Duodenojejunal Bypass and Strictureplasty for Diffuse Small Bowel Crohn's Disease with a Step-by-Step Visual Guide

Chun Hin Angus Lee MD,[*] *Florian Rieder MD,*[†] *and Stefan D. Holubar MD, MS*[*]

Duodenal strictures in Crohn's disease (CD) are rare, and surgical management is challenging. Although short segment duodenal strictures may be managed by strictureplasty, longer strictures historically were managed with gastroduodenal bypass, and rarely with Whipple's procedure. However, both those operations are associated with significant short- and long-term complications. For long strictures of the third portion of the duodenum, a duodenojejunal (DJ) bypass procedure, which has rarely been reported in the CD surgical literature, may be a more physiologic option in select cases. We present a case of a patient with diffuse jejunoileitis with 26 strictures, including a 7-cm stricture of the third portion of the duodenum, who was managed successfully with a DJ bypass, multiple strictureplasty procedures, and a limited small bowel resection with a focus on intra-operative technique. DJ bypass is an alternative for successfully managing such strictures.

Key Words: Crohn's disease, enteritis, duodenal strictures, obstruction, strictureplasty, bypass

CLINICAL CASE

A 38-year-old male with Crohn's disease (CD) was referred to our colorectal surgery clinic with concerns of multiple duodenal and small bowel strictures based on endoscopic and radiologic findings. He was initially diagnosed with CD 10 years prior with clinically quiescent disease, without any perianal involvement, and was managed expectantly off medications. However, 3 months before presentation, he was admitted as an outpatient for an episode of acute exacerbation of CD with obstructive symptoms and was treated with a corticosteroid taper and anti-TNF antibody therapy with infliximab. At that time, esophagogastroduodenoscopy (EGD) revealed a long segment stricture (7 cm in length) in the third part of duodenum (D3); in addition, he had multiple strictures throughout the jejunum and ileum on a small bowel follow-through study (Fig. 1).

Upon evaluation he endorsed a 9-month history of postprandial abdominal pain associating with poor appetite, was only tolerating a liquid diet, and had lost 7 kg in weight over 2 months. He had no previous abdominal surgery and had already tapered off steroids. Clinical examination revealed a thin young male with a body mass index of 23 kg/m^2; his abdominal examination revealed a scaphoid nontender but diffusely tympanic abdomen. Laboratory evaluation revealed a mild microcytic anemia (hemoglobin 9.9 g/dL, mean corpuscular volume of 77.6 fL); and mildly elevated C-reactive protein of 9 mg/dL. Prealbumin was within normal range (36 g/dL) but albumin was low (3.0 g/dL). The patient subsequently had a repeat EGD for further evaluation at our institution which demonstrated one long stricture with variable luminal diameters in the third part of duodenum (Fig. 2). Biopsy taken from this area confirmed chronic active duodenitis with detached fragments of fibrinopurulent debris consistent with ulcers and no evidence of malignancy. The strictures were not amendable to balloon dilatation due to their length.

The decision was made to perform an elective exploratory laparotomy to manage his duodenal and jejunoileal strictures 4 weeks after his last dose of anti-TNF therapy.

Preoperatively, his nutritional status was optimized by using exclusive enteral nutrition with a commercially available clear high-protein diet supplementation (6 cans of Ensure per day), which was well tolerated and resulted in weight gain of several pounds.

OPERATIVE FINDINGS

The entire length of small bowel was measured at 575 cm. A total of 26 small bowel strictures were identified

Received for publications February 3, 2019; Editorial Decision March 26, 2019.

*From the Department of Colon & Rectal Surgery, Digestive Diseases and Surgery Institute, Cleveland Clinic, Cleveland, OH 44195-0001, USA; †Department of Gastroenterology, Hepatology and Nutrition, Digestive Diseases and Surgery Institute, Cleveland Clinic, Cleveland, OH 44195-0001, USA

Conflict of interest: FR is consultant to Allergan, AbbVie, Boehringer-Ingelheim, Celgene, Cowen, Gilead, Gossamer, Helmsley, Jannsen, Koutif, Metacrine, Pliant, Pfizer, Receptos, RedX, Roche, Samsung, Takeda, Thetis, UCB and receives funding by NIH, Cleveland Clinic, UCB, Celgene and Pliant.

Address correspondence to: Stefan D. Holubar MD, MS, FACS, FASCRS, Department of Colon & Rectal Surgery, Digestive Disease and Surgery Institute, Cleveland Clinic, 9500 Euclid Avenue, A30, Cleveland, OH 44195-0001, USA (holubas@ccf.org).

doi: 10.1093/crocol/otz002
Published online 7 May 2019

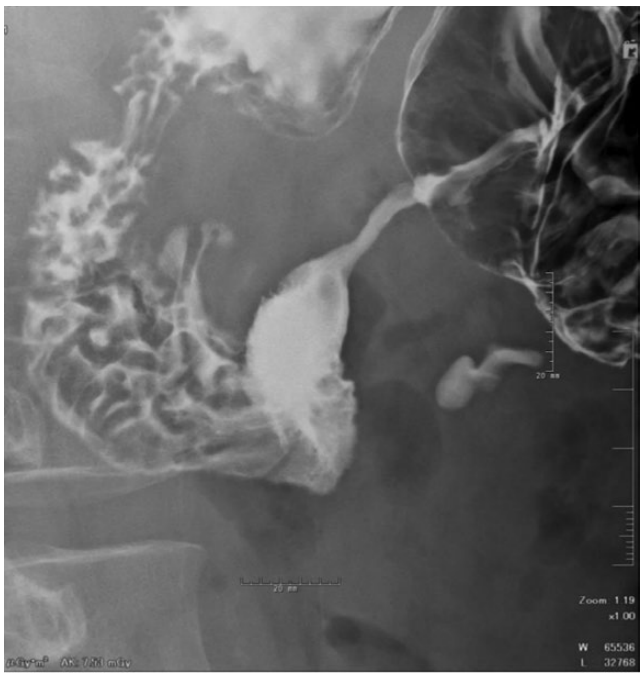

FIGURE 1. Small bowel follow-through demonstrating long stricture of the third/fourth portion of duodenum. ©Cleveland Clinic Foundation 2019.

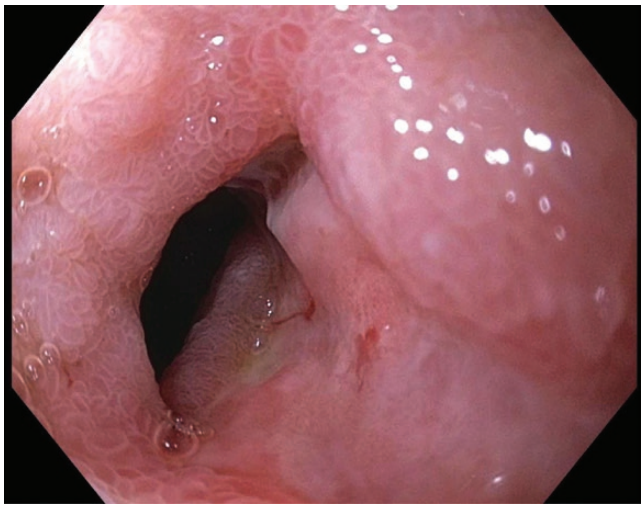

FIGURE 2. Endoscopic image of duodenal inflammation and strictures. ©Cleveland Clinic Foundation 2019.

intraoperatively, including a long stricture of the third and fourth portion of the duodenum, extending to the proximal jejunum (Fig. 3).

The first and second part of duodenum remained pliable without any evidence of disease, and the stomach was not excessively dilated. To expose the second and third parts of the duodenum, we mobilized the right colon and proximal transverse colon medially and Kocherized the duodenal c-sweep and

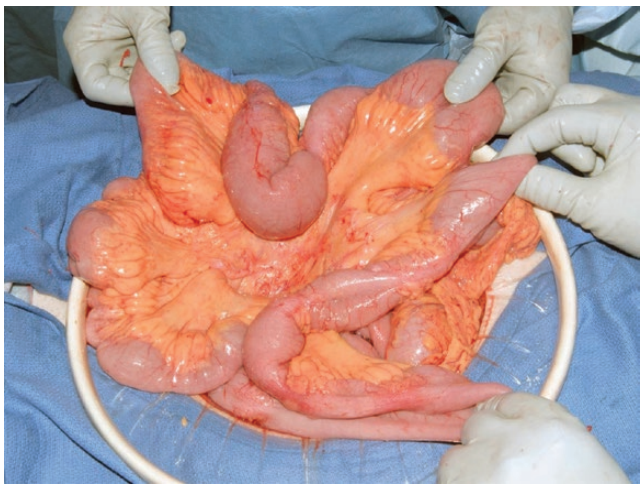

FIGURE 3. Gross intra-operative photo, diffuse jejunoileitis with creeping fat, pseudo- sacculation between strictures. ©Cleveland Clinic Foundation 2019.

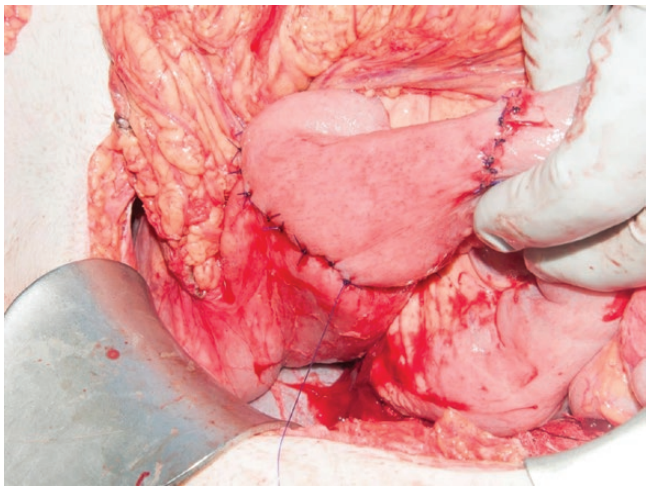

FIGURE 4. Gross intra-operative photo, handsewn duodenojejunal bypass (left, marked by long suture) and a Heineke–Mikulicz strictureplasty (right). ©Cleveland Clinic Foundation 2019.

head of the pancreas. We proceeded to perform a hand-sewn 2-layered duodenojejunal (DJ) bypass (Fig. 4) by bringing a loop of proximal jejunum, within 10 cm distal to the ligament of Treitz in a segment without any strictures, through a retrocolic mesenteric window. The intervening bowel between the proximal and distal ends of the stricture was left in situ. Step-by-step photographs of the anastomotic technique are shown in Supplementary File A. Interrupted seromuscular 3-0 slowly absorbable sutures were used for the back and front walls, while a single running full-thickness 3-0 slowly absorbable suture was used for the inner wall. An omental flap was constructed to close the mesenteric defect to prevent internal herniation, and a Stamm gastrostomy tube placed for gastric decompression given the chronic nature of the duodenal

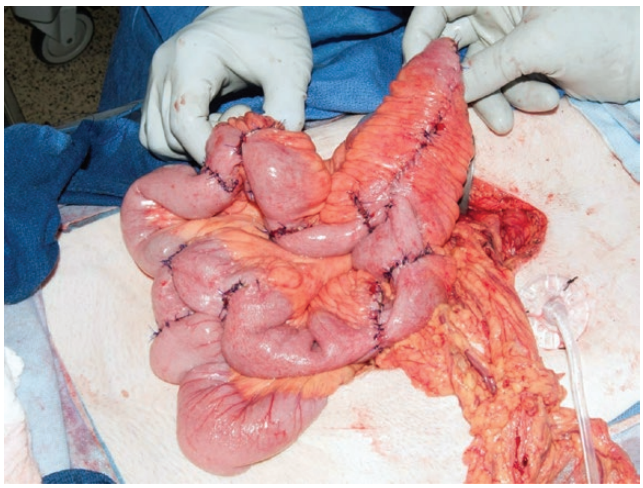

FIGURE 5. Gross intra-operative photo, 12 handsewn Heineke–Mikulicz and a single Finney strictureplasty. ©Cleveland Clinic Foundation 2019.

obstruction. The remaining small bowel strictures were managed using a combination of surgical techniques depending of the length of strictures, including 12 Heineke–Mikulicz (H–M) strictureplasty procedures for short (5–10 cm) strictures and 1 Finney strictureplasty for a 15-cm stricture (Fig. 5). Step-by-step photographs demonstrating the H-M technique are shown in Supplementary File B. There were clusters of mid-distal ileal strictures that were not amenable to strictureplasty and were managed by resecting 75 cm of ileum and a stapled anastomosis. A total of 500 cm of small bowel remained in situ at the end of the case.

The patient was recovered on an enhanced recovery pathway. A nasogastric tube was not used postoperatively, and the gastrostomy was left to gravity drainage for the first 48 hours. He then resumed a clear liquid diet with nutritional supplements (Ensure Clear) 2 days after surgery. An upper gastrointestinal series with water soluble contrast was performed day 5 which showed no anastomotic leak. He was discharged 6 days after surgery. He was tolerating soft diet and remained well. At the 6 weeks visit, he had gained weight and experienced no post-operative complications and resumed on anti-TNF therapy.

DISCUSSION

Duodenal strictures remain a rare clinical entity in patients with CD with reported incidence ranges from 0.5 to 4.0%.[1] The duodenal bulb tends to be the most commonly affected site.[2] Optimal management of these complex patients requires a multi-disciplinary team approach. Fixed fibrostenotic disease requires mechanical intervention.

Endoscopic balloon dilatation (EBD) is a safe and feasible option in managing short segment upper GI strictures secondary to CD. In a pooled analysis evaluating technical efficacy of EBD in CD-related ileal strictures, technical and clinical success rates were 89.1% and 80.8%, respectively.[3] Unlike ileal disease, there is paucity of data in regard to the use of EBD for CD-related upper tract strictures. Recent published case series from the Cleveland Clinic reported high technical success rate (93%) and clinical efficacy (88%) of EBD for short segment strictures (<5 cm). Although 47% of duodenal strictures required re-dilatation within the follow-up period of 23 months, none in this series required surgical intervention.[4]

Importantly, EBD can be used to a "bridge to surgery" to facilitate enteral feeding as nutrition optimization in perioperative period in patients with CD-related duodenal stricture is crucial. On the basis of the most recent European Society for Parental and Enteral Nutrition (ESPEN) guidelines, enteric feeding is recommended with modified texture and exclusive enteral nutrition in our case was well tolerated even without EBD.[5] Another option to consider for nutritional optimization in these cases is poststenotic enteric feeding via endoscopic or radiographically placed feeding tubes, with total parental nutrition reserved for those with severe malnutrition or who cannot tolerate enteric feeding.[5]

Long segment strictures in third part of duodenum (D3) pose a significant challenge owing to its strategic location in relation to major vasculature of the small bowel and the pancreas. Surgical options for duodenal strictures CD range from least to most morbid. Least invasive is H-M strictureplasty which is interesting as the original indication for this procedure was peptic ulcer disease-related duodenal strictures. When performing H-M strictureplasty on the duodenum, care must be taken to avoid the ampulla and pancreaticoduodenal structures, and the rate limiting step is the stricture length and location, with this choice being obviated for long (>10 cm) strictures or those involving the third/fourth portion of the duodenum. Historically, the next option includes gastroduodenal bypass with a gastro-jejunostomy, although other variations exist such as duodeno-duodenal bypass and DJ bypass as in this case. Antecolic or retrocolic gastrojejunal bypass has historically been the work-hose bypass in these cases, but patients are at risk of developing marginal ulcers and dumping syndrome, and given widespread antacids, vagotomy has become a lost art. Finally, resection in this area may be accomplished, including pancreas-sparing duodenectomy and pancreaticoduodenectomy (Whipple's procedure); however, these approaches carry significant morbidity and, given a normal pancreas, Whipple procedure for CD has been abandoned and relegated to the history books. Jejunal resection in this region is the less favorable option as mobilization of D3 can be technically difficult and carries risk of pancreatic leak and superior mesenteric vessels injuries.

To date, literature in surgical management in CD-related duodenal stricture is limited due to their low frequency. In 1999, Worsey et al. published their experience from the Cleveland Clinic

describing the surgical outcome of 34 patients with predominantly proximal duodenal strictures. Although symptomatic improvement was observed in both groups with similar recurrence rate, the author advocated the use of strictureplasty in order to avoid dumping syndrome and marginal ulcers seen after gastrojejunal bypass.[6] In the same year, conflicting results were reported in a retrospective series originating from Birmingham, the United Kingdom. Yamamoto et al. reported high anastomotic leak rate in the strictureplasty group (2 out of 13 patients, 15%); in addition, nearly half (6 out of 13 patients, 46%) required reoperation due to stricture recurrence.[7] Nonetheless, results based on more contemporary series suggest that each surgical technique such as strictureplasty, bypass and resection each has a unique role and these options need to be tailored to strictures characteristics (number, length, and location) and patient's co-morbidities.[8,9] An update of the Cleveland Clinic experience with both stricturing and fistulizing upper track CD is forthcoming.[10] Nonetheless, the report herein represents one of the few, if not only, reports of the successful use of DJ bypass in CD. It is more physiologic as it minimizes dumping syndrome and marginal ulcer which occur in 10% of patients who had gastro-jejunostomy for duodenal CD.[6] DJ bypass is a safe alternative and is easy to perform without the need of excessive mobilization.[11,12]

Of note, the construction of our bypass was facilitated by several factors. First, the most proximal segment of jejunum was free from strictures for a length of about 10 cm, which gave a soft pliable segment to work with, and also allowing the diverticularized segment of strictured duodenum to drain both proximally and distally. Second, the patient had a favorable anthropoid body habitus, specifically he was tall and thin with minimal visceral adiposity with a thin mesocolon and obvious bare area between the ascending and middle colic vasculature, all of which facilitated swinging the jejunal loop through the mesenteric defect. Finally, the mesentery of this loop was soft and pliable, and not foreshortened.

CONCLUSIONS

CD resulting in duodenal strictures is rare, and a multidisciplinary approach and optimizing preoperative nutrition are paramount to ensure superior outcomes. Perioperative management of biologics requires close liaison between gastroenterologists and IBD surgeon. Surgical management of duodenal strictures can be managed by endoscopic balloon dilation or strictureplasty in most cases. Bypass is the alterative option with minimal morbidity. DJ bypass is a feasible option, particularly for long strictures of the third portion of the duodenum, and should be in armamentarium of an IBD surgeon.

REFERENCES

1. Kimmins MH, Billingham RP. Duodenal Crohn's disease. *Tech Coloproctol.* 2001;5:9–12.
2. Laube R, Liu K, Schifter M, et al. Oral and upper gastrointestinal Crohn's disease. *J Gastroenterol Hepatol.* 2018;33:355–364.
3. Bettenworth D, Gustavsson A, Atreja A, et al. A pooled analysis of efficacy, safety, and long-term outcome of endoscopic balloon dilation therapy for patients with stricturing Crohn's disease. *Inflamm Bowel Dis.* 2017;23:133–142.
4. Singh A, Agrawal N, Kurada S, et al. Efficacy, safety, and long-term outcome of serial endoscopic balloon dilation for upper gastrointestinal Crohn's disease-associated strictures—a cohort study. *J Crohns Colitis.* 2017;11:1044–1051.
5. Forbes A, Escher J, Hébuterne X, et al. ESPEN guideline: clinical nutrition in inflammatory bowel disease. *Clin Nutr.* 2017;36:321–347.
6. Worsey MJ, Hull T, Ryland L, Fazio V. Strictureplasty is an effective option in the operative management of duodenal Crohn's disease. *Dis Colon Rectum.* 1999;42:596–600.
7. Yamamoto T, Bain IM, Connolly AB, et al. Outcome of strictureplasty for duodenal Crohn's disease. *Br J Surg.* 1999;86:259–262.
8. Shapiro M, Greenstein AJ, Byrn J, et al. Surgical management and outcomes of patients with duodenal Crohn's disease. *J Am Coll Surg.* 2008;207:36–42.
9. Tonelli F, Alemanno G, Bellucci F, et al. Symptomatic duodenal Crohn's disease: is strictureplasty the right choice? *J Crohns Colitis.* 2013;7:791–796.
10. Schwartzberg D. JA, Holubar SD, Steele SR, Shen B, Stocchi L, Hull T, Shawki S. Duodenal strictures in Crohn's disease. *Diseases of the Colon and Rectum.* 2018;61:P140.
11. Zilberstein B, Sorbello MP, Orso IR, Cecconello I. Laparoscopic duodenal-jejunal bypass for the treatment of duodenal obstruction caused by annular pancreas: description of a surgical technique. *Surg Laparosc Endosc Percutan Tech.* 2011;21:e60–e64.
12. Pottorf BJ, Husain FA, Hollis HW Jr, Lin E. Laparoscopic management of duodenal obstruction resulting from superior mesenteric artery syndrome. *JAMA Surg.* 2014;149:1319–1322.