Laparoscopic Pancreas-Sparing Duodenectomy with Roux en Y Reconstruction for Duodenal Polyposis

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Abbreviations:

DP - duodenal polyposis;
FAP - familial adenomatous polyposis;
PSD - pancreas-sparing duodenectomy;
PD - pancreatoduodenectomy;
LPSTD - laparoscopic pancreas sparing total duodenectomy;
APC - adenomatous polyposis coli;
ECM - extracolonic manifestations;
SDR - segmental duodenal resection;
TDA - trans duodenal ampullectomy;
PSD - pancreas-sparing duodenectomy;
MIS - minimally invasive surgery;
CT - computer tomography;
CBD - common bile duct;
IVC - Inferior Vena Cava;
BMI - Body Mass Index.

Rezumat

Rezecție duodenală totală cu conservarea pancreasului și reconstrucție pe ansa în Y pentru polipoza duodenală

Introducere: Polipoza duodenală (PD) este frecvent asociată la pacienții cu polipoză adenomatoasă familială (PAF), iar riscul de malignizare a acesteia este evaluat endoscopic folosind scorul Spigelman. Tratamentul endoscopic este prima opțiune pentru PD în timp ce, tratamentul chirurgical este indicat pentru stadiile avansate (Spigelman III-IV). Rezecția duodenală totală cu conservarea pancreasului a fost propusă ca o metodă de tratament mai puțin agresivă în comparație cu duodenopacreatectomia cefalică (DPC), păstrând întregul pancreas *“in situ”* și scăzând numărul de anastomoze necesare pentru reconstrucție. Rezecția duodenală totală este în general efectuată prin abord clasic, cu anastomoză tip Billroth sau cu preservare pilorică. Folosirea unei anse în Y *“a la Roux”* este limitată din cauza complexității crescute a procedurii, a numărului de anastomoze și din cauza limitării accesului endoscopic necesar monitorizării postoperatorii.

Scopul articolului este de a descrie tehnica rezecției duodenale totale cu conservarea pancreasului pe cale laparoscopică (LPSTD – *Laparoscopic Pancreas Sparing Total Duodenectomy*) cu reconstrucție pe ansa în Y *“a la Roux”* și de a prezenta rezultatele procedurii la un pacient cu polipoză duodenală (Spigelman IV) și colectomie totală pe cale deschisă pentru polipoza adenomatoasă familială asociată.

Metoda: Am efectuat LPSTD cu antrectomie, colecistectomie și

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reconstrucție pe ansa în Y la un pacient de 39 de ani, de sex masculin, cu polipoza duodenală, cu antecedente de polipoză adenomatoasă familială ce a necesitat, anterior, colectomie totală cu anastomoză ileorectală pe cale deschisă. Investigațiile preoperatorii și etapele abordului chirurgical laparoscopic au fost descrise în detaliu.

Rezultate: timpul operator a fost de 280 minute. Au apărut două complicații postoperatorii, o sângerare autolimitată perianastomotică (la anastomoza pancreatico-jejunală) în ziua PO 1; și necroza bontului cistic cu coleperitoneu secundar (PO 7). Ambele au necesitat explorarea laparoscopică. Alimentația orală a fost introdusă în ziua 2 PO, pacientul fiind externat în ziua 14 PO. Nu au existat alte complicații, de tipul întârzierii evacuării gastrice, a fistulei pancreatice sau biliare. Evaluarea la 6 luni postoperator, care a inclus tomografia computerizată și inspecția endoscopică retrogradă a neopapilei, nu a evidențiat recurențe la nivelul jejunului.

Concluzii: Deși este o procedură complexă, LPSTD reprezintă o alternativă a rezecției pancreaticoduodenale pentru pacienții cu polipoză adenomatoasă familială și adenoame vilozitate voluminoase periampulare, în special a celor cu grad înalt de displazie. Abordul laparoscopic și reconstrucția pe ansa în Y “a la Roux” pot contribui la reducerea morbidității postoperatorii în duodenectomia totală cu conservarea pancreasului.

Cuvinte cheie: polipoza adenomatoasă familială, adenoame duodenale, duodenectomie totală cu conservarea pancreasului, laparoscopia, reconstrucția pe ansa în Y “a la Roux”

Abstract

Background: Duodenal polyposis (DP) is often associated in patients with in patients with familial adenomatous polyposis (FAP) and the risk of malignancy is endoscopically assessed using the *Spigelman score*. Endoscopic therapy is the first option for PD while surgery is indicated for the advanced stages of the disease (*Spigelman III-IV*). Pancreas-sparing duodenectomy (PSD) was proposed as a less aggressive alternative to pancreatoduodenectomy (PD), leaving the entire pancreas “*in situ*” while the number of anastomoses is reduced. Open PSD with Billroth or pylorus preserving reconstruction is the general used. The use of a Roux limb is very limited in literature, as it increases the procedure complexity, the number of anastomosis and it may reduce the endoscopic access for the postoperative surveillance after total duodenectomy.

We aim to describe the technique for *Laparoscopic Pancreas Sparing Total Duodenectomy (LPSTD)* with Roux-en-Y reconstruction and to present the procedure's outcomes in a patient presenting Spigelman IV duodenal polyposis associated with FAP after open total colectomy.

Method: Laparoscopic Pancreas Sparing Total Duodenectomy (LPSTD) with antrectomy cholecystectomy and Roux en Y reconstruction was performed in a 39-year-old man with a history of FAP, open colectomy with ileorectal anastomosis and duodenal polyps. The preoperative investigations and the surgical steps of the laparoscopic approach are described in details.

Results: The operative time was 280 minutes. Two postoperative complications were encountered, a self-limited pancreatico-jejunal anastomosis hemorrhage occurred in POD 1 and necrosis of the cystic duct stump with bile peritonitis (POD7). Both of them required laparoscopic exploration. Oral feeding was introduced in the POD 2. The patient has been discharged in the POD 14. No other complications like delayed gastric emptying, pancreatic or biliary fistula at the site of PJA or ulcer were encountered. The 6 months postoperative evaluation, including the CT scan and the endoscopic retrograde inspection of the neo-papilla revealed no recurrence on the jejunum.

Conclusions: Although it is a complex technique, LPSTD represents a good alternative to PD for patients with FAP and large, periampullary villous adenoma especially those with high grade dysplasia. The use of laparoscopy and of Roux en Y reconstruction may reduce the postoperative morbidity rate in PSD.

Key words: familial adenomatous polyposis, duodenal adenoma, pancreas-sparing total duodenectomy, laparoscopy, Roux en Y reconstruction

Introduction

Familial adenomatous polyposis (FAP) is a rare autosomal dominant generalized disorder caused by Adenomatous Polyposis Coli (APC) gene mutation. FAP is characterized by the presence of multiple colorectal adenomas starting to appear from the second decade of patient's life (1). It appears that the risk of developing colorectal cancer in untreated patients is almost 100 %, thereby prophylactic colectomy represents the cornerstone of FAP management (2). After colectomy, extracolonic manifestations (ECM) such as duodenal polyps and desmoid tumors are responsible for the increased morbidity and mortality in these patients (3, 4, 5). The incidence of duodenal polyps (DP) in FAP is very high but only 3-5 % of them might progress to cancer (6). The risk of malignancy in DP is assessed during upper gastrointestinal endoscopy, using *the Spigelman score*. Spigelman stages vary from I to IV depending on size, number, histology and grade of dysplasia of the duodenal adenomas (7).

While colectomy is mandatory for FAP, the majority of patients with associated DP can achieve long-term, cancer-free survival without surgery. However, endoscopic surveillance is mandatory for all of them and endoluminal interventions might be needed in some (8).

The endoscopic approaches are recommended for small polyps, with limited extension on the duodenum (Spigelman I-III) and consist of standard polypectomy, local ablation techniques (plasma argon coagulation, thermal ablation)(9) or endoscopic ampullectomy (10).

Surgery is recommended for more advanced stages (Spigelman III-IV) and in the presence of malignancies (11). Segmental duodenal resection (SDR), trans duodenal ampullectomy (TDA) and pancreas-sparing duodenectomy (PSD) are only indicated in proven benign

situations (12). Radical surgical resection, as pancreatoduodenectomy (PD) is indicated for patients with invasive carcinomas (13).

On the other hand, both PSD and PD offer definitive therapy in preventing duodenal carcinoma and they are mostly used as therapy for Spigelman III-IV duodenal polyposis associated with FAP. Thus, a prophylactic duodenectomy to avoid cancer to cancer is further advised in cases of Spigelman IV adenomatosis and after failed local endoscopic or surgical local resection (14).

Moreover, as the adenomas have a recurrence rate up 78% in the neo-duodenum the endoscopic access for life time surveillance in these patients is very important (15).

PSD was proposed as a less aggressive alternative to PD, leaving the entire pancreas in situ while the number of anastomoses is reduced. The gut reconstruction after the total duodenectomy may be performed in the Billroth 1, or Billroth 2 or pylorus-preserving fashion (16, 17). Open approach is used in the majority of cases, while laparoscopic pancreas sparing duodenectomy (LPSD) was rarely performed for duodenal polyposis associated with FAP (18).

The use of a Roux limb is very limited in literature, as it increases the procedure complexity, the number of anastomosis and it may reduce the endoscopic access for the post-operative surveillance after total duodenectomy.

Nowadays, the technology for the minimally invasive surgery (MIS) allows the safe use of this approach for PSD (18) or PD, the more functional Roux-en-Y reconstruction is standard for laparoscopy while the retrograde access in the biliopancreatic limb is not anymore a strict limitation for the endoscopic surveillance.

Our primary objective is to describe the technique for *Laparoscopic Pancreas Sparing Total Duodenectomy (LPSTD)* with *Roux-en-Y* reconstruction. We also aim to present the out-

comes of LPSTD in a patient presenting Spigelman IV duodenal polyposis associated with FAP after open total colectomy.

Method

The technique of Laparoscopic Pancreas Sparing Total Duodenectomy (LPSTD) described in this paper is proposed in patients with familial adenomatous polyposis (FAP), with surgical history of colectomy or recto colectomy for polyposis, presenting duodenal polyposis with indication for surgery: Spigelman IV with/without recurrence after endoscopic therapy.

The preoperative investigations may include Upper GI Endoscopy with Spigelman scoring, biopsy and histopathological examination of the duodenal polyposis, Blood tests, CT scan.

As LPSTD is an organ preservation procedure, the preoperative investigations should exclude the presence of duodenal carcinoma.

Clinical Case

A 39-year-old man, BMI 24kg/m², with history of FAP, a previously performed open colectomy with ileorectal anastomosis and recurrence of the duodenal polyps after endoscopic treatment was referred from the Gastroenterology Department for surgical resection. The Upper endoscopy showed more than 20 duodenal and ampullary adenomas with size varying from 5 to 15 mm. Histopathological examination revealed tubulo-villous adenomas with high grade dysplasia (Spigelman stage IV).

Computer Tomography (CT) scan was performed and it excluded an infiltrating adenocarcinoma or disseminated disease. Serum bilirubin, transaminases, alkaline phosphatase pancreatic enzymes, complete blood count, coagulogram were required in order to rule out biliary obstruction, pancreatitis, bleeding or malabsorption of vitamin K. The results were inside the normal range.

Rectoscopy revealed several small rectal polyps and the biopsies excluded dysplasia at this level.

Furthermore, after preanesthetic and cardiac assessment the patient was admitted for surgery and LPSTD was proposed. The pre-operative planning also included an extended adhesiolysis considering the previously performed open colectomy and the strategic extension of the total duodenal resection, proximally to the antrum and distally to the first jejunal loop (*Fig. 1*). The gut reconstruction was planned to be in the Roux en Y fashion, with one limb dedicated to the biliopancreatic flow and a separate one for the alimentary passage.

The laparoscopic intervention was performed in Ponderas Academic Hospital, after obtaining IRB approval, while the patient signed the informed consent.

Surgical Technique

The patient was placed in French position on

Figure 1. The preoperative planning for Laparoscopic Pancreas Sparing Total Duodenectomy (LPSTD) including the extension of the resection, proximally to the antrum and distally to the first jejunal loop.

the operating table and the procedure involved general anesthesia with orotracheal intubation.

The insufflation of the peritoneal cavity was performed in the left flank through-out blind insertion of the a Veress needle.

Five trocars were used for this operation, a 10 mm optical trocar in the umbilical scar, a 12 mm trocar in the left flank, and three 5 mm trocars (one epigastric and two into the right flank). Extended adhesiolysis is carefully performed by means of sharp dissection with the 5 mm laparoscopic scissors. In the absence of colon, (removed during the previous surgery), the anterior aspect of the pancreas and duodenum is now exposed (*Fig. 2*).

The pancreatico-duodenal complex is mobilized, dissecting its posterior aspect (Kocher maneuver), thus exposing the anterior face of the IVC and the Aorta.

The next step was to open the gastro-colic ligament, entering the bursa omentalis, in order to inspect the posterior aspect of the antrum and to evaluate the cranial limit of the resection.

Next, the first jejunal loops and their mesentery are evaluated, and the distal limit of the resection is marked 10 cm from the

angle of Treiz. At this level, the mesentery is opened with a 5 mm LigaSure device (Medtronic, Covidien, US), and the small bowel is divided using a 60 mm white stapler cartridge (60-2.5). Thus, the dissection the fourth part of the duodenum (D4) is facilitated and it will progress cranially as close as possible to the intestine, in order to avoid injuring the superior mesenteric vessels. This is also possible due to the benign histology of the duodenal lesions. After resecting the shortest duodenal branches emerging from the superior mesenteric vessels, the first jejunal loop and the D4 may be de-crossed, passing it behind the mesenteric pedicle to its right. The dissection of the third portion of the duodenum toward the papilla area, is completed from the right side.

At this point, the duodenal dissection is carried out to its cranial segments, starting from the stomach side. As a preparing step for the dissection of the first (D1) and second (D2) part of the duodenum, an antegrade cholecystectomy with trans-cystic cholangiography is performed. The assessment of the common bile duct's (CBD) morphology and of the duodenal papilla position is very important for LPSTD. The cholangiography demonstrated

Figure 2. Intraoperative aspect before LPSTD

a very narrow thin CBP (3 mm), the papilla insertion in a common position, and an accessory pancreatic duct (Santorini), 1,5 cm cranially from papilla.

With the acknowledged anatomy of the CBD, the posterior aspect of D1 is dissected, exposing the gastro-duodenal artery (*Fig. 3*). The right gastric artery is divided with the LigaSure device (Medtronic-Covidien, Minneapolis, MN, USA) and the dissection of the antral lesser curvature is completed with the same device. The antrum is transversally divided with two 60 mm purple cartridge (Tristaple, Medtronic-Covidien, Minneapolis, MN, USA), at six cm from the pylorus.

With both, cranial and distal ends mobilized, the duodenum is carefully dissected from the external aspect of the pancreatic head, using the bipolar device and monopolar hook, using a painstaking process, and advancing from both ends to the insertion of the CBD. Every vascular branch is carefully sealed, clipped or ligated in order to reduce the chance for any postoperative bleeding and to avoid the pancreatic thermal injury. The dissection succeeds to end up isolating only two anatomical structures still attaching the duodenum to the pancreatic head: the Santorini duct (cranially) and the CBD together with the main pancreatic duct (caudally). Both structures are suspended on elastic vascular

loops, specifically marked with Titanium clips (*Fig. 4*). The intraoperative cholangiography is repeated and the above-mentioned anatomical structures is confirmed by radiology (*Fig. 5*).

The Santorini's duct and the duodenal papilla are sharply transected by scissors lifting the duodenal mucosa at this level. As expected, the accessory pancreatic duct is very thin (0.5-1 mm) but the CBD and the main pancreatic duct allow the access of 4 French stents. These stents are fixated with 5.0 resorbable suture to the very structures Papila Major, with the intention to leave them lost inside of the jejuno-pancreatic anastomosis (JPA).

After the resection steps, a Roux-en-Y fashion reconstruction of the gut is planned, consisting of: a pancreatic, a gastric and a jejunal anastomosis (*Fig. 6*). Strategically, the JPA will be fashioned in the end, in order to avoid any tension or twist of this very fragile digestive connection.

The gastro-jejunal anastomosis (GJA), is the first one to be performed, by using a 60 mm Tan linear stapler (Tristaple technology, Medtronic-Covidien, Minneapolis, MN, USA). The anterior opening is closed manually with a double layer of running suture (Prolene 3.0 - Ethicon,US).

The second anastomosis is the side-to-side jejuno-jejunal one (JJA), with a 60 mm white linear stapler, closing the anterior opening

Figure 3. LPSTD - Dissection of posterior aspect of D1. The gastroduodenal artery is exposed

Figure 4. LPSTD - CBP and Santorini's duct are suspended on vascular loops

with a double layer of running suture (Prolene 3.0). The mesenteric gap is closed with a non-resorbable running suture (Prolene 3.0), for preventing the internal hernias.

Although JPA is the most cranial on the

Roux-en-Y limb, it is last to be performed, thus being reduced the negative influence of any potential problem of the GJA or the JJA.

The JPA is performed in two layers using resorbable stitches (3.0) The first posterior

Figure 5. LPSTD - Intraoperative Cholangiogram demonstrating the CBP and Santorini's duct anatomy side by side the duodenum.

Figure 6. LPSTD - The Roux en Y reconstruction after antro-duodenectomy. PSJ- PancreaticoJejunoAnastomosis; GJA- GastroJejuno Anastomosis; JJA - Jejuno-Jejuno-Anastomosis

Figure 7. LPSTD - PSJ- PancreaticoJejunoAnastomosis. CBD and the main pancreatic duct are calibrated with 4 Fr. Stents

suture is a running suture, making sure that the CBD is not injured on the posterior aspect of the pancreas. Next, the jejunum is opened, and the second posterior layer is passed at the proximity of the CBD, the main pancreatic duct and Santorini's duct. The JPA's anterior aspect is closed in the same manner, after making sure that both papilla (with the two stents) and the Santorini's duct are matched with the jejunal opening (*Fig. 7*).

After the final inspection and checking the reconstruction, two intraperitoneal drains (a spiral drain in the right sub-hepatic area and a silicon drain in Douglas pouch) are left in place for 24 h.

The specimen was extracted in an Endo-bag throughout the 12 mm incision (*Fig. 8*). and sent to the histopathological examination.

The histology revealed the presence of tubulo-villous adenomas with high grade dysplasia and no malignancies.

Results

The operative time was 280 minutes. On the postoperative course 2 complications were encountered: a self-limited pancreaticojejunal anastomosis hemorrhage occurred in the first postoperative day (POD 1) and necrosis of the

cystic duct stump with bile peritonitis occurred in the 7th day (POD7). Both of them required laparoscopic exploration with limited lavage for the bleeding complications and the cystic duct stump suturing, drainage, and extended peritoneal lavage for the second one. Oral feeding was introduced in the POD 2. The patient has been discharged in the POD

Figure 8. Specimen after Pancreas Sparing Total Duodenectomy. The Resection is extended to antrum (cranially) and jejunum (distally)

14. No other complications like delayed gastric emptying, pancreatic or biliary fistula at the site of PJA or ulcer were encountered.

CT scan and endoscopic retrograde inspection of the neo-papilla, and revealed no recurrence on the jejunum.

Discussions

Familial adenomatous polyposis (FAP) is characterized by the presence of multiple colorectal adenomas (1) and the risk of developing colorectal cancer in untreated patients is almost 100 %, thereby prophylactic colectomy represents the cornerstone of FAP management (2). Nevertheless, the timing and the type of surgery in FAP individuals is a matter of debate and may depend on a lot of factors such as: sex (fertility), extensiveness of rectal involvement, polyp burden, mutation site, history of desmoid disease, personal factors. Additionally, European Society of Gastrointestinal Endoscopy (ESGE) has recently stated that endoscopic surveillance of the rectum or pouch after proctocolectomy should be done every 1-2 years (8).

After colectomy, extracolonic manifestations (ECM) such as duodenal polyps and desmoid tumors are responsible for the increased morbidity and mortality in these patients (3). Development of duodenal adenomas takes place mainly in the second and third part of the duodenum with a focus on the periampullary region. The incidence of duodenal polyps in FAP may approach 100% by the age of 70 years, although only 3-5 % of them might progress to cancer (6). Furthermore, it is known that prolonged contact with bile acids may accelerate adenoma-carcinoma sequence in duodenal polyps (19). Thus, endoscopic duodenal surveillance, with the use of cap assisted endoscopy for a good evaluation of the papillary region, is recommended to be started at the age of 25 years in all the patients with FAP (20).

The risk of malignancy in duodenal polyposis is assessed during upper gastrointestinal endoscopy, using Spigelman score (7). Patients with Spigelman stage I-II are advised to perform endoscopy every 3-5 years. However,

intervals should be reduced in stages III-IV to 1 year-6 months, taking also into consideration endoscopic or surgical treatment.

Ampullary adenomas have an increased risk of malignancy, thus a separate surveillance strategy has been proposed. It is advisable that patients with ampullary adenomas less than 10 mm undergo endoscopy every 3 years while those presenting ampullary adenomas bigger than 10 mm should be checked endoscopically every 12 months (21). To conclude, both Spigelman stage and of the ampullary region evaluation should dictate the surveillance intervals, suggested to be the shortest agreed.

In FAP patients with non-ampullary duodenal adenomas sizing more than 10 mm, endoscopic resection is recommended. Endoscopic approach may consist of standard polypectomy and local ablation techniques (plasma argon coagulation, thermal ablation) (9). Bleeding, post-procedural abdominal pain, recurrence rate varying from 22-100% have been the most frequently reported complications (22). On the other hand, for ampullary lesions, endoscopic ampullectomy is recommended. However, ampullectomy carries severe complication rates such as pancreatitis, bleeding, abdominal pain, recurrence rate, therefore it should be performed only in tertiary centers with high caseload volumes (23).

Surgery is recommended whenever the endoscopic approach cannot control the evolution of the disease. The organ preservation procedures (SDR, TDA and PSD) are only indicated in proven benign situations (12) while radical surgical resection, such as pancreatoduodenectomy (PD) is indicated for patients with invasive carcinomas (13).

PSD was proposed as a less aggressive alternative to PD, leaving the entire pancreas in situ while the number of anastomoses is reduced. The first report of an experimental study proposing PSD was published by Sillin et al (24) in 1984. Same group subsequently published their experience in a cohort of patients, most of them with FAP (16). They succeeded in preserving the pancreas and in restoring the anatomical configuration of gastrointestinal tract. In Whipple procedure

this reconstruction is generally not used.

Another retrospective review (11) has emphasized on two aspects: PSD enables better endoscopic access for follow-up and less anastomosis are required than in Whipple procedure.

The endoscopic access advantage may be very important as the follow-up is crucial for these patients. The adenomas have a recurrence rate of 78% in the neo-duodenum according to a prospective study (25). Also chemoprevention has been proposed in order to reduce the polyp formation. Even though cyclooxygenase inhibitors were tested with promising results, there is no drug with approved indication for FAP (26).

However, comparative studies of PSD and standard pancreaticoduodenectomy for ampullary adenocarcinoma has been shown comparable short-term morbidity (62% vs. 57%; $P=0.05$) and mortality (4% vs. 3%; $P=0.05$) rate (27). Furthermore, PSD might leave areas of ampullary mucosa that may still undergo malignant change (12) and may also result in increased anastomotic tension secondary to delayed gastric emptying, as well as adversely affecting the function of the patient's ileoanal pouch (28).

The reconstruction after total duodenectomy for duodenal polyposis associated with FAP is usually a Billroth 1 or Billroth 2 anastomosis (16, 17). Open approach is used in the majority of cases, while laparoscopic pancreas sparing duodenectomy (LPSTD) was rarely performed in these patients (18). The use of a Roux limb is very limited in literature, as it increases the procedure complexity, the number of anastomo-

sis and it may reduce the endoscopic access for the postoperative surveillance after total duodenectomy.

The complication rate is high (Table 1) and intra-abdominal hemorrhage, acute pancreatitis, fistulae of the pancreatico-jejunal and gastrojejunal anastomosis, intrabdominal abscess or infection of the surgical wound, delayed gastric emptying and recurrence seemed to be more frequent (29). Some of them may be theoretically reduced by the use of the Roux en Y reconstruction: delayed gastric emptying (DGE), ulcers, whilst others may be better managed with this type of reconstruction (pancreatic or biliary fistula as the PJA is on an excluded isoperistaltic limb). On the other hand, the actual technology for minimally invasive surgery (MIS) allows the safe use of this approach for PSD (18) or PD, the more functional Roux en Y reconstruction is standard for laparoscopy while the retrograde access in the biliopancreatic limb is not anymore a strict limitation for the endoscopic surveillance. Taking into consideration the above mentioned arguments, we propose the use of Laparoscopic Pancreas Sparing Total Duodenectomy (LPSTD) with Roux en Y reconstruction in patient presenting Spigelman IV duodenal polyposis associated with FAP after open total colectomy (Fig. 6). The limitations of this procedure might be related to the complexity of the reconstruction with more anastomosis and mesenteric gaps and to the endoscopic retrograde access to the neo papilla. Both limitations are relatively easy to be overcome by the experience in MIS and endoscopy.

Table 1. Outcomes of Pancreas Sparing Total Duodenectomy

study	No.Pts	SC	Approach	type	TS	HS	Complications (%)	ReOP	Rec.
Imamura, M., et al. (2005).(17)	1	NS	open	B1	NS	NS	NS	NS	NS
de Castro, S. M., et al. (2008).(27)	26	III-IV	open	B2	NS	14	45%		
PF, DGE, IAA	4	4							
Sarmiento, J. M., et al. (2002).(12)	5	NS	open	NS	370	18	PF,PB,IAA,Ulcer,PA	1	2
Augustin, T., et al. (2018).(13)	42	III-IV	open	NS	NS	NS	BF,PA,PB,Ulcer,	6	16

SC – Spiegelman Score, ReOP- Reinterventions, Rec. -Recurrency, NS – not specified, B1- Billroth 1, B2 – Billroth 2, PF – Pancreatic Fistula, BF- Biliary Fistula, DGE- Delayed Gastric Emptying, IAA- Intraabdominal Abscess, PB- Postoperative Bleeding

Conclusions

Although it is a complex technique, LPSTD with Roux en Y reconstruction represents an alternative for patients with FAP and large, periampullary villous adenoma especially those with high grade dysplasia. Infiltrating adenocarcinoma in duodenal polyposis represents a clear indication for Pancreaticoduodenectomy (Whipple procedure).

Due to relative high short-term morbidity rates comparable to those of standard pancreaticoduodenectomy, (27) LPSTD should be performed in expert center being demanding even for experienced surgeons. In our case the complications were promptly identified due to post-operative ultrasound follow up and managed accordingly.

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Conflict of Interest: No

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