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Preoperative evaluation is not predictive of transpyloric feeding conversion in gastrostomy dependent pediatric patients

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Abstract

Objectives—Limited literature exists as to whether preoperative GT evaluation may predict which patients will go onto require GJ feeding. The goal of this study was to compare the preoperative evaluations between patients maintained on GT feeds versus patients who required conversion to GJ feeds.

Methods—We identified patients at Boston Children's Hospital who underwent GT placement and required GJ feeding between 2006–2012. GT patients were matched according to age, neurologic, and cardiac status with GJ converted patients. Preoperative characteristics, rates of total hospitalizations, and respiratory related admissions were reviewed.

Results—79 GJ patients (median (IQR): age 15 (4.3, 55.7) months; weight 8.8 (4.6, 14.5) kg) were matched with 79 GT patients (median (IQR): age 14.6 (4.7, 55.7) months; weight 8.5 (5, 13.6) kg). Median time from GT to GJ conversion was 8 (IQR 3, 16) months. Both groups had similar rates of successful preoperative nasogastric feeding trials (GT (84.5%) vs GJ (83.1%), $p=1.0$), upper GI series (GT (89.1%) vs GJ (93.2%), $p=0.73$), abnormal videofluoroscopic swallow studies (GT (53.8%) vs GJ (62.2%), $p=0.4$), and completion of gastric emptying studies (GT (10.1%) vs GJ (5.1%), $p=0.22$). No differences were seen in preoperative hospitalization rates ($p=0.25$), respiratory admissions ($p=0.36$), although GJ patients had a mean reduction in the number of hospitalization of -1.5 ± 0.5 days, $p<0.001$, after conversion.

Conclusions—No differences in preoperative patient characteristics or diagnostic evaluations were seen in GT fed versus GJ converted patients. GJ patients did experience an overall decrease in total admissions after GJ conversion.

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Statement of Disclosure:

I, Maireade McSweeney, MD wrote the first draft of this manuscript and as the responsible author certify that all coauthors have seen and agree with the contents of this manuscript. I take responsibility for the accuracy of this data and certify that this information is not under review by any other publication. I have no conflicts of interest or sources of funding to disclose. All authors had no financial conflicts of interest or sponsorship relevant to this article to disclose.

Keywords

gastrostomy; gastrojejunostomy; gastroenterology; diagnostic; children

Introduction

Gastrostomy (GT) placement is a commonly performed procedure in pediatric patients who have a variety of feeding difficulties, poor growth, or other gastrointestinal disorders, in order to allow for more permanent enteral access and to potentially improve pulmonary status in patients with aspiration.^{1,2} Prior literature suggests that a small percentage (<10%) of pediatric patients undergoing primary GT placement, may experience gastric feeding intolerance and require subsequent conversion to gastrojejunal (GJ) feeds, surgical jejunostomy, or require a fundoplication procedure.^{3–9} Prior gastrojejunostomy literature in pediatric patients has largely focused on potential tube-related complications.^{10–12} Also, studies have examined, especially in the neurologically impaired patient population, whether or not fundoplication versus gastrojejunostomy placement will more positively impact patients' post-operative rehospitalization rates and pneumonia risk; to date, no significant differences have been found between these two interventions.^{6,9,13,14}

When evaluating a patient prior to GT placement, there is no consensus on the necessary preoperative diagnostic testing and evaluation that should be performed; limited data exists as to whether or not certain preoperative evaluations may predict which patients will undergo transition to GJ feeding.^{3,8,15–17} Therefore, the primary aim of this study was to compare the preoperative evaluation performed between patients successfully maintained on GT feeding versus patients going on to require GJ feeding. Secondary aims included assessment of the frequency of preoperative respiratory evaluations and intensive care unit (ICU) level hospitalizations prior to GT placement, as well as a comparison of hospitalization rates and respiratory related admissions in GT patients versus GJ converted patients. The frequency of permanent tube removal between GT fed versus GJ converted patients was also assessed. Finally, among GJ patients, the differences in the frequency of hospitalization rates and pulmonary-related admissions both before and after initiation of GJ feeding were reviewed.

Methods

Institutional Review Board approval was granted to complete a chart review of all patients undergoing primary gastrostomy tube placement at Boston Children's Hospital between January 2006 and December 2012; during this time period, gastrostomy tubes were primarily placed using the percutaneous endoscopic technique. Queries of hospital administrative lists and data abstraction using Epic (V 2008; Epic Systems Corporation, Verona, Wisconsin) were performed to identify patients who underwent a percutaneous endoscopic gastrostomy tube (PEG) placement followed by conversion to GJ feeding ("GJ patients"). Any patients who underwent primary PEG placement at another hospital, or who underwent a primary GJ tube placement, jejunostomy, or fundoplication with GT procedure were excluded.

Patient records were reviewed for age, sex, ASA class, and weight at the time of PEG procedure. Patient comorbidities were categorized as neurologic, metabolic/genetic, cardiac, premature (<37 weeks gestation at the time of birth), oncologic, oropharyngeal malformations, cystic fibrosis and other (renal, immunodeficiency, and gastrointestinal disorders); comorbidities were not considered to be mutually exclusive. Indications for GT placement were also noted and included: (1) aspiration, as documented by having an abnormal videofluoroscopic swallow study (VFSS), (2) failure to thrive, or (3) other feeding difficulties, including food refusal.

Primary and secondary outcomes were compared between GT dependent and GJ converted groups. The primary outcome was defined as the completion of the following diagnostic evaluations prior to GT placement: (1) nasogastric feeding trial (of note, initiation of nasogastric (NG) tube feeding trials, or any other initiation of any type of enteral feeding at our institution, are routinely performed as inpatients with a minimum of a two night stay with dietician consultation), (2) pH-impedance probe study, (3) fluoroscopic upper gastrointestinal series (Upper GI series), (4) VFSS, and (5) a one hour nuclear medicine gastric emptying scintigraphy (either solid or liquid study based on patient's oral feeding practices and tolerance with normal being defined 60% residual at one hour). Secondary outcomes included: (1) type of feeding regimen (bolus/continuous/both) used preoperatively (with NG tube), as well as postoperatively after GT placement, (2) evaluation by pulmonary medicine prior to GT placement, (3) number of ICU admissions prior to GT placement, and (4) number of total admissions and pulmonary-related admissions between birth and GT placement. In addition, among GJ patients only, mean change in number of total admissions, respiratory-related admissions, emergency department (ED) visits, and respiratory related ED visits were reviewed both before and after GJ conversion; counts of admissions and ED visits were controlled by using equivalent time periods both before and after GJ placement. Advancement back to GT feedings after GJ placement and permanent tube (GT or GJ) removal, resulting in stoma closure, were reviewed for all patients; all data reviews were completed through June 1, 2016.

A propensity score analysis was used to adjust for imbalances between the two primary groups of interest: GT patients who transitioned to GJ feeding versus patients who remained GT dependent. Propensity scores were determined using a multivariate logistic regression model, with dependent variable GJ conversion (yes/no) and the following independent variables: cardiac disease (yes/no), age, and neurologic/seizure disorder (yes/no). Patients who transitioned to GJ feeding were then matched one-to-one with patients who remained GT dependent, based on individual propensity scores. The absolute difference between propensity scores for all matched patients was within 2%.

Results are presented as n (%) when categorical and either median (interquartile range; IQR) or mean with standard deviation (SD) or standard error (SE) when continuous. To account for potential between-patient correlation imposed by the propensity score matching, conditional logistic regression was used for all comparisons between GT and GJ dependent patients. Within the GJ dependent group, the number of hospitalizations from birth until GJ placement was compared to the number of hospitalizations during an equivalent amount of time after GJ conversion. This within-patient comparison was evaluated with the paired t-

test. All tests of significance were 2-sided, with $P < 0.05$ considered statistically significant. Data analysis was performed with SAS version 9.4 (Cary, NC).

Results

A total of 902 patients underwent primary PEG placement during this time period; a cohort of 158 matched patients who underwent GT placement were included in the analysis with 79 patients requiring conversion to GJ feedings. Median time from GT to GJ conversion was 9 (IQR 4, 16) months. No differences in preoperative comorbidities were found between the two groups (Table 1). Post-operatively, 11 (13.9%) GJ patients had a fundoplication procedure, and no GT patients required fundoplication ($P=0.04$), largely because institutional practices at our center encourage a trial of post-pyloric feeds in order to determine if patients are candidates for fundoplication. Thirty-six (45.6%) GJ patients returned to GT feeds; two (2.5%) GJ patients had their tube permanently removed versus 16 (20.5%) of GT patients ($P=0.006$) which may reflect severity of feeding intolerance. No differences in frequency of preoperative evaluations were seen between GT versus GJ patients (Table 2). There were also no differences in the results of the preoperative testing though the numbers for each test were small (Table 2).

For patients who underwent a documented NG tube trial preoperatively, 53/118 (45%) patients had bolus feedings, 51/118 (43.2%) had continuous feeding trials, and 17/118 (14%) had a combination of both bolus and continuous feedings. Postoperatively, after initial GT placement, 153 patients had documented bolus, continuous or combination bolus/continuous feedings at the time of discharge; 102/153 (66.7%) were bolus fed, 93/153 (61.8%) were continuous fed, and 42/153 (27.5%) had a combination bolus/continuous feeding regimen. GT patients who were on bolus feeds at the time of discharge were less likely to go onto GJ feeding (59 versus 43, $p=0.03$). No differences were found in patients, who were on continuous feedings or combination bolus/continuous feedings at the time of discharge, and their likelihood of going on to GJ placement.

After adjusting for age at the time of GT placement, no difference in the proportion of patients with an ICU admission prior to tube placement was seen (50 (63.3%) GT dependent patients vs. 55 (69.6%) GJ patients; adjusted odds ratio 1.35, $P=0.38$), and similarly no difference was seen in the proportion of patients with a pulmonary medicine evaluation prior to tube placement (18 (22.8%) GT dependent patients vs. 25 (31.7%) GJ patients; adjusted odds ratio 1.58, $P=0.22$). Also, no differences in the rate of total admissions or respiratory related admissions before GT placement were seen between the two groups, with incidence rate ratios of 0.84 (95% CI 0.55 – 1.28; $P=0.41$) and 0.67 (95% CI 0.31 – 1.45; $P=0.31$), respectively (Table 3).

Among GJ patients only, mean change in total admissions before and after GJ conversion was $-1.5 (\pm 0.5 \text{ SE})$ days, $P=0.001$. No within-patient differences in respiratory related admissions, ED visits, or respiratory related ED visits were seen before versus after GJ placement (Figure 1).

Discussion

Gastrojejunostomy tube feeding is a commonly used method of feeding in patients with gastric feeding intolerance, especially in patients who have failed gastric feeding trials.¹⁸ Prior literature has estimated about 4–6% of patients undergoing primary G-tube placement may go on to require conversion to transpyloric feeding, and in our cohort, approximately 8.8% required conversion.^{3,7} Limited literature exists as to what diagnostic evaluation prior to tube placement may help predict which patients will go on to require transpyloric feeding; most of the pediatric literature to date has focused on differences in the pre-operative evaluation of patients who underwent a G-tube versus those who may also have required a G-tube and fundoplication procedure.^{3,19}

While there is no study looking at the role of preoperative testing/feeding trials in patients prior to GJ placement, there is a body of literature on the workup prior to fundoplication. While the complications of fundoplication are more significant, and the risks are higher than GJ placement, we can learn something from this literature as both fundoplication and GJ feeding are “steps up” in reflux and feeding difficulty management and may have a definite impact on patient feeding practices. Prior fundoplication literature has proposed that younger age, the presence of a neurologic comorbidity, history of dysphagia with resultant aspiration, as seen on videofluoroscopic swallow studies, may be associated with an increased need for potential fundoplication, while other authors have proposed that preoperative abnormal pH probe studies may have a higher likelihood of predicting patients who may go on to need fundoplication.^{3,8,19,20} Two additional studies explored the relationship between esophagitis found on esophageal biopsies and presence of gastroesophageal reflux on upper GI findings prior to GT placement, and the eventual risk of having a subsequent fundoplication procedure; neither the presence of esophagitis nor the findings of reflux via fluoroscopy seemed to correlate well with the need for fundoplication.^{15,21}

In our study, we chose to control for various patient factors which could possibly influence the potential for feeding intolerance after tube placement; even after matching for age, neurologic, and cardiac comorbidities, neither the successful completion of a nasogastric feeding trial, nor emesis with an upper GI series, or presence of an abnormal VFSS, seemed to predict which patients may go on to require GJ feeding. Interestingly, it does seem that patients who were bolus fed at the time of GT discharge may be less likely to go onto require GJ feeding, but future studies may be needed to support this finding. Also, no differences in the presence of a preoperative abnormal gastric emptying study or impedance probe testing result seemed to increase the chances of transition to postpyloric feeding, although the frequency with which these studies were performed prior to gastrostomy tube placement was quite low in our cohort.

Two prior larger retrospective patient population studies, based on hospital billing code data, have previously assessed patients requiring anti-reflux procedures and those undergoing GT placement versus those having a GT with concomitant fundoplication; in these studies, the frequency of preoperative 24-hour pH monitoring and gastric emptying studies being performed were higher than our retrospective cohort, but unfortunately, due to the

limitations of billing data, the frequency of abnormal test results for our study were unknown but again may be worth further investigation.^{20,22}

In addition, our study found that 62% of our entire cohort had an abnormal swallow study, but again, no differences in rates of aspiration via VFSS were seen between patients who remained GT dependent, and those who went on to have a GJ conversion. Two prior studies have noted that abnormal swallowing may potentially influence clinicians' decisions to perform certain anti-reflux (e.g. fundoplication) procedures at the time or following GT placement.^{3,22} Therefore, we tried to examine if differences between patients who remained GT dependent, versus those who transitioned to GJ feeds, existed in relation to the frequency of pulmonary medicine evaluations or ICU admissions prior to tube placement, total hospitalization rates, as well as respiratory-related admissions; no differences were seen in any of these variables between the two groups. With prior literature of patients undergoing either a fundoplication or GJ placement suggesting that anti-reflux procedures may have minimal/no impact on subsequent respiratory related admissions (because the pulmonary complications in the majority of aspirating children are not a result of gastroesophageal reflux but instead because of a lack of thickening of oral feeds or aspiration of saliva), in turn, it makes sense that abnormal swallowing, or aspiration on a swallow study, should not preclude the placement or use of a gastrostomy tube; in fact, one could argue that for oropharyngeal dysphagia, an enteral tube is not even indicated anymore based on prior published data.^{9,22,23}

Interestingly, for GJ converted patients, the overall frequency of total hospitalizations decreased with a trend towards a decrease in respiratory related visits, when comparing equivalent time periods before versus after transition to transpyloric feeding. This finding is in contrast to a prior study by King et al 2014 of 33 GJ fed patients, all with neurological impairment, which reported no changes in the total number of visits before versus after GJ placement, and an actual increase in the number of "gastroesophageal reflux and dysfunctional swallowing" related-visits.⁶ Of note, the authors found these visits were primarily due to procedure or feeding-tube related visits and not respiratory related visits.⁶ This discrepancy between this finding and our study may be explained by certain patient factors, as their study included only patients with neurologic disability and the tracking of other radiology-related patient visits, but there may also be possible differences in certain institution based practices in regards to the care and maintenance of GJ tubes that may also contribute to higher versus lower visit rates after GJ placement.

It is interesting to note that only 2% of our GJ patients' went on to have their feeding tubes permanently removed ($P=0.001$), but 36 (45.6%) went back to GT feeding, suggesting the GJ placement may not always be a permanent exchange. Prior data from our institution has suggested that upwards of 20% of all patients undergoing primary GJ placement may go on to full oral feeding.²⁴ Therefore, there may be additional patient confounders in this cohort of matched patients, and a specific relation to their feeding intolerance and having failed an initial gastrostomy trial, which may have subsequently impacted certain patients ability to advance back to GT feedings and/or a full oral diet.

Limitations to this study include its retrospective nature and involvement of institution-specific practices of when to pursue subsequent placement of gastrojejunol feedings. In addition, during this time period, our institution had adoption of a new electronic medical record system which may limit the availability of some data. Also, our institution involves a large cohort of attendings and variation in clinical practice may have also influenced pre-operative evaluations. We also did not collect data on esophageal biopsies, type of formula used with nasogastric tube feeding trial, or other medical therapies prior to GT placement, and those practices may have also influenced the conversion from GT to GJ feeding. Future studies are needed to more prospectively study what other types of diagnostic, motility, and patient characteristics may predict subsequent need for gastrojejunol placement.

Conclusion

To date, no differences in preoperative patient characteristics, hospitalization rates, or diagnostic evaluations were seen in patients remaining GT dependent versus those going on to require GJ feeding. Interestingly, GJ patients did experience an overall decrease in total admissions after GJ conversion. Future prospective studies are needed to address what other types of diagnostic, motility, and patient characteristics may predict subsequent need for gastrojejunol placement.

Literature Cited

1. Srinivasan R, Irvine T, Dalzell M. Indications for percutaneous endoscopic gastrostomy and procedure-related outcome. *Journal of pediatric gastroenterology and nutrition*. 2009; 49:584–8. [PubMed: 19820413]
2. McSweeney ME, Smithers CJ. Advances in Pediatric Gastrostomy Placement. *Gastrointest Endosc Clin N Am*. 2016; 26:169–85. [PubMed: 26616903]
3. Fortunato JE, Troy AL, Cuffari C, et al. Outcome after percutaneous endoscopic gastrostomy in children and young adults. *Journal of pediatric gastroenterology and nutrition*. 2010; 50:390–3. [PubMed: 20179645]
4. Onwubiko C, Bairdain S, Murphy AJ, et al. Laparoscopic Gastrojejunostomy Tube Placement in Infants with Congenital Cardiac Disease. *Journal of laparoendoscopic & advanced surgical techniques Part A*. 2015; 25:1047–50. [PubMed: 26402465]
5. Raval MV, Phillips JD. Optimal enteral feeding in children with gastric dysfunction: surgical jejunostomy vs image-guided gastrojejunol tube placement. *Journal of pediatric surgery*. 2006; 41:1679–82. [PubMed: 17011268]
6. King M, Barnhart DC, O’Gorman M, et al. Effect of gastrojejunol feedings on visits and costs in children with neurologic impairment. *Journal of pediatric gastroenterology and nutrition*. 2014; 58:518–24. [PubMed: 24164905]
7. McSweeney ME, Jiang H, Deutsch AJ, Atmadja M, Lightdale JR. Long-term outcomes of infants and children undergoing percutaneous endoscopy gastrostomy tube placement. *Journal of pediatric gastroenterology and nutrition*. 2013; 57:663–7. [PubMed: 24177786]
8. Novotny NM, Jester AL, Ladd AP. Preoperative prediction of need for fundoplication before gastrostomy tube placement in children. *Journal of pediatric surgery*. 2009; 44:173–6. discussion 6–7. [PubMed: 19159739]
9. Srivastava R, Downey EC, O’Gorman M, et al. Impact of fundoplication versus gastrojejunol feeding tubes on mortality and in preventing aspiration pneumonia in young children with neurologic impairment who have gastroesophageal reflux disease. *Pediatrics*. 2009; 123:338–45. [PubMed: 19117901]
10. Campwala I, Perrone E, Yanni G, Shah M, Gollin G. Complications of gastrojejunol feeding tubes in children. *The Journal of surgical research*. 2015; 199:67–71. [PubMed: 26227672]

11. Al-Zubeidi D, Demir H, Bishop WP, Rahhal RM. Gastrojejunal feeding tube use by gastroenterologists in a pediatric academic center. *Journal of pediatric gastroenterology and nutrition*. 2013; 56:523–7. [PubMed: 23254445]
12. Michaud L, Coopman S, Guimber D, Sfeir R, Turck D, Gottrand F. Percutaneous gastrojejunostomy in children: efficacy and safety. *Archives of disease in childhood*. 2012; 97:733–4. [PubMed: 22504731]
13. Stone B, Hester G, Jackson D, et al. Effectiveness of Fundoplication or Gastrojejunal Feeding in Children With Neurologic Impairment. *Hosp Pediatr*. 2017
14. Livingston MH, Shawyer AC, Rosenbaum PL, Jones SA, Walton JM. Fundoplication and gastrostomy versus percutaneous gastrojejunostomy for gastroesophageal reflux in children with neurologic impairment: A systematic review and meta-analysis. *Journal of pediatric surgery*. 2015; 50:707–14. [PubMed: 25783384]
15. Heikenen JB, Werlin SL. Esophageal biopsy does not predict clinical outcome after percutaneous endoscopic gastrostomy in children. *Dysphagia*. 2000; 15:167–9. [PubMed: 10839831]
16. Gonzalez KW, Dalton BG, Boda S, et al. Utility of Preoperative Upper Gastrointestinal Series in Laparoscopic Gastrostomy Tube Placement. *Journal of laparoendoscopic & advanced surgical techniques Part A*. 2015; 25:1040–3. [PubMed: 26258954]
17. Pruijsen JM, de Bruin A, Sekema G, Koetse HA, van Rheeën PF. Abdominal plain film before gastrostomy tube placement to predict success of percutaneous endoscopic procedure. *Journal of pediatric gastroenterology and nutrition*. 2013; 56:186–90. [PubMed: 22922374]
18. El-Matary W. Percutaneous endoscopic gastrojejunostomy tube feeding in children. *Nutrition in clinical practice: official publication of the American Society for Parenteral and Enteral Nutrition*. 2011; 26:78–83. [PubMed: 21266702]
19. Sulaeman E, Udall JN Jr, Brown RF, et al. Gastroesophageal reflux and Nissen fundoplication following percutaneous endoscopic gastrostomy in children. *Journal of pediatric gastroenterology and nutrition*. 1998; 26:269–73. [PubMed: 9523860]
20. McAteer J, Larison C, LaRiviere C, Garrison MM, Goldin AB. Antireflux procedures for gastroesophageal reflux disease in children: influence of patient age on surgical management. *JAMA Surg*. 2014; 149:56–62. [PubMed: 24197138]
21. Acker SN, Trinh BB, Partrick DA, Stewart CL, Bensard DD. Is Routine Upper Gastrointestinal Contrast Study Necessary prior to Laparoscopic Gastrostomy Tube Placement in Children? *Eur J Pediatr Surg*. 2016; 26:29–33. [PubMed: 26382658]
22. Barnhart DC, Hall M, Mahant S, et al. Effectiveness of fundoplication at the time of gastrostomy in infants with neurological impairment. *JAMA Pediatr*. 2013; 167:911–8. [PubMed: 23921627]
23. McSweeney ME, Kerr J, Amirault J, Mitchell PD, Larson K, Rosen R. Oral Feeding Reduces Hospitalizations Compared with Gastrostomy Feeding in Infants and Children Who Aspirate. *The Journal of pediatrics*. 2016; 170:79–84. [PubMed: 26687714]
24. Onwubiko C, Weil BR, Bairdain S, et al. Primary laparoscopic gastrojejunostomy tubes as a feeding modality in the pediatric population. *Journal of pediatric surgery*. 2017; 52:1421–5. [PubMed: 28549684]

What is known?

- Gastrojejunostomy tube (GJ) placement is a commonly performed procedure for allowing ongoing enteral access in pediatric patients with gastric feeding intolerance
- Limited data exists as to whether or not certain preoperative evaluations may predict which patients will undergo transition from gastrostomy (GT) to GJ feeding

What is new?

- No differences in preoperative patient characteristics, hospitalization rates, or diagnostic evaluations were seen in GT fed versus GJ converted patients
- GJ patients did experience an overall decrease in total hospital admissions after GJ conversion

Figure 1.

Mean change (with 95% Confidence Interval) in number of total hospital admissions and Emergency Department visits in GJ dependent patients, when comparing equivalent time periods before and after GJ tube placement. Numbers to the left of the dotted line indicate a reduction in admissions after the GT was converted to a GJ tube; numbers to the right of the dotted line indicate an increase in admissions after GJ placement. P-values are from a paired t-test.

Table 1

Characteristics of patients undergoing gastrostomy tube (GT) placement (n=158). Patients were matched on propensity scores, based on age, neurologic disorder, and cardiac disease at time of GT placement.

	Total (n=158)	GT patients (n=79)	GJ patients (n=79)	p-value *
Male sex, n (%)	88 (55.7)	45 (57.0)	43 (54.4)	0.76
Age at GT placement (months), median (IQR)	14.6 (4.5, 55.7)	14.6 (4.7, 55.7)	14.7 (4.3, 55.7)	0.64
Age < 6 months, n (%)	45 (28.5)	22 (27.8)	23 (29.1)	–
Weight (kilograms), median (IQR)	8.6 (5.0, 14.4)	8.5 (5.0, 13.6)	8.8 (4.6, 14.5)	0.72
Weight < 4 kilograms, n (%)	25 (15.8)	10 (12.7)	15 (19.0)	–
ASA Class, n (%)				0.67
Class I	1 (0.6)	1 (1.3)	0 (0.0)	
Class II	37 (23.4)	20 (25.3)	17 (21.5)	
Class III	100 (63.3)	47 (59.5)	53 (67.1)	
Class IV	19 (12.0)	10 (12.7)	9 (11.4)	
Class V	1 (0.6)	1 (1.3)	0 (0.0)	
Comorbidities, n (%)				
Neurologic Disorder	94 (59.5)	46 (58.2)	48 (60.8)	0.40
Metabolic/Genetic Disorder	46 (29.1)	22 (27.8)	24 (30.4)	0.71
Cardiac Disease	34 (21.5)	18 (22.8)	16 (20.3)	0.34
Prematurity	29 (18.4)	11 (13.9)	18 (22.8)	0.13
Cancer	9 (5.7)	7 (8.9)	2 (2.5)	0.10
Oropharyngeal Malformations	9 (5.7)	5 (6.3)	4 (5.1)	0.74
Cystic Fibrosis	14 (8.9)	5 (6.3)	9 (11.4)	0.26
Other	9 (5.7)	3 (3.8)	6 (7.6)	0.33
Indications for GT placement, n (%)				
Aspiration	49 (31.0)	21 (26.6)	28 (35.4)	0.21
Failure to Thrive	62 (39.2)	33 (41.8)	29 (36.7)	0.48
Other Feeding Difficulties	46 (29.1)	24 (30.4)	22 (27.8)	0.70
Size of G-tube, n (%)				
12 French	103 (65.2)	55 (69.6)	48 (60.8)	0.10
16 French	50 (31.6)	21 (26.6)	29 (36.7)	0.07
20 French	5 (3.2)	3 (3.8)	2 (2.5)	0.66
Fundoplication performed	11 (7.0)	0 (0.0)	11 (13.9)	0.04
Tube permanently removed	18 (11.5)	16 (20.5)	2 (2.5)	0.006
Patient expired	17 (10.8)	7 (8.9)	10 (12.7)	0.44

* P-values are from conditional logistic regression

Table 2

Comparison of completed diagnostic evaluation prior to GT placement (n=158).

	Total (n=158)	GT patients (n=79)	GJ patients (n=79)	p-value *
NG Feeding Trial Prior to GT	118 (74.7)	59 (74.7)	59 (74.7)	1.00
Tolerated NG Trial	98 (83.8)	49 (84.5)	49 (83.1)	1.000
If no, emesis?	16 (13.7)	6 (10.3)	10 (16.9)	0.421
If no, respiratory symptoms?	6 (5.1)	4 (6.9)	2 (3.4)	0.439
Impedance Study Prior to GT	9 (5.7)	2 (2.5)	7 (8.9)	0.12
Abnormal by MII	0 (0)	0 (0)	0 (0)	–
Abnormal by pH	2 (50.0)	–	2 (50.0)	–
Upper GI Prior to GT	90 (57.0)	46 (58.2)	44 (55.7)	0.75
Upper GI Normal?	82 (91.1)	41 (89.1)	41 (93.2)	0.71
If no, reflux?	6 (6.7)	4 (8.7)	2 (4.5)	0.42
If no, other abnormality?	2 (2.2)	1 (2.2)	1 (2.3)	1.00
VFSS prior to GT	82 (51.9)	37 (46.8)	45 (57.0)	0.21
Aspiration on VFSS	49 (59.8)	21 (56.8)	28 (62.2)	0.53
Laryngeal Penetration	3 (3.7)	1 (2.7)	2 (4.4)	1.00
Aspiration of thin only	14 (26.9)	5 (22.7)	9 (30.0)	0.57
Aspiration of thin and nectar thick	14 (26.9)	8 (36.4)	6 (20.0)	1.00
Aspiration of thin, nectar and honey thick	4 (7.7)	2 (9.1)	2 (6.7)	1.00
Aspiration of thin, nectar thick, honey thick, and purees	20 (38.5)	7 (31.8)	13 (43.3)	0.34
Gastric Emptying Study	12 (7.6)	4 (5.1)	8 (10.1)	0.22
% Residual, median (IQR)**	60 (45, 67)	52 (39, 84)	63 (45, 66.5)	–

* P-values are from conditional logistic regression

Comparison of the frequency of total admissions and respiratory-related admissions prior to primary GT placement in GT patients versus those patients converted to GJ feedings.

Table 3

	GT patients N=79			GJ patients N=79			
	Range	Median (IQR)	Mean±SD	Range	Median (IQR)	Mean±SD	p-value*
Total Admissions	1 – 27	2 (1, 5)	3.4±3.8	1 – 15	2 (1, 4)	2.9±2.3	0.25
Respiratory Admissions	0 – 4	0 (0, 1)	0.8±1.1	0 – 4	0 (0, 1)	0.6±0.9	0.32

* P-value from conditional logistic regression, adjusted for time from birth until initial GT placement.