

Why Wait?: Early Enteral Feeding After Pediatric Gastrostomy Tube Placement

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ABSTRACT

Purpose: Early initiation of feedings after gastrostomy tube (GT) placement may reduce associated hospital costs, but many surgeons fear complications could result from earlier feeds. We hypothesized that, irrespective of placement method, starting feedings within the first six hours following GT placement would not result in a greater number of post-operative complications.

Methods: An IRB-approved retrospective review of all GTs placed between January 2012 and December 2014 at three academic institutions was undertaken. Data was stratified by placement method and whether the patient was initiated on feeds at less than six hours or after. Baseline demographics, operative variables, post-operative management and complications were analyzed. Descriptive statistics were used and p-values<0.05 were considered significant.

Results: 1048 patients met inclusion criteria. GTs were inserted endoscopically (48.9%), laparoscopically (44.9%), or via an open approach (6.2%). Demographics were similar in early and late fed groups. When controlling for method of placement, those patients who were fed within the first six hours after gastrostomy placement had shorter lengths of stay compared to those fed greater than six hours after placement ($p<0.05$). Total post-operative outcomes were equivalent between feeding groups for all methods of placement (laparoscopic ($p=0.87$), PEG ($p=0.94$), open ($p=0.81$)).

Conclusions: Early initiation of feedings following GT placement was not associated with an increase in complications. Feeds initiated earlier may shorten hospital stays and decrease overall hospital costs.

Key Words: gastrostomy tube placement; early feedings; outcomes; pediatric

Type of Study: Multi-institutional Retrospective

Level of Evidence: III

1. INTRODUCTION

Gastrostomy tube (GT) placement is one of the most commonly performed procedures in pediatric surgical practice [1]. GTs are placed for a variety of indications including significant neurologic disability preventing oral feeding, congenital heart disease, renal failure, metabolic disorders, and for nutritional supplementation in children with failure to thrive or feeding dysfunction [2, 3]. The timing of initiation of feedings following GT placement continues to be non-standardized and dependent on both institutional practices and surgeon preferences [4]. This lack of standardization can result in variability in the average length of hospital stay, which secondarily can increase overall acquired hospital costs.

Previous literature demonstrated that early feeding (i.e. within 1-6 hours) is safe following percutaneous endoscopic gastrostomy (PEG) placement [5-8]. Additionally, a randomized prospective trial of early feeding after PEG found that starting feedings as early as the first hour after placement does not increase short-term or long-term complication rates [9]. Prior studies have focused only on PEG placement with no reports in the literature describing the safety of early feeding after laparoscopic or open placement of gastrostomy tubes.

The laparoscopic technique is currently one of the most common methods for gastrostomy tube placement in pediatric patients. Comparisons of PEG and laparoscopic placement methods have demonstrated the techniques have similar outcomes, with some studies reporting lower complication rates with laparoscopically placed tubes [10-12]. In keeping with recent national efforts to improve standardization of care, which can maintain quality care while decreasing hospital costs, we identified post-operative practices after GT placement as a target for improvement. We hypothesized that: 1) regardless of placement technique, initiation of feedings early (at or prior to six hours) in the post-operative period would not be associated with an increase in the frequency of post-operative complications when compared to later (after six hours) initiation of feedings, and 2) earlier initiation of feedings would be associated with shorter length of hospital stay.

2. METHODS

2.1. Study Design

After individual Institutional Review Board approval, three individual academic institutions reviewed patient electronic medical records for pediatric patients (age <18 years) who underwent gastrostomy tube/button placement during a three-year period from January 2012 to December 2014. Patients with gastrojejunostomy placement were excluded. In addition, patients whose records lacked information regarding feeding data in the immediate post-operative period were excluded. Patients who underwent gastrostomy tube placement were identified by the Current Procedural Terminology (CPT) codes for open placement, PEG placement, and laparoscopic placement.

2.2. Outcomes

Charts were reviewed and the following data was extracted: patient demographics, indication for procedure, operative time, antibiotic administration, placement method, concurrent procedures, post-operative management including feeding initiation of enteral feeds and time to full feeds, post-operative narcotic use, and post-operative complications.

2.3. Definitions

“Early feeding” was defined as initiation of gastrostomy feeds at less than or equal to six hours following placement while “late feeding” was defined as initiation of gastrostomy feedings later than six hours after placement. Six hours was defined as the cutoff for “early feedings” based on a literature search for studies examining early feedings following PEG placement [6, 7]. Included post-operative complications were restricted to those occurring within two weeks following surgery in order to ensure that identified complications were related to the procedure itself. “Stoma site infection” was defined as cellulitis or abscess requiring antibiotic therapy. “GT leak” was defined as an extra-abdominal leak requiring intervention. “Vomiting” was defined as any emesis within the first 24 hours after GT placement. “Delay in advancement of feeds” was defined as any discontinuation of feeds following initiation. “Aspiration” was defined as entry of

feeds from the GI tract into lower respiratory tract following GT placement as documented in physician notes. "Need for the operating room" (OR) was defined as any unexpected trip to the OR for an unplanned intervention related to the GT. "Hemorrhage" was defined as bleeding related to the gastrostomy tube site and requiring intervention for treatment, such as transfusion or operative procedure. "Tube dislodgement" was defined as any unintentional extrusion of the GT. "Peritonitis" was defined as an exam consistent with progressive intra-abdominal inflammation as documented in physician notes. "Death" was defined as a death related to the GT as opposed to other underlying medical conditions.

2.4. Statistical Analysis

All statistical analyses were performed using IBM SPSS 24 statistical software (Chicago, IL). Data was stratified by procedure type (laparoscopic, PEG or open) along with early or late feedings (before six hours or after six hours). All baseline demographics, operative details, peri-operative management and post-operative complications were summarized using medians with interquartile ranges (quartile 1-quartile 3) for continuous variables and frequencies with percentages for categorical variables (none of the data was normally distributed). To compare patient characteristics and post-operative outcomes between patients with early and late initiation of feeds, Pearson Chi-Square or Fisher exact tests were used for categorical variables and Mann Whitney U tests were used for continuous variables. P-values <0.05 were considered statistically significant.

3. RESULTS

3.1. Patient Characteristics

From 2012-2014 1086 pediatric patients underwent gastrostomy tube or button placement. Procedures were performed by 28 individual surgeons with 39 ± 8 (mean \pm SEM) cases performed per surgeon. Regarding surgical preferences, 10 of the surgeons preferred the laparoscopic method, 10 preferred PEG placement, 2 preferred open placement, 2 had an equal mixture of both LAP and PEG, and 4 of them did not express a defined preference. Of these

gastrostomy placements, 38 patients were excluded for missing data regarding initiation of feeds (13 (1.2%) laparoscopic, 20 (1.8%) PEG, and 5 (0.5%) open). Excluded patients did not differ from the included patients with regards to demographic data, surgical management and post-operative complications. Of the 1048 included patients, 490 (46.8%) started feedings within six hours post-operatively while 558 (53.2%) started feedings more than six hours after surgery. There were no significant differences between laparoscopic and open groups for age, gender, and weight at time of procedure (Table 1). In the PEG group, patients who started on feedings after six hours tended to be older and had higher weights. When these three placement groups were combined there were no significant differences between the early and late feeding groups with regards to age, gender and weight ($p=0.21$, 0.86 , and 0.33 respectively). Patients underwent GT placement for a variety of indications within all groups.

3.2. Operative Variables

Operative time for all gastrostomy tube placements had a median of 40.5 (21-69) minutes. Interestingly, when this was stratified by type, the patients in the laparoscopic group who were fed early had statistically significantly longer operative times compared to those fed late ($p<0.01$; Table 2). In the PEG group, patients who were fed late had longer operative times ($p<0.01$). There was no difference with regards to initiation of feeds and operative time in the open group ($p=0.61$). Most patients were given cefazolin (89.1%) peri-operatively. Patients in the PEG group who were started on feeds at or before six hours were more likely to undergo a concurrent procedure (13.5%) compared to those patients who were started on feeds later (8.8%, $p=0.02$). There was no significant difference between patients who underwent a concurrent procedure with GT placement with regards to initiation of feeding in the laparoscopic and open groups ($p=0.2$ and 0.43 respectively).

3.3. Post-Operative Care

A total of 101 (9.6%) patients went to the PICU and 189 (18.1%) went to the NICU post-operatively. A total of 181 (17.3%) patients remained intubated post-operatively. When analyzed

as a group and not respective of procedure, patients in the PICU, patients in the NICU, and those remaining intubated were more likely to start feedings later than six hours post-operatively ($p<0.1$, $p<0.01$, $p<0.01$ respectively; Table 2). When stratified by gastrostomy type, PEG patients in the PICU or remaining intubated were more likely to start late feeds. Similarly, in the laparoscopic group, those in the NICU or intubated post-operatively were more likely start feeds after six hours ($p<0.01$, $p<0.01$ respectively; Table 2). In the open group, there was no statistically significant difference among these patients with regards to initiation of feeding although this may have been due to the small number of patients analyzed within this group.

Overall, the type of initial feeding (pedialyte, breast milk, or formula; Table 2) was not associated with a difference in post-operative feeding practice. However, mode of initial feeding was associated with a difference in timing. In both the laparoscopic and open groups, there was an association between bolus feeding and early initiation, and continuous feeding with later initiation of feeding. Most patients in the PEG group were started on bolus feeds regardless of timing of initiation of feeding (81.6%, $p<0.01$).

The results demonstrated that timing of feeding had some important associations with post-operative course. In the laparoscopic group, fewer patients fed early received post-operative narcotics when compared to those fed later (22.9% vs. 57.5%, $p=0.03$; Table 3). This difference was not seen in those patients undergoing PEG or open placement ($p=0.18$ and $p=0.69$ respectively). Both the PEG and open placement groups did not have significant differences in the number of narcotic doses given between early and late fed groups ($p=0.7$ and $p=0.6$ respectively).

With respect to time from surgery to full feeds, patients who were initiated on feeds at less than six hours reached full feeds faster ($p<0.01$ in all groups; Table 3). However, this difference disappeared for some placement groups when the time from actual initiation to achievement of full feeding was examined. Once started on feeds, patients in the PEG group advanced very quickly to full feeds irrespective of early initiation or late initiation of feeds (14 (8-

19.25) hours vs. 13 (6-26) hours, $p=0.44$; Table 3). Of those in the open placement group, there was no statistical difference in the time it took to reach full feeds between patients who had late initiation of feeds compared to those started early (early 15 (6-41.5) hours vs. 28 (14-50) hours, $p=0.22$). In the laparoscopic group, those in the early group more quickly advanced to full feeds compared to late-starters ($p<0.01$). Therefore, the delay in initiation of feeding was associated with significant contribution to an overall delay in achievement of full feeding, while starting feedings earlier was not associated with a slower course of advancement of feeds. Early feeding was also associated with shorter overall length of stay regardless of placement type ($p<0.01$ in all groups).

3.4. Post-Operative Complications

With regards to post-operative outcomes, overall the early and late groups had similar rates of complications, regardless of type of placement (laparoscopic $p=0.87$, PEG $p=0.94$, open $p=0.81$; Table 3). When examining specific complications, late feeding was associated with more emesis within the first 24 hours for those undergoing laparoscopic placement ($p<0.01$). There were no differences seen between groups in terms of stoma site infection, GT leak, feeding intolerance, delay in advancement of feeds, aspiration, hemorrhage, tube dislodgement, peritonitis or death in any of the gastrostomy placement types (Table 3).

4. DISCUSSION

This study evaluated the outcomes of patients following different post-operative feeding practices. While three different types of insertion practices were used in the care of these children, overall, this study demonstrated no significant association between timing of initiation of feeding and post-operative complications, irrespective of gastrostomy placement method. Although multiple studies have examined the post-operative outcomes of PEG tubes with regards to early feeds, there is limited published data on early feeds in patients following laparoscopic GT placement.

A study done by Sunstrom et al. examined implementation of a standard protocol for gastrostomy tube placement in which patients who underwent laparoscopic GT placement were fed 8 hours after placement [13]. They demonstrated that starting feeds eight hours after surgery did not worsen the post-operative complication rate. Other institutions have also developed standardized protocols in which feeds were initiated as early as 4 hours after PEG tube placement with minimal complications [6]. When examining early feeding following PEG tube placement in children, Werlin et al. had no complications related to feeds initiated six hours after the procedure with full volume feeds accomplished within 24 hours of initiation [7]. In this study, when feedings were initiated at or less than six hours following placement, the time from completion of surgical procedure to achievement of full feeds was shorter than with later initiation of feeding, regardless of procedure type. In addition, this study did not see an association between timing of initiation of feedings and rate of post-operative complications.

The study of laparoscopic GT placement noted above also found that a standardized protocol with early initiation of feeds significantly decreased hospital length of stay [13]. However, due to the small size of the study, a difference in acquired hospital costs between the two groups was not observed. Similarly with PEG tubes, Islek et al. observed a significant reduction in duration of hospital stay from 28.3 ± 3.74 hours in the late feeding group compared to 6.7 ± 0.64 hours in the early feeding group ($P < 0.001$) [8].

In this study, there was an association between time to full feeding and timing of initiation of feeding. However, when the total time from initiation to goal was examined, there was no difference between the early and late groups for the PEG and open placement groups. The data seems to suggest that once feeds are initiated, similar schedules for advancement to goal are used. Therefore, the difference in the amount of time needed to reach feeding goal may be the time delay from surgery to initiation of feeding, which, according to individual physician practice, may be 12 hours, overnight, or even 24 hours after placement procedure. This in turn is reflected in the difference in length of stay that was associated with the early and

late groups. Our study seems to suggest that there is no real benefit derived from delaying feeds for more than 6 hours after tube placement.

5. LIMITATIONS

There are several limitations to our study. First, the data collected was retrospective in nature. Although all charts were reviewed, there may have been differences in surgeon specific practice that led to variations in outcomes that we are unable to account for with this study design. Secondly, while we examined indications for procedure, an ASA classification score for each patient was not obtained. It is difficult to determine if those patients in our cohort that were in the group that was fed after six hours had feedings held due to severity of other co-morbidities. We surmise though that most children who were “well enough” to undergo a surgical procedure for gastrostomy placement should not have had any current contraindications (i.e. hemodynamic instability, uncorrectable coagulopathy, distal enteral obstruction, etc.) since it is, for the most part, an elective procedure. Thus, we believe that these patients should be medically well enough to initiate feedings following surgery. To that end, the decision to start feedings late was likely surgeon preference based on perceived complications associated with early feeding.

6. CONCLUSIONS

The management of gastrostomy tubes post-operatively varies greatly. Results of this study have demonstrated that regardless of placement technique, initiation of feedings early in the post-operative period is not associated with a higher complication rate. Our findings suggest early initiation of feedings following gastrostomy tube placement irrespective of placement method is safe and feasible. Additionally, we observed an association between earlier initiation of feedings and a decreased length of hospital stay. To this end, earlier feeding may decrease hospital stays and overall costs. Early initiation of feeds should be considered for all pediatric patients following gastrostomy tube placement. Future prospective studies and those evaluating

the implementation of a standardized post-procedure feeding protocol can assist physicians in expediting the care of pediatric patients requiring gastrostomy tubes.

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7. TABLE LEGENDS

Table 1. Baseline characteristics for included patients.

Table 2. Peri-operative variables for patients with feeding initiation before six hours and after six hours.

Table 3. Post-operative patient care for patients with initiation of feeds before six hours and after six hours and post-operative outcomes within two weeks of gastrostomy tube placement.

Table 1.

Baseline Characteristics	LAPAROSCOPIC			PEG			OPEN			TOTAL		
	p=471			p=512			p=65			p=1048		
	Initiation of Feeds:		P-Value	Initiation of Feeds:		P-Value	Initiation of Feeds:		P-Value	Initiation of Feeds:		P-Value
≤ 6 hours	After 6 hours	≤ 6 hours		After 6 hours	≤ 6 hours		After 6 hours	≤ 6 hours		After 6 hours		
	(N=124 (26.3))	(N=347, (73.7))		(N=357, (69.7))	(N=155, (30.3))		(N=9, (13.8))	(N=56, 86.2))		(N=490, (46.8))	(N=558, (53.2))	
Age at Procedure (months)	6.5 (3-11)	6.5 (2-28)	0.65	8 (5-18)	21 (7-97)	<0.01*	7 (2-14.5)	7 (3-21.5)	0.32	8 (4-15)	9 (3-37.25)	0.21
Male	71 (57.3)	177 (51)	0.23	184 (51.5)	89 (57.4)	0.22	4 (44.4)	32 (57.1)	0.5	259 (52.9)	298 (53.4)	0.86
Weight (kg)	6.3 (4.9-8.1)	5.9 (3.9-10.4)	0.35	7.6 (5.79-10.4)	9.7 (6.12-18.6)	<0.01*	5.38 (4.75-7.1)	5.78 (3.6-11.1)	0.92	7.2 (5.5-9.9)	7.0 (4.1-12.6)	0.33
Indication			<0.01*			<0.01*			0.67			<0.01*
<i>Failure to Thrive</i>	22 (4.7)	104 (22.1)		66 (12.9)	35 (6.8)		2 (3.1)	15 (23.1)		90 (8.6)	154 (14.7)	
<i>Feeding Dysfunction</i>	69 (14.6)	110 (23.4)		189 (36.9)	63 (12.3)		4 (6.2)	18 (27.7)		262 (25)	191 (18.2)	
<i>Congenital Heart Disease</i>	11 (2.3)	22 (4.7)		30 (5.9)	9 (1.8)		1 (1.5)	2 (3.1)		42 (4.0)	33 (3.1)	
<i>Neurological Disease</i>	13 (2.8)	80 (17)		52 (10.2)	22 (4.3)		0 (0)	8 (12.3)		65 (6.2)	110 (10.5)	
<i>Renal Failure</i>	0 (0.0)	7 (1.5)		2 (0.4)	7 (1.4)		0 (0)	0 (0)		2 (0.2)	14 (1.3)	
<i>Metabolic Disorder</i>	2 (0.4)	5 (1.1)		10 (2)	5 (1)		0 (0)	3 (4.6)		12 (1.1)	13 (1.2)	
<i>Other</i>	7 (1.5)	19(4)		8 (1.6)	14 (2.7)		2 (3.1)	10 (15.4)		17 (1.6)	13 (4.1)	

Significant values (p<0.05). Data summarized as median (interquartile range) for continuous variables and frequency (percentage of total for gastrostomy type) for categorical variables. P values are from Pearson Chi-Square or Fisher exact tests for categorical variables and Mann Whitney U tests for continuous variables.

Table 2.

Peri-Operative Variables	LAPAROSCOPIC			PEG			OPEN			TOTAL		
	N=471			N=512			N=65			N=1048		
	Initiation of Feeds:			Initiation of Feeds:			Initiation of Feeds:			Initiation of Feeds:		
	≤ 6 hours	After 6 hours	P-Value	≤ 6 hours	After 6 hours	P-Value	≤ 6 hours	After 6 hours	P-Value	≤ 6 hours	After 6 hours	P-Value
	(N=124 (26.3))	(N=347, (73.7))		(N=357, (69.7))	(N=155, (30.3))		(N=9, (13.8))	(N=56, 86.2))		(N=490, (46.8))	(N=558, (53.2))	
Operative Time (min)	66 (33-94.5)	40 (26.5-71.5)	<0.01*	25 (13-53)	41 (16-67)	<0.01*	47 (42.5-76.5)	54 (38.5-91.5)	0.61	37 (16-62.5)	41 (25-72)	<0.01*
Concurrent Procedure	39 (8.3)	88 (18.7)	0.2	69 (13.5)	45 (8.8)	0.02*	1 (1.5)	17 (26.2)	0.43	109 (10.4)	150 (14.3)	0.08
PICU	8 (1.7)	37 (7.9)	0.17	23 (4.5)	27 (5.3)	<0.01*	0 (0)	6 (9.2)	0.58	31 (3.0)	70 (6.7)	<0.01*
NICU	20 (4.2)	116 (24.6)	<0.01*	20 (3.9)	15 (2.9)	0.09	1 (1.5)	17 (26.2)	0.43	41 (3.9)	148 (14.1)	<0.01*
Remained Intubated	10 (2.1)	107 (22.8)	<0.01*	20 (3.9)	28 (5.5)	<0.01*	0 (0)	16 (24.6)	0.1	30 (2.9)	151 (14.4)	<0.01*
TPN Use	1 (0.2)	53 (11.5)	<0.01*	4 (1.1)	7 (4.6)	0.02*	0 (0)	11 (17.5)	0.34	5 (0.5)	71 (6.9)	<0.01*
Type of Initial Feed			0.19			0.6			0.83			<0.01*
<i>Pedialyte</i>	13 (2.8)	60 (12.9)		30 (5.9)	17 (3.4)		2 (3.1)	18 (27.7)		45 (4.4)	95 (9.2)	
<i>Breastmilk</i>	12 (2.6)	34 (7.3)		22 (4.4)	8 (1.6)		1 (1.5)	5 (7.7)		35 (3.4)	47 (4.5)	
<i>Formula</i>	97 (20.9)	248 (53.4)		301 (59.6)	127 (25.1)		6 (9.2)	33 (50.8)		404 (39.1)	408 (39.5)	
Mode of Initial Feed			<0.01*			<0.01*			0.03*			<0.01*
<i>Continuous</i>	11 (2.3)	210 (44.8)		44 (8.6)	50 (9.8)		2 (3.1)	36 (55.4)		57 (5.5)	296 (28.4)	
<i>Bolus</i>	112 (23.9)	136 (29)		311 (61.0)	105 (20.6)		7 (10.8)	20 (30.8)		430 (41.2)	261 (25)	

Significant values ($p < 0.05$). Data summarized as median (interquartile range) for continuous variables and frequency (percentage of total type) for categorical variables. P values are from Pearson Chi-Square or Fisher exact tests for categorical variables and Mann Whitney U tests for continuous variables.

Table 3.

	LAPAROSCOPIC			PEG			OPEN			TOTAL		
	N=471			N=512			N=65			N=1048		
	Initiation of Feeds:			Initiation of Feeds:			Initiation of Feeds:			Initiation of Feeds:		
	≤ 6 hours	After 6 hours	P-Value	≤ 6 hours	After 6 hours	P-Value	≤ 6 hours	After 6 hours	P-Value	≤ 6 hours	After 6 hours	P-Value
	(N=124 (26.3))	(N=347, (73.7))		(N=357, (69.7))	(N=155, (30.3))		(N=9, (13.8))	(N=56, 86.2))		(N=490, (46.8))	(N=558, (53.2))	
Post-Operative Care												
Narcotic Use	108 (22.9)	271 (57.5)	0.03*	323 (90.5)	134 (86.5)	0.18	6 (9.4)	41 (64.1)	0.69	437 (41.7)	446 (42.6)	<0.01*
# Narcotic Doses	4 (2-7)	3 (1-6)	0.02*	5.5 (3-8.25)	6 (2-9)	0.7	1 (0-5.5)	2 (0-5)	0.6	5 (2-8)	4 (1-7)	<0.01*
Surgery to Full Feeds (hours)	17.4 (11.3-24.5)	58.3 (43.3-85.3)	<0.01*	17.66 (11.4-23.7)	23.65 (16.3-41.9)	<0.01*	18.3 (11.6-43.3)	51.1 (40.9-78.5)	<0.01*	17.6 (11.4-23.8)	49.7 (31.3-75.8)	<0.01*
Initiation to Full Feeds (hours)	12.5 (6-20)	25 (15-52)	<0.01*	14 (8-19.25)	13 (6-26)	0.44	15 (6-41.5)	28 (14-50)	0.22	14 (7-20)	22 (12-46)	<0.01*
Length of Stay (days)	1 (1-5)	6.5 (4-14.5)	<0.01*	1 (1-2)	2 (1-7)	<0.01*	1 (1-2)	5 (3-25)	<0.01*	1 (1-3)	5 (3-12)	<0.01*
Post-Operative Complications												
Stoma Site Infection	7 (1.5)	9 (1.9)	0.14	41 (8)	11 (2.2)	0.13	0 (0)	6 (9.5)	0.58	48 (4.6)	26 (2.5)	<0.01*
G-tube Leak	1 (0.2)	11 (2.3)	0.2	14 (2.7)	8 (1.6)	0.52	2 (3.1)	3 (4.6)	0.14	17 (1.6)	22 (2.1)	0.69
Vomiting within 24 hours	24 (5.1)	31 (6.6)	<0.01*	72 (14.1)	26 (5.1)	0.39	3 (4.6)	5 (7.7)	0.07	99 (9.5)	62 (5.9)	<0.01*
Feeding Intolerance	11 (2.3)	41 (8.7)	0.37	19 (3.7)	9 (1.8)	0.83	1 (1.5)	4 (6.2)	0.54	31 (3.0)	54 (5.2)	0.05*
Delay in Advancement of Feeds	8 (1.7)	35 (7.4)	0.23	21 (4.1)	15 (2.9)	0.12	0 (0)	7 (10.8)	0.58	29 (2.8)	57 (5.4)	0.01*
Aspiration	0 (0)	5 (1.1)	0.33	3 (0.6)	0 (0)	0.56	0 (0)	1 (1.5)	0.99	3 (0.3)	6 (0.6)	0.51
Need for OR	0 (0)	4 (0.8)	0.58	0 (0)	3 (0.6)	0.03*	0 (0)	2 (3.1)	0.99	0 (0)	9 (0.9)	<0.01*
Hemorrhage	0 (0)	1 (0.2)	0.99	2 (0.4)	0 (0)	0.99	0 (0)	0 (0)		2 (0.2)	1 (0.1)	0.6
Tube Dislodgement	1 (0.2)	9 (1.9)	0.47	2 (0.4)	2 (0.4)	0.59	0 (0)	3 (4.6)	0.99	3 (0.3)	14 (1.3)	0.02*
Peritonitis	0 (0)	1 (0.2)	0.99	0 (0)	1 (0.2)	0.3	0 (0)	1 (1.5)	0.99	0 (0)	3 (0.3)	0.25
Death	2 (0.4)	1 (0.2)	0.11	0 (0)	1 (0.2)	0.3	0 (0)	2 (3.1)	0.99	2 (0.2)	4 (0.4)	0.69
Total Complications	54 (3.64)	148 (3.56)	0.87	174 (4.06)	76 (4.11)	0.94	6 (5.56)	34 (5.07)	0.81	234 (3.98)	258 (3.86)	0.75

* Significant values (ps0.05). Data are summarized as median (interquartile range) for continuous variables and frequency (percentage of total type) for categorical variables. P values are from Pearson Chi-Square or Fisher exact tests for categorical variables and Mann Whitney U tests for continuous variables.