Emergency Department Visits and Readmissions among Children after Gastrostomy Tube Placement

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Objectives To define the incidence of 30-day postdischarge emergency department (ED) visits and hospital re-admissions following pediatric gastrostomy tube (GT) placement across all procedural services (Surgery, Interventional-Radiology, Gastroenterology) in 38 freestanding Children's Hospitals.

Study design This retrospective cohort study evaluated patients <18 years of age discharged between 2010 and 2012 after GT placement. Factors significantly associated with ED revisits and hospital readmissions within 30 days of hospital discharge were identified using multivariable logistic regression. A subgroup analysis was performed comparing patients having the GT placed on the date of admission or later in the hospital course.

Results Of 15 642 identified patients, 8.6% had an ED visit within 30 days of hospital discharge, and 3.9% were readmitted through the ED with a GT-related issue. GT-related events associated with these visits included infection (27%), mechanical complication (22%), and replacement (19%). In multivariable analysis, Hispanic ethnicity, non-Hispanic black race, and the presence of ≥3 chronic conditions were independently associated with ED revisits; gastroesophageal reflux and not having a concomitant fundoplication at time of GT placement were independently associated with hospital readmission. Timing of GT placement (scheduled vs late) was not associated with either ED revisits or hospital readmission.

Conclusions GT placement is associated with high rates of ED revisits and hospital readmissions in the first 30 days after hospital discharge. The association of nonmodifiable risk factors such as race/ethnicity and medical complexity is an initial step toward understanding this population so that interventions can be developed to decrease these potentially preventable occurrences given their importance among accountable care organizations. *(J Pediatr 2016;■:■-■)*.

Gastrostomy tube (GT) placement for assistance with enteral nutrition is the third most common non-cardiac in-patient surgical procedure performed in children in the US, following circumcision and appendectomy.[1] It is commonly thought of as a routine operation, with a short hospital stay and low morbidity. Although some reports support this notion, others have described a high rate of postoperative complications (up to 83%) and emergency department (ED) visits.[2-6]

This study sought to determine the incidence of GT-associated ED visits and hospital readmissions related to GT complications after the index admission (during which the GT was placed originally) and to identify a subset of children at high risk for devel-oping such complications. Understanding the burden of GT complications in a large, representative cohort of patients will help to set realistic expectations for physicians and patients and may improve outcomes by guiding future prospective studies.

AHR	All hospital readmission
CCC	Complex chronic condition
DHR	Different hospital readmission
ED	Emergency department
GERD	Gastroesophageal reflux disease
GT	Gastrostomy tube
ICD-9-CM	*International Classification of Diseases, Ninth Revision, Clinical Modification*
LOS	Length of stay
PEG	Percutaneous endoscopic gastrostomy
PHIS	Pediatric Health Information System
SHR	Same hospital readmission

Methods

We conducted a retrospective cohort study using data from the Pediatric Health Information System (PHIS) database, which contains administrative and resource utilization data from 43 freestanding children's hospitals. Participating hospitals are located in noncompeting markets of 27 states plus the District of Columbia and account for approximately 15% of all pediatric hospitalizations in the US.[7] Participating hospitals provide patient-level data including demographics, diagnoses, and procedures as well as billing data, which includes daily medication, diagnostic imaging, laboratory, and supply charges to individual patients. Data are deidentified prior to inclusion in the database; however, encrypted medical record numbers allow for tracking individual patients across hospital visits and admissions. The Children's Hospital Association (Overland Park, Kansas) and participating hospitals jointly assure the quality and integrity of the data, as previously described.[8] This study was approved by the Institutional Review Board (SCH IRB 14816).

We identified patients in the PHIS database from 38 hospitals providing inpatient and ED data who were <18 years of age and had an *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) procedure code for surgical gastrostomy (43.0), percutaneous endoscopic gastrostomy (PEG) tube placement (43.11), or other gastrostomy (43.19) between calendar years 2010 and 2012. Patients who had prior admissions in the database with attention to GTs, or who died during their index admission were excluded. Patients with mortality were excluded because the primary outcome for the study was return to ED or readmission, and patients who died during their index hospitalization would not be at risk either for the outcomes of interest.

Demographic characteristics analyzed included age (0-1 years, 2-4 years, 5-9 years, 10-14 years, or 15-17 years), sex, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, Asian, or other/unknown), census region, disposition (home health, home, skilled nursing facility, and other), and insurance type (government, private, and other/unknown). We also included gastroesophageal reflux disease (GERD) diagnosis (ICD-9-CM of 560.11 or 530.81), fundoplication (ICD-9-CM of 44.66 or 44.67), and neurologic impairment as these patient-related issues were thought to be clinically associated with higher association of complications a priori.[9] Children were classified as having complex chronic conditions (CCCs) using a previously described ICD-9-CM coding scheme that included the following 9 categories: neuromuscular, cardiovascular, respiratory, renal, gastrointestinal, hematologic/immunologic, metabolic, congenital or genetic, and malignancy.[10] Children could have more than 1 CCC. Technique of GT placement (eg, endoscopic, surgical) also was described.

We had also hypothesized a priori that the entire cohort likely represented 2 distinct populations of children with different risk factors; children who had a GT placed on the date of admission (scheduled GT admission cohort), and children who had a GT placed later in the hospitalization (unscheduled GT admission cohort). After evaluating the entire cohort, we compared outcomes between these subsets of children.

Outcomes

We defined 2 primary outcomes: 30-day ED revisit for a GT-associated event followed by discharge from the ED and 30-day inpatient readmission through an ED for a GT-associated event. Patients were considered to have a GT-associated event if they had an ED revisit or hospital readmission within 30 days of discharge from the index admission that included any of the following ICD-9-CM diagnosis or procedure codes: unspecified gastrostomy complication (536.40); infection of gastrostomy (536.41); mechanical complication of gastrostomy (536.42); other gastrostomy complication (536.49); disruption of wound: dehiscence of operation wound, disruption of any suture materials or other closure method, rupture of operation wound (998.3); disruption of internal operation (surgical) wound (998.31); other postoperative infection (998.59); attention to gastrostomy (V55.1); reclosure of postoperative disruption of abdominal wall (546.1); or suture of laceration of small intestine (467.5); or suture of laceration of large intestine (467.5) This list of complication codes was assembled by author consensus during the study design.

Complications during the hospitalization for the initial GT placement were not included in this study as it is difficult to distinguish complications from GT placement from those occurring as a consequence of other operative procedures or medical problems during typically complex and lengthy hospitalizations. We measured ED revisits and hospital readmissions through the ED with GT-related complications within 30 days of discharge from the index admission. We chose to include readmissions only if they occurred through the ED in order to avoid misclassification of patients admitted electively for scheduled gastrostomy care. This strategy would bias us toward the null and underestimate complications, which we believed was preferable to overestimation. Our data were validated through a sample chart review at several institutions. The initial results yielded 100% accuracy (56/56) on the date of the initial GT placement, 93% accuracy (14/15) for readmission, and 100% (11/11) for ED return.

Statistical Analyses

Patient-level characteristics were summarized using frequencies and percentages or medians with IQRs for categorical and continuous variables, respectively. We compared these characteristics between children with and without 30-day readmissions as well as 30-day ED visits using χ^2 statistics. We derived multivariable logistic regression models to evaluate the independent role of patient-level covariates on the odds of experiencing a 30-day readmission or a 30-day ED visit using generalized estimating equations in order to account for patient clustering of outcomes within hospitals. By choosing to utilize logistic regression, we categorized