



## Practice Management

## Same-day discharge for pediatric laparoscopic gastrostomy☆

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## ARTICLE INFO

## Article history:

Received 4 September 2020

Accepted 22 September 2020

## Key words:

Button gastrostomy

Laparoscopic gastrostomy

Same-day surgery

## ABSTRACT

**Background:** Laparoscopic gastrostomy is a common procedure in children. We developed a same-day discharge (SDD) protocol for laparoscopic button gastrostomy.

**Methods:** We performed a prospective observational study of children undergoing laparoscopic button gastrostomy and were eligible for SDD from August 2017–September 2019. Patients were eligible if: 1) the family was comfortable with eliminating overnight admission and were suitable candidates for outpatient surgery (absence of major co-morbidities), 2) they were not undergoing additional procedures requiring admission, and 3) they received pre-operative education.

**Results:** Sixty-two patients who underwent laparoscopic button gastrostomy were eligible for SDD. The median age was 2.1 years [IQR 0.9–4.1], and the median weight was 10.5 kg [IQR 7.6–15.5]. Forty-one (66%) were previously nasogastric fed. The median operative time was 22 min [IQR 16–29]. The median time to initiation of feeds was 4.4 h [IQR 3.4–5.5]. Fifty-one (82%) were discharged the same day with a median length of stay of 9 h [IQR 7–10]. Eleven were admitted, most commonly for further teaching. Eleven SDD patients were seen in the emergency room <30 days at a median 5 days [IQR 3–12] post-operatively, primarily for mechanical complications.

**Conclusion:** Same-day discharge following laparoscopic gastrostomy is safe and feasible for select pediatric patients who undergo pre-operative education. The SDD pathway results in a low admission rate and relatively low ER visits.

**Type of study:** Prospective Observational Study.

**Level of Evidence:** Level II.

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Gastrostomy tube (GT) placement for patients requiring long-term enteral access is a common surgical procedure in children. While there are various techniques, the laparoscopic approach has become the preferred method in the pediatric population [1–3]. Laparoscopic gastrostomy allows direct visualization, primary button placement, and the ability to perform the procedure in small babies [2,4]. Furthermore, recent studies have shown that initiation of feeds in the early post-operative period following this approach does not lead to increased complications and efforts to develop an enhanced recovery pathway are underway [5–11].

We previously retrospectively reviewed pediatric patients who underwent Feeding Advancement and Simultaneous Transition to Discharge (FASTDischarge) laparoscopic gastrostomy at our institution to

determine the feasibility of a same-day discharge (SDD) pathway [10]. We found that 97% of patients achieved full volume feeds within 24 h of initiation of feeds, 70% achieved full volume feeds within 12 h, and median length of stay (LOS) was 26 h [10]. As a result of this study, we developed a SDD pathway for elective laparoscopic button gastrostomy. The aim of this study was to prospectively study SDD for pediatric laparoscopic gastrostomy.

## 1. Materials and methods

### 1.1. Same day discharge consultation

Patients requiring long-term enteral access are assessed for SDD eligibility by surgeons and/or surgery advanced practice providers (APPs) in the ambulatory Surgery clinic. Patients are deemed eligible if there are no major co-morbidities (e.g., ventilator-dependence, significant congenital heart disease, need for ICU monitoring postoperatively). Patients in whom laparoscopic GT placement is to be done with another procedure requiring an overnight stay and those requiring a special diet that would need monitoring, or those for whom there is a concern for refeeding syndrome, were excluded. Families uncomfortable taking

☆ How this paper will improve care: Select pediatric patients who undergo preoperative education can be safely discharged on the day of surgery following laparoscopic button gastrostomy placement. Our same day discharge pathway did not affect clinical outcomes negatively and may reduce cost.

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the child home without an overnight stay (often due to social factors, lack of comfort with gastrostomies or feeding regimens, or great distance from home) are excluded, as are those who the providers felt were poor candidates (for similar reasons).

Pre-operative GT teaching is performed at the same clinic visit. Education tools used during the clinic visit include written instructions, a video available on the public access site of our institution's website, and hands-on teaching using dolls for parents to practice inserting and removing the button as well as connecting and disconnecting tubing. Handouts for care of gastrostomy supplies and post-operative care are provided. If the caregiver was comfortable after pre-operative teaching, same day discharge is an option with a plan to stay overnight if there are any concerns.

### 1.2. Preoperative multidisciplinary coordination

Once the patient is deemed eligible for SDD, patients are scheduled for their procedure within 2 weeks of their consultation visit. Patients are scheduled as "extended stay" with a longer observation period compared to normal outpatient procedures. An 8-week post-operative visit is scheduled for the first tube exchange. The surgical care management coordinator assesses for durable medical equipment needs including GT supplies and need for a feeding pump, as well as arranging for home health nursing visits for weight checks and GT care if needed. Concurrently, the patient is referred to the Nutrition Clinic for evaluation and feeding recommendations if the patient does not already have a current plan. Once nutrition recommendations are available, an order set for post-operative feeding is placed, to be initiated on the day of surgery. If the patient is unable to be evaluated by nutrition pre-operatively, the nutrition service can arrange to evaluate and provide recommendations for the patient on the day of surgery.

### 1.3. Day of surgery

Our operative technique for laparoscopic gastrostomy button placement has been previously described [10]. Following the procedure, patients recover in the post-anesthesia care unit and are then transferred to the extended recovery unit. The saved order set with feeding instructions is initiated and formula is delivered in approximately 1 hour. As soon as formula arrives, the nurse may initiate GT feeds, generally starting with partial feeds and advancing per nutrition recommendations. The nurse then performs further teaching with the family and allows family members to do care whenever possible. Post-operative pain is managed with acetaminophen, ketorolac if the patient is >6 months of age, and 1–2 doses of fentanyl or morphine as needed if the patient is >12 months of age. Post-operative nausea is managed with ondansetron if the patient is >6 months of age. The patient is discharged from the extended recovery unit once tolerating feeds, pain is controlled, and the family is comfortable. Post-operative education handouts are provided. If the patient does not discharge the day of surgery, they are admitted to a hospital floor unit overnight.

### 1.4. Study design

Following IRB approval (#17070451) and a waiver of consent, a single-institution prospective observational study of children undergoing laparoscopic gastrostomy button placement and were eligible for SDD from August 2017 to September 2019 was performed.

### 1.5. Outcome measures

Our primary outcome was successful same-day discharge defined as >50% successfully discharged on the day of surgery. Secondary outcome measures included time to initial feeds, length of stay (LOS), reasons for post-operative admission, emergency room (ER) visit within 30 days,

time to ER visit, admission from ER within 30 days, reason for ER visit, and time to clinic follow-up.

### 1.6. Statistical analysis

Descriptive statistics were calculated with categorical variables reported in percentages and continuous variables reported as medians with interquartile ratios (IQR). Fisher's Exact tests were used for comparison of categorical data and Wilcoxon rank sum tests were used for comparison of continuous data. Analysis was performed using STATA (StataCorp 2017. Stata Statistical Software: Release 15. College, Station, TX: StataCorp LLC) in which alpha at 0.05 was considered statistically significant.

## 2. Results

### 2.1. Cohort characteristics

Of 150 patients who were screened for SDD, 62 (41.3%) were eligible and comprised the study cohort. Sixty percent were male, the median age was 2.1 years [IQR 0.9–4.1], and the median weight was 10.5 kg [IQR 7.6–15.5]. Sixty-six percent were already receiving nasogastric feeds (Table 1).

### 2.2. Hospital course outcomes

Hospital course outcomes are also shown in Table 1. The median operative time was 22 min [IQR 16–29]. There were no intra-operative complications. Time to initiation of feeds was 4.4 h [IQR 3.4–5.5]. Fifty-six percent of patients were fed via pump and 44% were fed by gravity. Ninety-two percent of patients were formula-fed, 3% were fed breastmilk, 3% were fed water due to planned outpatient initiation of feeds, and 2% were fed their normal ketogenic diet. The median volume of feed administered at any one time was 120 ml [IQR 70–150]. By the time of discharge, 71% of patients were on partial feeds while 29% reached goal feeds. Same-day discharge was achieved in 82% (n = 51) while 18% of patients (n = 11) were admitted post-operatively. Reasons for admission included desire for more teaching for 5 patients, unknown due to lack of documentation for 5 patients, and feeding intolerance for 1 patient. The total LOS for those who achieved SDD was 9 h [IQR 7–10] while the LOS for those admitted was 28 h [IQR 25–29].

The median follow-up for the entire cohort was 8 weeks [IQR 3–8], which was the time period for initial button exchange. Thirty-two percent of patients (n = 20) had follow-up prior to the scheduled 8 week

**Table 1**  
Clinical characteristics and outcomes for patients eligible for same-day discharge (SDD).

	Proportion or median [IQR] N = 62
Male (%)	60
Age (y)	2.1 [0.9–4.1]
Weight (kg)	10.5 [7.6–15.5]
Pre-operative nasogastric feeds (%)	66
Operative time (min)	22 [16–29]
Time to feeds (h)	4.4 [3.4–5.5]
Type of feed (%)	
Formula	92
Breastmilk	3
Water	3
Ketogenic diet	2
Bolus feeding volume (ml)	120 [70–150]
Goal feeds reached (%)	29
SDD (%)	82
Admitted post-operatively (%)	18
SDD LOS (h)	9 [7–10]
Admitted LOS (h)	28 [25–29]
Follow-up (wk)	8 [3–8]

visit for GT exchange. Of these, 45% (n = 9) were seen early for evaluation/treatment of granulation tissue, 20% (n = 4) were seen in the ED within 30 days for various reasons (see section 2.3 below), 15% (n = 3) were seen for skin irritation at the GT site, 5% (n = 1) for umbilical incision drainage, 5% (n = 1) for post-operative constipation, 5% (n = 1) for a weight check, and 5% (n = 1) for GT dislodgement while inpatient on another service. Of the 20 patients who had early follow-up, 80% (n = 16) were among those who were SDD and 20% (n = 4) were among those who were admitted following GT placement. Of the 16 SDD patients, 44% (n = 7) were seen for granulation tissue, 25% (n = 4) were seen in the ED within 30 days, 13% (n = 2) for skin irritation, 6% (n = 1) for umbilical incision drainage, 6% (n = 1) for post-operative constipation, and 6% (n = 1) for GT dislodgement while inpatient on another service. Of the 4 admit patients, 50% (n = 2) were seen for granulation tissue, 25% (n = 1) for skin irritation at the GT site, and 25% (n = 1) for a weight check.

### 2.3. Post-operative emergency room visits

Of the entire cohort, 14 patients (23%) returned to the ER within 30 days of surgery. Of these, 11 patients were among those who were SDD and 3 were among those who were admitted following GT placement ( $p = 0.68$ ). The median time to ER presentation was 5 days [IQR 3–12]. Reasons for the ER visit included GT dislodgement in six patients, emesis or feeding intolerance in four patients, surgical site concerns in two patients, GT mechanical issues in one patient, and pain at the site in one patient (Table 2).

Five of the 6 patients with GT dislodgement were able to have the tube successfully replaced bedside in the ER while one required operative revision. Four patients with emesis or feeding intolerance returned to the ER. One patient had Leigh syndrome, a rare neurometabolic disorder, and required admission for severe dehydration. Another patient was admitted to the general medical pediatric service for an ongoing oxygen requirement due to an upper respiratory infection. The other two patients were discharged from the ER following a diagnosis of gastroenteritis and constipation respectively.

Two patients were seen with surgical site concerns. One patient with cellulitis around the tube and pain with feed administration required admission for intravenous (IV) antibiotics. The other patient with cellulitis and no intolerance of feeds was discharged on an oral antibiotic. The patient seen for mechanical issues had a clogged GT and was discharged after it was unclogged in the ER. The patient with pain at the GT site had a normal tube contrast study and following repositioning in his wheelchair and administration of non-narcotic analgesics, the pain resolved, and they were discharged home.

Overall, 3 patients (4.8%) were admitted from the ER for GT related complications within 30 days of surgery, all among those who underwent SDD. These patients included the patient with a dislodged

tube requiring operative intervention, the patient with feeding intolerance requiring rehydration and slow advancement of feeds, and the patient with cellulitis requiring IV antibiotics. No patients who were among those admitted post-operatively were admitted from the ER.

### 3. Discussion

Value-based care is becoming increasingly imperative in the field of surgery and improvement processes such as Enhanced Recovery After Surgery (ERAS) protocols have been shown to improve clinical outcomes and reduce costs [12]. While these protocols have been successfully implemented for adult surgical patients, only recently has it been proposed in pediatric surgical patients [11,13,14]. Laparoscopic gastrostomy in pediatric patients is a procedure ripe for an enhanced recovery approach as several studies have shown safety of early initiation of feeds leading to a reduction in LOS with no increase in post-operative complications [6–11]. Our own retrospective study of patients undergoing laparoscopic gastrostomy following development of a FASTDischarge pathway showed initiation of feeds at a median of 2.8 h after surgery with 97% of patients achieving full feeds well within 24 h and a median LOS of 26 h [10]. Families were evaluated by nutrition and received GT education during their overnight stay on the FASTDischarge pathway, and we modified the protocol so that the nutrition evaluation and GT education were performed pre-operatively on an outpatient basis.

One of the main reasons for overnight admission was for further teaching. This was usually per family request as patients were only discharged once caregivers were comfortable administering feeds and handling GT supplies independently. Caregivers that requested admission generally wanted more practice with the feeding process. With maturation and global acceptance of the SDD protocol we anticipate that education provided by supporting staff and overall process efficiency may improve; this may increase the rate of successful discharge on the day of surgery.

Of those who were discharged the day of surgery, 22% returned to the ER within 30 days. Although this return rate seems (and is) high, it is similar to the ~20% ER visit rate < 30 days from placement of a balloon gastrostomy device reported in the literature [15,16]. The median time to ER presentation in our study was 5 days. Though this is relatively early in the post-operative period, the average LOS following laparoscopic GT placement ranges from 1 to 4 days in the literature with most patients being discharged on post-operative day (POD) 2 [7,10,11,16]. This indicates that keeping patients an extra day following laparoscopic gastrostomy would not impact the incidence of ER visits within 30 days.

Overall, only three patients were admitted from the ER for GT-related complications, all of whom were discharged the day of surgery. The GT dislodgement requiring operative intervention presented 2 weeks after discharge and admission on the day of surgery would not have prevented admission. The patient admitted for IV antibiotics did not develop symptoms until 4 days post-operatively and would not have been prevented by an additional initial hospital day. The patient with major comorbidity (Leigh syndrome) who was admitted for intolerance of feeds was likely an inclusion error. Nonetheless, one avoidable admission yields a 2% admission rate from the ER within 30 days for patients who underwent SDD. This rate is comparable to what is reported in the literature [11,15].

One complication of GT placement that can cause distress for families and does carry some morbidity is GT dislodgement. We found a GT dislodgement rate of 10% in this study with only 1 requiring operative intervention. GT dislodgement rates vary significantly in the literature, from 4 to 27% [1,8,15–19]. Teaching for GT dislodgement is provided in the pre-operative counseling session. Tips to avoid dislodgement are provided via verbal and written instructions and caregivers practice re-inserting the GT button on dolls during this session. While education is provided on preventing dislodgement, we acknowledge that it is not uncommon, and provide additional education on the management of a dislodged GT should it occur. Management is dependent

**Table 2**  
Emergency room visits for same-day discharge (SDD) vs those admitted post-operatively.

	SDD Number/median [IQR] N = 11	Admitted post-op Number/median [IQR] N = 3	p-Value
Reason for presentation			
Tube dislodgement	3	3	
Emesis/feeding intolerance	4	0	0.28
Surgical site concerns	2	0	
Mechanical issues	1	0	
Pain	1	0	
Time to ER presentation (days)	4 [3–12]	5 [5–14]	0.48
Disposition from ER			
Discharge	8	3	0.68
Admitted	3	0	

on how far they are out from surgery. If they are less than 8 weeks out from initial placement, they are to go to the ER or clinic as soon as possible. If they are more than 8 weeks out from initial placement, they can replace the button themselves and if they are unsuccessful or the patient develops symptoms following replacement, they are to bring them in for evaluation. All of the pre-operative education, including prevention and management of GT dislodgement, is then reviewed in the extended recovery unit post-operatively before discharge.

One limitation of this study is the incomplete documentation of reasons for admission post-operatively in five patients. However, upon review of these charts there was no indication that admission was due to instability or intolerance of feeds. Anecdotally, other reasons not documented may include need for further teaching, parent request, and/or the time of day the patient was ready for discharge as many patients may come from several hours away and prefer to drive during daylight hours. While the need for further teaching and parent request as reasons for admission will likely persist even with maturation of the protocol, we have begun to try to schedule eligible SDD laparoscopic gastrostomy procedures as morning cases to allow adequate recovery time and potential for SDD.

Another limitation is a lack of comparison group in the study. However, we do have a historical cohort used our retrospective study of the FASTDischarge pathway which has been previously published [10]. Therefore, a prospective study was thought to be the most appropriate next step. Furthermore, since the decision to discharge the same day was ultimately up to patients' caregivers, it would be difficult to randomize or create a control group.

We also did not perform a cost analysis in this study. However, based on an internal analysis of the cost associated with a laparoscopic gastrostomy, SDD would lead to reduction in cost of approximately \$4230 due to the elimination of the inpatient admission. Therefore, we can estimate that the yearly reduction in cost was approximately \$107,865 in the cohort of 51 patients who were successfully discharged the day of their procedure. This is a substantial cost reduction for not only the hospital but for the patient as well. Furthermore, opportunity for increased cost savings may improve with maturation of the protocol.

Finally, there is a potential lack of generalizability to other institutions due to the availability of preoperative multidisciplinary resources. Our institution has been able to transition most inpatient resources to an outpatient setting (nutrition, social work, case management, etc.) that is supported by robust ancillary staff who can coordinate and implement preoperative multidisciplinary teaching which may not be achievable at other institutions.

#### 4. Conclusion

Same-day discharge following laparoscopic gastrostomy button placement is safe and feasible for select pediatric patients who undergo pre-operative education. The SDD pathway results in a low admission rate and relatively low ER visits.

#### Acknowledgements

We would like to thank Shubhika Jain and Kartik Depala for their assistance with this study.

#### Disclosures

##### Declarations of competing interest

None.

#### Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jpedsurg.2020.09.044>.

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