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Revisits after pediatric tracheotomy: Airway concerns result in returns

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ABSTRACT

Objectives: Children undergoing tracheotomy represent a medically vulnerable patient population, and understanding the reasons for revisiting the hospital setting following tracheotomy is critical for improving the quality of care for these patients. This study aims to investigate the incidence and characteristics of revisits following pediatric tracheotomy.

Methods: Cross-sectional, population-based study using state databases. The State Inpatient Databases and State Emergency Department Databases for California, Florida, Iowa and New York 2010–11 were linked and examined for cases of pediatric tracheotomy (patients < 18.0 years) and corresponding subsequent 30-day post-discharge revisits. Demographic and descriptive data were analyzed determining the revisit rate, revisit diagnoses, procedures, and discharge dispositions.

Results: 2,248 pediatric tracheotomy cases were extracted (60.8% male, mean age 8.3 years). There were 373 inpatient or emergency department revisits (30-day revisit rate, 16.6%), of which 34.3% occurred within 48 h after discharge. Of these, 59.2% were inpatient readmissions. There were ≤10 deaths during these revisits (30-day revisit mortality rate, ≤2.7%). The most common primary revisit diagnoses were "fitting of prosthesis and adjustment of devices" (25.7%, likely representing adjustment/replacement of the tracheotomy tube), respiratory failure (11.0%), intracranial injury (5.4%), pneumonia (4.0%), "other upper respiratory disease" (3.8%), and "complications of surgical procedures or medical care" (3.8%). The most common revisit procedures were endotracheal intubation (11.4%), mechanical ventilation (8.8%), and replacement of tracheostomy tube (≤2.7%). Children discharged to a skilled care facility (47.1%) were more likely than those discharged to home (52.9%) to have a revisit (23.3% versus 12.0%, respectively; p < 0.001).

Conclusions: Children undergoing tracheotomy have a substantial 30-day revisit rate, most notably during the first 48 h after discharge, often involving tracheotomy tube or pulmonary complications. Improvements in discharge planning should target prevention of these complications.

1. Introduction

Pediatric tracheotomy is a relatively common procedure performed at tertiary care institutions, with more than 4800 performed annually in the United States alone [1]. Tracheotomy is currently performed for children with upper airway anomalies, the need for prolonged mechanical ventilation, or significant complex comorbidities such as neurologic impairment or chronic lung disease [2–6]. In the pre-vaccination era, pediatric tracheostomies were primarily performed for acute infections such as diphtheria, croup, and epiglottitis, with relatively shorter time to decannulation. The shift in modern preventive therapies is paralleled by a rise in long-term tracheostomies performed amongst premature infants, as well as older infants and children with complex and chronic medical conditions [1,7,8]. Infants and children with chronic medical conditions are afforded longer survival as a result of improved multi-disciplinary medical and surgical care. Particularly for infants and children requiring prolonged mechanical ventilation, tracheotomy placement is an important step towards hospital discharge.

Despite advances in short- and long-term care, pediatric tracheotomy is still associated with significant postoperative complications, with estimates in the literature ranging from 24.3 to 60% [9–11]. In the early postoperative period, these complications include hemorrhage, accidental decannulation, tracheitis, stomal granulation, and local wound breakdown. Very little is known about tracheotomy-related complications following hospital discharge. Mahida et al. (2016) recently reported that for children under the age of 2 years, pneumonia (7.8%), sepsis (5.8%), death (5.8%), and deep or organ space surgical

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site infections (3.9%) were the most common complications within 30 days following tracheotomy, though the majority of these patients (53.9%) remained hospitalized in their initial admission following these complications [11]. Watters et al. (2016) reported that for the two-year period following tracheotomy, 4.5% of children were readmitted to the hospital for tracheostomy-related complications, while 41% were readmitted for respiratory diagnoses [6].

Improved understanding of why pediatric patients with tracheotomies revisit the hospital for emergency department services or inpatient admission is essential towards reducing postoperative morbidity. The objective of the current study was to identify the incidence of and indications for unscheduled revisits following pediatric tracheotomy at a nationally representative, population-based level. In this study, we define revisits to encompass hospital readmissions and emergency room visits following pediatric tracheotomy. This study seeks to identify complications and postoperative sequelae that may be addressed in efforts to reduce the rate of post-tracheotomy revisits and improve postoperative outcomes.

2. Methods

The State Inpatient Databases (SID) and State Emergency Department Databases (SEDD) for California, Florida, Iowa, and New York 2010–11 were linked and examined for cases of pediatric (age < 18.0 years) tracheotomy and corresponding subsequent 30-day post-discharge revisits. These databases are part of the Healthcare Cost and Utilization Project (HCUP) maintained by the Agency for Healthcare Research and Quality (AHRQ). This was a completely deidentified, publicly available data set; therefore, institutional review board approval was not required.

Standard demographic information was extracted and tabulated for the cases of pediatric tracheotomy. Age was defined at the time of initial hospital admission during which tracheotomy was performed. Next, for each patient who had a revisit encounter, the timing of revisit (from day of initial hospital discharge) was tabulated. The site of revisit encounter was determined as inpatient admission or emergency department visit. Primary diagnosis codes (*Clinical Classification System* [CCS]) associated with the initial tracheotomy placement were extracted. Next, primary and secondary CCS diagnosis codes associated with the revisit encounter were extracted for each case. Primary and secondary procedure codes (*International Classification of Diseases, Ninth Edition* [ICD-9] and *Current Procedural Terminology, Fourth Edition* [CPT-4]) associated with the revisit encounter were also extracted for each case. Emergency department specific procedure codes of complexity of emergency department encounter were excluded. Discharge dispositions were determined for each patient with a hospital revisit. The data were then imported into SPSS, version 22.0, statistical software (SPSS Inc) for analysis. In order to protect confidentiality requirements, individual statistics with a resulting sample size less than 10 are reported as less than or equal to 10 according to the data use agreement. Additionally, univariate χ^2-analyses were performed for the proportions of revisits against patient age, gender, and discharge disposition. For χ^2-analysis of age as a factor for post-tracheotomy revisit, age was stratified into two groups: 1) less than 2 years of age, and 2) greater than or equal to 2 years of age. Statistical significance was set at $p = 0.05$. Statistics are presented as the raw sample size or percentage distribution where appropriate.

3. Results

A total of 2248 pediatric tracheotomies were evaluated. The mean age at tracheotomy tube placement was 8.28 ± 7.42 years, and the median age was 7.5 years. Fig. 1 depicts the age distribution of pediatric tracheotomies. Males represented 60.8% of pediatric tracheotomies. There was a 4.8% mortality rate during initial hospitalization. Overall discharge dispositions for pediatric tracheotomy patients were:

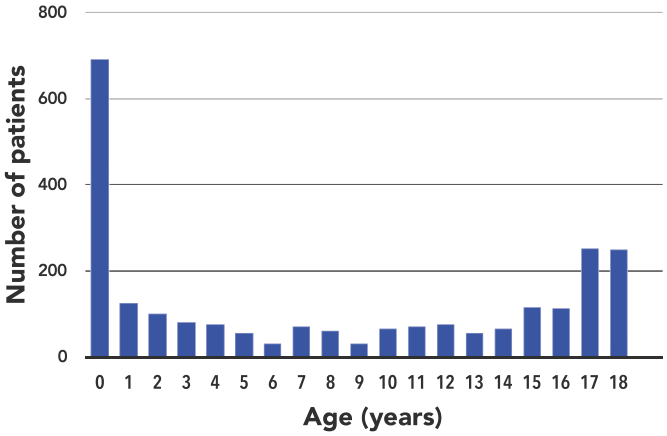

Fig. 1. Distribution of age, in years at admission for pediatric tracheotomy.

routine/home (30.1%), transfer to another acute care hospital (15.9%), transfer to a skilled care facility (including skilled nursing facility and intermediate care facility; 28.8%), home with home health (19.9%), against medical advice (≤0.4%), and unknown (≤0.4%).

There were 373 (16.6%) patients who revisited the emergency department or had a subsequent inpatient admission within 30 days of initial hospital discharge. Of these patients, 152 (40.8%) were seen in the emergency department, while 221 (59.2%) were readmitted as inpatients. There were ≤10 deaths during these revisits (30-day revisit mortality rate, ≤2.7%). Fig. 2 depicts the distribution of revisits by date following hospital discharge. Notably, 128 (34.3%) patients revisited within 48 h of hospital discharge. Table 1 depicts the top ten primary diagnoses associated with initial tracheotomy procedure. Tables 2 and 3 demonstrate the top ten primary and overall revisit admission diagnoses, respectively. Tables 4 and 5 demonstrate the primary and overall procedures performed during the revisit, respectively.

On χ^2-analyses, children older than 2 years of age were significantly more likely to have a revisit than those under 2 years of age (21.7% vs 7.2%, respectively; $p < 0.001$). Males were more likely to have a revisit following tracheotomy than female counterparts (17.9% vs 14.2%, respectively, $p = 0.023$). Children discharged to a medical facility (including skilled care facility and acute care hospital) were more likely than those discharged to home (with or without home health services) to have a revisit (23.3% versus 12.0%, respectively; $p < 0.001$).

4. Discussion

This large-scale, multistate analysis demonstrated an overall revisit rate of 16.6% following pediatric tracheotomy, which is consistent with

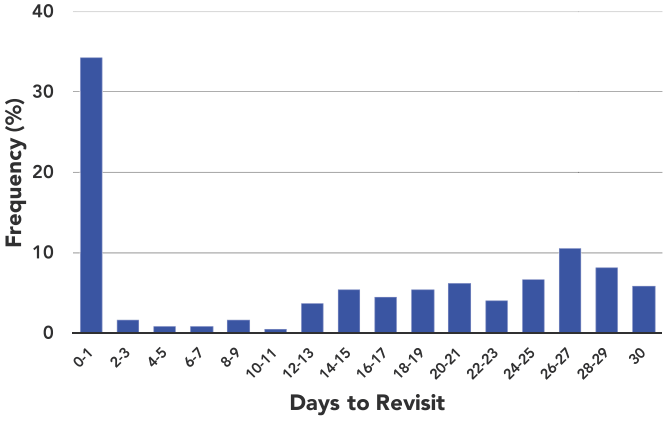

Fig. 2. Distribution of revisit by days following hospital discharge.