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Reasons, Outcomes, and Risk Factors for Emergency Department Visits in Pediatric Tracheostomy Patients: A Five-Year Single-Center Study

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Abstract

Aim: To evaluate the frequency, causes, and clinical outcomes of emergency department (ED) visits among pediatric patients with tracheostomies and to identify the risk factors associated with frequent ED utilization.

Materials and Methods: This retrospective case-control study included pediatric patients (0-18 years) with tracheostomies who were followed up at a tertiary care center between January 2020 and December 2024. Patients were divided into two groups based on the number of ED visits per year (<2 vs. ≥2). Demographic, clinical, and caregiver-related data were collected. Statistical analyses were conducted to identify factors associated with frequent ED visits.

Results: A total of 157 patients were included, with a median age of 28 months at the time of tracheostomy. During the 5-year period, these patients visited the ED 978 times. The most common reasons for ED visits were tracheostomy cannula replacement (37.9%) and acute respiratory failure (20.1%). Patients who visited the ED ≥2 times per year (n=31, 19.7%) were more likely to be fed orally (p=0.006), have less caregiver training in tracheostomy and device care (p=0.014 and p=0.030, respectively), and have Pseudomonas aeruginosa colonization (p=0.020). Mortality was also significantly higher in this group (32.3% vs. 11.9%, p=0.011).

Conclusion: Frequent ED visits in children with tracheostomies are associated with modifiable factors such as feeding method, caregiver training, and chronic airway colonization. Structured education programs and preventive care strategies may reduce healthcare utilization and improve patient outcomes in this vulnerable population.

Keywords: Tracheostomy, pediatric emergency department, caregiver training, respiratory complications, pseudomonas aeruginosa, frequent emergency department visits

Introduction

Tracheostomy is an invasive, life-saving procedure performed for reasons such as upper airway obstruction, prolonged mechanical ventilation, or inadequate secretion clearance (1,2). Although tracheostomy is less common in children than in adults, this intervention requires significant care, poses a high risk of complications, and has significant social effects (3,4). Children with tracheostomies may require frequent hospital visits due to acute complications, such as respiratory tract infections, cannula obstruction, and cannula dislodgement (5,6). A significant proportion of these visits occur in emergency departments (EDs).

Data on ED visits of children with tracheostomies are critical to improving the management of these patients and preventing

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possible complications. However, the current literature is limited with regard to data on the causes, frequency, and outcomes of these visits (6,7). This may make it difficult for healthcare professionals to meet the needs of this special patient group (5,8).

This study aims to retrospectively examine the reasons for ED visits, clinical conditions during these visits, hospitalization rates, and the risk factors for frequent ED visits among children with tracheostomies.

Materials and Methods

Study Design

This retrospective case-control study was carried out between January 2020 and December 2024 in the Department of Pediatric Pulmonology at the Necmettin Erbakan University Faculty of Medicine. The study was approved by the Ethics Committee of Necmettin Erbakan University with (decision number: 2025/5711, date: 25.04.2025).

We retrospectively reviewed the medical records of patients aged 0-18 years with tracheostomies who were under follow-up at our clinic between January 2020 and December 2024. Patients with incomplete data and those older than 18 years were excluded from the study.

The following patient demographics were recorded: age at tracheostomy, educational status, parents' educational status, caregiver, distance from home to hospital, routine feeding method [oral, nasogastric tube, or percutaneous endoscopic gastrostomy (PEG)], and caregiver training information were recorded. Furthermore, the clinical characteristics of patients, including Pseudomonas colonization, primary cause of tracheostomy, current status (deceased or alive with tracheostomy), number of ED visits, primary diagnosis/reasons for ED visits, ED outcomes [discharged, admission to ward, and admission to pediatric intensive care unit (PICU)], and length of stay in hospital, were recorded.

The primary endpoint of the study is to determine the frequency of ED visits in the period following tracheostomy placement. Visits to other hospitals' EDs were not considered. Frequent visits were defined as two or more ED visits per year.

Statistical Analysis

SPSS 22 (IBM Corp., released in 2011) IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.) was used to analyze the data in our study. The Shapiro-Wilk test was used to determine if the variables were normally distributed. Descriptive analyses were expressed as the mean ± standard deviation for normally distributed variables and as the median (minimum-maximum) for non-normally distributed variables. Categorical data were expressed as n (%). Patients were divided into two groups based on the number of ED visits per year (<2 and ≥ 2). All ED visits were considered equal, regardless of the complexity of the reason for the visit (e.g., basic tube cleaning or respiratory failure). Risk factors for frequent ED visits were identified by comparing the two groups. Categorical variables were compared using the chi-squared test. The Mann-Whitney U test was used for continuous variables in comparisons between the two groups. A p value of <0.05 was accepted as the level of significance.

Results

A total of 165 children with tracheostomies who were being followed up at our clinic were to be included in the study. However, eight patients were excluded because their data could not be accessed. Finally, 157 patients were included in the study. The median (minimum-maximum) age at tracheostomy was 28 (1-210) months. Among the patients, 87 (55.4%) were male and 70 (44.6%) were female. The primary caregiver was the mother for most patients (n=145, 92.4%). The most common reason for tracheostomy was severe neurological disease (n=107, 68.2%). More than half of the patients (n=85, 54.1%) were fed via PEG. The median (minimum-maximum) number of ED visits per year for all children was 1.13 (1-11.34). Thirty-one patients (19.7%) had two or more ED visits per year. These patients were statistically significantly more likely to be fed per oral, have caregivers with less training in tracheostomy care, and have caregivers with less device training. Additionally, patients with Pseudomonas colonization visited the ED significantly more frequently ($p<0.05$). Table 1 presents the demographic data of the patients included in the study, grouped according to the number of ED visits.

During the 5-year period, 157 patients visited the ED a total of 978 times. The most common reason for ED visits was tracheostomy tube replacement (n=371, 37.9%), followed by acute respiratory failure (n=197, 20.1%) and upper respiratory tract infections/pneumonia (n=134, 13.7%). Of these patients, 599 (61.2%) were discharged, 229 (23.4%) were admitted to a ward, and 150 (15.3%) were admitted to the PICU. The median length of hospital stay for these visits was 10 days (range 1-135 days). The clinical characteristics of the patients' ED visits are shown in Table 2.

Discussion

This retrospective study examined the reasons for ED visits among pediatric patients with tracheostomies, as well as the risk factors associated with frequent visits. Over a five-year period, a total of 157 patients with tracheostomy visited the ED 978 times, with approximately one-fifth of the patients visiting two

Table 1. Comparison of patient demographics and risk factors according to emergency department visit frequency				
	<2 visits/year	**≥2 visits/year**	**Total**	**p value**
Total number of patients, n (%)	126 (80.3)	31 (19.7)	157 (100)	-
Tracheostomy age, months, median (minimum-maximum)	29 (1-210)	19 (1-182)	28 (1-210)	0.268
Male gender, n (%)	73 (57.9)	14 (45.2)	87 (55.4)	0.200
Education status, n (%) Going to school Education at home At school age but not going to school Not at school age	 7 (5.6) 10 (7.9) 61 (48.4) 48 (38.1)	 1 (3.2) 2 (6.5) 11 (35.5) 17 (54.8)	 8 (5.1) 12 (7.6) 72 (45.9) 65 (41.4)	0.403
Mother education status, n (%) Primary school graduate High school graduate University graduate	 83 (65.9) 25 (19.8) 18 (14.3)	 15 (48.4) 11 (35.5) 5 (16.1)	 98 (62.4) 36 (22.9) 23 (14.6)	0.140
Father education status, n (%) Primary school graduate High school graduate University graduate	 64 (50.8) 36 (28.6) 26 (20.6)	 15 (48.4) 9 (29) 7 (22.6)	 79 (50.3) 45 (28.7) 33 (21)	0.963
Primary caregiver, n (%) Mother Father Other family member Nurse	 114 (90.5) 8 (6.3) 3 (2.4) 1 (0.8)	 31 (100) 0 (0) 0 (0) 0 (0)	 145 (92.4) 8 (5.1) 3 (1.9) 1 (0.6)	0.362
Distance to our hospital, n (%) <10 km 10-50 km >50 km	 42 (33.3) 40 (31.7) 44 (34.9)	 13 (41.9) 12 (38.7) 6 (19.4)	 55 (35) 52 (33.1) 50 (31.8)	0.249
Transport, n (%) Private vehicle Ambulance	 94 (74.6) 32 (25.4)	 20 (64.5) 11 (35.5)	 114 (72.6) 43 (27.4)	0.259
Feeding, n (%) Per oral Via nasogastric catheter Via percutaneous endoscopic gastrostomy	 25 (19.8) 29 (23) 72 (57.1)	 14 (45.2) 8 (25.8) 9 (29)	 39 (24.8) 37 (23.6) 81 (51.6)	**0.006**
Was the caregiver fully trained in managing tracheostomy patients? n (%) Yes	 120 (95.2)	 25 (80.6)	 145 (92.4)	**0.014**
Was the caregiver fully trained on how to use the devices? n (%) Yes	 114 (90.5)	 23 (74.2)	 137 (87.3)	**0.030**
Was the caregiver fully trained in cardiopulmonary resuscitation? n (%) Yes	 103 (81.7)	 22 (71)	 125 (79.6)	0.182
Does the device have a humidifier? n (%) Yes	 94 (74.6)	 21 (67.7)	 115 (73.2)	0.439
Is there a coughing device? n (%) Yes	 19 (15.1)	 7 (22.6)	 26 (16.6)	0.314
Is there a electric generator for devices? n (%) Yes	 48 (38.1)	 12 (38.7)	 60 (38.2)	0.950
Primary cause of tracheostomy? n (%) Preterm birth Severe neurological disease Severe lung disease	 10 (7.9) 91 (72.2) 25 (19.8)	 1 (3.2) 16 (51.6) 14 (45.2)	 11 (7) 107 (68.2) 39 (24.8)	**0.013**
Pseudomonas colonization, n (%) Yes	 60 (47.6)	 22 (71)	 82 (52.2)	**0.020**
Does he/she perform regular respiratory physiotherapy? n (%) Yes	 96 (76.2)	 21 (67.7)	 117 (74.5)	0.333
Current status, n (%) Alive with tracheostomy Deceased	 111 (81.1) 15 (11.9)	 21 (67.7) 10 (32.3)	 132 (84.1) 25 (15.9)	**0.011**

Table 2. Distribution of clinical diagnoses and ed outcomes in pediatric tracheostomy patients

Primary diagnosis and reasons for visit, n (%)	
Acute gastroenteritis	91 (9.3)
Sepsis	57 (5.8)
Upper respiratory tract infection/pneumonia	134 (13.7)
Tracheostomy cannula exchange	371 (37.9)
Gastrostomy care	40 (4.1)
Epileptic seizure	53 (5.4)
Acute respiratory failure	197 (20.1)
Urinary tract infection	9 (0.9)
Bradycardia/tachycardia	18 (1.8)
Trauma	8 (0.8)
Emergency department outcomes, n (%)	
Discharged from emergency department	599 (61.2)
Ward admission	229 (23.4)
Intensive care unit admission	150 (15.3)
Length of stay in hospital, days, median (minimum-maximum)	10 (1-134)

or more times per year. The main risk factors for frequent visits were per-oral feeding, a lack of caregiver training in managing tracheostomy patients and devices, Pseudomonas colonization, and preterm birth.

A study by Tarfa et al. (6) also reported that respiratory complications and cannula-related problems were the most common reasons for ED visits among children with tracheostomies. In this study, the most common reasons for ED visits were tracheostomy cannula replacement (37.9%) and acute respiratory failure (20.1%). Of the cases admitted to the hospital, approximately 40% required the PICU, with some stays exceeding 100 days. These findings demonstrate that children with tracheostomies require significant healthcare resources. These findings underscore the significant impact of technical and clinical challenges in home care on ED visits.

The results of this study showed that frequent ED users had significantly less tracheostomy and device training. These results suggest that caregiver training plays a key role in reducing the frequent ED visits for this patient group. The American Association for Respiratory Care's clinical practice guideline states that training caregivers at home can reduce complications and limit the use of health services (5). Inadequate caregiver training may lead to delays in recognizing early warning signs of airway obstruction, secretion accumulation, or tube malfunction, all of which can result in avoidable ED visits. Clearly, including caregivers in simulation-based training, video training, or structured home care programs, as well as supporting families through training, will reduce ED visits.

This study found that severe neurological diseases were the most common cause of tracheostomy. For these patients, a combination of muscle weakness and difficulty swallowing increases the risk of aspiration. Studies showed that children fed via PEG experience fewer complications (9). The reason our patients who are fed orally visited the ED more frequently is also due to an increased risk of aspiration. Early identification of high-risk patients and timely transition to safer feeding routes may prevent recurrent respiratory complications and hospital visits. Trained caregivers also play an important role in the early identification of patients at high risk of aspiration.

The presence of Pseudomonas in the airway often leads to persistent inflammation and mucus overproduction, which may exacerbate respiratory distress and prompt frequent ED utilization. This study showed that patients with Pseudomonas aeruginosa colonization visited the ED more frequently, which can be explained by an increased risk of respiratory tract infection. Previous studies have demonstrated that Pseudomonas aeruginosa causes chronic colonization in tracheostomized patients, leading to increased hospital admissions (6,7). A large-scale study by Russell et al. (10) found that Pseudomonas aeruginosa colonization was associated with the severity of respiratory symptoms and hospital admissions.

A total of 32.3% of patients who visited the ED more than two times per year died. This rate was significantly higher than the rate of patients who visited the ED less than twice per year. These results suggest that frequent hospital visits may indicate serious underlying clinical problems. Berry et al. (8) demonstrated that frequent hospital visits among children with tracheostomies are associated with mortality. Various studies have reported higher mortality rates in children with complex care needs, such as neurological diseases, respiratory device dependence, and enteral feeding requirements (11,12).

It is well known that a significant proportion of ED visits after tracheostomy are avoidable (13). Strategies such as structured programs that support tracheostomy and device training, regular respiratory physiotherapy, and the early detection of infections may reduce repeat visits. However, numerous variables such as socioeconomic factors, caregiver education, and access to healthcare services in the area of residence influence this process (14). Although our study did not find a significant correlation between age at tracheostomy and visit frequency, the literature suggests that children who undergo tracheostomy at an early age may be more susceptible to complications and infections (15). This is thought to be influenced by factors such as home care conditions, the number of devices used, and applications of physical therapy.

Study Limitations

This study has several limitations. First, it is retrospective and single-center, which makes it difficult to evaluate referrals from

external centers. Additionally, some care factors are based on subjective reports, introducing a risk of bias. However, the study's reliability is enhanced by its relatively large patient sample size and five-year follow-up period.

Conclusion

In conclusion, this study revealed that a significant proportion of children with tracheostomies frequently visit EDs, and these visits are associated with various clinical and educational factors. Developing comprehensive care programs, expanding caregiver education, and providing increased home care support for this patient group could effectively reduce healthcare utilization and complications.

Ethics

Ethics Committee Approval: The study was approved by the Ethics Committee of Necmettin Erbakan University with (decision number: 2025/5711, date: 25.04.2025).

Informed Consent: This is retrospective study.

Footnotes

Authorship Contributions

Surgical and Medical Practices: F.E., B.E.T., Concept: H.T.Ç., G.Ü., F.N.A., Design: H.T.Ç., F.N.A., T.K., Ö.M.A., Data Collection or Processing: H.T.Ç., S.P., G.Ü., F.E., F.N.A., S.S., B.E.T., T.K., A.B.A., Ö.M.A., M.G., Analysis or Interpretation: H.T.Ç., G.Ü., F.N.A.,B.E.T. Literature Search: H.T.Ç., G.Ü., F.N.A., A.B.A., Writing: H.T.Ç., S.P., F.E., M.G.

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