
Laparoscopic Management Of Acquired Benign Duodenal Strictures In Adults

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Citation

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Abstract

Background & Aims: Benign duodenal strictures in adults are a rare cause of gastric outlet obstruction. The application of laparoscopic surgery to the management of benign duodenal pathology has previously been scantily explored. Our experience with the laparoscopic approach is presented and discussed.

Methods: Six patients (4 men) with a median age of 46.5 years (range 31-74 years) underwent seven laparoscopic procedures for symptomatic duodenal (D) strictures/stenoses. The morphology of the duodenal disease included diaphragm-like strictures at the junction of D1/D2 in two patients, stenosis of D2 in two patients, a long post-bulbar D1 stricture in one patient, and long distal strictures (D3/D4) in two patients. The aetiology of the strictures was related to non-steroidal anti-inflammatory drugs (n=2), acute pancreatitis (n=1), chronic pancreatitis (n=1) and duodenal tuberculosis (n=1), and was idiopathic in one patient. Attempts at endoscopic and medical therapy were unsuccessful. Surgical treatment included laparoscopic pancreas-preserving distal duodenectomy with duodeno-jejunal anastomosis (n=1), loop gastroenterostomy (n=4), Roux-en-Y gastroenterostomy (n=1), and a loop gastroenterostomy combined with a Roux-en-Y hepaticojejunostomy and bilateral thoracoscopic splanchnotomy in one patient.

Results: All operations were completed laparoscopically. Re-laparoscopy for bleeding was required after duodenectomy in one patient. The median postoperative hospital stay was 4 days (range 3-19 days). The patient who underwent a duodenectomy developed a further diaphragm-like stricture at D1/D2 that was managed 3 months postoperatively with a laparoscopic Roux-en-Y gastroenterostomy, and a subsequent laparoscopic revision of this anastomosis 2 months later. No evidence of further recurrence of the gastric outlet obstruction was observed at a median follow up of 9 months (range 2-32 months).

Conclusions: In patients with benign duodenal obstruction, surgery should be reserved to those in whom medical or endoscopic therapy has failed and when suspicion of malignancy persists. Laparoscopic surgery (duodenal resection or gastroenterostomy) offers a safe and effective alternative to laparotomy in the management of benign duodenal strictures in adults.

INTRODUCTION

In the modern era of proton pump inhibitors (PPI), benign duodenal strictures are a rare cause of gastric outlet

obstruction in adults, whilst malignancy is the main culprit. The causes of duodenal stenosis and obstruction may be classified as congenital and acquired, and the latter may be subdivided into benign and malignant causes (Table 1).

Figure 1

Table 1: Aetiology of duodenal stenosis and obstruction

Congenital causes	
	Duodenal atresia [21]
	Duodenal webs [37]
	Annular pancreas [12]
	Abdominal situs inversus [1]
	Duodenal haemangioma [11]
	Choledochal cyst [20]
Acquired diseases	
Benign conditions	
	Peptic ulcer disease [28], Zollinger-Ellison syndrome [39]
	Chronic pancreatitis [9,15]
	Duodenal Crohn's disease [50]
	NSAID (diaphragm-like strictures) [8,23]
	Iatrogenic [18]
	Trauma [43], child abuse [42]
	Cystic Fibrosis [32]
	Duodenal tuberculosis [51]
	Hyperplasia of the Brunner's gland (Brunneroma) [22]
	Superior mesenteric artery syndrome [19]
	Ingestion of corrosive agents [46]
	Anaphylactoid purpura (purpura rheumatica) [10]
Malignant causes:	
	Cancer of the duodenum, pancreas, ampulla, bile duct or gallbladder [34]
	Metastases from intra-abdominal [31] or extra-abdominal malignancies [16,24]

NSAID: non-steroidal anti-inflammatory drugs

We report our experience with the laparoscopic management (duodenal resection and bypass) of five patients who developed gastric outlet obstruction secondary to benign duodenal strictures. The applications of laparoscopic surgery in patients with benign duodenal pathology are discussed.

MATERIAL AND METHODS

PATIENTS

Between February 2001 and March 2003, we have treated six patients (4 men, 2 women) with a median age of 46.5 years (range 31-74 years) who presented with symptoms of gastric outlet obstruction secondary to duodenal strictures/stenoses. The patient details are summarised in Table 2. The median duration of preoperative symptoms was 4 months (range 1-42 months).

Figure 2

Table 2: Details of the patients

Patient No.	Age/Sex	ASA score	Presentation	Preoperative duration of symptoms	Preoperative hospital stay
1	71 M	3	Progressively worsening vomiting since a CABG procedure 2 months prior to admission	3 months	33 days
2A	49 F	2	Repeated vomiting, episodes of haematemesis and melaena requiring blood transfusion, and weight loss	6 months	3 days
2B			Recurrence of vomiting 2 months after laparoscopic distal duodenectomy	1 month	6 days
3	31 F	2	Persistent vomiting following an attack of acute necrotising biliary pancreatitis 4 months earlier	3 months	92 days
4	44 M	3	Obstructive jaundice, episodes of cholangitis, repeated vomiting, and opiate-dependent chronic abdominal pain	42 months	1 day
5	74 M	3	Repeated vomiting and weight loss (symptoms started after discontinuation of steroid therapy for temporal arteritis)	5 months	42 days (at referring hospital) + 19 days
6	40 M	2	Repeated vomiting and weight loss	4 months	25 days

ASA: American Society of Anesthesiology, CABG: coronary artery bypass graft

PREOPERATIVE ASSESSMENT OF THE DUODENAL PATHOLOGY

All patients underwent thorough investigations to assess the nature of the duodenal strictures including endoscopy, endoscopic biopsies, computed tomography (CT), and barium meal (Table 3). These demonstrated a diaphragm-like stricture at the junction between the first and second parts of the duodenum in one patient, a long post-bulbar proximal duodenal stricture in one patient, duodenal stenosis (second part) in two patients (Figure 1), and long distal duodenal strictures (third & fourth parts) in two patients (Figure 2).

Figure 3

Table 3: Diagnosis

Patient No.	Extent & location of the duodenal stricture	Aetiology	Investigations	Non-operative management of the duodenal stricture
1	Diaphragm-like stricture at junction of D1/D1	NSAID (acetylsalicylic acid for more than 5 years)	Endoscopy & Barium meal: tight stricture CT scan: no tumour mass	NSAID discontinued High-dose PPI therapy Attempted balloon dilatation → unsuccessful
2A	Long stricture in D3/D4	NSAID (Ibuprofen for more than 2 years)	Endoscopy: superficial ulcers in antrum/D1 Barium meal: long stricture in D3/D4 CT scan: no tumour mass Hormonal assessment excluded a gastrinoma	NSAID discontinued A few months of high-dose PPI therapy → no benefit
2B	Diaphragm-like stricture at junction of D1/D2		Endoscopy & barium meal: short diaphragm-like tight stricture at junction of D1/D2	Balloon dilatation was rewarded by short-lived (2 weeks) symptomatic improvement
3	Stenosis in D2	Acute necrotising biliary pancreatitis	Barium meal 16 weeks after onset of attack: hold up in D2 with a delayed partial emptying (Figure 1) Repeat CT: no pseudocyst or collections	Conservative treatment with intravenous nutrition for up to 3 months → duodenal stenosis failed to resolve either clinically or radiologically
4	Stenosis and rigidity in D2	Alcohol-related calcific chronic pancreatitis	ERCP: tight and rigid duodenum Isotope studies: delayed gastric emptying	Previous balloon dilatation + prokinetics & anti-emetics →

Figure 4

			CT scan: small duct, calcific chronic pancreatitis, no tumour mass MRCP: smooth 2-cm stricture in distal CBD	no detectable benefit
5	Long stricture in D3/D4	Idiopathic	Barium meal: long stricture in D3/D4 (Figure 2) Repeated CT scans over 4 months: no tumour mass, marked proximal duodenal dilatation (Figure 3) Laparoscopy: no tumour mass Hormonal assessment excluded a gastrinoma	High-dose PPI therapy Intravenous nutrition Attempted balloon dilatation → failed to advance the balloon over the guide wire
6	2-cm post-bulbar stricture in D1	Tuberculosis	Endoscopy & barium meal: 2-cm post-bulbar duodenal stricture USS & CT: mesenteric and peripancreatic lymphadenopathy	High-dose PPI therapy Intravenous nutrition Endoscopic dilatation → no symptomatic response

NSAID: non-steroidal anti-inflammatory drugs, D1/D2: first and second parts of duodenum, D3/D4: third and fourth parts of duodenum, USS: abdominal ultrasonography, CT: computed tomography, ERCP: endoscopic retrograde cholangiopancreatography, MRCP: magnetic resonance cholangiopancreatography, CBD: common bile duct, PPI: proton pump inhibitor

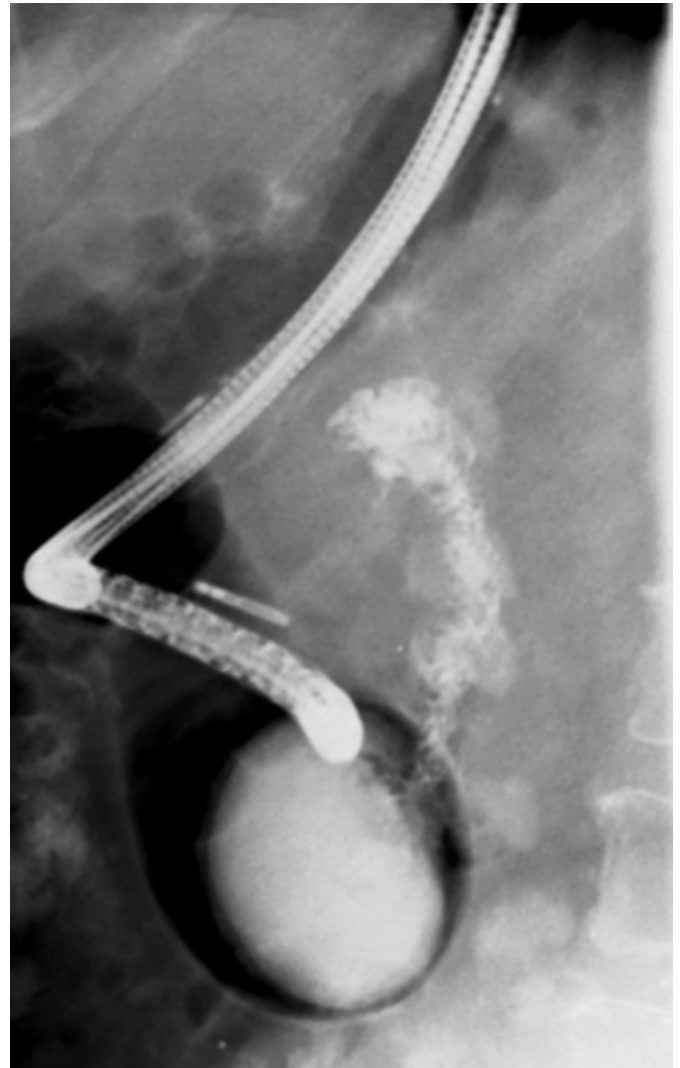
Figure 5

Figure 1: Barium study via a percutaneous gastrostomy in Patient No. 3 with severe necrotising pancreatitis showing a tight stricture/stenosis (arrow) in the second part of duodenum (passage of contrast into the distal duodenum was delayed)



Figure 6

Figure 2: Endoscopic contrast study in Patient No. 5 showing a long stricture in the third/fourth parts of the duodenum with marked proximal duodenal dilatation



One of the patients (Patient No. 2) developed a further proximal diaphragm-like stricture at the junction between the first and second parts of duodenum two months after resection of a benign distal duodenal stricture. No tumour mass was shown on CT imaging of any of the patients. In addition to the investigations above, hormonal assessment in one of the patients with recurrent duodenal and gastro-enteric anastomotic stricture (Patient No. 2) ruled out a gastrinoma. The data available from these investigations, as well as from post-resection pathological evaluation (Patient No. 2), and from clinical, radiological and endoscopic follow up (Table 5) confirmed or supported their benign nature (Table 3).

Figure 7

Table 5 : Results and follow up

Patient No.	Postoperative complications	Postoperative hospital stay	Histology	Duration of follow up	Outcome
1	None	4 days	Endoscopic biopsies: chronic inflammation	32 months	Symptom-free
2A	Intraoperative bleeding on 1 st postoperative day → re-laparoscopy and peritoneal lavage	4 days	NSAID-related stricture	29 months	Developed a symptomatic stricture at D1/D2 junction 2 months after duodenectomy, and had a short-lived response to endoscopic balloon dilatation → laparoscopic g Roux-en-Y GE
2B	None	3 days	N/A		1. 5 months post-duodenectomy: obstruction of GE → laparoscopic refashioning of GE 2. Remains symptom-free since (on PPI therapy)
3	None	18 days	N/A	9 months	Symptom-free
4	None	5 days	N/A	9 months	Symptoms of gastric & biliary compromise relieved, and opiate dosage gradually reduced. Emergency admission 6 weeks post-surgery with loss of consciousness (possibly due to a transient hypoglycaemia) and sustained brain injury for which he is receiving rehabilitation therapy.
5	Central line sepsis	19 days	Repeated endoscopic biopsies (over	8 months	Occasional vomiting (once/week), regained weight

Figure 8

			6-months): chronic inflammation		Repeat endoscopy and enteroscopy with biopsies of both ends of the duodenal stricture → benign disease Repeat CT scan at 6 months: no tumour mass
6	None	4 days	Peripancreatic lymph node biopsy: features of tuberculosis	2 months	Symptom-free, and currently receiving anti-tuberculous chemotherapy

GE: gastroenterostomy, PPI: proton pump inhibitor

Options for non-operative management of these strictures including prolonged intravenous feeding (in the patient with acute necrotising pancreatitis), high-dose PPI therapy, discontinuation of NSAID, and balloon dilatation as appropriate were explored and exhausted before embarking on surgery (Table 3).

OPERATIVE PROCEDURES

The six patients underwent seven laparoscopic operative procedures to treat their duodenal disease (Table 4). These included a gastroenterostomy that was fashioned as a loop (n=5) or in a Roux-en-Y configuration (n=1), and a pancreas-preserving distal duodenectomy [3] with a

duodeno-jejunal anastomosis (n=1). In one of the patients (No. 4) who suffered with alcohol-related chronic pancreatitis, the laparoscopic loop gastroenterostomy was combined with a Roux-en-Y hepaticojejunostomy for a symptomatic benign distal bile duct stricture and a concomitant bilateral thoracoscopic splachnotomy for an opiate-dependent intractable abdominal pain [2].

Figure 9

Table 4: Details of surgery

Patient No.	Surgical treatment	Duration of operation (minutes)	Conversion	Blood transfusion (units)
1	Laparoscopic loop gastroenterostomy	55	No	0
2A	Laparoscopic pancreas-preserving distal duodenectomy with duodeno-jejunal anastomosis	300	No	Intraoperative: 0 Postoperative: 4
2B	Laparoscopic Roux-en-Y gastroenterostomy	170	No	0
3	Laparoscopic loop gastroenterostomy	160	No	2
4	Laparoscopic loop gastroenterostomy, Roux-en-Y hepaticojejunostomy (previous cholecystectomy), + (concomitant) bilateral thoracoscopic splachnotomy	330 + 25	No	0
5	Laparoscopic loop gastroenterostomy	30	No	0
6	Laparoscopic loop gastroenterostomy & peripancreatic lymph node biopsy	100	No	0

OPERATIVE TECHNIQUE

All the laparoscopic gastroenterostomies were fashioned in an antecolic anterior arrangement. Every effort was made to ensure that the gastroenteric anastomosis was placed distally on the gastric/antral wall. The anastomoses were fashioned in a side-to-side manner using two or three firings of an endo-stapler (ATB45 45mm-articulating, Ethicon Endo-Surgery, Cincinnati, Ohio, USA), and the common gastroenteric side opening was closed with a continuous Vicryl 2-0 suture (Ethicon Inc., Somerville, New Jersey, USA). The Roux-en-Y entero-enteric anastomoses were fashioned in a similar manner.

The Roux-en-Y hepaticojejunostomy was constructed in a retrocolic side-to-side manner (previous open cholecystectomy) to the common hepatic duct, and the anastomosis was fashioned with a single firing of an endo-stapler (TSW35 35mm, Ethicon Endo-Surgery, Cincinnati, Ohio, USA), and completed with interrupted absorbable

sutures (Vicryl 3-0).

The operative technique for the laparoscopic distal duodenectomy has been described previously [3].

RESULTS

OPERATION-RELATED OUTCOMES

The intraoperative course was uneventful in all cases and all procedures were completed laparoscopically. The operating time (median 160 minutes) ranged between 30 minutes for a loop gastroenterostomy to 355 minutes for the combined laparoscopic gastric and biliary bypass and bilateral thoracoscopic splanchnotomy (Table 4).

The recovery from surgery was uneventful in five of the seven procedures (Table 5). Intraoperative bleeding developed on the first postoperative day following the duodenectomy, and was managed by re-laparoscopy and peritoneal lavage successfully (no source of bleeding was identified). Central line sepsis presented on the second postoperative day in a patient who had a prolonged preoperative course and was fed parenterally.

The median duration of postoperative hospital stay (Table 5) was 4 days (range 3-19 days), and appeared to relate to the duration of preoperative hospital stay (Table 2). All patients were discharged on long-term PPI therapy.

AETIOLOGY OF DUODENAL DISEASE

Determination of the aetiology of the duodenal strictures was based on the preoperative data as well as the histological findings of operative specimens (Patients No. 2 and No. 6) and was supported by follow up information. The aetiology is shown in Table 3.

FOLLOW UP

The median duration of follow up was 9 months (range 2-32 months). One of the patients (Patient No. 2) developed a further NSAID-related diaphragm-like duodenal stricture at the junction of the first and second parts of duodenum 2 months after a distal duodenectomy and duodeno-jejunal anastomosis [4] that was initially managed by endoscopic balloon dilatation with only a short-lived response. A month later she underwent a laparoscopic Roux-en-Y gastroenterostomy, which subsequently occluded (stricture) and was managed by laparoscopic revision gastroenterostomy with a successful outcome. At the time of writing, all patients remain symptom-free, but for occasional vomiting in one of the patients (Patient No. 5).

DISCUSSION

Patients presenting with benign duodenal strictures that fail to respond to medical or endoscopic therapy may be managed successfully with minimally invasive surgery without the need to resort to a laparotomy. Relief of the obstruction may be simply accomplished in the majority of patients with a laparoscopic gastroenterostomy. This procedure was employed by Nagy et al [30] in a patient with duodenal obstruction secondary to peptic ulcer disease and by Reissman et al [35] in three patients with duodenal Crohn's disease, and we have applied it successfully in five patients. However, laparoscopic resection of the diseased distal duodenum (with preservation of the pancreas) was necessary in one of our patients who also had clinical evidence of recurrent bleeding from the stricture [3]. In addition, uncertainty about the diagnosis of a 'benign' pathology in this good-risk 'young' patient supported a duodenal resection.

The role of laparoscopic surgery in the palliation of malignant duodenal and biliary obstruction is now well recognised, and is associated with significant reduction in hospital stay compared with open surgery [7,36,38]. In addition, laparoscopic surgery has its applications in the management of benign duodenal conditions in adults and children.

In adults, the laparoscopic approach to closure of perforated duodenal ulcers is well established [4]. In addition, laparoscopic transgastric or transduodenal resection of large duodenal villous adenomas [40], Brunner's gland hamartoma (Brunneroma) [5] or duodenal stromal tumour [48], resection of bleeding distal duodenal diverticulum [45] or a carcinoid tumour of the duodenal bulb [47], transgastric removal of an obstructing gallstone impacted in the duodenum (Bouveret's syndrome) [26], duodenotomy and under-running of actively bleeding duodenal ulcers [27], and duodenojejunostomy for the superior mesenteric artery syndrome [19] have all been described. In paediatric patients, laparoscopic duodenoduodenostomy for duodenal atresia [6] as well as laparoscopic division of congenital Ladd's bands that cause intermittent duodenal obstruction in neonates with malrotation of the gut [13] have been practiced.

It is essential to establish the diagnosis of a 'benign' disease and to explore non-surgical management options before embarking on a laparoscopic gastric bypass as a definitive treatment. Although the benign nature of the stricture may be readily evident as the case was in one of our patients who

developed the stricture a month into an acute attack of severe necrotising pancreatitis, the establishment of a benign aetiology often poses a diagnostic dilemma. Endoscopic evaluation with repeated biopsies, a barium study to examine the length, morphology and location of the stricture, and cross-sectional imaging to exclude a tumour mass are essential investigations. The detection of histologically benign, diaphragm-like duodenal strictures in patients with a history of NSAID intake and absent tumour mass on computed tomography may suggest a NSAID-related disease [23,41]. Absence of a tumour mass on imaging in patients with an established history of chronic pancreatitis attests to the benign nature of the duodenal stenosis, although caution should be exercised in order to avoid missing a progression of disease to pancreatic cancer [25,49]. Other causes shown in Table 1 ought to be considered when a long distal duodenal stricture is detected.

In patients with benign duodenal strictures, it is worthwhile exploring the non-surgical treatment options in the first instance. Either medical treatment (PPI therapy) alone [17] or in combination with endoscopic balloon dilatation [44] may provide a long-lasting relief of gastric outlet obstruction secondary to peptic ulcer disease in some patients, though some 50 per cent of patients may still require further endoscopic or surgical intervention [29]. We employed the techniques of endoscopic balloon dilatation in four of the five patients and found its results disappointing. Duodenal obstruction secondary to Crohn's disease may respond to medical therapy [14]. Duodenal tuberculosis causing obstruction is a rare condition that is usually seen in the tropics; it is rarely diagnosed preoperatively by endoscopic biopsy and may then respond to drug therapy [33].

Surgery for benign duodenal obstruction should therefore be reserved to patients in whom non-operative management options fail, and when the diagnosis remains in doubt. In the former scenario, relief of the obstruction may be accomplished by a laparoscopic gastroenterostomy; whilst in the latter a duodenal or pancreaticoduodenal resection is warranted in the good surgical-risk patient and may be safely accomplished laparoscopically.

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