Laparoscopic Roux-en Y duodenojejunostomy: A safe and physiological treatment for symptomatic annular pancreas in adults

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Abstract

Background: Annular pancreas is a rare, congenital, rotational anomaly of pancreas, seen usually in newborns who present with features of duodenal obstruction. However, in adults, only 24% of cases are present with duodenal obstruction. Surgery remains the procedure of choice in patients in whom symptoms can be attributed to duodenal obstruction and the goal of surgery is to relieve obstruction by bypassing the annulus. Laparoscopic Roux-en Y duodenostomy (DJ) is our preferred bypass approach for this condition. Literature search revealed that very few case reports have been published about laparoscopic management of annular pancreas, especially about duodenojejunal anastomosis. We present our experience in the laparoscopic management of symptomatic annular pancreas in adults and technique of the laparoscopic Roux-en Y DJ for annular pancreas.

Materials and Methods: Between 1996 and 2016, a total of six adult patients underwent laparoscopic management for symptomatic annular pancreas. The demographic, perioperative and follow-up details were documented.

Results: All surgeries were successfully performed by laparoscopic approach with no conversion to open. Five cases underwent Roux-en Y DJ and one underwent gastrojejunostomy. No major perioperative events occurred. The mean length of hospital stay was 5.6 days. Five out of six patients were followed up for 24 months, and no symptom recurrence was seen.

Conclusion: Laparoscopic Roux-en Y duodenojejunostomy could be used as a safe and physiological treatment for annular pancreas in adult patients and should be preferred for the treatment of duodenal obstruction due to annular pancreas.

Keywords: Annular pancreas, congenital pancreatic anomaly, duodenal obstruction, laparoscopy, Roux-en Y duodenojejunostomy

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INTRODUCTION

Annular pancreas is a rare congenital rotational anomaly of the pancreas, seen usually in newborns who present with features of duodenal obstruction. However, in most of the cases, the obstruction may be of minimal degree to cause any symptoms at birth. As a result, most patients remain asymptomatic for life. In those who are symptomatic at a later life (in adults), the presentation varied from chronic abdominal pain, nausea, postprandial fullness and vomiting. Other symptoms include upper gastrointestinal (GI) bleeding from peptic ulceration, acute or chronic pancreatitis and, rarely, jaundice due to biliary obstruction.\(^\text{[1,2]}\) Surgery remains the procedure of choice in patients in whom symptoms can be attributed to duodenal obstruction due to annular pancreas, and the goal of surgery is to relieve duodenal or gastric outlet obstruction by bypassing the annulus\(^\text{[3]}\) by doing duodenoduodenostomy (DD) or duodenojejunostomy (DJ) or gastrojejunostomy (GJ). Literature search revealed that very few case reports have been published about the laparoscopic management of annular pancreas, especially about duodenojejunal anastomosis.\(^\text{[4]}\)

We present our experience in the laparoscopic management of symptomatic annular pancreas in adults and technique of the laparoscopic Roux-en Y DJ for annular pancreas.

MATERIALS AND METHODS

After getting Institutional Review Board approval, we retrospectively reviewed our medical records of patients diagnosed with annular pancreas between the years 1996 and 2016. Data collection included patient demographics and outcomes, operative findings, morbidity and follow-up visits. Our preferred approach is to do Roux-en Y duodenojejunalostomy (DJ) bypass and the technique is explained here.

Technique for laparoscopic Roux-en Y DJ bypass

The patient was placed supine with legs apart and in reverse Trendelenburg’s position. The main operating surgeon operates standing in between the patient’s legs and the camera surgeon stood to the right of the patient. The scrub nurse with another assistant (for retraction) stood to the left of the patient [Figure 1a]. Pneumoperitoneum was established using a Veress needle technique at the umbilicus. A 10-mm camera port is placed at the umbilicus. Then, a 5-mm port in the epigastrium for liver retraction, a 12-mm port in the right hypochondrium in midclavicular line for a left-hand working port and a 5-mm port in the left hypochondrium for a right-hand working port were inserted [Figure 1a]. Lesser sac entered by opening gastrocolic omentum, and the duodenal and hepatic flexure of colon mobilised to visualise the annulus of pancreas [Figure 1b]. A Roux limb of jejunum about 40 cm from the duodenojejunal flexure was brought up to the duodenum via mesocolic window done to the right of the middle colic vessels. The most distal part of the second part of the duodenum was selected for anastomosis to create the most dependent stoma. A small enterotomy is made in both the duodenum and jejunum using hook, and a side-to-side duodenojejunal anastomosis is created using a 45-mm EndoGIA stapler (white cartridge with 25-mm staple pins, Ethicon, Somerville, NJ, USA) [Figure 1c]. The common opening thus created was closed intracorporeally with 2-0 polydioxanone sutures in a single layer [Figure 1d]. The size of the lumen was 4.5 cm. The intermesenteric gap was obliterated with a few interrupted silk sutures. Stapled jejuno-jejunal anastomosis is done to establish the enteral continuity. Ryle’s tube is placed in the stomach for decompression.

Postoperatively, nasogastric tubes were routinely used and were removed after gastrograffin swallow was performed in the morning of the 1st post-operative day in the majority of patients. Diets were subsequently graduated from liquids to normal diet. Patients were discharged home after tolerating a regular diet. Patients were advised for follow-up visits at approximately 7 and 30 days after surgery. Five of the six patients underwent close follow-up and one patient was lost to follow-up. Follow-up was conducted as outpatient visits or by telephone, and follow-up data included any symptom recurrence, quality of life and associated complications such as pancreatitis and stomal ulceration.

RESULTS

A total of 11 cases of annular pancreas were diagnosed between 1996 and 2016, of which six cases (54.5%) were symptomatic due to annulus of pancreas causing duodenal obstruction. These six patients underwent laparoscopic intervention for symptomatic annular pancreas. Details of operated cases are shown in Tables 1 and 2. All were men with age range from 22 to 63 years. The main presenting symptoms were recurrent abdominal pain and vomiting of bile and ingested food. Two patients had recurrent pancreatitis; one due to associated pancreatic divisum and another chronic pancreatitis due to inducing ethanol.

Upper GI endoscopic evaluation was done in all cases and showed the evidence of duodenal obstruction and peptic ulcers in the stomach. Five of the six cases of annular pancreas were diagnosed on computed tomography (CT).
abdomen while one case was diagnosed to have duodenal obstruction based on hypotonic duodenography, which on diagnostic laparoscopy found to the duodenal obstruction due to annular pancreas. One patient had intrapancreatic cystic lesion in the head region, for which magnetic resonance imaging (MRI) showed annular pancreas with pancreatic divisum and cystic lesion of size 4.1 cm × 2 cm, endoscopic ultrasound fine-needle aspiration cytology confirmed it to be small pseudocyst, and minor papillotomy was done via endoscopic retrograde cholangiopancreatography (ERCP). Five of the six patients underwent laparoscopic Roux-en Y DJ, while one patient underwent laparoscopic Roux-en Y GJ because of scarred D1 (the first part of duodenum). The average operative time for DJ was 105 ± 19.7 min (range 100–120 min) and for GJ, it was 80 min [Table 3]. The average time for starting orals was 2.6 days. No major complications such as intra-abdominal bleed and pancreatitis were seen postoperatively. The average hospital stay was 5.6 ± 1.5 days. Five out of the six patients (one patient was lost to follow-up) were followed for 24 months, and no symptom recurrence was seen.

**DISCUSSION**

Annular pancreas is an uncommon anomaly of pancreas, which results from a ring of pancreatic tissue around the descending portion of duodenum. In adults, the most common time of presentation is in the third and fourth decades. The second part of the duodenum is most often affected as seen in all the six cases in the present study, whereas the first and third duodenal parts can also be affected, seen only in 21% of cases.[3] The annulus may contain pancreatic tissue or just fibrous tissue and surrounds the 2nd portion of the duodenum completely or incompletely in varying proportions in anterior and/or posterior directions. Most of the neonates due to annular pancreas present with duodenal obstruction and have associated congenital anomalies in up to 50% of the cases such as Down’s syndrome, oesophageal atresia/fistula, imperforate anus and Hirschsprung’s disease.[4] However, in adults, approximately two-thirds of patients with annular pancreas are asymptomatic and, in those who are symptomatic, only 24% of cases will have the features of duodenal obstruction. Other manifestations of annular pancreas in adults include peptic ulcers, acute or chronic pancreatitis, obstructive jaundice and pancreatobiliary

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**Table 1: Presenting symptoms**

| Case | Sex | Age (years) | Complaints | Duration of symptoms | History of pancreatitis |
|------|-----|-------------|------------|----------------------|------------------------|
| 1    | Male| 22          | Recurrent pain, vomiting | 1.5 year | No          |
| 2    | Male| 46          | Recurrent pain, vomiting | 1 month  | No          |
| 3    | Male| 63          | Vomiting | 1 week | Yes         |
| 4    | Male| 52          | Pain, vomiting | 1 year | Yes         |
| 5    | Male| 28          | Pain, nausea, vomiting | 10 years | No          |
| 6    | Male| 48          | Pain, vomiting | 3 years | No          |

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**Table 2: Diagnostic modalities used for annular pancreas**

| Case | CT abdomen | Upper GI scopy | MRI abdomen | Others |
|------|------------|----------------|-------------|--------|
| 1    | AP with dilated stomach and D2 luminal narrowing | D1 and pangastritis | Not done | Barium meal-abrupt narrowing in D1 with delayed passage of dye |
| 2    | AP with dilated stomach with D2 obstruction | Peptic ulcer, D2 narrow | AP and D2 obstruction | Not done |
| 3    | Not done | Peptic ulcer, dilated D1, D2-D3 narrow | AP, D2 obstruction, pseudocyst in head, divisum+ | MRCP - pancreatic divisum. EUS/FNA s/o pseudocyst |
| 4    | D2 narrowing, few LN in HDL | D1 duodenitis, D2 oedema and narrow | Not done | EUS - annular pancreas, FNAC-negative |
| 5    | - | Gastric bile reflux gastritis, and a dilated D2 Pangastritis with narrow D2-D3 | Not done | Barium meal study also confirmed duodenal obstruction |
| 6    | AP with dilated stomach | | Not done | Not done |

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**Table 3: Perioperative outcomes**

| Case | Procedure | Operative time (min) | Intraoperative findings | Time to orals-POD | Hospital stay (days) | Complications |
|------|-----------|----------------------|------------------------|------------------|---------------------|---------------|
| 1    | DJ        | 105                  | Complete ring of AP    | 2                | 5                   | None          |
| 2    | DJ        | 120                  | Complete AP, dilated D1 | 4                | 7                   | None          |
| 3    | GJ        | 80                   | Cicatrised D1, partial AP | 2                | 5                   | None          |
| 4    | DJ        | 100                  | Complete AP, dilated D1 | 3                | 8                   | DGE           |
| 5    | DJ        | 110                  | Complete AP            | 2                | 5                   | None          |
| 6    | DJ        | 120                  | Partial AP             | 3                | 4                   | None          |

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AP: Annular pancreas, D1, D2, D3: Duodenum 1st, 2nd and 3rd parts, respectively, LN: Lymph node, HDL: Hepatoduodenal ligament, EUS: Endoscopic ultrasound, CT: Computed tomography, GI: Gastrointestinal, MRI: Magnetic resonance imaging, MRCP: Magnetic resonance cholangiopancreatography, FNA: Fine-needle aspiration; FNAC: FNA cytology
Recurrent abdominal pain was present in all of our cases.

In adults, annular pancreas is usually diagnosed incidentally during the course of evaluation of the patient's symptoms of abdominal pain and is established by the presence of pancreatic tissue surrounding the descending portion of the duodenum on abdominal imaging. In older children and adults, the diagnosis is established with an upper GI series and an abdominal CT scan, respectively. Upper GI barium study reveals dilated proximal duodenum with an abrupt cut-off or a linear cut-off at the D2 level and delayed gastroduodenal transit of 4–6 h [Figure 2a]. In equivocal cases, hypotonic duodenography may be required to diagnose the obstruction. Contrast-enhanced CT abdomen [Figure 2b] and MRI abdomen [Figure 2c] show a characteristic ring of pancreatic tissue that surrounds the descending duodenum, in continuity with the pancreatic head, extending posterolaterally or anterolaterally, on to the 2nd part of the duodenum or the pancreatic tissue is seen anterior and posterior to the duodenum (crocodile jaw configuration), along with the features of gastric outlet obstruction which should raise the suspicion of annular pancreas. However, it is not necessary to visualise a complete ring of pancreatic tissue around the duodenum for the diagnosis of annular pancreas; patients can be symptomatic even with partial annulus causing fibrosis and obstruction [Figure 2d]. One of our cases was diagnosed on barium upper GI study and the remaining five cases were diagnosed on CT. Magnetic resonance cholangiopancreatography (MRCP) is performed when the results from upper GI series or CT are equivocal and in suspected pancreatic divisum as seen in one of our cases who had pancreatic divisum along with annular pancreas. ERCP-guided biopsy or endoultrasound biopsy is reserved for patients in whom a periampullary malignancy is suspected on MRCP or abdominal CT scan.

Most patients with annular pancreas are asymptomatic and thus the mere presence of annular pancreas is not an indication for surgery, as seen in our series where only six of the 11 diagnosed cases were symptomatic. In both children and adults with symptomatic annular pancreas, bypass surgery of the annulus is advised which can be achieved through DD, duodenojunostomy (DJ) or GJ. Both DD and DJ are preferred bypass procedures for annular pancreas as they are more physiological and avoid pancreatic and bile refluxes into the stomach, thereby avoiding alkaline reflux gastritis, but in adults, due to less mobile nature of the duodenum, it is difficult to mobilise it for performing a proximal-to-distal duodenum anastomosis and it will also be technically challenging to perform for such a benign disease, especially laparoscopically. Hence, it is preferred to perform DJ wherever feasible to maintain the enteric continuity. However, in cases of deformed duodenum due to pancreatitis or peptic ulcer disease, it is advisable to avoid duodenal anastomosis for fear of duodenal leak and prefer to perform GJ as seen in one of our cases. Though GJ is technically less difficult, duodenal decompression may be inadequate and its drainage is through duodenal-gastric reflux, which frequently leads to the occurrence of ulcers at the anastomosis, strictureting, dumping syndrome, bile reflux gastritis and anaemia. Resection of the pancreatic annulus should be avoided as it is associated with morbidity complications such as pancreatitis, pancreatic fistula formation and incomplete relief of...
Laparoscopic Roux-en Y DJ was done in five of our cases with a mean operative time of 105 min with no major intraoperative complication. One patient had mild delayed gastric emptying which was managed with Ryle’s tube aspiration and prokinetics. The DJ procedure gave good results in the patients in this report for a long period of time. Laparotomy is the most widely used access technique in the absolute majority of published cases, and there are very few reports of the use of laparoscopy to approach the entity in adults and mainly involve performing GJ anastomosis to overcome the obstacle created by the annular pancreas. Though DJ anastomosis has been mentioned in conventional open surgery for annular pancreas, only two case reports of laparoscopic DJ anastomosis for annular pancreas are reported yet. Being a benign disease, minimally invasive nature of laparoscopy is more beneficial and can be feasibly used in the treatment of this disease, with less surgical trauma and a probable earlier return to normal activity, as was seen in the cases described here, with less post-operative pain; however, it requires technical expertise to perform the procedure. Laparoscopic Roux-en Y DJ could be used as a safe and available treatment for annular pancreas due to the earlier achievement of enteral nutritional support, which avoids reflux-associated complications of GJ and leads to shorter hospital stay compared with that of open procedure.

This study was presented due to the rare nature of the disease and even more rarer in its symptomatic presentation in adults and, to our knowledge, this is the largest series on laparoscopic management of annular pancreas, especially the Roux-en Y duodenojejunal approach. Limitation of this study is being its retrospective nature and a non-comparative study as treatment strategies for rare diseases can be challenging mainly due to the limited number of patients eligible to participate in the given study and uncertainty about or heterogeneity in the natural history of the disease.

CONCLUSION

Laparoscopic duodenojejunalostomy could be used as a safe and physiological treatment for annular pancreas in adult patients and should be preferred for the treatment of duodenal obstruction due to annular pancreas.

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Conflicts of interest
There are no conflicts of interest.

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