



Tapering duodenoplasty: a beneficial adjunct in the treatment of congenital duodenal obstruction

Lindel C. Dewberry¹ , Sarah A Hilton¹,
Raphael N. Vuille-dit-Bille²  and
Kenneth W. Liechty³

Abstract

Objective: Congenital duodenal obstruction is typically treated by duodenoduodenostomy. Tapering of the dilated segment has been indicated to reduce duodenal dysmotility. The purpose of this study was to review the outcomes between these two approaches.

Methods: We retrospectively reviewed cases of duodenal obstruction repair performed at a quaternary care referral pediatric hospital from 2007 to 2017. The length of stay, time to full enteral feeding, and complications were compared between patients who underwent duodenoduodenostomy with and without tapering duodenoplasty (n=4 and n=35, respectively).

Results: Both groups had similar times to initial enteral feeding (7 days) and full enteral feeding (14 vs. 15 days). Among the 35 patients who underwent duodenoduodenostomy alone, 6 (17%) required a return to the operating room; in contrast, no patients who underwent tapering required a return to the operating room. Of those who returned to the operating room, two underwent tapering at that time because of duodenal dilation and feeding intolerance.

Conclusions: Although limited by the small sample size, this study suggests that patients undergoing tapering duodenoplasty may have a slightly shorter time to full enteral feeding and a lower rate of complications than patients undergoing duodenoduodenostomy alone.

¹Department of Surgery, University of Colorado, Denver, CO, United States

²Department of Surgery, Kantonsspital Winterthur, Winterthur, Switzerland

³Division of Pediatric Surgery, Children's Hospital of Colorado, Denver, CO, United States

Corresponding author:

Lindel C. Dewberry, Department of Surgery, University of Colorado, 1016 Cook Street, Denver, CO 80206, United States.

Email: lindel.krige@gmail.com



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Introduction

Congenital duodenal obstruction occurs in approximately 1 in 5000 live births.¹ It may be associated with other anomalies including trisomy 21, cardiac defects, malrotation, and, less frequently, esophageal atresia and anorectal malformations. Congenital duodenal obstruction is caused by atresia, stenosis, duodenal web formation, or an annular pancreas. Duodenal obstruction may cause mega-duodenum, leading to stasis and feeding intolerance.² Although the dilation is related to the distal obstruction, associated dysmotility also occurs because the bowel wall cannot contract and provide the pressure gradient necessary for peristalsis even after the obstruction is relieved.^{3,4} This may lead to bile reflux and gastroesophageal reflux disease in the short term⁵ and poor weight gain, chronic abdominal pain, and blind loop syndrome in the long term.^{6,7}

Congenital duodenal obstruction is treated by open or laparoscopic duodenoduodenostomy⁸ or duodenojejunostomy. Tapering of the proximal dilated duodenum has been indicated to reduce dysmotility and associated symptoms resulting from mega-duodenum. The present study was performed to compare the outcomes of patients undergoing treatment for duodenal obstruction with duodenoduodenostomy with versus without tapering duodenoplasty.

Methods

Study design

We retrospectively reviewed all patients who had undergone surgery for congenital

duodenal obstruction (i.e., open or laparoscopic duodenoduodenostomy or duodenojejunostomy) with or without tapering enteroplasty of the dilated proximal duodenum from 2007 to 2017. All surgeries were performed at a quaternary care center. The study was approved by the Colorado Institutional Review Board (protocol number 17-1838). Consent was not required because a de-identified chart review was performed.

Patients

Patients were included using the International Classification of Diseases 9th and 10th edition diagnostic codes for congenital duodenal obstruction. Patients were excluded if they had duodenal obstruction for any reason other than atresia (e.g., annular pancreas, stenosis, or duodenal web). The patients were then divided into those who had undergone tapering enteroplasty at the time of the duodenoduodenostomy and those who had undergone duodenoduodenostomy alone.

Surgical procedure

All surgical procedures were performed by board-certified pediatric surgeons or under their direct supervision. For tapering duodenoplasty, a transverse incision was made in the right upper abdominal quadrant, and the right colon was mobilized to expose the duodenum. A diamond-shaped duodenoduodenostomy was performed between the first and third portions of the duodenum, and a red rubber catheter was passed distally to check for distal patency.

Traction sutures were then placed at the pylorus and proximal to the anastomosis to perform the tapering procedure. A red rubber catheter was used as a stent, and half of the duodenal circumference was removed with an Endo GIA stapler (Medtronic, Dublin, Ireland), taking care to stay clear of the ampulla of Vater. The staple line was oversewn with interrupted 5-0 silk sutures.

Data review

The electronic medical records of selected patients were reviewed for demographic information, comorbidities, length of stay, length of time to initial and full enteral feeding, postoperative complications (including return to the operating room), requirement for later fundoplication, and mortality. Preoperative abdominal radiographs were used to estimate the duodenal diameter in each group.

Statistical analysis

Data are presented as median with interquartile range for continuous variables and as proportion for categorical variables. Groups were compared using the Wilcoxon rank sum test (continuous variables) or the two-tailed Fisher's exact test (categorical variables). All p-values of <0.05 were considered statistically significant. Linear regression models were used with the time to full enteral feeding as the dependent variable and gestational age (prematurity vs. term), associated disorders (trisomy 21, cardiac disease, and malrotation), laparoscopic (vs. open) repair, and duodenal tapering (vs. not) as independent variables based on a bivariate analysis. All analyses were performed using Stata software (StataCorp, College Station, TX, USA).

Results

Patient demographics

Thirty-five patients underwent duodeno-duodenostomy alone and four underwent duodenoduodenostomy with concurrent duodenoplasty. Only one patient underwent duodenojejunoscopy (in the non-tapered group). The mean age at surgery was 2 days in each group. The distribution of males and females was even between the groups. Both groups had similar proportions of premature infants. The non-tapered group had higher proportions of patients with malrotation (14% vs. 0%) and trisomy 21 (31% vs. 0%), and the tapered group had a higher proportion of patients with cardiac disease (50% vs. 26%) (Table 1).

No patients in the tapered group underwent laparoscopic repair, while 26% (9/35) patients in the non-tapered group underwent laparoscopic repair. A transanastomotic tube was placed in 35% (12/34) of duodenoduodenostomy repairs, and none were placed in the tapered group. The length of surgery was 140 minutes in the tapered group and 120 minutes in the non-tapered group. The estimated blood loss was minimal in both groups. The duodenal diameter was slightly higher in the tapered group (33 mm) than in the non-tapered group (27 mm) (Table 1).

Outcomes

The length of stay was 5 days longer in the duodenoplasty group (32 vs. 27 days), but the time to full enteral feeding was 1 day shorter (14 vs. 15 days). The time to initial enteral feeding was the same in both groups (median of 7 days). The route of initial feeding was gavage in 75% (3/4) of patients in the tapered group compared with a more even distribution in the non-tapered group

Table 1. Patient characteristics between duodenoduodenostomy with and without duodenoplasty.

	Duodenoduodenostomy with duodenoplasty (n = 4)	Duodenoduodenostomy alone (n = 35)	p-value
Age at surgery, days	2 (2–6)	2 (2–5)	0.80
WGA	37 (35–38)	38 (35–38)	0.85
Duodenal diameter, mm	33	27	0.43
Laparoscopic repair	0/4 (0%)	9/35 (26%)	0.60
TA tube placed	0/4 (0%)	12/34 (35%)	0.30
Length of surgery, min	140 (130–145)	120 (110–140)	0.30
Male	2/4 (50%)	18/35 (51%)	0.89
Comorbidities			
Prematurity	2/4 (50%)	16/35 (46%)	0.30
Cardiac disease	2/4 (50%)	9/35 (26%)	0.60
Malrotation	0/4 (0%)	5/35 (14%)	1.00
Trisomy 21	0/4 (0%)	11/35 (31.4%)	0.30

Data are presented as median (range) or n (%) unless otherwise indicated.

WGA, weeks gestational age; TA, transanastomotic.

Table 2. Patient outcomes between duodenoduodenostomy with and without duodenoplasty.

	Duodenoduodenostomy with duodenoplasty (n = 4)	Duodenoduodenostomy alone (n = 35)	p-value
LOS, days	32 (14–55)	27 (18–48)	0.90
Time to initiation of feeding, days	7 (6–7)	7 (4–11)	0.90
Nissen fundoplication	0/4 (0%)	0/34 (0%)	
Time to full feeding, days	14 (11–20)	15 (10–26)	0.70
Route of feeding			0.28
Mouth	1/4 (25%)	9/32 (28%)	
Orogastric/nasogastric tube	3/4 (75%)	12/32 (38%)	
Transanastomotic tube	0/4 (0%)	11/32 (34%)	
Complications			
Minor	0/4 (0%)	1/35 (3%)	1.00
Major	0/4 (0%)	6/35 (17%)	1.00
Reoperation within 30 days	0/4 (0%)	4/35 (11%)	1.00

Data are presented as median (range) or n (%).

LOS, length of stay.

among oral (28%), gavage (38%), and transanastomotic tube feeding (34%).

Patients who underwent duodenostomy with duodenoplasty had no complications, compared with a 17% (6/35) rate of major complications (return to the operating room) in the duodenostomy alone group (Table 2). The major complications involved a return to the operating room

for the following reasons: adhesive small bowel obstruction (n = 1), anastomotic revision (n = 3), feeding intolerance (n = 1), exploratory laparotomy for pneumatosis (n = 1), and exploratory laparotomy with necrosis of the entire small bowel (n = 1). Adhesive small bowel obstruction occurred in a patient who underwent open duodenoduodenostomy. The anastomoses were

revised in three patients because they were considered to be too narrow. Of these three patients, two underwent tapering at the time of the second operation. Those who underwent surgery for gastric feeding intolerance had a gastrojejunostomy tube placed. The patients with pneumatosis were found to have a dilated colon, and colonic biopsies revealed a diagnosis of Hirschsprung disease. The patient with pan small bowel necrosis had a history of tetralogy of Fallot and developed sudden abdominal distention and clinical deterioration; pan small bowel necrosis of unclear etiology was found on laparotomy. The one minor complication in the duodenoduodenostomy alone group was deep venous thrombosis.

Linear regression was performed to evaluate predictors of the time to full enteral feeding, and no factors were statistically significant [including prematurity, cardiac disease, malrotation, type of duodenal repair (laparoscopic vs. open), or type of repair (resection vs. tapering)].

Discussion

This study has demonstrated the potential benefit of tapering duodenoplasty in patients with congenital duodenal obstruction and associated megaduodenum. Although the study was underpowered to detect statistical significance, the data showed a trend toward earlier achievement of full enteral nutrition and a decreased proportion of patients requiring a reoperation for duodenal dilation.

A decreased time to enteral feeding was also noted by Adzick et al.⁹ in their review of six patients. They performed tapering duodenoplasty in patients with a megaduodenum measuring ≥ 5 cm. Using this technique, they initiated feeding within <7 days in these patients, suggesting a faster time to return of normal bowel motility, consistent with our results.⁹ In our study, tapering was

left to the discretion of the surgeon, but those who chose to taper based their decision on a 4:1 mismatch of proximal:distal bowel. Weisgerber and Boureau¹⁰ also demonstrated a shorter time to initiation of enteral feeding. Other techniques of duodenoduodenostomy without tapering have shown similarly high rates of reoperation for duodenal dilation and bowel dysmotility ranging from 4% to 18%.^{2,11} Notably, however, these studies are older; therefore, most of the duodenoduodenostomies were side-to-side rather than diamond-shaped, whereas most of the patients in our study underwent diamond-shaped duodenoduodenostomies.

The optimal surgical technique for congenital duodenal obstruction continues to evolve. Although limited by its small sample size and retrospective nature, this study highlights the potential benefit of tapering duodenoplasty as an adjunct in patients with megaduodenum with respect to the time to full enteral feeding as well as a lower rate of reintervention for bowel dysmotility and duodenal dilation.


Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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ORCID iD

Lindel C. Dewberry  <https://orcid.org/0000-0002-8135-7356>

Raphael N. Vuille-dit-Bille  <https://orcid.org/0000-0002-0884-9493>

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