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Timing and Trajectory of Pediatric Tracheostomy in the PICU: A Four-Year Experience from North India Running Title – Timing and Outcomes of Pediatric Tracheostomy

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Abstract

Purpose: Pediatric tracheostomy is increasingly performed for prolonged airway and ventilatory support, but data on timing, trajectory, and outcomes from low- and middle-income countries remain limited. We evaluated indications, timing, complications, and outcomes of tracheostomy in a tertiary pediatric intensive care unit (PICU), determined whether timing independently predicts mortality, and identified predictors of decannulation failure and readmission.

Methods: This retrospective observational study (July 2021-June 2025) included children aged 1 month-12 years undergoing tracheostomy in a tertiary PICU in Northern India. Early tracheostomy was defined as placement within 14 days of intubation. Complications were classified as immediate, early, or late.

Results: A total of 116 children underwent tracheostomy (median age 38 months; 69.8% male). Neurological indications predominated (75.9%). Tracheostomy was elective in 96.6%; 31.9% underwent early and 68.1% late tracheostomy. Late tracheostomy was associated with longer PICU and hospital stay ($p<0.001$) but not mortality. Overall, 27.6% of children experienced at least one complication (5.2-15.5% across immediate, early, and late categories). Survival to discharge was 87.9%; 81.5% of deaths were illness-related and 18.5% tracheostomy-related. Longer PICU stay independently predicted death (adjusted OR 1.31, 95% CI 1.06-1.60), while timing did not. Decannulation succeeded in 98.4% of attempted cases (54.3% of the cohort); no clinical variable predicted failure. Over 70% of children required hospital readmission during tracheostomy dependence.

Conclusion: Pediatric tracheostomy showed high survival and favorable decannulation success once attempted, with mortality driven by underlying disease rather than timing or procedural factors. High readmission burden supports structured caregiver training and follow-up pathways.

What is Known

- Pediatric tracheostomy is increasingly used for prolonged ventilation and neurological impairment, but timing's effect on mortality remains debated.
- Post-tracheostomy readmission and decannulation trajectories are poorly characterized in South Asian settings.

What is New:

- In this Indian cohort, tracheostomy timing did not independently predict mortality; longer PICU stay did.
- Over 70% of children required readmission during tracheostomy dependence, and decannulation success exceeded 98% once attempted.

INTRODUCTION

Tracheostomy is a well-established, lifesaving procedure in pediatric critical care. Indications have shifted substantially over recent decades: previously performed predominantly for acute upper airway obstruction, tracheostomy is now more commonly used for prolonged mechanical ventilation, airway protection, and secretion management in children with severe neurological injury, neuromuscular disease, or chronic lung disease (1-3). Tracheostomy-related mortality in children has declined with improvements in critical care and post-procedure management, and adverse outcomes now correlate more closely with underlying disease than with the procedure itself (4,5).

The optimal timing of tracheostomy remains contested. A meta-analysis found early tracheostomy (<14 days) reduced ventilator days and length of stay but conferred no mortality benefit (6). In contrast, a large U.S. administrative-database study of >10,000 children found early tracheostomy independently associated with lower mortality (7), while single-center cohorts, including a cardiac ICU series, found late tracheostomy independently predicted higher mortality (8,9). Whether these associations reflect a causal timing effect or confounding by indication and severity remains unresolved, particularly as registry-based studies cannot fully capture illness trajectory at the point of decision-making.

Indian data parallel global epidemiological shifts. Sachdev et al. reported a 20-year transition from upper airway obstruction to central neurological impairment as the leading indication, with overall mortality 31.4% but tracheostomy-related death of only 3.1% (10). An indication-stratified follow-up found early tracheostomy shortened post-tracheostomy ventilation and PICU/hospital stay, without addressing mortality directly (11). Subramani et al. reported neurological illness as predominant (57.4%) in a South Indian PICU cohort, with complications in 42.6% and low tracheostomy-related mortality (2.9%) (12). Eastern Indian data show 9.1% of ventilated children required tracheostomy, predominantly for prolonged ventilation, with 11.5% overall mortality and no procedure-related deaths (13).

Despite this literature, few studies examine whether tracheostomy timing independently predicts survival once severity is accounted for. Internationally, longer-term cohorts increasingly report survival and decannulation as continuous trajectories, a U.S. cohort estimated cumulative decannulation of 54.1% by 10 years using Kaplan-Meier methods (14), and post-tracheostomy readmission has emerged as a major outcome domain, with a Taiwanese national cohort reporting 78% one-year readmission (15). Comparable trajectory data spanning timing, decannulation, and readmission together remain absent from the Indian and broader South Asian literature. This is particularly important in low- and middle-income countries, where structured home-care and long-term ventilatory support services are limited.

This study describes the four-year experience of pediatric tracheostomy in a tertiary PICU in Northern India, aiming to characterize indications, timing, complications, and outcomes; determine whether timing independently predicts in-hospital mortality; and identify predictors of decannulation failure, readmission, and post-tracheostomy morbidity.

MATERIALS AND METHODS

Design and Setting:This retrospective observational study was conducted in the PICU of a tertiary care teaching hospital in Northern India (July 2021-June 2025), approved by the *'Institutional Ethics Committee (Intramural)'* with a waiver of consent (IEC-INT/2026/SPL-630; approved 16/05/2026).

Children were identified from the institutional tracheostomy register; of 121 register entries during the study period, 5 were excluded following verification against clinical records (3 had not actually undergone tracheostomy per discharge documentation, 1 patient's records could not be traced, and 1 underwent tracheostomy only after transfer out of the PICU to another unit), leaving 116 children aged 1 month-12 years for final analysis. Children with tracheostomy performed elsewhere were also excluded.

Data Collection:Data were extracted from electronic and physical case records using a structured proforma, covering demographics, clinical profile, admission severity (PRISM III), tracheostomy timing and urgency, mechanical ventilation duration, complications, decannulation, readmission, and in-hospital mortality.

Definitions:Early tracheostomy was defined as placement within 14 days of intubation, late as after 14 days, consistent with recent literature including the largest published cohort using this threshold (7,12,16). Prolonged mechanical ventilation was defined as invasive ventilation ≥14 consecutive days (4,10,17). Complications were classified as immediate (during procedure/first 24h), early (24h-7 days), or late (>7 days). Children with complications spanning more than one time window were counted in each relevant category. Successful decannulation was defined as maintenance of a patent airway and adequate ventilation without a tracheostomy tube for >48h (13,18); decannulation failure was defined only among children in whom an attempt was made, with tube-in-situ children who had not yet undergone an attempt classified separately as “not yet decannulated.” Hospital readmission was defined as any-cause readmission occurring after index discharge up to the point of successful decannulation; because the observation window therefore varied with each child's individual time to decannulation, readmission figures represent a cumulative proportion ever readmitted during tracheostomy dependence rather than a rate over a fixed period.

Statistical Analysis:Analyses were performed using IBM SPSS Statistics. Normality was assessed by Shapiro-Wilk test; continuous variables are presented as mean±SD or median (IQR) as appropriate, categorical variables as frequencies/percentages. Group comparisons used chi-square/Fisher's exact test (categorical) and independent t-test/Mann-Whitney U test (continuous). Kaplan-Meier survival analysis estimated time to decannulation. $p<0.05$ was considered significant.

Use of Large Language Models:Claude (Anthropic), a large language model, was used to assist with literature search and synthesis. All scientific content, clinical interpretation, and conclusions are the sole responsibility of the authors.

RESULTS

Cohort Characteristics:During the study period, 116 children underwent tracheostomy *(Figure 1).* Median age was 38 months (IQR 13-97) and median weight 13 kg (9.5-22). By age category, 24 children (20.7%) were <1 year, 45 (38.8%) were 1-5 years, and 47 (40.5%) were >5 years; no neonates were included given the 1-month minimum age criterion. Males predominated (81, 69.8%). Median PRISM III was 10 (6-14) and median GCS was 9 (7-12).

Neurological indications predominated (88, 75.9%), most commonly neuromuscular disorders (37, 31.9%), followed by CNS infection (12, 10.3%), hypoxic–ischemic injury (11, 9.5%), multifactorial neurological etiology (10, 8.6%), and autoimmune encephalitis (7, 6.0%); structural malformation, metabolic/degenerative disease, and spinal cord pathology each accounted for 3 (2.6%). Among non-neurological indications (28, 24.1%), prolonged ventilation for lung disease was most common (8, 6.9%), followed by post-extubation airway obstruction (6, 5.2%) and upper airway anomaly (5, 4.3%).

Most children (64, 55.1%) underwent tracheostomy without a prior extubation attempt; 25 (21.6%) had one attempt and 27 (23.3%) had ≥2. Median MV duration before tracheostomy was 18 days (13-23). Tracheostomy was elective in 112 (96.6%) and emergency in 4 (3.4%) *(Table 1).*

Post-Tracheostomy Course:Median PICU stay was 26 days (18-33) and hospital stay 42 days (33-56) *(Table 2).* BiPAP was the most common post-weaning support (77, 66.4%); 25 (21.5%) required none at discharge. Immediate, early, and late complications occurred in 6 (5.2%), 11 (9.5%), and 18 (15.5%) children respectively (details of the 6 immediate complications are provided in Supplementary Table S1); three children experienced complications spanning two time windows (one with immediate malposition and early infection, one with immediate bleeding and late tracheitis, and one with early bleeding and late stoma infection). Overall, 32 children (27.6%) experienced at least one complication, and 98 (84.5%) had no late complications.

At discharge, 102 (87.9%) were alive, 9 (7.8%) had died, and 5 (4.3%) left against medical advice. Of 102 followed post-discharge, 61 (52.6%) were alive and tube-free and 13 (11.2%) remained tracheostomy-dependent. Post-discharge mortality occurred in 18 (15.5%): 16 (13.8%) before and 2 (1.7%) after decannulation; 10 (8.6%) were lost to follow-up.

Cause of Death:Of 9 in-hospital deaths, 8 (88.9%) were illness-related and 1 (11.1%) tracheostomy-related. Of 18 post-discharge deaths, 14 (77.8%) were illness-related and 4 (22.2%) tracheostomy-related. Overall, of 27 deaths with attributable cause, 22 (81.5%) were illness-related and 5 (18.5%) tracheostomy-related.

Tube changes occurred predominantly in-hospital (81, 69.8%), most commonly every two weeks (54, 46.6%). Among children on noninvasive support, median time from BiPAP to room air was 45 days (25-86), and from room air to decannulation 115 days (47.5-231.5) *(Figure 2).*

Decannulation:Attempted in 64 (55.2%), successful in 63 (98.4%), failed in 1 (1.6%). Of the 13 children (11.2%) who remained tracheostomy-dependent, 1 had a failed decannulation attempt (already included

above) and 12 (10.3%) had not yet undergone any attempt. Decannulation was inaccessible in a further 40 (34.5%): 14 pre-discharge deaths (12.1%), 16 pre-decannulation deaths (13.8%), and 10 lost to follow-up (8.6%).

Readmissions:Tracked from discharge to decannulation, 51 children (44%) had one readmission, 20 (17.2%) had two, and 13 (11.2%) had ≥3, a majority requiring at least one readmission during tracheostomy dependence.

Early vs. Late Tracheostomy:37 (31.9%) underwent early and 79 (68.1%) late tracheostomy, with no significant differences in age, sex, indication, PRISM, or prior extubation attempts. Late tracheostomy was associated with significantly longer PICU (29 vs 17 days, p<0.001) and hospital stay (48 vs 31 days, p<0.001), but not post-tracheostomy ventilation duration (p=0.850) or mortality (18.9% vs 8.9%, p=0.121) *(Table 3).*

Predictors of Mortality:Fourteen children (12.1%) died. Non-survivors were younger (median 13.5 vs 49 months; OR 0.98, 95%CI 0.96-0.99; p=0.018), more often <1 year (42.9% vs 17.6%; OR 0.13, p=0.020), and more often had non-neurological indications (50% vs 21.6%; OR 3.64, p=0.028) on univariate analysis. On multivariable analysis, longer PICU stay independently predicted mortality (aOR 1.31, 95%CI 1.06-1.60; p=0.011), while longer hospital stay was associated with lower mortality (aOR 0.80, 95%CI 0.68-0.93; p=0.003), likely reflecting survival bias *(Table 4).*

Predictors of Decannulation Failure:Among 92 children with evaluable decannulation status, 63 (68.5%) succeeded and 29 (31.5%) had not yet been decannulated, comprising 13 children alive with a persistent tracheostomy and 16 who died after discharge before a decannulation attempt could be made. Among the 13 with persistent tracheostomy, only 2 underwent a decannulation attempt (one subsequently required re-tracheostomy); the remainder had not been formally reassessed. Five of the 13 remained BiPAP-dependent at last follow-up, as did 12 of the 16 who died. No variables like age, indication, PRISM, GCS, ventilation duration, PICU/hospital stay, differed significantly between groups (all p>0.05) *(Table 4).*

DISCUSSION

In this four-year PICU cohort, neurological disorders predominated as tracheostomy indications (75.9%); procedure-related mortality was low (18.5% of deaths tracheostomy-related vs. 81.5% illness-related); timing was not independently associated with mortality; decannulation succeeded in over half the cohort (98.4% when attempted); and post-tracheostomy readmissions were frequent.

Our findings reinforce the global shift from emergency airway obstruction toward elective tracheostomy for prolonged ventilation in children with chronic neurological impairment, mirroring Sachdev et al. (10), Subramani et al. (12), and a Bengaluru decannulation cohort (19). That 55.1% of our children underwent tracheostomy without any prior extubation attempt suggests early anticipation of long-term ventilatory dependence, particularly in neuromuscular and severe neurological disease.

The optimal timing of tracheostomy remains genuinely unresolved, and our null mortality finding adds a relevant data point. A meta-analysis found no mortality benefit from early tracheostomy despite reduced ventilator days (6), consistent with our result. This contrasts with a large U.S. registry showing early tracheostomy independently lowered mortality (7), and single-center cohorts, including a cardiac ICU series, where late tracheostomy predicted higher mortality (8,9). We believe large registries, which code timing without capturing illness reversibility at the bedside, are more susceptible to confounding by indication than granular single-center data such as ours or Sachdev et al.'s indication-stratified analysis (11), which found early tracheostomy shortened ventilation and stay without addressing mortality directly. A 12-year Northern Indian series with median 11-day time-to-tracheostomy (20) suggests evolving practice toward earlier intervention, but our data indicate patient-specific factors, not timing alone, remain central to outcome, arguing against a fixed-cutoff protocol in favor of individualized decision-making, a view echoed in a recent correspondence calling for deeper reflection on tracheostomy decision-making in children (21).

Complication rates (5.2% immediate, 9.5% early, 15.5% late; 27.6% of children overall) were largely minor and consistent with published series; a small subset of children (n=3) experienced complications across two time windows, reflecting cumulative rather than isolated morbidity in this group. Mortality was predominantly illness-driven (81.5% of deaths), paralleling Hebbar et al. (5). Our complication rate is consistent with the pooled estimate from a systematic review of 49 pediatric tracheostomy studies, which reported an average complication rate of 40% and procedure-related mortality of up to 6%, associated with younger age, prematurity, comorbidities, and emergency tracheostomy (22), while a 12-year Northern Indian series reported minimal immediate complications (20), differences likely reflecting case-mix and institutional expertise.

Younger age and non-neurological indication predicted mortality, consistent with Sachdev et al. (10), and with markedly worse outcomes in infant-specific cohorts internationally: an Egyptian infant-only series reported 32.1% mortality and 28.6% decannulation by 36 months (23), and a U.S. infant cohort reported 26.3% mortality with 69.3% decannulation among survivors (24), consistent with a 20-year Taiwanese national survey showing a rising proportion of pediatric tracheostomies performed in infants over time (25). Our broader age distribution (median 38 months) likely explains our comparatively favorable aggregate outcomes, age at tracheostomy appears to be a major independent driver of trajectory across settings, not simply a severity marker. The inverse association between longer hospital stay and mortality likely reflects survival bias.

Our 54.3% decannulation rate is comparable to Indian reports (36–65%) (10–12, 20) and sits toward the higher end of international single-center cohorts; a UK series reported 44.4% (26), while a U.S. Kaplan-Meier analysis estimated 54.1% cumulative decannulation at 10 years (14), closely matching ours despite our shorter follow-up. No clinical variable predicted decannulation failure, consistent with recent literature identifying airway patency and bronchoscopic findings (27) and feeding route (28), rather than severity or demographics, as the true predictors of decannulation readiness. This reinforces that decannulation prospects cannot be reliably predicted at the time of tracheostomy itself.

Among children who remained tracheostomy-dependent, the predominant driver appeared to be ongoing neurological or ventilatory dependence rather than confirmed anatomical airway obstruction; most had underlying neuromuscular or encephalitic diagnoses, and the majority remained BiPAP-dependent. However, formal decannulation attempts or airway reassessment occurred in only a small minority of this group, so true airway patency and stenosis status remain largely unassessed rather than excluded. This highlights a potential missed opportunity: systematic bedside or endoscopic airway assessment by the ENT team in children remaining tracheostomy-dependent beyond an expected timeframe could identify candidates for earlier decannulation who might otherwise remain tube-dependent by clinical inertia rather than genuine necessity.

The high readmission burden (majority ≥1 readmission, 11.2% ≥3) closely parallels a Taiwanese national cohort reporting 78% one-year readmission (15) and European(29) and U.S. (30) data on medically complex children, suggesting high utilization is intrinsic to pediatric tracheostomy-dependent care generally, not simply a resource-scarcity marker. What differs is the infrastructure available to buffer it: evidence from a Cape Town LMIC program shows structured caregiver training can substitute for formal home nursing regardless of socioeconomic status (31), and a broader review identifies hands-on training, not income, as the key enabler of safe discharge (32). These findings support discharge bundles incorporating hands-on training, emergency drills, and tele-follow-up to reduce preventable readmissions even in resource-constrained settings.

We identified no peer-indexed pediatric tracheostomy cohorts from Pakistan, Bangladesh, Nepal, or Sri Lanka, indicating South Asian evidence on this topic remains almost entirely confined to India — a gap our data help address.

Strengths and Limitations: This study provides detailed, contemporary single-center data with granular chart-level analysis of complications, cause-specific mortality, and readmissions, allowing us to address confounding-by-indication concerns limiting larger registries. Limitations include its retrospective, single-center design; a readmission window tied to time-to-decannulation rather than fixed, limiting direct comparison with fixed-window studies; modest subgroup sizes (14 deaths, 92 decannulation-evaluable children) limiting multivariable power; the comparator group in the decannulation-failure analysis was heterogeneous, combining children with persistent tracheostomy and those who died before an attempt was possible, and airway status was not systematically reassessed in most non-decannulated children; and the absence of quality-of-life and caregiver-burden data.

Conclusion:Pediatric tracheostomy in this cohort was predominantly used for chronic neurological impairment and prolonged ventilation, with a favorable safety profile and high decannulation success when attempted. Timing was not independently associated with mortality, supporting individualized, trajectory-based decision-making over fixed cutoffs. The high readmission burden, comparable even to high-resource systems, reflects an intrinsic feature of tracheostomy-dependent care that is compounded here by limited home-care infrastructure, underscoring the need for structured caregiver training and discharge-support systems.

Abbreviations

- **aOR** - adjusted odds ratio
- **BiPAP** - bilevel positive airway pressure
- **CI** - confidence interval
- **CNS** - central nervous system
- **GCS** - Glasgow Coma Scale
- **IQR** - interquartile range
- **LAMA** - left against medical advice
- **MV** - mechanical ventilation
- **NIV** - noninvasive ventilation
- **OR** - odds ratio
- **PICU** - pediatric intensive care unit
- **PRISM III** - Pediatric Risk of Mortality III (score)
- **SD** - standard deviation
- **SPSS** - Statistical Package for the Social Sciences

Declarations

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Ethics approval:

Approved by the *'Institutional Ethics Committee (Intramural)'* (Approval number: IEC-INT/2026/SPL-630; approved 16/05/2026)

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Author's Contributions: Arun Bansal conceived the study idea, contributed to data analysis, literature review, and manuscript preparation, and was involved in PICU management of the patients. Jyothi Jayaram collected the data and contributed to data analysis, literature review, and drafting of the manuscript. Siva Vyasam contributed to data analysis. Ram Samujh, Anurag Snehi Ramawat, J. K. Mahajan, Jaimanti Bakshi, and Sandeep Bansal performed the tracheostomy procedures. Neerja Bhardwaj, Sandhya Yaddanapudi, and Indu M Sen contributed to perioperative anesthetic management.

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Consent to participate: This retrospective observational study used de-identified data collected as part of routine clinical care. The Institute Ethics Committee (IEC-INT/2026/SPL-630) granted a waiver of informed consent given the retrospective, non-interventional nature of the study.

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Tables

Table 1. Baseline Demographic, Clinical Characteristics, and Indications for Tracheostomy (N = 116)

Characteristic	N = 116
Age at tracheostomy (months), median (IQR)	38 (13-97)
Weight (kg), median (IQR)	13 (9.5-22)
Male sex, n (%)	81 (69.8)
PRISM III score, median (IQR)	10 (6-14)
GCS score, median (IQR)	9 (7-12)
Age category, n (%)	
<1 year	24 (20.7)
1-5 years	45 (38.8)
>5 years	47 (40.5)
Timing of tracheostomy, n (%)	
Elective	112 (96.6)
Emergency	4 (3.4)
Extubation attempts prior to tracheostomy, n (%)	
None	64 (55.1)
One	25 (21.6)
≥ Two	27 (23.3)
Duration of MV prior to tracheostomy (days), median (IQR)	18 (13–23)
Primary indication – Neurological, n (%)	
Neurological (overall)	88 (75.9)
Neuromuscular disorders	37 (31.9)
CNS infection	12 (10.3)
Hypoxic-ischemic injury	11 (9.5)
Multifactorial neurological etiology	10 (8.6)
Autoimmune / immunologic encephalitis	7 (6.0)
Structural / congenital malformation	3 (2.6)
Metabolic / degenerative disorder	3 (2.6)
Spinal cord pathology	3 (2.6)
Unspecified neurological	2 (1.7)

Characteristic	N = 116
Primary indication - Non-Neurological, n (%)	
Non-neurological (overall)	28 (24.1)
Prolonged ventilation (lung disease)	8 (6.9)
Post-extubation airway obstruction	6 (5.2)
Upper airway anomaly	5 (4.3)
Multifactorial non-neurological etiology	5 (4.3)
Infective causes	4 (3.4)
Cardiopulmonary disease	1 (0.9)

IQR - interquartile range; **PRISM III** - Pediatric Risk of Mortality III (score); **GCS** - Glasgow Coma Scale; **CNS** - central nervous system; **MV** - mechanical ventilation

Table 2. Post-Tracheostomy Course, Complications, and Outcomes (N = 116)

Outcome	N = 116
PICU length of stay (days), median (IQR)	26 (18-33)
Hospital length of stay (days), median (IQR)	42 (33-56)
Post-weaning respiratory support, n (%)	
BiPAP	77 (66.4)
None (room air)	25 (21.5)
Complications, n (%)	
Immediate (procedure / first 24 h)	6 (5.2)
Early (24 h – 7 days)	11 (9.5)
Late (> 7 days)	18 (15.5)
None (late)	98 (84.5)
Any complication (unique children)	*32 (27.6)*
Hospital discharge outcome, n (%)	
Alive	102 (87.9)
Died in-hospital	9 (7.8)
Left against medical advice (LAMA)	5 (4.3)
Post-discharge status at follow-up (n = 102), n (%)	
Alive, tube-free	61 (52.6)
Alive, tracheostomy-dependent	13 (11.2)
Died before decannulation	16 (13.8)
Died after decannulation	2 (1.7)
Lost to follow-up	10 (8.6)
Cause of death among all 27 deaths (in-hospital + post-discharge), n (%)	
Primary illness	22 (81.5)
Tracheostomy-related	5 (18.5)
Decannulation, n (%)	
Attempted (of N = 116)	64 (55.2)
Successful (of attempted)	63/64 (98.4)
Not yet attempted - alive, tracheostomy-dependent	12 (10.3)

Outcome	N = 116
Not attempted / not accessible	40 (34.5)
Hospital readmissions, tracked to decannulation, n (%)	
One readmission	51 (44.0)
Two readmissions	20 (17.2)
≥ Three readmissions	13 (11.2)
Weaning / decannulation timeline, median (IQR)	
BiPAP → room air (days)	45 (25–86)
Room air → decannulation (days)	115 (47.5–231.5)

IQR *- interquartile range;* ***BiPAP*** *- bilevel positive airway pressure;* ***PICU*** *- pediatric intensive care unit*

 Three children experienced complications spanning two time windows (one immediate/early: malposition and infection; one immediate/late: bleeding and tracheitis; one early/late: bleeding and stoma infection), so category totals sum to more than the number of unique affected children.

Table 3. Comparison of Early versus Late Tracheostomy

Variable	Early (n=37)	Late (n=79)	p-value
Age at tracheostomy (months), median	25	60	0.074
Male sex, n (%)	25 (67.6)	56 (70.9)	0.717
Neurological indication, n (%)	24 (64.9)	63 (79.7)	0.084
PRISM III score, median	11	10	0.426
Prior extubation attempts, median	0	0	0.078
PICU stay (days), median	17	29	< 0.001
Hospital stay (days), median	31	48	< 0.001
MV days after tracheostomy, median	4	4	0.850
Mortality at discharge, n (%)	7 (18.9)	7 (8.9)	0.121

Early tracheostomy defined as placement ≤ 14 days of intubation; late as > 14 days.

PRISM III *- Pediatric Risk of Mortality III (score);* ***PICU*** *- pediatric intensive care unit;* ***MV*** *- mechanical ventilation*

Table 4. Predictors of In-Hospital Mortality and Decannulation Failure

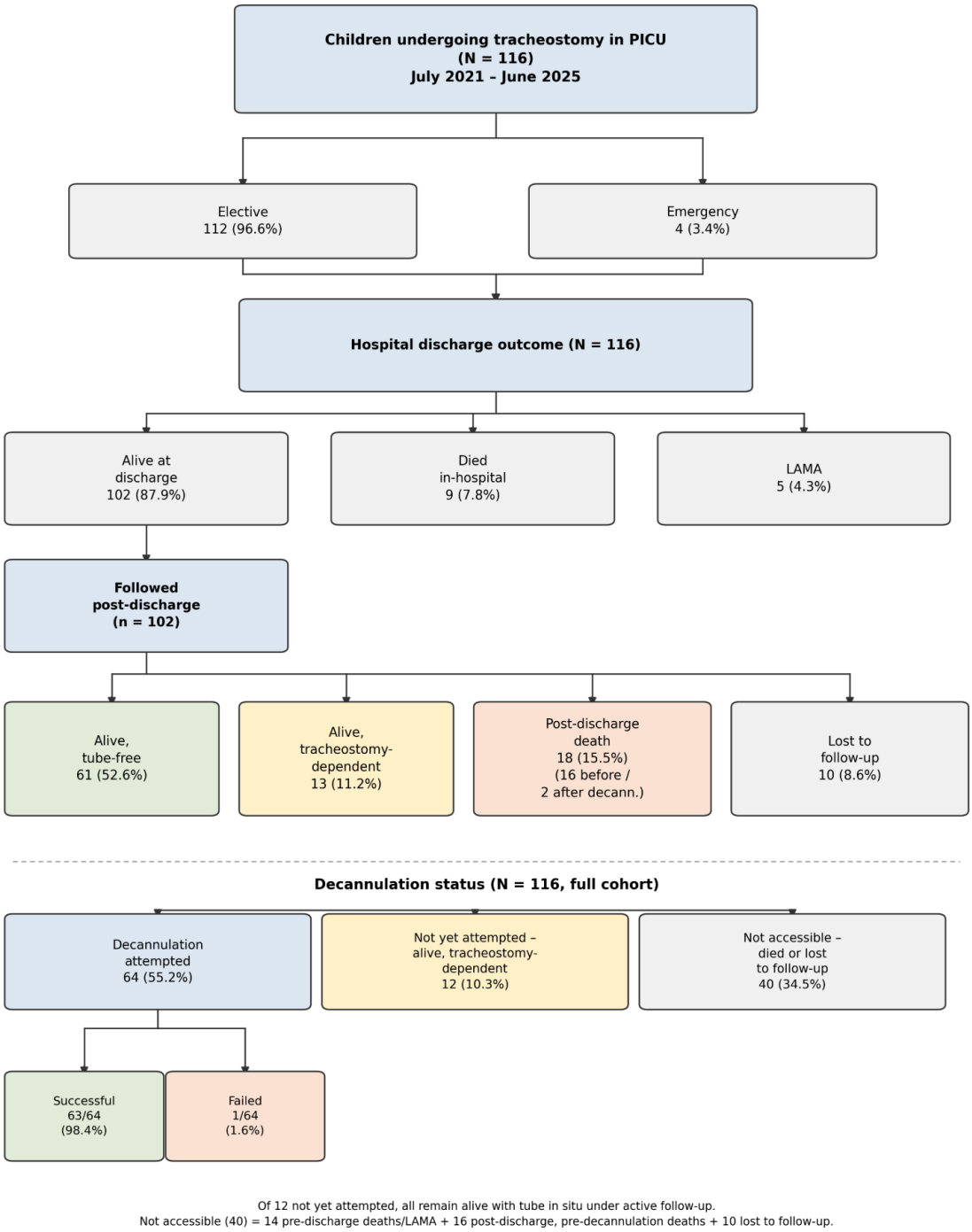
Variable	Group A	Group B	Statistic
Predictors of In-Hospital Mortality			
Univariate analysis	**Survivors (n=102)**	**Non-survivors (n=14)**	
Age at tracheostomy (months), median	49	13.5	OR 0.98 (0.96-0.99), p=0.018
Age < 1 year, n (%)	18 (17.6)	6 (42.9)	OR 0.13 (0.03-0.72), p=0.020
Non-neurological indication, n (%)	22 (21.6)	7 (50.0)	OR 3.64 (1.15-11.47), p=0.028
PRISM III score, median (IQR)	10 (6-14)	12 (10-18.5)	OR 1.06 (0.99-1.13), p=0.097
GCS score, median (IQR)	9 (7-11)	10.5 (7-13.5)	OR 1.14 (0.95-1.37), p=0.172
Timing - Elective, n (%)	99 (97.1)	13 (92.9)	OR 2.54 (0.25-26.24), p=0.434
MV duration before tracheostomy (days), median (IQR)	18.5 (13-23)	14 (10.8-29)	OR 1.02 (0.96-1.07), p=0.585
PICU stay (days), median (IQR)	26 (17.8-32.3)	26 (18.5-54.8)	OR 1.03 (0.99-1.07), p=0.187
Hospital stay (days), median (IQR)	42.5 (33-53.8)	30.5 (20.5-64.3)	OR 0.98 (0.95-1.02), p=0.319
Multivariable analysis			
PICU stay (days)	-	-	aOR 1.31 (1.06-1.60), p=0.011
Hospital stay (days)	-	-	aOR 0.80 (0.68-0.93), p=0.003
Predictors of Decannulation Failure			
Univariate analysis	**Successful(n=63)**	**Decannulated (n=29)**	-
Age at tracheostomy (months), median	60	39	
Neurological indication, n (%)	51 (81.0)	22 (75.9)	p = 0.575
PRISM III score, median	8	11	-
GCS score, median	10	8	-
MV before tracheostomy (days), median	18	19	p > 0.05

Variable	Group A	Group B	Statistic
MV after tracheostomy (days), median	4	3	p > 0.05
PICU stay (days), median	27	26	p > 0.05
Hospital stay (days), median	44	41	p > 0.05

aOR = adjusted odds ratio (multivariable logistic regression). Panel B analysis restricted to the 92 children with evaluable decannulation status (excludes pre-discharge deaths and those lost to follow-up). The "not yet decannulated" group comprises both children with persistent tracheostomy (n=13) and those who died after discharge before a decannulation attempt could be made (n=16).

PRISM III *- Pediatric Risk of Mortality III (score);* **GCS** - Glasgow Coma Scale; **MV** - mechanical ventilation; ***PICU*** *- pediatric intensive care unit; OR – Odds Ratio*

Figures



PICU, pediatric intensive care unit; LAMA, left against medical advice.

Figure 1

Patient flow and outcome diagram. A CONSORT/STROBE-style flow from the full cohort through discharge outcomes, post-discharge status, and decannulation status.

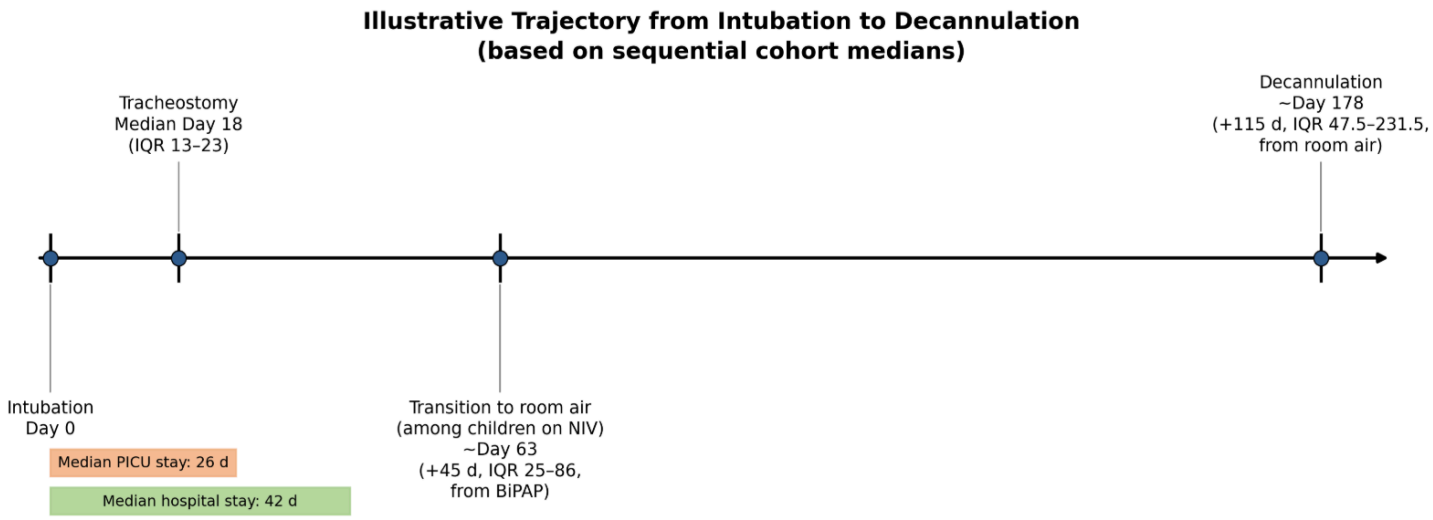


Figure 2

Illustrative trajectory timeline. A horizontal timeline plotting intubation → tracheostomy → room-air transition → decannulation using sequential medians, with PICU/hospital-stay reference bands underneath.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementaryTableS1.docx