

Spleen preserving laparoscopic distal pancreatectomy for treatment of pancreatic lesions



Ann. Ital. Chir., 2015 86: 273-278
pii: S0003469X15023581

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AIM: Aim of this study is to evaluate the feasibility and safety of the laparoscopic approach in the treatment of distal pancreas tumors, from prospectively collected data.

MATERIAL OF STUDY: From January 2003 to July 2013, 20 patients were treated by laparoscopic approach for distal pancreatic lesions. Nine patients underwent laparoscopic pancreatic tumorectomy (LPT) (Group A) for insulinoma (mean lesion diameter 1.2 cm, range, 0.5-2) and 11 patients underwent spleen preserving laparoscopic distal pancreatectomy (SP-LDP) (Group B) for ductal adenocarcinoma (pT1N0R0) (1), cystic mucinous neoplasm (5), serous cystadenoma (4) and lymphoepithelial cysts (1).

RESULTS: Mean operative time was 94.3 minutes (range 80-110) for Group A and 164 minutes (range 90-240) for Group B. Intraoperative bleeding occurred in 4 cases (20%) and was easily controlled by laparoscopy. Conversion to open surgery was not required in any case. Morbidity was observed in 2 patients (18%) in Group A: pancreatic fistula (1) and peritoneal fluid collection (1); and a peritoneal fluid collection occurred in one patients (11%) in Group B. Mean hospital stay was 6.8 days (range 3-11) in Group A and 6.5 days (range 3-10) in Group B. Mortality was nil. At a mean follow-up of 82 months (range 15-141) local recurrence and distant metastases were not observed.

DISCUSSION: LDP is a valid treatment showing the same rate of complication to open surgery but allowing the advantages of a minimally invasive procedure.

CONCLUSIONS: SP-LDP is feasible and safe for benign and malignant pancreatic lesions.

KEY WORDS: Distal pancreatectomy, Spleen preserving Laparoscopic distal pancreatectomy (SPLDP), Laparoscopic pancreatic tumorectomy (LPT), Laparoscopic surgery

Introduction

Recently, laparoscopic approach for treatment of distal pancreatic lesions has been gradually spreading, however the role of minimally invasive surgery in pancreatic resection is still limited to a few centers due to the deep

location of the pancreas and its anatomic relations with the duodenum and spleen with its vessels. Initially the use of laparoscopy was limited to the operative staging or the palliative procedures ¹⁻⁵, but in 1994, Gagner performed the first laparoscopic Whipple procedure in a patients with chronic pancreatitis ⁶, and two years later he reported a retrospective review of eight cases of laparoscopic distal pancreatectomy (LDP) for benign tumors ⁷. After histological examination one patient resulted to be affected by adenocarcinoma: this is the first report of a malignant tumor of pancreas treated laparoscopically. In 1999 the second case of LDP for adenocarcinoma was published in Italy ⁸.

Aim of this study is to evaluate the feasibility and safety of the laparoscopic approach in the treatment of distal pancreatic tumors, from prospectively collected data.

Pervenuto in Redazione Dicembre 2014. Accettato per la pubblicazione Febbraio 2015

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Materials and Methods

From January 2003 to July 2013, 20 patients were treated by laparoscopic approach for lesions of distal pancreas. Of these, 9 (2 males and 7 females, mean age 40.8 years, range 25-54) underwent laparoscopic pancreatic tumorectomy (LPT) for benign lesions (Group A) (mean lesion diameter 1.2 cm, range 0.5-2) and 11 patients (4 males and 7 females, mean age 47.4 years, range 20-70) underwent spleen preserving laparoscopic distal pancreatectomy (SP-LDP) (Group B). Preoperative assessment included clinical examination, hormonal and tumor markers' assay, abdominal magnetic resonance (MRI) and total body computed tomography (CT) scan. For insulinoma also scintigraphy with octreotide, insulin/glycemia ratio (>0.4) and fasting test were used. In the group tumorectomy, 6 patients was referred at authors' attention by endocrinologist for hypoglycemia, the remaining patients in both groups were admitted for aspecific symptoms like abdominal pain and dyspepsia, in five patients the pancreatic lesions were incidentalomas. Hormonal assay resulted positive for hyperinsulinemia in 6 patients, and, in four out of six, scintigraphy confirmed a pancreatic lesion. One patient showed increase of the tumoral markers assay. Preoperative patients feature and pre-operative assessment are shown in Table I.

SURGICAL TECHNIQUE

Surgery is performed under general anesthesia. A nasogastric tube and urinary catheter are placed.

Pneumoperitoneum is established by Veress needle at the umbilicus and seted at 13-14 mmHg of pressure, with carbon dioxide flow adjusted at 30 lt /minute. Four trocars and a 45° forward oblique optic are required. This approach is performed with the patient supine, in anti-Trendelenburg position and with the operating table turned 30° on the right, to facilitate exposure of the surgical field. The surgeon stands on the left side of the operative table. After induction of pneumoperitoneum, the first 12 mm optical trocar (n. 1) is inserted above the umbilicus. The second 12 mm trocar (n. 2) is placed under vision subxiphoid. The third (n. 3) and fourth (n. 4) trocar are then inserted, one along the left emiclavicular line below the ribs and the other one on the left anterior axillary line at level of the transverse umbilical line (Fig. 1). For spleen salvage procedure, authors prefer perform surgery according to technique described by Kimura⁹ whenever possible. Surgery starts by exploration of the abdominal cavity to exclude metastases and if it is necessary laparoscopic ultrasound can be performed. By vessel sealing device (LigaSure™ tissue fusion, Covidien, Mansfield, Massachusetts, USA) instrumentation, gastrosplenic and gastrosplenic ligament were divided. Above the transverse colon, by blunt dissection, the upper and lower border of the pancreas were separated from splenic artery and vein, preserving them and revealing thus the superior mesenteric vein and the portal vein. Pancreas was divided by an endoscopic stapler (Endo-Gia, Echelon 60 stapler, Echelon Corporation, San Jose, CA, USA). Monopolar electrocautery is selectively used for hemostasis. After mobilization, the pancreas is removed by an extraction bag through the umbilical

Table I - Patients' characteristics and results

	Group A	Group B
Surgical Procedure, (n. patients)	Tumorectomy, (9)	Distal pancreatectomy, (11)
Sex ratio (M:F)	2:7	4:7
Mean age, years (range)	40.8, (25-54)	47.4, (20-70)
BMI*, kg/m ² (range)	26.2 (18.2-36.3)	28.2 (18.8-38.5)
ASA** class, (n. patients)	I, (2) II, (5) III, (2) IV, (0)	I, (3) II, (6) III, (2) IV, (0)
Clinical presentation (patients)		
Hypoglycemia	6	0
Abdominal pain	0	4
Dyspepsia	0	2
Incidentalomas	3	5
Mean tumor diameter at imaging, cm (range)	1.5 (0.8-2.0)	2.7 (1.8-4.5)
Positive scintigraphy with octreotide (n. patients)	4	0
Endocrinological assay, (n. patients) Insuline	6	0
Other (Somatostatin, Cromogranine, NSE, VIP, Gastrin)	0	0
Tumor markers assay, (n. patients)		
CEA	0	1
Ca 19.9	0	1
Ca 125	0	0

* BMI: Body Mass Index; ** American Society of Anesthesiologists'

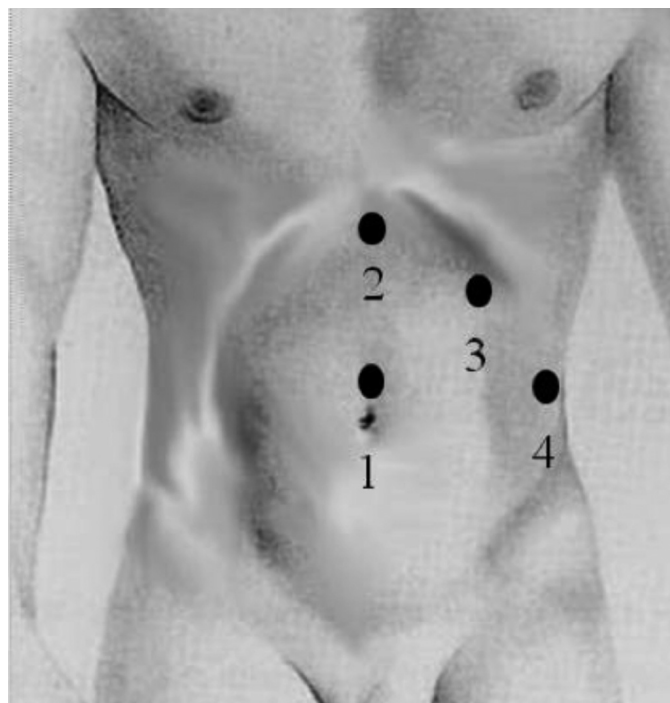


Fig. 1: Trocar position.

trocars site. The surface of the pancreatic section is then covered with hemostatic agent (FloSeal, Baxter Healthcare Corporation, Deerfield, Illinois, USA) and a drainage is left in place.

FOLLOW-UP PROTOCOL

Patients with endocrine and/or benign tumors were followed up after surgery by clinical examination, hormonal markers' assay, abdominal MRI and /or total body CT scan, every six months for the first year and every twelve months for the next 2 years. Patients with malignant neoplasm were strictly followed up by clinical examina-

tion, tumoral markers' assay every three months and total body CT scan every six months for the first 2 years and by the same protocol one time at year until the 5th years after surgery.

Results

Mean operative time was 94.3 minutes (range 80-110) for Group A and 164 minutes (range 90-240) for Group B. Intraoperative ultrasound (US) evaluation of the pancreatic gland and lesion was performed systematically, in four cases the lesion was not evident and it had been detected by US. Intraoperative bleeding was observed in 4 cases (20%) and was easily controlled by laparoscopy by monopolar electrocautery and hemostatic agents. Conversion to open surgery was not required in any case. Spleen preservation was achieved in all cases (100%). Final pathological staging was: insulinoma (9) (mean lesion diameter 1.2 cm, range, 0.5-2.0), ductal adenocarcinoma (pT1N0R0), cystic mucinous neoplasm (5), serous cystadenoma (4) and lymphoepithelial cysts. Patients' resumption of an oral diet occurred on the second postoperative day. Mean hospital stay was 6.8 days (range 3-11) in Group A and 6.5 days (range 3-10) in Group B. Postoperative complications, according to Clavien-Dindo's Classification¹⁰, were observed in 2 patients (18%) of Group A: one pancreatic fistula (5%) (Grade II), diagnosed according to the criteria by International Study Group for Pancreas Fistula (ISGPF)¹¹, radiological drain was not required because fistula was detected in III post-operative day and the surgical drain was left in place until its resolution (32 days), the patient was treated by enteral nutrition and administration of antibiotics and octreotide; and one peritoneal fluid collection (Grade II), treated by antibiotics administration. One patient (11%) in Group B developed a peritoneal abscessed fluid collection (Grade IIIa) that was treated by radiologic drainage, left in place for 25 days. Patients who experienced complications requiring drainage (pancreatic fistula and fluid collection) were discharged with

TABLE II - Results and complications.

	Group A	Group B
Operative time, min. (range)	94.3, (80-110)	164, (90-240)
Histopathological staging, (n.)	Insulinoma (9)	Ductal adenocarcinoma (pT1N0R0) (1) Cystic mucinous neoplasm (5) Serous cystadenoma (4) Lymphoepithelial cysts (1)
Mean tumor diameter, cm (range)	1.2 (0.5-2)	2.5 (1.5-4.3)
Complications, n. (Clavien's classification, class)	2 (II)	1 (IIIa)
Pancreatic fistula, n. (%)	0	1 (9%)
Grade	—	A
Treatment	—	Enteral nutrition, antibiotics, octreotide
Mean hospital stay, days (range)	6.8, (3-11)	6.5, (3-10)

the abdominal drain that had been removed, after control CT scan, at 32 and 25 postoperative days respectively (Table I). Mortality was nil (Table II). At mean follow-up of 82 months (range 15-141) no local recurrence and distant metastases were observed.

Discussion

Recently, laparoscopic pancreatic surgery has significantly increased due to a rate of major complications and pancreatic fistula comparable to conventional surgery in high-volume centers¹²⁻¹⁴. The most important factors to reduce the learning curve are the strict selection criteria, high-volume hospital, and an experts team in pancreatic surgery¹⁵.

Nowadays the Kimura's and Warshaw's are the most frequently used techniques for spleen-preserving pancreatic distal resection^{9,16}. In Kimura's technique the splenic vein is identified behind the pancreas and isolated from the pancreatic body toward the spleen; the pancreas is then removed from the splenic artery from the spleen toward the head of the pancreas⁹. Warshaw's technique is useful when it's not possible to preserve the splenic vessels or in case of an uncontrollable bleeding; the pancreas is separated from the spleen by dividing the splenic artery and vein distal to the tip of the pancreas; the spleen perfusion is provided by the short gastric vessels, which are carefully preserved¹⁶. Both procedures can be performed laparoscopically.

In literature, statistically significant difference between laparoscopic and open approach for distal pancreatic lesions in terms of operative time¹⁷⁻¹⁹, pancreatic fistula and mortality²⁰ are not reported. Also in terms of oncological results, in patients with pancreatic ductal adenocarcinoma, laparoscopic approach provides similar short and long-term oncologic outcomes if compared to open approach²¹. Furthermore the laparoscopic approach has many advantages as intraoperative blood loss, smaller incisions, less bowel manipulation, less pain that reduces analgesic administration, facilitating early recovery of bowel function and decreasing the postoperative hospital stay²⁰.

Moreover, the spleen-preservation rate with laparoscopic approach is significantly higher than open approach and ranges from 15.5% to 44.2% for LDP and from 5.7% to 15.6% in open distal pancreatectomy, due to a better view of the laparoscopic field²². In this series spleen preservation was achieved in 100% of cases. Splenectomy usually leads to an increased risk of infection, hematologic complications and to an increased postoperative morbidity^{23,24}. In literature, incidence of pancreatic fistula in LDP and in open surgery, ranges from 8.1% to 27.9% and from 6.5% to 18.2% respectively²². In the present series, pancreatic fistula rate in patients who underwent tumorectomy was 11.1 %, and overall pancreatic fistula rate, across the entire series, was 5%.

Recently robotic surgery has increased its interest and diffusion for pancreatic resection, due to its technical advantages as the 3D and magnified vision of the operative field and the increased freedom movement of the instruments, that can easily reproduce the open technique²⁵. All the improvements above mentioned have opened a new approach to the pancreatic minimally invasive surgery. Actually are not available in literature randomized control studies comparing open, laparoscopic and robotic pancreatic surgery, however more exhaustive data are been provided by a recent review article, including non-controlled-case series with a total of 251 robot assisted pancreatic procedures²⁵. Conversion rate results 10.6%, with a total complication rate of 30.7%^{25,26}. Pancreatic fistula was observed in 19,9% of the patients, however considering only the grade B and C, according to the ISGPS classification, the fistula rate amounted to 11.6%, mortality reached the 1.6% and positive margins were found in 7.1% of patients undergone to pancreatoduodenectomy^{25,27}. Analyzing only the robotic assisted distal pancreatectomy series, the conversion rate decrease to 7.7% , complications rate to 17,6% and fistula rate to 16,1%, no mortality has been reported²⁵. In these series was observed an overall complications rate of 15% and mortality was nil. Probably the most interesting data concern the spleen preservation rate registered up to 87,1%²⁵. The main limit of robot assisted pancreatic surgery is the longer operative time and the higher initial cost²⁵. However, a non-randomized study recently published, compared laparoscopic distal pancreatectomy with robotic distal pancreatic resection, and does not show statistically significant differences between the two groups, except for the increase of cost and operative time in robotic arm, resulting in procedure technical equivalence in terms of complications and oncological results²⁸.

In centers where robotic instrumentation and expertise are not available, laparoscopic distal pancreatectomy is a valid alternative treatment due to the same complication rate if compared to open surgery and with lower incidence of wound infection and late incisional hernia. It can be performed in patients with a variety of pancreatic disorders providing no mortality and morbidity rates lower than open surgery, but allowing the advantages of a minimally invasive procedure with lower pain, better cosmetic results, reducing hospital stay and faster postoperative recovery²⁹⁻³⁰. It required however an adequate learning curve in mini-invasive laparoscopic and pancreatic surgery.

Conclusions

Based on the present experience, the authors conclude that the spleen preserving laparoscopic distal pancreatectomy technique for treatment of distal pancreatic lesions is feasible and safe for benign and malignant lesions. A larger series of patients are required to confirm these conclusions.

Riassunto

OBIETTIVO: Scopo dello studio è di valutare la fattibilità e la sicurezza dell'approccio laparoscopico nel trattamento dei tumori della coda del pancreas, con dati raccolti in modo prospettico.

MATERIALE DI STUDIO: Da Gennaio 2003 a Luglio 2013, 20 pazienti sono stati trattati con approccio laparoscopico per lesioni del pancreas distale. Di questi, 9 sono stati sottoposti a tumorectomia pancreatica (Gruppo A) per insulinoma (diametro medio della lesione 1.2 cm, range 0.5-2) e 11 pazienti sono stati sottoposti a resezione distale del pancreas con conservazione della milza (Gruppo B) per adenocarcinoma duttale (pT1N0R0) (1), neoplasia mucinoso-cistica (5), cistoadenoma sieroso (4) e cisti linfoepiteliale (1).

RISULTATI: Il tempo operatorio medio è stato di 94.3 minuti (range 80-110) per il Gruppo A e di 164 minuti (range 90-240) per il Gruppo B. È stato osservato un sanguinamento intraoperatorio in 4 casi (20%), che è stato facilmente controllato in laparoscopia. La conversione a cielo aperto dell'intervento non è stata richiesta in nessun caso. La morbidità è stata osservata in 2 pazienti (18%) del Gruppo A: fistola pancreatica (1) e raccolta peritoneale (1); e una raccolta peritoneale è stata osservata in un paziente (11%) del Gruppo B. La degenza media è stata di 6.8 giorni (range 3 - 11) nel Gruppo A e di 6.5 giorni (range 3 - 10) nel Gruppo B. Non è stata osservata mortalità. Ad un follow-up medio di 82 mesi (range 15-141) non sono state osservate recidive locali né metastasi a distanza.

DISCUSSIONE: La pancreatectomia distale laparoscopica è una valida alternativa di trattamento in quanto ha lo stesso tasso di complicanze della chirurgia tradizionale ma ha i vantaggi della chirurgia mini-invasiva.

CONCLUSIONI: La pancreatectomia distale laparoscopica con preservazione della milza è un approccio sicuro e fattibile per le lesioni benigne e maligne del pancreas.

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