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Resource utilization after implementing a hospital-wide standardized feeding tube placement pathway☆,☆☆,★

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ABSTRACT

Background/purpose: Children requiring gastrostomy/gastrojejunostomy tubes (GT/GJ) are heterogeneous and medically complex patients with high resource utilization. We created and implemented a hospital-wide standardized pathway for feeding device placement. This study compares hospital resource utilization before and after pathway implementation.

Methods: We performed a retrospective cohort study comparing outcomes through one year of follow-up for consecutive groups of children undergoing GT/GJ placement prepathway (n = 298, 1/1/2010–12/31/2011) and postpathway (n = 140, 6/1/2013–7/31/2014) implementation. We determined the change in the rate of hospital resource utilization events and time to first event.

Results: Prior to implementation, 145 (48.7%) devices were placed surgically, 113 (37.9%) endoscopically and 40 (13.4%) using image guidance. After implementation, 102 (72.9%) were placed surgically, 23 (16.4%) endoscopically and 15 (10.7%) using image guidance. Prior to implementation, 174/298 (58.4%) patients required additional hospital resource utilization compared to 60/143 (42.0%) corresponding to a multivariate adjusted 38% reduced risk of a subsequent feeding tube related event.

Conclusions: Care of tube-feeding dependent patients is spread among multiple specialists leading to variability in the preoperative workup, intraoperative technique and postoperative care. Our study shows an association between implementation of a standardized pathway and a decrease in hospital resource utilization.

Children requiring gastrostomy/gastrojejunostomy tubes (GT/GJ) represent a heterogeneous and complex patient population with high resource utilization [1]. Pediatric feeding tube placement is a common procedure that has been shown to be increasing nationally with 18.5 GTs placed per 100,000 children in 2009 [2]. Every pediatrician, specialist and subspecialist cares for patients requiring nutritional support. Multiple services place operative feeding tubes with significant practice variability [3–8]. This has led to a complex system in which single physician ownership across care environments for patients with feeding tubes is rare. Despite the fact that GT/GJ placement is a relatively simple procedure, complications and subsequent hospital utilization are frequent [2,5,9,10]. Fascetti-Leon et al. found a cumulative incidence rate of complications after pediatric percutaneous endoscopic gastrostomy tube (PEG) placement of 47.7% within 24 months of follow-up [11]. After surgical placement, Correa et al. found that 20% of patients presented to the emergency department [1]. Clinic visits (both planned and unplanned) are likely even higher [1]. Major complications such as infection, bowel perforation, hemorrhage, and esophageal tear may occur in as many as 5–17% of cases [12]. Minor complications including excess granulation tissue, minor infection and tube dysfunction have been reported to occur in more than 50% of cases [12].

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Table 1
Electronic preoperative gastrostomy readiness checklist to be completed prior to scheduling feeding tube.

Question	Possible Answer	Possible Answer
Nasogastric/nasoduodenal feeding trial successfully completed (at goal feeding regimen)?	Yes	No — Reason
Upper gastrointestinal study completed and ligament of Treitz is in correct position?	Yes	No — Reason
Medical home identified?	Yes — Who?	No — Reason
Nutrition/tube feeding plan determined (including goals and timelines)?	Yes	No — Reason
Is the patient followed by a dietitian at Seattle Children's hospital?	Yes — Who?	No — Who?
Is the patient already followed by a Seattle Children's feeding therapist (OT/PT/SLP[1])?	Yes — Who?	No — Reason
Family social/psych readiness assessed?	Yes	No — Reason
Home health care company identified?	Yes — Who?	No — Reason
Based on the questions above, is the patient ready to be scheduled for gastrostomy tube placement?	Yes	No — Reason

[1] OT: Occupational Therapy, PT: Physical Therapy, SLP: Speech language pathologist.

Beyond the risk of complications, GT/GJ placement is associated with a significant burden on the health care system. Wound care, device management, and planned tube exchanges or conversions are some of the many indications for routine follow-up in this patient population. Current literature focuses either on tube placement techniques (such as endoscopic or fluoroscopic), or on select patient populations such as those with neoplasm or neurologic anomalies [11,13–20]. To our knowledge there has been no report of a hospital-wide approach to this complex patient population. Seattle Children's Hospital is a 332 bed pediatric hospital at which between 120 and 150 gastrostomy/gastrojejunostomy tubes are placed annually. The insertion of these devices is distributed between General Surgery, Gastroenterology and Interventional Radiology services. A standardized preoperative gastrostomy pathway was established at our institution in 2013 to help decrease variability in the preoperative workup, intraoperative technique and postoperative care of patients requiring operative feeding tube support between these different services, and to ensure the appropriate referral of patients to the General Surgery service (indications including weight < 4 kg, high risk of forceful pulling of gastrostomy tubes, anatomic anomalies, kyphoscoliosis, hiatal hernia, prior abdominal surgery precluding percutaneous placement, and concomitant operations). The purpose of this study was to evaluate the effects of implementation of this pathway on hospital resource utilization.

1. Methods

1.1. Previous state

Prior to pathway implementation the process for gastrostomy placement was not standardized. Almost any physician involved in a child's care could make the decision for gastrostomy placement with variable preoperative workup. Decisions were frequently made without input from physicians involved in the child's long-term care. Both in the outpatient clinic and as an inpatient consult, the services placing the feeding tubes (surgeons, gastroenterologists, and interventional radiologists) variably participated in determining the appropriateness for feeding tube placement, which depended on the extent of the preoperative workup by the team or provider that requested placement. Coordination of care for the proceduralist team was time consuming and unpredictable with inconstant patient ownership throughout the process.

1.2. Intervention

In May of 2013, the general surgeons, gastroenterologists, and interventional radiologists jointly created and implemented a clinical pathway with input from referring pediatric services (Fig. 1 in the online version at http://dx.doi.org/10.1016/j.jpedsurg.2016.05.012 – Supplementary File). A key component of the pathway was an online preoperative gastrostomy readiness checklist (Table 1) in Cerner PowerChart that included (1) identification of a "Medical Home" physician-partner that oversees a dietician and therapist and ensures ongoing support of each child's unique and complex medical needs across care environments, and (2) family and patient preparation with a nasogastric feeding trial.

The feeding trial serves four purposes: it confirms gastrostomy-feeding tolerance, initiates Home Health service engagement, verifies parent comfort with the equipment and confirms that a nutrition plan is in place well in advance of tube placement and eventual hospital discharge. Intraoperatively, proceduralists were encouraged to use the same size and type of device at placement and to standardize the location of placement on the abdominal wall. Additionally, a postoperative pathway was instated, which allowed for medications to be used through the device after 6 h and feeds to be resumed 24 h after placement. Order sets for preoperative consultation and postoperative orders were created to simplify the ordering process. Feeding device readiness for inpatients was managed by the medically complex service, which completed a full history and physical exam for patients requiring nutritional support.

1.3. Analysis plan

We performed a retrospective cohort study of consecutive GT/GJs placed at our institution comparing utilization before and after implementation of the pathway. The unexposed cohort (298 patients) included all consecutive patients with a new surgical, endoscopic or fluoroscopic GT/GJ placement from January 1, 2010 to December 31, 2012. The exposed cohort (140 patients) included all consecutive patients receiving a new GT/GJ beginning after the pathway's implementation from June 1, 2013 to July 31, 2014. For the postpathway implementation period, we also assessed utilization of the pathway by examining the number of patients with pathway activation. Pathway activation was defined as completion of the Gastrostomy Readiness Checklist (Table 1) in the electronic medical record.

All patients from birth to 22 years of age receiving an initial GT/GJ during both periods were identified using internal billing data and information was collected through chart review. Patients were excluded if they had a concurrent fundoplication since those patients require a distinct workup and preoperative evaluation. We included patients who received a GT primarily and those placed in conjunction with other abdominal operations. When GTs were placed laparoscopically and using the open technique, the surgeons at our institution sew the stomach to the posterior abdominal wall fascia. Additionally, patients were excluded if they had a long-term feeding device placed previously. Data abstraction was completed by a medical professional and a trained medical abstractor and included demographic information such as age, race, insurance status, comorbidities, operative characteristics (including specialty and location of device placement), and postpathway implementation hospital utilization. Hospital utilization included feeding device-related emergency visits, device-related operations, endoscopic procedures or fluoroscopic studies and interventions that occurred within 365 days of the initial device placement in both cohorts. All such encounters were recorded. Patient follow-up data was limited to either the end of the study period or to a limit of 365 days. Those with limited follow-up time were censored in the analyses and exact time at risk was used. Patients were not excluded if they had less than