



Elective laparoscopic gastrostomy in children: potential for an enhanced recovery protocol

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Abstract

Purpose Gastrostomy tube placement is one of the most commonly performed pediatric surgical procedures and discharge is possible as early as the first postoperative day with early initiation of feeds postoperatively. We examined a national database to determine hospital length of stay (LOS) after elective laparoscopic gastrostomy in children.

Methods We queried the 2012–2013 National Surgical Quality Improvement Program Pediatric (NSQIP-P) database, including all patients who underwent elective laparoscopic gastrostomy tube placement for failure to thrive or feeding difficulties. Demographic data, admission status, disposition at discharge, surgical subspecialty data and hospital LOS were extracted.

Results A total of 599 patients underwent gastrostomy tube placement for failure to thrive or feeding intolerance. The majority, 52%, was male and 69.3% were White. The median age was 2.2 years (IQR 0.9–6.3). Of the total, 28.7% were infants. The median total hospital LOS was 2 days (IQR 1–2), with only 39% discharged in a day or less.

Conclusion Pediatric patients undergoing elective laparoscopic gastrostomy have a median hospital length of stay of 2 days, despite evidence that early feeding and discharge within 24 h is both feasible and safe. There is potential for the implementation of an enhanced recovery protocol as a quality metric for this procedure.

Keywords Laparoscopic gastrostomy · Pediatric · Length of stay

Introduction

In the current era of value-based healthcare, there has been an increasing trend towards optimization of postoperative recovery with decreased hospital length of stay and fewer complications [1, 2]. These enhanced recovery after surgery (ERAS) protocols have been extensively studied in the adult literature and successfully implemented, particularly in the colorectal population [1, 2]. Favorable outcomes are accompanied by a simultaneous reduction in cost, which is of great significance given the trend of rising healthcare

expenditure in the United States. Despite popularity in the adult surgical population, enhanced recovery protocols have been much less studied and implemented among children [3]. However, a few studies have shown a similar decrease in hospital length of stay (LOS) and narcotic use, with no increase in postoperative complications [3]. There is therefore great potential for more efficient resource utilization in the pediatric surgical subpopulation.

Gastrostomy tube placement is one of the most commonly performed elective pediatric surgical procedures [4]. The most common indication is feeding intolerance and the laparoscopic approach is increasing in popularity. Single-institution studies have demonstrated the safety of early initiation of feeds postoperatively and discharge as early as the first postoperative day [5]. These protocols have resulted in decreased hospital length of stay without any increase in complications [5, 6]. There is significant practice variation with respect to initiation of feeds and hospital length of stay after gastrostomy among pediatric hospitals [7, 8]. Although several studies have validated the safety of early feeds after gastrostomy tube insertion, [9–11] this has been met with slow uptake, with several pediatric centers maintaining the

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practice of overnight gravity drainage of the newly placed tube.

The aim of this study was to investigate the current practice among children's hospitals in the United States as it relates to hospital length of stay after elective laparoscopic gastrostomy tube placement.

Methods

Data source and study population

This study was a retrospective review of the American College of Surgeons National Surgical Quality Improvement Program Pediatric (ACS NSQIP-P) database for the period January 1, 2012 to December 31, 2016.

NSQIP-P is a multi-institutional multispecialty program that facilitates quality-based, risk-adjusted assessment of 30-day postoperative outcomes for neonates and patients less than 18 years of age who have undergone inpatient surgical procedures [12]. NSQIP-P is designed for benchmarking and quality improvement and was adapted specifically for the pediatric surgical population. The pediatric institution supports full-time surgical clinical reviewers who collect more than 300 variables per case [12]. Demographics, preoperative and intraoperative variables, and postoperative occurrence and discharge variables are all recorded.

All patients who underwent laparoscopic gastrostomy tube placement as their primary operative procedure, using *Current Procedural Terminology* (CPT) code 43653, were included. Only those patients with the indications “failure to thrive” or “feeding difficulties and mismanagement” were kept for analysis. Patients with any other indications for gastrostomy tube placement were excluded, as this may have potentially influenced the LOS. Those who had other procedures during that admission were also excluded, as well as those with a case type of “emergent” or “urgent”, so that only elective cases were analyzed. The primary outcome measure was hospital LOS. Secondary outcomes included 30-day related readmissions or reoperations as well as a composite variable of “complication” which included any occurrence of surgical site infection, wound complication, bleeding, pneumonia, reintubation, pulmonary embolism, renal insufficiency, urinary tract infection or sepsis.

Statistical analysis

There was no sample size calculation as all eligible patient records were reviewed over the specified time period. Demographics, admission status, disposition at discharge, and total hospital LOS were descriptively analyzed. Categorical data are reported as frequencies and continuous variables as median (interquartile range, Q_3-Q_1). Total

hospital LOS was then analyzed as two groups—those who stayed 1 day or less, and those with LOS > 1 day. 30-day outcomes were compared between these groups using Chi-square analysis. STATA version 13 (College Station, TX) was used for analysis and a p value less than 0.05 was considered statistically significant.

Results

Patient characteristics

A total of 6750 patients underwent laparoscopic gastrostomy tube placement during the study period. After excluding those who had emergent or urgent procedures, 6346 patients were identified who had the procedure electively. Of these, 1466 patients with the indications of failure to thrive (54%) or feeding intolerance (46%) were analyzed. The median age of the study population was 1.9 years (IQR 0.8–5.6). The majority, 743 (51%), was male, and White, 1046 (71%). Most patients were admitted from home (95%) and then discharged back to home (95%) (Table 1).

Table 1 Baseline characteristics of 599 pediatric patients who underwent elective laparoscopic gastrostomy

Characteristic, n (%)	$N=1466$
Sex, n (%)	
Male	743 (51)
Female	723 (49)
Race, n (%)	
American Indian	6 (0.4)
Asian	67 (4.6)
Black or African American	159 (11)
Native Hawaiian or other	6 (0.4)
Unknown/not reported	182 (12.4)
White	1046 (71.3)
Age, years, median	1.9 (IQR 0.8–5.6)
Admission, n (%)	
From home	1394 (95)
Through ER	8 (0.6)
Chronic care/rehab	38 (3)
Transferred from other hospital	20 (1.4)
Other	6 (0.4)
Discharge destination, n (%)	
Home	1390 (94.8)
Rehab	13 (0.89)
Separate acute care	15 (1.02)
Skilled care	34 (2.32)
Unskilled facility	4 (0.27)
Other facility	9 (0.61)
Expired	1 (0.07)

Length of stay

The median total hospital LOS was 2 days (IQR 1–2) so that 63% of patients stayed in hospital for longer than a day (Fig. 1).

Secondary outcomes

Readmissions occurred in 64 (4.4%) of patients and 19 (1.3%) patients underwent reoperation. There were no statistically significant differences between those patients who were hospitalized 1 day or less, and those with LOS > 1 day in terms of readmissions ($p = 0.592$) or reoperations ($p = 0.114$). No complications were identified in either group with respect to surgical site infections, wound complications, bleeding, pneumonia, reintubation, pulmonary embolism, renal insufficiency, urinary tract infection or sepsis.

Discussion

This study shows that the median hospital length of stay among children admitted electively for laparoscopic gastrostomy tube placement for failure to thrive or feeding intolerance is two (2) days, with more than 60% of patients remaining hospitalized for greater than a day. We have also shown no difference in 30-day readmissions, reoperations, or complications in those who stay longer than a day compared to those who do not. There is significant variation in length of stay reported in the published literature around this procedure. Some of this variation may be attributed to differences in technique or approach—open, laparoscopic or endoscopic. However, the resulting differences in length of stay among techniques are small. Length of stay has actually been found to be more significantly associated with the timing of initiation of feeds postoperatively [5, 10].

To our knowledge, this is the first study to examine the length of stay after this procedure from a large national

database, allowing an assessment of practice across a number of pediatric institutions. Sunstrom et al. found a median length of stay of 2 days among 65 patients who underwent laparoscopic gastrostomy [5]. Wragg et al. in the UK found a median postoperative length of stay of 2 days for laparoscopic gastrostomy [13]. Early feeding within 6 h after percutaneous gastrostomy allowed for discharge within 24 h in 12 of 13 patients in a study by Werlin et al. [8]. Other investigators have shown greater variation in length of stay after laparoscopic gastrostomy in children. Angsten et al. found postoperative length of stay to be 3 days [14] while a study conducted in Switzerland found a mean hospital stay of 4.5 days for laparoscopic gastrostomy [15]. Jones et al. out of Australia found a median postoperative length of stay of 6 days [16].

Enhanced recovery after surgery protocols involve a multimodal approach to perioperative care aimed at reducing surgical stress, optimizing pain relief and minimizing postoperative morbidity [17]. Consensus guidelines developed by the Enhanced Recovery After Surgery Group incorporate several key components including preanesthetic medications, thromboembolic and antimicrobial prophylaxis, nasogastric intubation, perioperative fluid management, prevention of postoperative ileus, postoperative analgesia, early enteral feeding, and mobilisation [18]. These guidelines, initially developed in the colorectal population, have been applied to other surgical subspecialties. A meta-analysis of randomized controlled trials and systematic reviews showed that when compared to traditional postoperative care, enhanced recovery protocols are associated with significant reductions in hospital length of stay, postoperative complications and time to first passage of flatus and stool [19]. The rates of surgical gastrostomy tube placement have been increasing, particularly among infants [20], and investigators have shown that the timing of feeding postoperatively affects the length of stay [10]. In addition, the laparoscopic approach has been associated with shorter time to goal feeds [21]. In a recent retrospective review, Hendrickson et al. showed that with the initiation of feeds within 4 h of laparoscopic gastrostomy using a protocolized approach, the median LOS was 26 h, with 97% of patients achieving full feeds within 24 h [22]. This demonstrates the feasibility of using discharge protocols to promote standardization and reduce variation in care.

Besides the timing of feeding initiation, the other likely barriers to implementation of these protocols around this procedure include parental education and outpatient follow-up [23]. A system of preoperative education in the outpatient setting coupled with the setting of expectations with respect to recovery and discharge is likely to facilitate earlier discharge for these patients. In regard to enhanced recovery protocols in general, Pearsall et al. identified lack of manpower, poor communication and collaboration, resistance to change, and patient factors as the

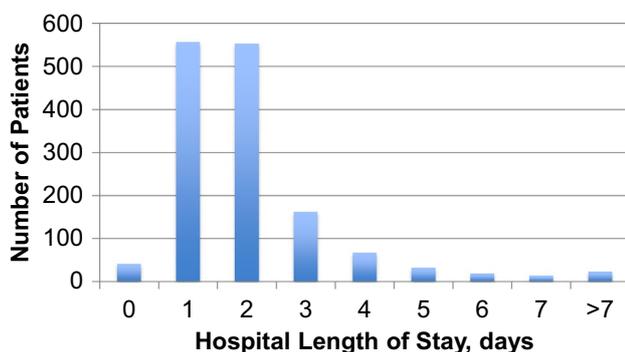


Fig. 1 Hospital length of stay after elective laparoscopic gastrostomy placement at pediatric hospitals

most common barriers to implementation [6]. However, with a multidisciplinary approach, team education along with standardized guidelines based on best evidence, these barriers can be overcome to effect change with respect to overall resource utilization for elective laparoscopic gastrostomy.

The main limitation of the study is that the hospitals contributing to NSQIP-P are not reflective of the full scope of institutions at which children are managed. Hospitals that contribute to NSQIP-P are usually tertiary-level academic institutions and so it is possible that the overall length of stay inclusive of community hospitals and other centers where children undergo this procedure is longer. In addition, laparoscopic gastrostomy does not have a designated CPT code but is grouped under a broader category of laparoscopic procedures on the stomach. However, in limiting our sample population to only those procedures performed electively for feeding intolerance and failure to thrive, it is likely that we captured primarily laparoscopic gastrostomies. There are also no variables in NSQIP-P that indicate when feeding was initiated postoperatively. Despite these limitations, this study serves to highlight the potential for implementation of an enhanced recovery approach to postoperative management after laparoscopic gastrostomy.

Conclusion

Pediatric patients undergoing routine elective laparoscopic gastrostomy tube placement have a median hospital length of stay of 2 days, despite evidence that early feeding and discharge within 24 h is both feasible and safe. There is, therefore, potential for the implementation of an enhanced recovery protocol as a quality metric for this commonly performed procedure in this population, which will possibly result in more efficient healthcare resource utilization without compromising the quality of care.

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Compliance with ethical standards

Conflict of interest The authors report no proprietary or commercial interest in any product mentioned or concept discussed in this article.

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