis, indication for tracheostomy, duration of mechanical ventilation, ICU stay, total hospital stay, and complications (classified as immediate, intermediate, or long-term).

Outcome Assessment

Outcomes were assessed at two time points: hospital discharge and three months post-procedure, categorized as improved, poor prognosis, or expired. Three-month follow-up was performed via structured telephonic interview with patients or their primary family contacts.

Statistical Analysis

Data were analysed using IBM SPSS v24.0. Continuous variables are reported as mean ± SD; categorical variables as frequencies and percentages. Between-group comparisons used the chi-square test for categorical data and Student's independent t-test or one-way ANOVA for continuous variables. A p-value <0.05 was considered statistic

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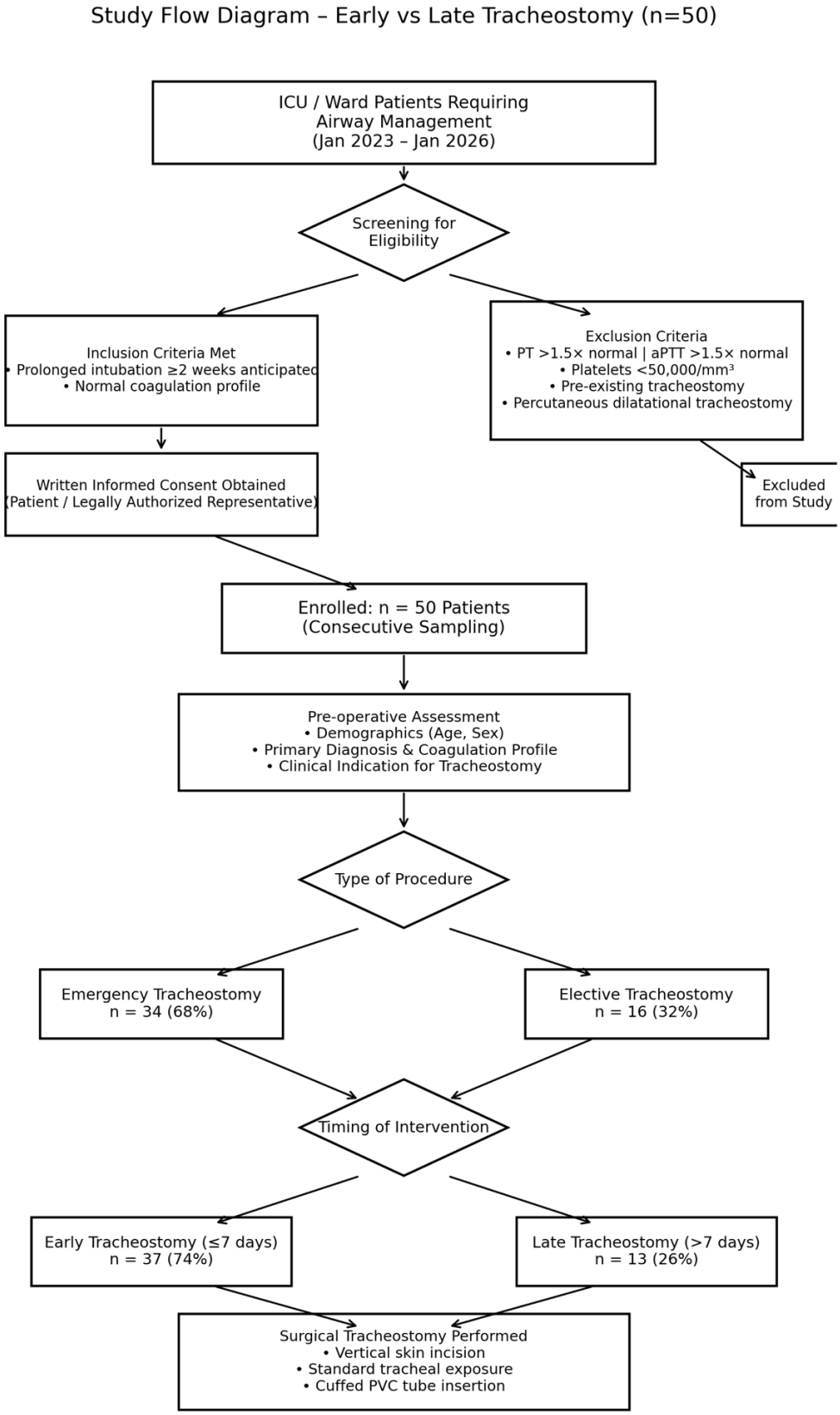

Fig. 1: Study flow diagram illustrating patient screening, eligibility assessment,enrollment, procedural classification, and follow-up protocol (Rajalakshmi Medical College, 2023–2026).

4 | RESULTS

A total of 50 patients who underwent surgical tracheostomy during the study period were analyzed. The findings are presented across five domains.

Demographic Profile

The cohort had a mean age of 44.22 ± 19.83 years, with the highest patient burden observed in the fifth and sixth decades of life. Males predominated at a ratio of 3.16:1, and female patients had a notably higher mean age than males, likely reflecting the greater burden of neoplastic disease in older women. Full age and sex distribution is shown in Table 1 , and the frequency pattern across age groups is illustrated in Figure 2

Table 1. Age and Sex Distribution (n=50)

Age Group	Male (n=38)	Female (n=12)	Total (n=50)
1–10 yrs	3 (7.9%)	0 (0%)	3 (6%)
11–20 yrs	6 (15.8%)	0 (0%)	6 (12%)
21–30 yrs	5 (13.2%)	0 (0%)	5 (10%)
31–40 yrs	3 (7.9%)	2 (16.7%)	5 (10%)
41–50 yrs	7 (18.4%)	1 (8.3%)	8 (16%)
51–60 yrs	7 (18.4%)	5 (41.7%)	12 (24%)
61–70 yrs	5 (13.2%)	4 (33.3%)	9 (18%)
71–80 yrs	2 (5.2%)	0 (0%)	2 (4%)
Mean ± SD	**41.13 ± 20.88 yrs**	**54 ± 12.15 yrs**	**44.22 ± 19.83 yrs**

Figure 2: Age and Sex Distribution of Patients (n=50)

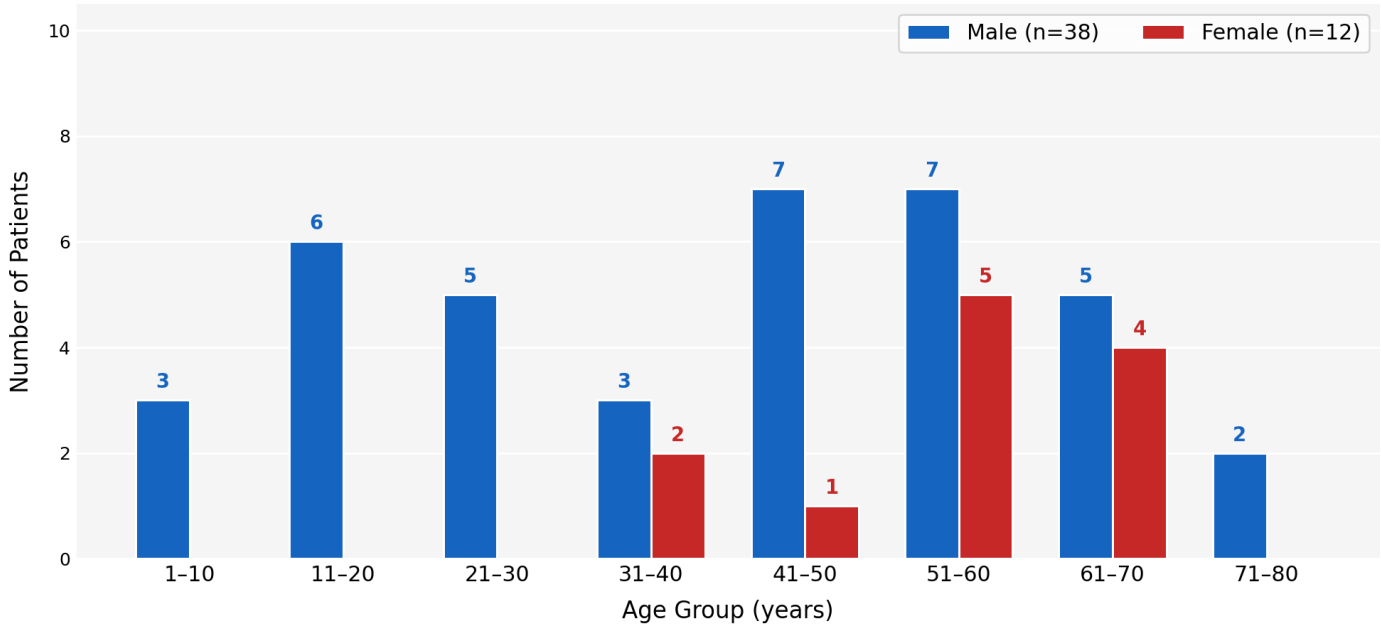

Fig. 2: showing age-group distribution by sex. Male preponderance was observed across all age groups below 50 years; female patients clustered in the 51–70-year range.

Primary Diagnosis, Procedural Type, and Timing

Head trauma was the dominant aetiology (58%, n=29), with intraparenchymal hemorrhage as its most frequent subtype. Emergency tracheostomy was significantly more prevalent in males (p=0.02). The distribution of functional indications differed significantly between timing groups (p=0.0028),

with prolonged ventilation predominating in the early group and respiratory insufficiency in the late group. All diagnostic, procedural, and indication data are consolidated in Table 2 ; the timing distribution is shown in Figure 3 .

Table 2. Primary Diagnosis, Procedure Type, Timing, and Functional Indication (n=50)

Parameter	Early ≤7 days (n=37)	Late >7 days (n=13)	Total (n=50)	p-value
Primary Diagnosis				
Head trauma	22 (59.45%)	7 (53.84%)	29 (58%)	—
Neoplasm / UAO	4 (10.81%)	3 (23.07%)	7 (14%)	
Infection / Inflammation	5 (13.51%)	1 (7.69%)	6 (12%)	
CVA	4 (10.81%)	1 (7.69%)	5 (10%)	
Others	2 (5.40%)	1 (7.69%)	3 (6%)	
Type of Procedure				
Emergency	26 (70.27%)	8 (61.53%)	34 (68%)	0.02*
Elective	11 (29.72%)	5 (38.46%)	16 (32%)	
Functional Indication				
Prolonged ventilation	21 (56.76%)	3 (23.07%)	24 (48%)	0.0028*
Tracheobronchial toileting	13 (35.13%)	3 (23.07%)	16 (32%)	
Respiratory insufficiency	3 (8.10%)	7 (53.84%)	10 (20%)	

UAO = upper airway obstruction; CVA = cerebrovascular accident; *p<0.05

Mechanical Ventilation and Hospital Resource Utilization

Early tracheostomy was associated with significantly shorter mechanical ventilation, ICU stay, and total hospital stay across all three measured parameters ($p \leq 0.010$). The magnitude of reduction was clinically substantial, exceeding four-fold for ventilator days and three-fold for ICU stay, as presented in Table 3 and illustrated in Figure 4 .

Complications and Patient Outcomes

The overall complication rate was 18% (n=9), with the late tracheostomy group experiencing a more than five-fold higher rate than the early group. Emergency procedures accounted for the large majority of complications. At three months, a profound and statistically significant divergence in survival was observed between the two groups (χ^2=12.78, p=0.0001). Complications stratified by type and timing, along with discharge and three-month outcome data, are presented in Table 4 . The three-month survival comparison is illustrated in Figure 5 .

5 | DISCUSSION

The present study evaluated the clinical profile, indications, complications, and outcomes of tracheostomised patients in a suburban Indian population. The mean age of patients was 44.22 ± 19.83 years, with a male predominance (3.16:1), consistent with the observation that traumatic injuries—the leading indication—affect younger males more frequently (1, 10). The majority of tracheostomies were performed emergently (68%), reflecting the high proportion of patients presenting with head trauma (58%). This aligns with reports that acute neurological insults constitute the most common indication for tracheostomy in intensive care settings (7, 8).

A key finding was the favourable outcome associated

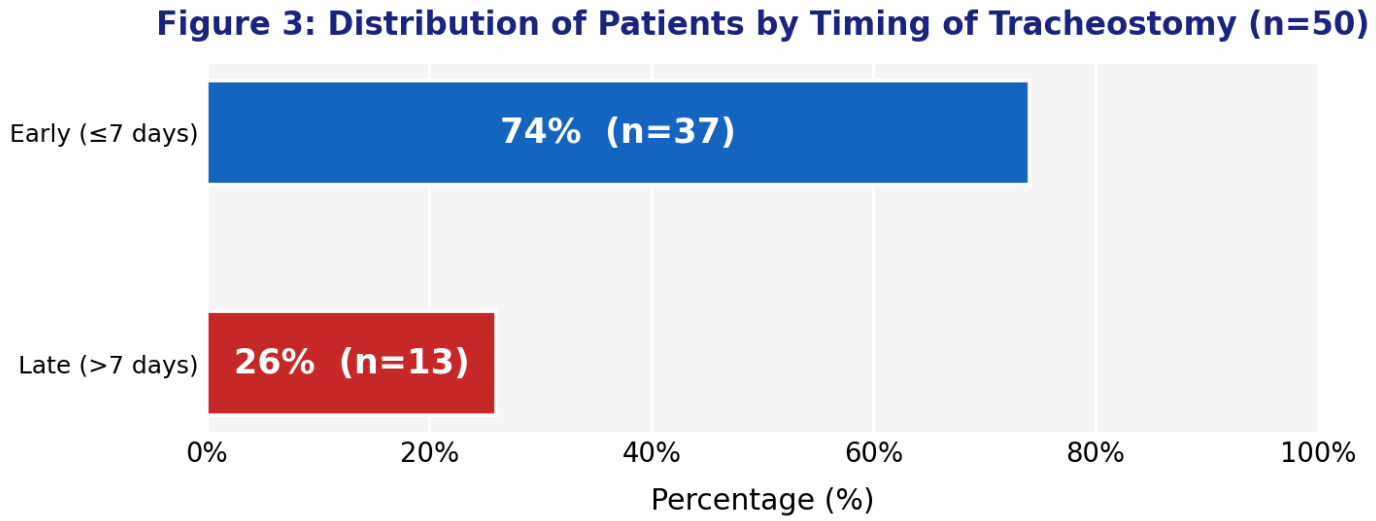

Fig. 3: illustrating timing distribution: Early tracheostomy (≤7 days) 74% (n=37) vs. Late tracheostomy (>7 days) 26% (n=13).

Table 3. Mechanical Ventilation, ICU Stay, and Hospital Stay by Timing Group

Parameter	Early (n=37) Mean ± SD	Late (n=13) Mean ± SD	Reduction (days)	t-value	p-value
Mechanical ventilation (days)	3.35 ± 2.08	14.61 ± 7.03	11.26	8.84	**0.0001***
ICU stay (days)	7.2 ± 5.3	24.3 ± 4.2	17.1	2.66	**0.010***
Hospital stay (days)	24.97 ± 19.59	41 ± 15.36	16.03	2.66	**0.010***

*p<0.05

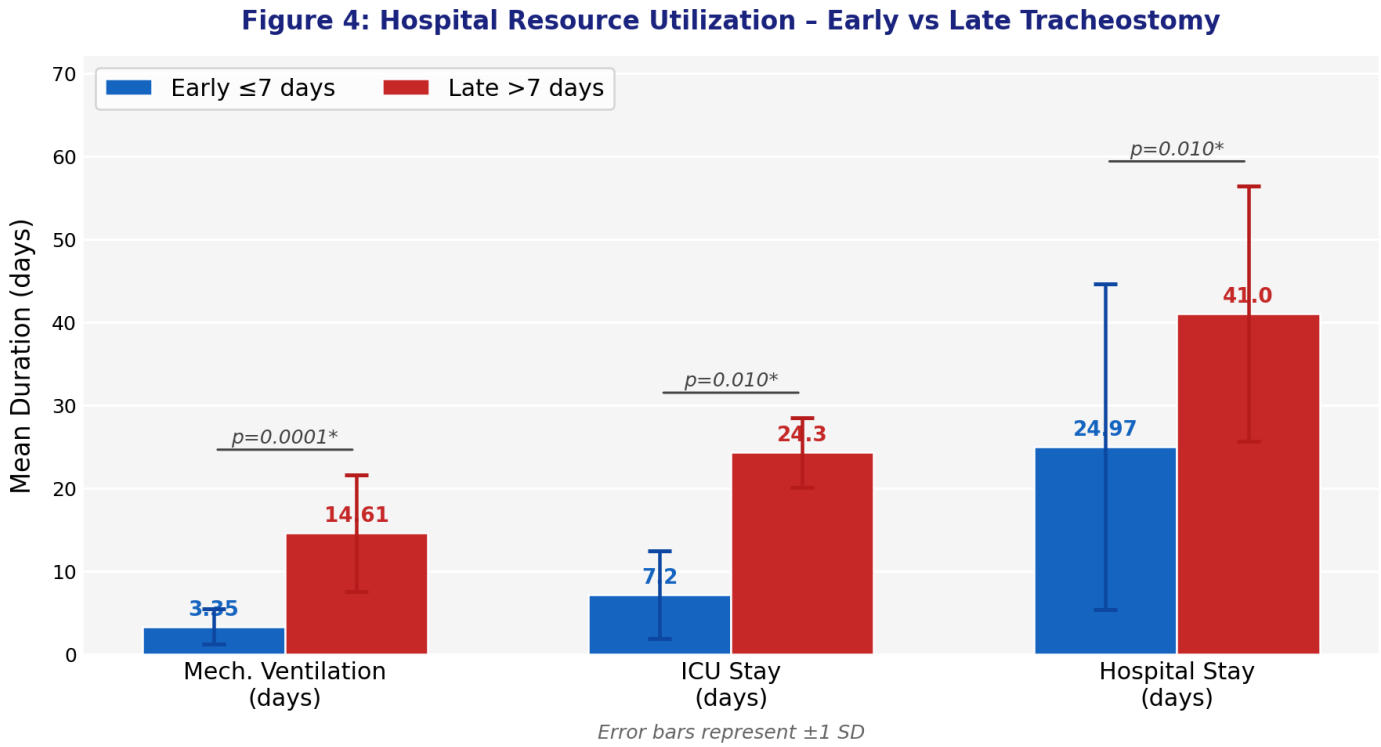

Fig. 4: Grouped bar chart with ±SD error bars comparing mechanical ventilation duration, ICU stay, and total hospital stay between early and late tracheostomy groups. All differences were statistically significant (p<0.05).

Table 4. Complications and Patient Outcomes by Timing of Intervention (n=50)

Parameter	Early ≤7 days (n=37)	Late >7 days (n=13)	Total (n=50)	p-value
Complications				
Total	3 (8.10%)	6 (46.15%)	9 (18%)	—
Bleeding from site	2	1	3 (33.33%)	
Tubal occlusion	0	2	2 (22.22%)	
Subcutaneous emphysema	1	0	1 (11.11%)	
Granulation tissue	0	1	1 (11.11%)	
Difficult decannulation	0	1	1 (11.11%)	
Tracheal stenosis	0	1	1 (11.11%)	
Outcome at Discharge				
Improved	25 (67.56%)	6 (46.15%)	31 (62%)	—
Poor prognosis	11 (29.72%)	7 (53.84%)	18 (36%)	
Expired	1 (2.70%)	0 (0%)	1 (2%)	
Outcome at Three Months				
Improved	24 (64.86%)	2 (15.38%)	26 (52%)	**0.0001***
Poor prognosis	10 (27.02%)	3 (23.07%)	13 (26%)	
Expired	3 (8.10%)	8 (61.53%)	11 (22%)	

*p<0.05 (χ^2=12.78)

Figure 5: Three-Month Patient Outcomes by Timing of Tracheostomy

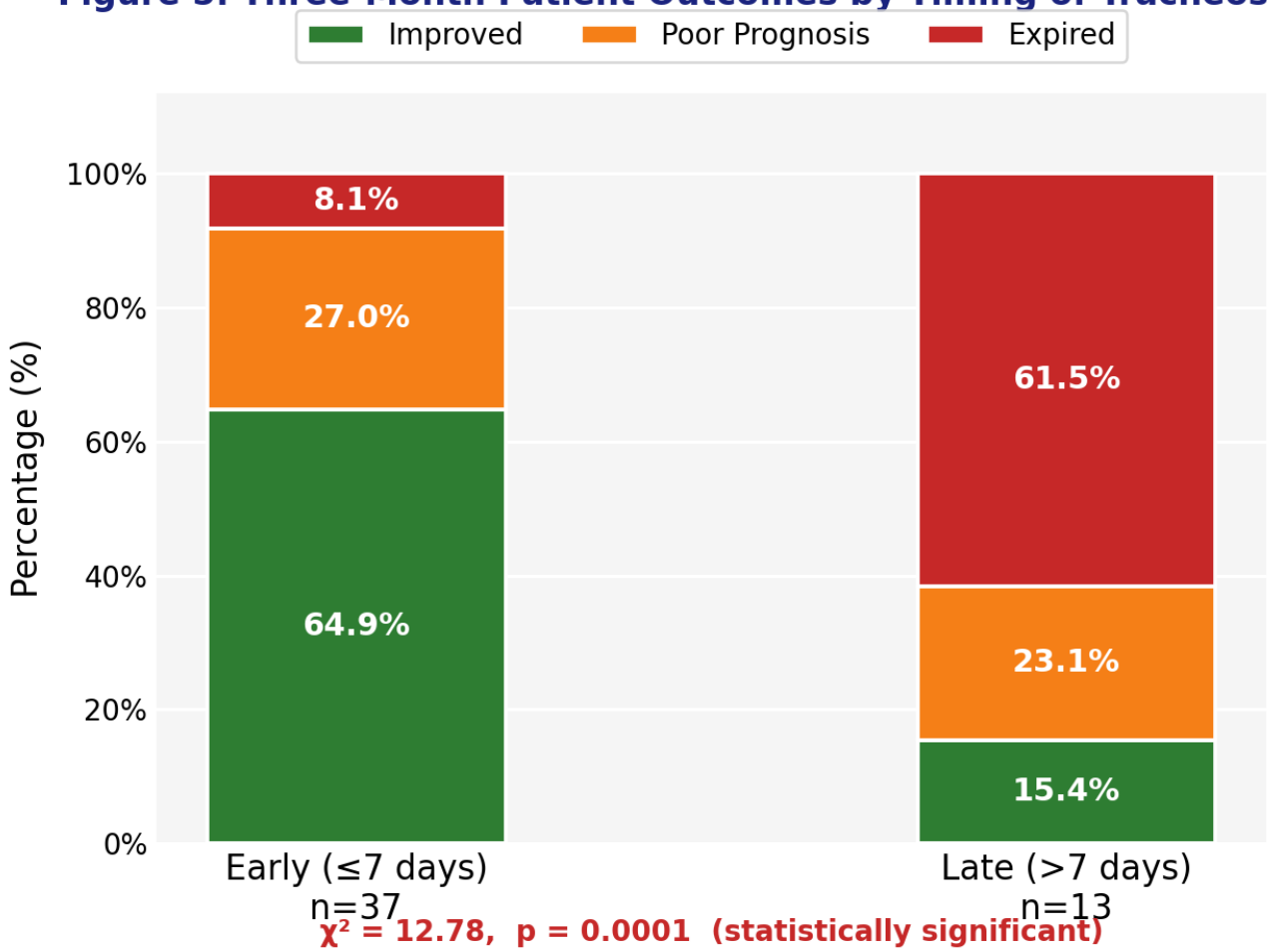

Fig. 5: 100% stacked bar chart comparing three-month outcomes between early and late tracheostomy groups. The early group demonstrated a 4.2-fold higher improvement rate and a 7.6-fold lower mortality than the late group, confirming a significant survival benefit from timely intervention (p=0.0001).

with early tracheostomy (≤7 days). Early intervention was associated with significantly shorter durations of mechanical ventilation (3.35 vs. 14.61 days, p=0.0001), reduced ICU stay (7.2 vs. 24.3 days, p=0.010), and lower overall hospital stay (24.97 vs. 41 days, p=0.010). These results corroborate earlier meta-analyses demonstrating that early tracheostomy reduces ventilator days and ICU length of stay without increasing mortality (11, 12). Moreover, the complication rate was substantially lower in the early group (8.10% vs. 46.15%), echoing the findings of Rana et al., who reported fewer procedure-related adverse events when tracheostomy was performed within the first week (8).

The predominant functions of tracheostomy in this cohort were prolonged ventilation (48%) and tracheobronchial toileting (32%), similar to the indications described by De Leyn et al. (7). Notably, the ratio of early to late tracheostomy was 2.84:1, and the choice of timing was significantly associated with outcome. At three months, 64.86% of early tracheostomy patients had improved, whereas 61.53% of late tracheostomy patients had expired (p=0.0001). This strong association supports the argument that delaying the procedure may contribute to higher mortality, likely due to prolonged exposure to translaryngeal intubation and its attendant risks (13, 14).

The overall complication rate was 18%, with bleeding being the most common (33.33% of complications). This is comparable to published figures where bleeding occurs in 5–10% of patients overall (15). Emergency tracheostomy was associated with a higher complication rate (77.77% of all complications), which is expected given the urgency and often unstable clinical condition of these patients (16).

Several limitations of this study should be acknowledged. The sample size was relatively small (n=50), and it was a single centre observational review, which limits generalizability. Selection bias may have influenced the timing decisions, as patients who underwent late tracheostomy likely had more complex underlying illnesses (17). Additionally, the thre month outcome assessment relied partly on telephonic follow ;up, which may have introduced recall or reporting bias.

Despite these limitations, the study reinforces the growing body of evidence that early tracheostomy in appropriately selected patients improves clinical outcomes and reduces healthcare resource utilisation [18, 19]. The results advocate for a protocol driven approach to tracheostomy timing, rather than relying on subjective or delayed decision ;making [20]. In conclusion, in patients with an established need for prolonged airway sup-port, earlier intervention is associated with better survival, fewer complications, and shorter hospital stays.

Declaration Statements

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Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Watkinson JC, Clarke RW. Scott-Brown's otorhinolaryngology and head and neck surgery. Boca Raton: CRC Press; 2019.
2. Kawale MA, Keche PN, Gawarle SH, Bhat SV, Buche A. A prospective study of complications of tracheostomy and management in tertiary care hospital in rural area. Int J Otorhinolaryngol Head Neck Surg. 2017;3(3):687–92.
3. Muscat K, Bille A, Simo R. A guide to open surgical tracheostomy. Shanghai Chest. 2017;1:4–4.
4. Datta RK, Viswanatha B, Puneet PJ, Bobby M, Kumari T. Tracheostomy: our experience Res Otolaryngol. 2015;4(2):29–33.
5. Menon M, Deepa R, Balakrishnan E, Mukundan A, Annisseril A. Tracheostomy: a hospital based descriptive study. Med Int J ENT. 2017;1(2):31–40.
6. Lewith H, Athanassoglou V. Update on management of tracheostomy. BJA Educ. 2019;19(11):370–376.
7. Aijayan PV, Jacob AM, Nandakumar VP. Incidence of complications of emergency tracheostomy in a rural medical college setting: a

prospective study. Int J Otorhinolaryngol Head Neck Surg. 2017;24(3):522–529.

8. Tibballs J, Robertson C, Wall R. Tracheal ulceration and obstruction associated with PCT. Anaesth Intensive Care. 2006;35(4):495–502.

9. González AV, Valién L, J, Armijo V, J J, Lobera C, et al. Orotracheal tube ignited by an electrocautery device during tracheostomy. Rev Esp Anestesiol Reanim. 2009;56(1):47–56.

10. Dorland W. Dorland's illustrated medical dictionary. Saunders PWB, editor; 2011.

11. Pierson DJ. Tracheostomy from A to Z: historical context and current challenges. Respir Care. 2005;50(4):473–478.

12. Goodall EW. On infectious diseases and epidemiology in the Hippocratic collection (Section of the History of Medicine). Proc R Soc Med. 1934;27(5):525–559.

13. Tracheotomy JC. Laryngoscope. 1909;19(4):285–90.

14. Leyn PD, Bedert L, Delcroix M, Depuydt P, Lauwers G, Sokolov Y. Tracheotomy: clinical review and guidelines. Eur J Cardiothorac Surg. 2007;32(3):412–433.

15. Rana S, Pendem S, Pogodzinski MS, Hubmayr RD, Gajic O. Tracheostomy in critically ill patients. Mayo Clin Proc. 2005;80(12):1632–1640.

16. Freeman BD, Borecki IB, Coopersmith CM, Buchman TG. Relationship between tracheostomy timing and duration of mechanical ventilation in critically ill patients. Crit Care Med. 2005;33(11):2513–2533.

17. Frutos-Vivar F, Apezteguía EA, Anzueto C, Nightingale A, González P, M. Outcome of mechanically ventilated patients who require a tracheostomy. Crit Care Med. 2005;33(2):290–298.

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