https://doi.org/10.29309/TPMJ/2025.32.04.8852

The Professional Medical Journal
www.theprofesional.com
2025, Volume, 32 Issue, 04

ORIGINAL ARTICLE

Frequency and indications of elective tracheostomies in patients admitted at PICU (Pediatric Intensive Care Unit).

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Article Citation: Tanveer A, Gowa MA, Nawaz H, Chandio B, Jamal G, Bibi N. Frequency and indications of elective tracheostomies in patients admitted at PICU (Pediatric Intensive Care Unit). Professional Med J 2025; 32(04):379-384. https://doi.org/10.29309/TPMJ/2025.32.04.8852

ABSTRACT… Objective: To determine the frequency and indications of elective tracheostomies in patients admitted at pediatric intensive care unit (PICU) in a tertiary care hospital. **Study Design:** Cross-sectional study. **Setting:** The PICU of National Institute of Child Health, Karachi, Pakistan. **Period:** May 2024 to November 2024. **Methods:** A total of 62 children of any gender, aged 1 month to 14 years, and admitted to PICU were analyzed. Pre-designed study proforma was used to record study variables such as age, gender, PRISM-III score, admission type, disease categorization at admission. All patients admitting in PICU were closely monitored, and admitting consultant, on-board pediatric surgeon, intensivist and otorhinolaryngologist assessed the need to perform tracheostomy. Data were analyzed using IBM-SPSS Statistics, version 26.0. **Results:** In a total of 62 children, 35 (56.5%) were boys. The mean age of the children was 6.53±4.2 years. The mean PRISM-III score was 10.40±3.79. The most common disease categorization were neuromuscular diseases, and respiratory diseases, documented in 22 (35.5%), and 16 (25.8%) children, respectively. There were 11 (17.7%) children who underwent tracheostomy. Among 11 children undergoing tracheostomy, neurological impairments, upper airway obstruction, and cardiopulmonary indications were noted among 4 (36.4%), 4 (36.4%), and 3 (27.3%) children, respectively. The severity of illness, as per PRISM-III score, was significantly higher in children who underwent tracheostomy (p=0.023). **Conclusion:** The frequency of tracheostomy was 17.7% in children admitted in PICU. Patients requiring tracheostomy demonstrated significantly higher PRISM-III scores. Neurological impairments, upper airway obstruction, and cardiopulmonary complications were most common indications behind tracheostomy.

Key words: Cardiopulmonary, Neurological Impairment, PRISM-III Score, Tracheostomy, Upper Airway Obstruction.

INTRODUCTION

In order to describe the opening, maturation, and insertion of an indwelling tube through the neck into the trachea, Lorenz Heister coined the word "tracheostomy" in 1718.[1] Since then, the adoption and upkeep of the surgical airway have evolved in a variety of surgical and medical specialties. Over 100,000 tracheostomies are performed on average each year, with 4,000 of those operations being done on children.[2] Tracheostomy is a far less frequent procedure in the pediatric intensive care unit (PICU) compared to adult practice, therefore there is much less information available concerning current practice. Although it is generally agreed that tracheostomies must be performed in 1 or 2 weeks of ventilation in adult patients, there are currently no set standards about how long it takes for tracheostomies to be performed in children, so each patient is assessed individually.[3,4]

Tracheostomy has evolved into a different technique from endotracheal intubation for patients with acute respiratory failure who need extended mechanical ventilation (PMV). This is because tracheostomy is a safer operation that is linked to lower ventilator-associated morbidity and mortality than prolonged endotracheal intubation.[5,6] Prolonged endotracheal intubation is also linked to a higher risk of acquiring ventilator-associated pneumonia. The reasons for tracheostomy in children have dramatically changed during the past two decades.[2]

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Article received on: 14/11/2024
Accepted for publication: 20/01/2025

According to several studies, PMV is the most typical reason for an elective tracheostomy.[7-9] Schweiger et al. observed that a significant proportion (83%) of patients had tracheostomies because of an upper airway obstruction in their evaluation of tracheostomy justifications at their center.[10]

It might be difficult to decide whether paediatric patients should receive a tracheostomy, especially if they have severe difficulties. The choice of tracheostomy is currently based on clinical judgement since there are no current national or international recommendations. There is a scarcity of literature from developing world regardings aspects of treacheostomy. This is why we designed this study to identify the necessity for tracheostomies and their indication in the context of our community. The objective of this study was to determine the frequency and indications of elective tracheostomies in patients admitted at PICU in a tertiary care hospital.

METHODS

This cross-sectional study was conducted at the PICU of National Institute of Child Health, Karachi, Pakistan from May 2024 to November 2024. Approval from Institutional Ethical Review Board was acquired (IERB-03/2024, dated: 24-04-2024). Considering the proportion of 4.2% patients admitted in PICU undergoing elective tracheostomy[12], using 95% confidence interval, and 5% precision, a sample size of 62 patients was calculated using WHO sample size calculator. The inclusion criteria were children of any gender, aged 1 month to 14 years, and admitted to PICU. Children with existing tracheostomy before PICU admission, or those requiring to emergency tracheostomy were excluded. Parents not giving consent for participation of their child in this study were also excluded. Written and informed consents were obtained from all parents. Non-probability consecutive sampling technique was adopted.

Pre-designed study proforma was used to record study variables such as age, gender, PRISM-III score, admission type, admitting diagnosis, disease categorization at admission. All patients admitting in PICU were closely monitored by the assigned doctors and nurses as per the hospital protocols. The admitting consultant, on-board pediatric surgeon, intensivist and otorhinolaryngologist assessed the need to perform tracheostomy. The assigned residents collected the data accordingly and documented in the study proforma. Tracheostomy indication was categorized into five groups according to underlying causes as cardiopulmonary, craniofacial anomalies, neurological impairment, traumatic injury, or upper airway obstruction. PRISM-III score was noted and it has 17 physiological variables which contain both clinical and laboratory parameters.[11]

Data were analyzed using "IBM-SPSS Statistics, version 26.0". Descriptive statistics such as frequencies with percentages were used to summarize categorical variables like gender, admission type, admitting diagnosis, presenting complaint, disease categorization at admission, and tracheostomy indications. Numerical variables like age, and PRISM-III score were presented as mean ± standard deviation. Chi-square or Fisher exact test was applied to compare categorical variables between who needed tracheostomy and who did not undergo tracheostomy. Numerical variables were compared among patients undergoing and not undergoing tracheostomy using independent sample t-test. $P<0.05$ was taken as statistically significant.

RESULTS

A total of 62 children fulfilling the eligibility criteria and admitted to the PICU were analyzed. There were 35 (56.5%) were boys, and 27 (43.5%) girls. The mean age of the children was 6.53±4.2 years, ranging between 4 months to 14 years. The mean PRISM-III score was 10.40±3.79. The most common disease categorization were neuromuscular diseases, and respiratory diseases, documented in 22 (35.5%), and 16 (25.8%) children, respectively (Table-I).

There were 11 (17.7%) children who underwent tracheostomy. Among 11 children undergoing tracheostomy, upper airway obstruction, neurological impairment, and cardiopulmonary

indications were noted among 4 (36.4%), 4 (36.4%), and 3 (27.3%) children, respectively. Among those undergoing tracheostomy, 5 (45.5%) were boys and 6 (54.5%) were girls, while among those not undergoing tracheostomy, 30 (58.8%) were boys and 21 (41.2%) were girls (p=0.417). Age distribution was not found to have any significant association with tracheostomy (p=0.417). The severity of illness, as assessed by the PRISM-III score, was significantly higher in children who underwent tracheostomy (p=0.023). Underlying disease categorization was not found to have any significant association with tracheostomy (p=0.432). Table-II is showing details about the association of various demographic and clinical characteristics of children with tracheostomy.

Characteristics		Frequency (%)
Gender	Boys	35 (56.5%)
	Girls	27 (43.5%)
Age	1 month to 5 years	27 (43.5%)
	Above 5 to 14 years	35 (56.5%)
PRISM-III Score	Low severity (0-5)	7 (11.3%)
	Mild severity (6-10)	26 (41.9%)
	Moderate severity (11-15)	21 (33.9%)
	High severity (>15)	8 (12.9%)
Admission type	Medical	35 (56.5%)
	Surgical	27 (43.5%)
Disease categorization	Neuromuscular	22 (35.5%)
	Respiratory	16 (25.8%)
	Cardiovascular	7 (11.3%)
	Sepsis	6 (9.7%)
	Others	11 (17.7%)

Table-I. Demographic and clinical characteristics of children (N=62)

DISCUSSION

The reported tracheostomy frequency of 17.7% in this study is considerably higher than the 4.2% observed in a large retrospective cohort by Ishaque et al.[12], which analyzed PICU admissions over nearly a decade. Maheshwari et al. found a frequency of only 2.2% among PICU patients.[13] The higher frequency in this study could attributed to differences in patient population, institutional practices, and the broader indications for tracheostomy. This study included a higher proportion of children with neuromuscular diseases, and severe respiratory diseases, which frequently necessitate prolonged airway management.[14,15] These findings highlight most common indications for tracheostomy in PICU patients and underscore the need for a more standardized approach to patient selection and timing of the procedure.[16]

Neurological impairments, and upper airway obstruction emerged as the leading indications for tracheostomy in this study, each accounting for 36.4% of tracheostomy cases. Schweiger et al. observed that a significant proportion (83%) of patients had tracheostomies because of an upper airway obstruction in their evaluation of tracheostomy justifications at their center.[10]

Characteristics		Tracheostomy		P-Value
		Yes (n=11)	No (n=51)	
Gender	Boys	5 (45.5%)	30 (58.8%)	0.417
	Girls	6 (54.5%)	21 (41.2%)	
Age	1 month to 5 years	6 (54.5%)	21 (41.2%)	0.417
	Above 5 to 14 years	5 (45.5%)	30 (58.8%)	
PRISM-III Score	Low severity (0-5)	-	7 (13.7%)	0.023
	Mild severity (6-10)	2 (18.2%)	24 (47.1%)	
	Moderate severity (11-15)	5 (45.5%)	16 (31.4%)	
	High severity (>15)	4 (36.4%)	4 (7.8%)	
Admission type	Medical	4 (36.4%)	31 (60.8%)	0.138
	Surgical	7 (63.6%)	20 (39.2%)	
Disease categorization	Neuromuscular	6 (54.5%)	16 (31.4%)	0.432
	Respiratory	3 (27.3%)	13 (25.5%)	
	Cardiovascular	1 (9.1%)	6 (11.8%)	
	Sepsis	1 (9.1%)	5 (9.8%)	
	Others	-	11 (21.6%)	

Table-II. Demographic and clinical characteristics of children (N=62)

The findings of this study are also consistent with the study by Arpitha et al.[17], which reported neurological impairment as the primary indication in 56.2% of cases, followed by airway obstruction (19.2%). Jain et al.[18], showed prolonged mechanical ventilation as the predominant indication for tracheostomy. The variations may reflect differences in patient demographics, access to advanced ventilatory support, and institutional decision-making protocols. The predominance of neurological impairments, and upper airway obstruction as indications suggests that children with neuromuscular diseases, and structural airway anomalies represent a particularly vulnerable population in resource-limited settings. Recognizing these patterns can guide the development of tailored protocols to improve patient selection and optimize outcomes.

This research identified a significant association between higher PRISM-III scores and the need for tracheostomy ($p=0.023$), with 36.4% of tracheostomy cases involving patients in the high-severity category (scores >15). This aligns with findings from Ishihara and Tanaka[19], who reported that children with higher disease severity and chronic conditions were more likely to undergo tracheostomy. Unlike studies from high-income settings that emphasize early tracheostomy as a strategy to improve outcomes in mechanically ventilated patients, our results suggest that tracheostomy is often delayed until critical severity thresholds are met.[20] This practice may reflect limited resources and the hesitancy to perform invasive procedures without clear clinical necessity. The significant association between higher PRISM-III scores and tracheostomy underscores the importance of illness severity as a determinant of procedural necessity. Clinicians should consider incorporating severity scoring systems into decision-making frameworks to stratify patients and anticipate their needs for advanced airway management.

This study has several limitations that warrant consideration. Single-center design limits the generalizability of our findings. The relatively modest sample size reduces the statistical power of subgroup analyses and may overestimate certain associations. The cross-sectional nature of the study precludes longitudinal follow-up, preventing an evaluation of long-term outcomes, such as decannulation success or mortality rates. This study did not assess procedural complications or their impact on patient outcomes, which could provide valuable insights into the safety and efficacy of tracheostomy in this population. Future studies should focus on multicenter cohorts to enhance generalizability and evaluate the long-term outcomes of tracheostomy in pediatric populations. Efforts should be made to standardize procedural practices and develop evidence-based guidelines tailored to the unique challenges of resource-limited settings. Such initiatives could improve patient selection, enhance procedural safety, and ultimately contribute to better clinical outcomes for critically ill children requiring tracheostomy.

CONCLUSION

The frequency of tracheostomy was 17.7% in children admitted in PICU. Patients requiring tracheostomy demonstrated significantly higher PRISM-III scores. Neurological impairment, upper airway obstruction, and cardiopulmonary complications were most common indications behind tracheostomy. Further studies are warranted to explore specific clinical and procedural factors influencing the need for tracheostomy involving large sample size in PICU settings.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

REFERENCES

1. Fuller C, Wineland AM, Richter GT. **Update on pediatric tracheostomy: Indications, technique, education, and decannulation.** Curr Otorhinolaryngol Rep. 2021; 9(2):188-199.

2. **Agency for Healthcare Research and Quality.** https://www.hcup-us.ahrq.gov/reports/statbriefs/sb187-Hospital-Stays-Children-2012.pdf. Accessed July 25, 2023.

3. Kvolik PA, Tabak L, Lazar AM, Butković J, Mumlek I, Guljaš S, et al. **Special considerations in pediatric tracheostomy - a narrative review.** Acta Clin Croat. 2023; 62(Suppl1):113-118. doi: 10.20471/acc.2023.62.s1.14

4. McGrath BA, Ashby N, Birchall M, Dean P, Doherty C, Ferguson K, et al. **Multidisciplinary guidance for safe tracheostomy care during the COVID-19 pandemic: The NHS National Patient Safety Improvement Programme (NatPatSIP).** Anaesthesia. 2020; 75(12):1659-70. doi: 10.1111/anae.15120

5. Villemure-Poliquin N, Costerousse O, Lessard BP, Audet N, Lauzier F, Moore L, et al. **Tracheostomy versus prolonged intubation in moderate to severe traumatic brain injury: A multicentre retrospective cohort study.** Can J Anaesth. 2023; 70(9):1516-26. doi: 10.1007/s12630-023-02539-7

6. Amadi N, Trivedi R, Ahmed N. **Timing of tracheostomy in mechanically ventilated COVID-19 patients.** World J Crit Care Med. 2021; 10(6):345-54. doi: 10.5492/wjccm.v10.i6.345

7. Tai HP, Lee DL, Chen CF, Huang YT. **The effect of tracheostomy delay time on outcome of patients with prolonged mechanical ventilation: A STROBE-compliant retrospective cohort study.** Medicine (Baltimore). 2019; 98(35):e16939. doi: 10.1097/MD.0000000000016939

8. Can FK, Anıl AB, Anıl M, Gümüşsoy M, Çitlenbik H, Kandoğan T, et al. **The outcomes of children with tracheostomy in a tertiary care pediatric intensive care unit in Turkey.** Turk Pediatri Ars. 2018; 53(3):177-84. doi: 10.5152/TurkPediatriArs.2018.6586. PMID: 30459517; PMCID: PMC6239071.

9. Song JJ, Choi IJ, Chang H, Kim DW, Chang HW, Park GH, et al. **Pediatric tracheostomy revisited: A nine-year experience using horizontal intercartilaginous incision.** Laryngoscope. 2015; 125(2):485-92. doi: 10.1002/lary.24882

10. Schweiger C, Manica D, Becker CF, Abreu LSP, Manzini M, Sekine L, et al. **Tracheostomy in children: A ten-year experience from a tertiary center in southern Brazil.** Braz J Otorhinolaryngol. 2017; 83(6):627-32. doi: 10.1016/j.bjorl.2016.08.002

11. Pollack MM, Patel KM, Ruttimann UE. **PRISM III: An updated Pediatric Risk of Mortality score.** Crit Care Med. 1996; 24(5):743-52. doi: 10.1097/00003246-199605000-00004. PMID: 8706448.

12. Ishaque S, Haque A, Qazi SH, Mallick H, Nasir S. **Elective tracheostomy in critically Ill children: A 10-Year single-center experience from a lower-middle income country.** Cureus. 2020; 12(7):e9080. doi: 10.7759/cureus.9080

13. Kumar PK, Shan MR, Haque A. **Elective tracheostomy in mechanically ventilated children.** J Coll Phys Surg Pak. 2012; 22(60:414-415.

14. Voulgaris A, Antoniadou M, Agrafiotis M, Steiropoulos P. **Respiratory involvement in patients with neuromuscular diseases: A narrative review.** Pulm Med. 2019; 2019:2734054. doi: 10.1155/2019/2734054

15. Rudolph MW, Slager S, Burgerhof JGM, van Woensel JBM, Alffenaar JC, Wösten-van Asperen RM, et al. **Paediatric Acute Respiratory Distress Syndrome Neuromuscular Blockade study (PAN-study): A phase IV randomised controlled trial of early neuromuscular blockade in moderate-to-severe paediatric acute respiratory distress syndrome.** Trials. 2022; 23(1):96. doi: 10.1186/s13063-021-05927-w

16. Barash M, Kurman JS. **Patient selection and preoperative evaluation of percutaneous dilation tracheostomy in the intensive care unit.** J Thorac Dis. 2021; 13(8):5251-60. doi: 10.21037/jtd-2019-ipicu-18

17. Arpitha RA, Prem KP, Shivappa, SK, Ahmed M, Basavaraja, GV. **Indications and outcome of tracheostomy in a pediatric intensive care unit: A prospective observational study.** J Pediatr Crit Care. 2021; 8(4):182-185. doi: 10.4103/jpcc.jpcc_173_20

18. Jain MK, Patnaik S, Sahoo B, Mishra R, Behera JR. **Tracheostomy in Pediatric Intensive Care Unit: Experience from Eastern India.** Indian J Pediatr. 2021; 88(5):445-49. doi: 10.1007/s12098-020-03514-6

19. Ishihara T, Tanaka H. **Factors affecting tracheostomy in critically ill paediatric patients in Japan: A data-based analysis.** BMC Pediatr. 2020; 20(1):237. doi: 10.1186/s12887-020-02144-3

20. Tanaka A, Uchiyama A, Kitamura T, Sakaguchi R, Komukai S, Matsuyama T, et al. **Association between early tracheostomy and patient outcomes in critically ill patients on mechanical ventilation: A multicenter cohort study.** J Intensive Care. 2022; 10(1):19. doi: 10.1186/s40560-022-00610-x

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2	**Murtaza Ali Gowa:** Study concept and design, Proof reading, Critical revisions, Approved for publication.
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