Minimally invasive distal pancreatectomy
A retrospective review of 30 cases

Ann. Ital. Chir., 2017 88, 2: 122-128
pii: S0003469X17026410

Aziz Sümer*, Umut Barbaros**, Salvador Morales Conde***, Sebahattin Celik*, Nihat Aksakal**, Jose Maria Alamo***, Isaias Alarcon***, Nazim Güreş****, Hamit Karayağiz****, Ahmet Dinççag**, Ridvan Seven**, Selçuk Mercan**, Demir Budak**

**Department of General and Transplantation Surgery, Yuzuncu Yil University, Van, Turkey*
***Department of General Surgery, Istanbul University, Istanbul, Turkey*
****Unit of Innoviation of Minimally Invasive Surgery, University Hospital Virgen del Rocio,Sevilla,Spain*
*****Department of General Surgery, Acibadem Hospital, Istanbul, Turkey*

Minimally invasive distal pancreatectomy. A retrospective review of 30 cases

OBJECTIVES: *Pancreatic surgery has been greatly influenced by the advent of laparoscopic surgery and increasing experience in its performance and by advances in techniques and surgical devices. This study aimed to represent two centers' initial experiences in laparoscopic distal pancreatic surgery.*
METHODS: *This study was a bi-centric study including 30 patients undergoing distal pancreatectomy for pancreatic disorders. All the patients were operated on from November 2006 to November 2013 in Turkey and Spain.*
RESULTS: *Laparoscopic spleen-preserving distal pancreatectomy was performed in 9 patients, laparoscopic distal pancreatectomy was performed in 14 patients, laparoscopic enucleation was performed in 4 patients, and single-incision laparoscopic distal pancreatosplenectomy with splenectomy was performed in 3 patients.*
CONCLUSIONS: *Laparoscopic distal pancreatectomies for pancreatic disorders are feasible and safe procedures if performed by experienced laparoscopic surgeons.*

KEY WORDS: Laparoscopy, Pancreas, Multi-port, Tumor, SILS

Introduction

Laparoscopic surgery for distal pancreatic lesions has been increased recently. However, laparoscopic resection of the pancreas remains uncommon despite laparoscopic surgical approaches having become the standard techniques for several procedures [1-5]. The first laparoscopic pancreaticoduodenectomy was performed in 1994 by Gagner et al. [6]. The first laparoscopic distal resection for insulinoma was reported in 1996 by Sussman et al. [7], and the first distal resection for malignancy was reported in 1999 by Santoro et al. [8]. The first single- incision laparoscopic distal pancreatectomy was performed by our team members in 2010 [9].

Over the past decade, advances in laparoscopic techniques have allowed surgeons to approach the pancreas and to treat these lesions laparoscopically [10]. Laparoscopic excision of benign pancreatic disease and endocrine neoplasms has become a common practice in many centers [11-15]. Although laparoscopic distal pancreatectomy (LDPS) typically requires no anastomoses, laparoscopic pancreatic surgery remains uncommon due to the anatomic location of the pancreas, the technical difficulties with pancreatic resection, the relative rarity of pancreatic disorders treated surgically, and the requirement for highly experienced laparoscopic and pancreatic surgeons [5,16]. Laparoscopic surgery offers the advantages of minimally invasive surgery, such as a small incision, good cosmetic results, less surgical invasiveness, which shortens the hospital stay, decreased postoperative pain, and earlier

Pervenuto in redazione Settembre 2016. Accettato per la pubblicazione Dicembre 2016
Correspondence to: Sebahattin Celik M.D (Asst. Prof. of General Surgery), Department of General and Transplantation Surgery, Yuzuncu Yil Universitesi Tip Fakültesi, Genel Cerrahi Kliniği,Turkey (e-mail address: scelik@yyu.edu.tr)

recovery with return to normal activity. Moreover, areas that cannot be visualized with the naked eye can be clearly seen using the laparoscope [11,17-20].

This study aimed to assess the results of laparoscopic treatment of diseases of the pancreas and to represent two centers' initial experiences with laparoscopic pancreatic surgery.

Materials and Methods

From November 2006 to November 2013, 30 patients with pancreatic disorders were operated on laparoscopically. The patients' ages, sexes, operating times, blood loss, conversion rate, morbidity, incidence of pancreatic leak, mortality and length of hospital stay were analyzed retrospectively. Absolute contraindications for laparoscopy were infiltration of surrounding organs or vessels and distant metastases. Relative contraindications included tumor size and the patient's condition. Diagnoses were established using radiologic and biochemical modalities. All the operations were performed by AS, UB, and SMC with their teams, who were experienced in advanced minimally invasive surgery. The first single-incision laparoscopic splenectomy, distal pancreatectomy and liver resection in the world literature were performed by our team members [9,21,22].

For the investigation of complications, such as intra-abdominal abscess and pancreatic fistula, abdominal computerized tomography (CT) was used. Pancreatic fistula was defined according to the 2005 International Study Group of Pancreatic Fistula [23,24]. Pancreatic leakage included any amount of pancreatic output from the drain that contained amylase levels 3-fold greater than the normal serum level.

The final diagnosis was based on either a rapid pathological diagnosis or a postoperative histopathological analysis.

Operative Technique

Four surgical techniques — laparoscopic spleen preserving distal pancreatectomy (SPDP), laparoscopic distal pancreatosplenectomy (LDPS), laparoscopic enucleation (E), and single-incision laparoscopic distal pancreatosplenectomy (SILS-DPS) — were used.

Standard Multi-Port Laparoscopy

The patient was placed in a supine and reverse Trendelenburg position (30 degrees) with open legs. The surgeon stood between the legs; the first assistant was on the left side of the patient with the monitor placed on the patient's cranial side. A four-port laparoscopic technique was used. After the maintenance of a 12 mm Hg CO_2 pneumoperitoneum, three 10-mm trocars were inserted at the umbilicus 5 cm below the xiphoid area and in the anterior axillary line at the level of umbilicus.

A fourth 12-mm port was placed in the midclavicular line for tumors located in the tail of the pancreas. A 30 degree laparoscope was used. To attain exposure of the pancreas, the gastrocolic ligament was divided using vessel sealing devices (LigaSure device Tyco, US Surgical, Valleylab, Boulder, CO, USA). For tumors located in the tail of the pancreas, spleen-preserving distal pancreatectomy (SPDP) or distal pancreatectomy and splenectomy (LDPS) was chosen. For SPDP, care was taken to preserve the spleen together with splenic artery and vein and short gastric arteries. The gastrosplenic ligaments were transected, and the spleen was retracted superiorly. The tail of the pancreas was freed by careful dissection. To transect the pancreas and perform distal pancreatectomy, a 60-mm endoscopic linear stapler was used, which provided both closure of the pancreatic duct and hemostasis. A distal pancreatic specimen or enucleated tumor specimen was extracted in an endoscopic plastic bag (Endocatch; US Surgical). A single suction drain was left in the region of the resected pancreatic tail. All the ports were removed, and the sites of the ports were closed.

Single Incision Laparoscopic Surgery

The patient position was the same as with standard laparoscopic pancreatectomy. The umbilicus was raised using a Kocher clamp, and a 2 cm incision was made from the skin to the peritoneal cavity. A special three working channel flexible single port was introduced through the incision with a Sims Maier clamp. We used a rigid, 30-degree, 5-mm laparoscope, and 2 standard rigid but articulating 5-mm laparoscopic instruments for the SILS procedure. Once the laparoscope, grasper, and dissector were placed, the overall procedures were similar to the procedures performed in 4- to 5-port laparoscopic pancreatectomy. The most difficult part of this technique was that the working instruments crossed each other and roticulated. The 5-mm telescope was introduced under both of the working instruments and sometimes over them, changing according to the surgical step of the procedure. Following diagnostic laparoscopy, to attain exposure of the pancreas, the gastro-colic ligament was divided using a 5 mm LigaSure Advance device (Tyco, US. Surgical, Valleylab, Boulder, CO, USA). Before starting pancreatic dissection, we placed a loop encircling the corpus of stomach the by crossing the lesser curvature and greater curvature for preoperative continuous retraction. We prepared the loop using polypropylene sutures covered with a plastic tube of IV serum, which was set to prevent possible stomach injury. Two tips of this suture were removed from the abdominal cavity with a suture passer placed under the xiphoid process. During the entire procedure, stomach retraction was provided with this tensed loop of Prolene securing

the stomach. The pancreatic dissection obeyed the standard operative rules for open or standard laparoscopic techniques. The peritoneal lining along the inferior edge of the pancreas was dissected at the point where transection of the pancreas would be performed. An adequate window was created; a roticulated grasper was passed around the body of the gland. The splenic vein was identified and ligated with LigaSure at this level. Dissection of the pancreas from the pancreatic bed was started after ligation of the splenic artery near the celiac trunk. Pancreas transection was performed using an EndoGIA (4.8 mm/45 mm, Covidien, Mansfield, MA, USA) stapler. Distal pancreatectomy was performed with splenectomy as the single incision splenectomy technique that we previously described [21]. The proximal pancreatic stump was reinforced with fibrin glue. Before extraction, the pancreas and spleen were separated intracorporeally. Later, the spleen was removed after morcellation in an endobag. The pancreas was removed through the umbilical incision as an intact specimen. A single suction drain was left in the region of the pancreatic resection. After removal, the port site in the skin was closed.

Statistical Analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) for Windows (IBM SPSS Statistics for Windows, version 20.0; IBM Corp., Armonk, NY, USA). The variables were investigated using visual (histograms, probability plots) and analytic methods (Kolmogorov-Smirnov/Shapiro-Wilk tests) to determine whether they were normally distributed. Descriptive analyses are presented using means and standard deviations for normally distributed variables and using medians and minimum-maximum for non-normally distributed variables. We used the chi-square test with correction for continuity by Fisher's exact test to assess proportions between cases performed in Spain and Turkey in terms of pancreatic fistula. A p value less than 0.05 was considered statistically significant.

Results

The mean age of the patients was 50 years old (±14.6 years). Of 30 patients, 23 patients were female, while 7 patients were male. The diagnoses were well-differentiated neuroendocrine tumors in 5 patients, insulinomas in 7, mucinous cystadenoma in 4, adenocarcinomas in 7, intrapancreatic ectopic spleen in 2, renal cell cancer metastases in 2, nesidioblastosis in 1, somatostatinoma in 1, and papillary intraductal neoplasia in 1. Demographic and clinical data are shown Table I for the Turkish experience and Table II for the Spanish experience.

Nine of the patients underwent planned laparoscopic spleen-preserving distal pancreatectomy. During the operations, the splenic vessels and short gastric vessels were preserved. The Warshaw technique [25] was not used in the SPDP patients. Fourteen patients underwent laparoscopic distal pancreatosplenectomy. Three patients underwent single-incision laparoscopic distal pancreatosplenectomy, and four patients underwent laparoscopic enucleation. There was only one conversion to an open

Table I - *Data from patients who operated in Turkey.*

No	A/S	O	HS	C	TC	OT	P	FU
1	54/F	LDP	8	None	None	120	Adenocarcinoma	20
2	71/F	SPDP	24	None	None	160	Well differentiated neuro endocrine tumor	36
3	26/F	SPDP	4	None	None	130	Insulinoma	12
4	59/F	SPDP	12	Pancreatic fistula	Resolved spontaneously	150	Well differentiated neuro endocrine tumor	13
5	31/M	LDPS	7	None	None	110	Ectopic intrapancreatic spleen	13
6	48/F	LDPS	7	Intra-abdominal abscess	Re-operated 10 days later	100	Mucinous cystadenoma	36
7	47/M	E	14	Pancreatic fistula	ERCP	140	Insulinoma	12
8	65/F	SILS-LDPS	30	Pancreatic fistula and splenic artery aneurism	ERCP, CE	180	Insulinoma	12
9	59/F	SILS-LDPS	7	Pancreatic fistula	Resolved spontaneously	330	RCC Metastasis	12
10	54/M	LDPS	7	Pancreatic pseudocyst	Follow up	240	Adenocarcinoma	19
11	78/F	SPDP	10	Pancreatic fistula	Resolved spontaneously	100	Adenocarcinoma	5
12	63/M	SPDP	6	None	-	240	Nesidioblastosis	56
13	42/F	E	25	Pancreatic fistula	Re-operated 8 days later	150	Insulinoma	51

A/S: Age and Sex, O: Operation type, HS: Hospital stay(day), C: Complication, TC: Treatment of complication, OT: Operating time (minute), P: Pathology, FU: Follow-up (in months). LDP: Laparoscopic distal pancreatosplenectomy, LDPS: Spleen preserving distal pancreatectomy, E:Enucleation. SILS-DPS: Single incision Laparoscopic Distal Pancreatosplenectomy. ERCP: Endoscopic retrograde cholangio pancreatography, CE: Coil embolisation, RCC: Renal Cell Carcinoma. FU: Follow-up period (in months).

TABLE II - *Data from patients who operated in Spain.*

No	A/S	O	HS	C	TC	OT	P	FU
1	51/M	LDPS	10	None	-	210	Insulinoma	50
2	45/F	E	7	None	-	140	Insulinoma	48
3	67/F	E	25	Pancreatic fistula	Resolved spontaneously	130	Somatostatinoma	36
4	52/F	LDPS	18	Intra-abdominal abscess	Antibiotic	210	Mucinous cystoadenoma	26
5	61/F	LDPS	5	None	-	220	Papilar Intraductal Neoplasia	21
6	56/F	LDPS	12	Pancreatic fistula	Resolved spontaneously	300	Mucinous cystoadenoma	18
7	36/F	SPDP	6	None	-	230	Mucinous cystoadenoma	13
8	32/F	LDPS	11	None	-	220	Ectopic intrapancreatic spleen	15
9	40/M	LDPS	5	None	-	150	Adenocarcinoma	96
10	32/F	LDPS	3	None	-	90	Insulinoma	38
11	27/F	LDPS	3	None	-	130	Adenocarcinoma	84
12	64/F	SPDP	4	None	-	130	Metastasis of renal carcinoma	12
13	65/F	SPDP	5	None	-	120	Well differentiated neuro endocrine tumor	25
14	22/F	LDPS	5	Bledding – reoperation	-	140	Well differentiated neuro endocrine tumor	18
15	54/F	LDPS	4	None	-	140	Adenocarcinoma	22
16	60/M	SPDP	4	None	-	210	Adenocarcinoma	14
17	39 F	SILS-DPS	2	None	-	140	Well differentiated neuro endocrine tumor	15

A/S:Age and Sex, O: Operation type, HS: Hospital stay(day), C: Complication, TC: Treatment of complication, OT: Operating time (minute), P: Pathology, LDP: Laparoscopic distal pancreatosplenectomy, LDP: Spleen preserving distal pancreatectomy, E: Enucleation. SILS-DPS: Single incision Laparoscopic Distal Pancreatosplenectomy. ERCP: Endoscopic retrograde cholangio pancreatography, CE: Coil embolisation, RCC: Renal Cell Carcinoma. FU: Follow-up period (in months).

approach because we did not clearly visualize the pancreas due to a fatty abdomen.

The median duration of surgery was 145 minutes (min.-max. = 90-300). The median estimated blood loss was 100 ml (min.-max. = 50-150). Median length of hospital stay was 7 days (min.-max. = 2-30).

The total incidence of both major and minor abdominal complications was 40% (12 cases), including seven patients with pancreatic fistula, one patient with pancreatic fistula and splenic artery aneurysm, one pancreatic pseudocyst, two patients with intra-abdominal abscesses and one patient with postoperative bleeding. For the detection of complications, CT scans were performed. Post-operative splenic artery aneurysm was detected in a patient who had pancreatic fistula. Two patients with pancreatic fistulas were treated with endoscopic retrograde cholangiopancreatography (ERCP). The fistulas were resolved within 2 days after ERCP. The splenic artery aneurism was coil embolized by interventional radiologists. Two patients with pancreatic fistulas were submitted to re-operation; development of intraabdominal abscess and uncontrolled pancreatic fistulas were the reasons. The other pancreatic fistulas resolved spontaneously within 14 and 19 days, respectively. One patient was operated on for postoperative bleeding. We are currently following our patient with a pseudocyst. There were no in-hospital deaths. The median follow-up period for the patients was 19,5 months (min.-max = 5-96).

Discussion

Although the laparoscopy revolution in the early 1990s has changed standard procedures in the treatment of human diseases, laparoscopic approaches to the pancreas have been limited because pancreatic disease is relatively uncommon, and the pancreas has a deep location in the abdominal cavity. Laparoscopic distal pancreatectomy has gained wide acceptance in recent years in surgical practice for benign lesions of the pancreas. Currently, an increasing number of laparoscopic pancreatic procedures are performed worldwide. With rapid developments in surgical technology and advancement of laparoscopic skills, minimally invasive pancreatic surgery is becoming the first option for treating malignant pancreatic diseases (26,27). However, pancreatectomy by minimally invasive surgery for malignant disease should be respectful of oncological principles [28].

Because the first laparoscopic pancreatic resection for chronic pancreatitis was reported in 1994, several pancreatic operations have been performed laparoscopically, including internal drainage of pancreatic pseudocysts, distal pancreatectomy, and pancreatoduodenectomy [6,21,29-33].

For laparoscopic pancreatic surgery, four surgical approaches are used: SPDP, LDPS, E, and SILS-DPS. The choice of enucleation or resection will depend on the location of the tumor in the pancreas. Tumors located in the corpus or tail of the pancreas can be resected safely and with relative ease when they are not locat-

ed near the pancreatic duct or the portal venous confluence. The clear indications for tumor enucleation are tumors located at the periphery of the gland and tumors on the surface of the parenchyma that are totally or partially covered by a thin layer of pancreatic tissue [21,30]. Additionally, when the tumor is in close proximity to the Wirsung duct or is lying on the splenic vein, resection is indicated to avoid pancreatic fistula or profuse bleeding. In cases of inability to enucleate tumors located in the body or tail of the pancreas, the most common procedure is distal pancreatectomy with or without spleen preservation [18].

Laparoscopic distal pancreatectomy is an acceptable treatment option for most benign and indolent tumors located in the body or tail of the gland, but the current techniques describe transection of the pancreas at the region of the body regardless of the actual location of the tumor. The advantage of more proximal transection is that the splenic vessels have not branched considerably at this point, and there is theoretically a lower risk of hemorrhage from small splenic branches. The disadvantage of such a proximal transection, however, is that for very distal lesions, a large amount of normal pancreatic tissue must be sacrificed [9].

Preservation of the spleen is also an important factor in pancreatic surgery in terms of immunological aspects. Spleen preservation techniques in distal pancreatectomy have been divided into two types. In Kimura's technique, both the splenic artery and vein are preserved by identification and sealing of the small branches of the body and tail of the pancreas. This type of distal pancreatectomy with splenic preservation involves meticulous dissection of the splenic vessels and the small branches of these vessels between the pancreas and the splenic hilum [33,34]. The other type, which is called Warshaw's technique, involves the transection of the splenic vessels and preservation of the blood supply from the short gastric vessels [7,25,32-36]; however, the latter procedure has been associated with the potential risk of splenic infarction. In preserving the splenic vessels, the most important technique is removal of the splenic vein from the body of the pancreas toward the spleen [36]. Gentle and careful traction of the pancreas, including the tumor, and meticulous division of the transverse branches between the pancreas and splenic vein should be performed to avoid intraoperative blood loss. However, Warshaw reported that spleen preservation is difficult in cases of tumors involving the hilum of the spleen and splenic hilar scarring from prior acute inflammation or abscess formation [25,36]. In these cases, spleen preservation should be avoided because of several possible complications, such as bleeding or splenic injury [36-38].

Distal pancreatectomy with preservation of spleen is performed much more in laparoscopic approach versus open approach, since exposure is better in laparoscopy. In laparoscopic approach spleen preservation during distal pancreatectomy ranges from 15.5% to 44.2% and from 5.7% to 15.6% in open distal pancreatectomy. D'Ambrosio et al. achieved 100% spleen preservation in their laparoscopic distal pancreatectomy series [37]. Gagner et al. reported a series of 22 laparoscopic pancreatic resections with a high rate of distal pancreatectomy with splenectomy (59 %) [32]. In our study, the rate of distal pancreatectomy with splenectomy was 60%. We preserved the spleen in 40% of patients. We believe that in cases of insulinomas or benign diseases of the pancreas, the spleen must be preserved if possible. In our experience, spleen preserving distal pancreatectomy was performed due to close proximity of the tumor to the Wirsung duct but not the splenic vessels.

Today, although single-incision laparoscopic surgery is not the gold standard technique for pancreatic disorders, it is becoming popular because it is a minimally invasive procedure and results in minimal scarring. The major problem with the SILS technique is that all the instruments are closely packed together, and thus, clashing of instruments with the laparoscope is common. SILS has a unique learning curve, principally in navigating the instruments within a limited range of motion, and it requires significant coordination between the surgeon and the camera holder. In our study, the rate of a SILS pancreatectomy with splenectomy was 13.3 %.

Concerning postoperative complications, the most common complication in the surgical treatment of pancreatic disease is a pancreatic fistula that usually resolves spontaneously [18, 22,23]. The other pancreas-related complications have included abscesses and pseudocysts (25). In this study, the total incidence of both major and minor abdominal complications was 40%, including seven patients with pancreatic fistula, one patient with pancreatic fistula and a splenic artery aneurysm, one patient with a pancreatic pseudocyst, two patients with intra-abdominal abscesses and one patient with postoperative bleeding. Analysis of a series reported in the literature showed that pancreatic fistula after laparoscopic distal pancreatic resection occurred at a rate of 0-30 %; in the majority of patients, the pancreatic fistulas were low volume and not life threatening [3, 11, 28]. In contrast, there have been some reports of higher rates of postoperative fistula with laparoscopic pancreatic resection than with the open approach [25]. The incidence of postoperative complications is similar to that with open surgery. In our study, the pancreatic fistula rate was 26, 6%. Although, the pancreatic fistula rate was higher in Turkey's series of patients (5 of 13, 38, 5%) than in Spain's series of patients (3 of 17, 17,6%), there was no statistically significant difference between the two series (p = 0,242). Fistula formation was observed in all four operative techniques. Reinforcement techniques, which are used to prevent pancreatic fistula formation, have not yet been proven effective. Despite the use of fibrin glue for reinforcement, we observed a pancreatic fistula in one patient. The conversion rate reported for laparoscopic resection of the left pancreas is 0-53 %, but not specif-

ically for exocrine malignancies [3, 4, 28]. In our study, there was one conversion to an open approach because of a fatty abdomen.

Assuring the safety of oncologic surgery is of great importance. It was reported that laparoscopic pancreatic surgery had comparable results to open surgery in terms of tumor margins and lymph node dissection [39]. D'Ambrosio et al. based on their experience, concluded that SPDP for treatment distal pancreatic malignant lesion is feasible and safe in terms of oncological principles [37]. In our study, we harvested lymph nodes compatible with the report of the International Study Group of Pancreatic Surgery [40], and the resection margins were reported as clear in all cases. However; for pancreatic head lesion, Ialongo et al. [41] found that operative time for laparoscopic pancreatoduodenectomy is significantly longer than open technique. And, in laparoscopic approach hospital stay is not shorter than open approach.

Although it remains rarely reported, it is likely that single-incision pancreatic surgery will become more common in the surgical field [42,43]. Moreover, robotic surgery is a growing phenomenon in pancreatic surgery, and the progression of robotic technology could make the single access easier, safer and more precise [44, 45].

In conclusion, laparoscopic distal pancreatectomy with or without splenic preservation for pancreatic disorders is a feasible and safe procedure if performed by experienced laparoscopic surgeons. The potential advantages of laparoscopic approach over open surgery include less post-operative pain, shortened hospital stays and shorter recovery time with earlier return to previous activities.

Riassunto

La chirurgia del pancreas è stata grandemente influenzata dall'avvento della chirurgia laparoscopica e dalla crescente esperienza nella sua realizzazione e dai progressi delle tecniche e della strumentazione chirurgica. Questo studio è finalizzato alla presentazione dell'esperienza iniziale di due centri chirurgici nella pancreasectomia distale laparoscopica.

Lo studio comprende 30 pazienti di due centri diversi sottoposti a pancreasectomia distale per patologia del pancreas. Tutti gli interventi chirurgicisono stati eseguiti tra novembre 2006 e novembre 2013 in Turchia e in Spagna.

La pancreasectomia distale laparoscopica con conservazione della milza è stata eseguita su 9 pazienti, la pancreasectomia distale laparoscopica in 14 pazienti, una enucleoresezione laparoscopica in 4 pazienti ed una pancreasectomia distale laparoscopica con una singola incisione in 3 pazienti.

Si conclude affermando la possibilità dell'esecuzione della pancreasectomia distale per via laparoscopica con sicurezza se l'esecuzione è eseguita da chirurghi esperti nella tecnica laparoscopica.

References

1. Uranues S, Alimoglu O, Todoric B, et al.: *Laparoscopic resection of the pancreatic tail with splenic preservation.* Am J Surg, 2006; 2: 257-61.

2. Kooby DA, Gillespie T, Bentrem D, et al.: *Left-sided pancreatectomy: A multicenter comparison of laparoscopic and open approaches.* Ann Surg, 2008; 3:438-46.

3. Taylor C, O'Rourke N, Nathanson L et.al. :*Laparoscopic distal pancreatectomy: the Brisbane experience of forty-six cases*. HPB, 2008;1: 38-42.

4. Briggs CD, Mann CD, Irving GR. et. al.: *Systematic review of minimally invasive pancreatic resection*. J Gastrointest Surg, 2009; 6: 1129-137.

5. Sa Cunha A, Beau C, Rault A, Catargi B, Collet D, Masson B: *Laparoscopic versus open approach for solitary insulinoma*. Surg Endosc, 2007; 1:103-08.

6. Gagner M, Pomp A: *Laparoscopic pylorus-preserving pancreatoduodenectomy.* Surg Endosc, 1994; 8:408-10.

7. Sussman LA, Christie R, Whittle DE: *Laparoscopic excision of distal pancreas including insulinoma.* Aust N Z J Surg, 1996; 6: 414-16. Review.

8. Santoro E, Carlini M, Carboni F: *Laparoscopic pancreatic surgery: Indications, techniques and preliminary results*. Hepatogastroenterology, 1999; 26:1174-180.

9. Barbaros U, Sümer A, Demirel T. et al.: *Single incision laparoscopic pancreas resection for pancreatic metastasis of renal cell carcinoma.* JSLS, 2010; 4:566-70.

10. Mozell F, Stenzel P, Woltering EA, Rosch J, O'Dorisio TM: *Functional endocrine tumors of the pancreas: Clinical presentation, diagnosis, and treatment*. Curr Probl Surg, 1990; 27:301-86.

11. Nakamura Y, Uchida E, Aimoto T, Matsumoto S, Yoshida H, Tajiri T: *Clinical out-come of laparoscopic distal pancreatectomy*. J Hepatobiliary Pancreat Surg, 2009; 1:35-41.

12. Mabrut JY, Fernandez-Cruz L, Azagra JS, et. al.: *Hepatobiliary and Pancreatic Section (HBPS) of the Royal Belgian Society of Surgery; Belgian Group for Endoscopic Surgery (BGES); Club Coe-lio. Laparoscopic pancreatic resection: Results of a multicenter European study of 127 patients*. Surgery, 2005; 6:597-605.

13. Tagaya N, Kasama K, Suzuki N. et al.: *Laparoscopic resection of the pancreas and review of the literature.* Surg Endosc, 2003; 2: 201-16.

14. Lebedyev A, Zmora O, Kuriansky J, et al.: *Laparoscopic distal pancreatectomy*. Surg Endosc, 2004; 10:1427-430.

15. Ammori BJ, El-Dhuwaib Y, Ballester P, Augustine T: *Laparoscopic distal pancre-atectomy for neuroendocrine tumors of the pancreas*. Hepatogastroenterology, 2005; 62:620-24.

16. Rutz DR, Squires MH, Maithel SK: et al.: *Cost comparison analysis of open versus laparoscopic distal pancreatectomy*. HPB, 2014 doi: 10.1111/hpb.12288.

17. Isla A, Arbuckle JD, Kekis PB, Lim A, Jackson JE, Todd JF, Lynn J: *Laparoscopic management of insulinomas*. Br J Surg, 2009; 2:185-90.

18. Ayav A, Bresler L, Brunaud L, Boissel P:SFCL (Société Française

de Chirurgie Lapa-roscopique); AFCE (Association Francophone de Chirurgie Endocrinienne): *Laparo-scopic approach for solitary insulinoma: Amulticentre study*. Langenbecks Arch Surg, 2005; 2:134-40.

19. Fernández-Cruz L, Blanco L, Cosa R, Rendón H: *Is laparoscopic resection adequate in patients with neuroendocrine pancreatic tumors?* World J Surg, 2008; 5:904-17.

20. Jaroszewski DE, Schlinkert RT, Thompson GB, Schlinkert DK: *Laparoscopic localization and resection of insulinomas*. Arch Surg, 2004; 3:270-74.

21. Barbaros U, Dinççağ A: *Single incision laparoscopic splenectomy: the first two cases.* J Gastrointest Surg, 2009; 8:1520-523.

22. Barbaros U, Demirel T, Gozkun O. et al.: A *new era in minimally invasive liver resection (MILR) single-incision laparoscopic liver resection (SIL-LR): The first two cases*. Surg Technol Int, 2011; XXI:81-84.

23. Bassi C, Dervenis C, Butturini G. et al.: *International study group on pancreatic fistula definition. postoperative pancreatic fistula: an international study group (ISGPF) definition*. Surgery, 2005;1: 8-13.

24. Pratt W, Maithel SK, Vanounou T, Callery MP, Vollmer CM Jr: *Postoperative pancreatic fistulas are not equivalent after proximal, distal, and central pancreatectomy*. J Gastrointest Surg, 2006; 9: 1264-278; discussion 1278-279.

25. Warshaw AL: *Conservation of the spleen with distal pancreatectomy*. Arch Surg, 1988; 5:550-53.

26. Abu Hilal M, Takhar AS: *Laparoscopic left pancreatectomy: current concepts*. Pancreatology 2013;4: 443-48. doi: 10.1016/j.pan. 2013.04.196. Epub 2013 Apr 26. Review.

27. Durlik M, Matejak-Górska M, Jaworowski R, Kaszycka Z, Baumgart K*: Laparoscopic distal pancreatectomy. New standard in the pancreatic surgery.* Pol Przegl Chi, 2013; 10: 589-97. doi: 10.2478/pjs-2013-0088.

28. Pugliese R, Maggioni D, Sansonna F, et al.: *Laparoscopic distal pancreatectomy: A retrospective review of 14 cases.* Surg Laparosc Endosc Percutan Tech, 2008; 3:254-59.

29. Gagner M, Pomp A, Herrera MF: *Experience with laparoscopic resections of islet cell tumors*. Surgery, 1996; 120:1051-54.

30. Fernandez-Cruz L, Martinez I, Cesar-Borges G, et al.: *Laparoscopic surgery in patients with sporadic and multiple insu-linomas associated with multipl endocrine neoplasia type 1.* J Gastrointestin Surg, 2005; 3:381-88.

31. Berends FJ, Cuesta MA, Kazemier G, et al.: *Laparoscopic detection and resection of insulinomas.* Surgery, 2000; 128:386-91.

32. Gagner M, Inabnet WB, Biertho L, Salky B: *Laparoscopic pancreatectomy: A series of 22 patients.* Ann Chir, 2004; 129: 2-7.

33. Gramatica L, Herrera MF, Mercado-Luna A, Sierra M, Verasay G, Brunner N: *Videolaparoscopic resection of insulinomas: Experience in two institution*s. World J Surg, 2002; 26:1297-1300.

34. Lv GY, Wang GY, Jiang C, Ji B, Wang YC, Qiu W, Sun XD, Liu YH: *Laparoscopic spleen-preserving distal pancreatectomy with or without splenic vessel conservation: a retro-spective study of 20 cases*. Hepatogastroenterology, 2013; 127:1785-88.

35. Cuschieri A, Jakimowicz JJ, van Spreeuwel: *Laparoscopic distal 70% pancreatectomy and splenectomy for chronic pancreatitis.* Ann Surgm, 1996; 223:280-85.

36. Jossart GH, Gagner M: *Pancreaticoduodenal resection*. J Hepatobiliary Pancreat Surg, 2000; 7:21-27.

37. D'Ambrosio G, Quaresima S, Balla A, Intini G, De Laurentis F, M Paganini A: *Spleen preserving laparoscopic distal pancreatectomy for treatment of pancreatic lesions*. Ann Ital Chir, 2015; 86(3):273-78.

38. Rothmund M, Angelini L, Brunt LM. et al.: *Surgery for benign insulinoma: An international review*. World J Surg, 1990;14: 393-98.

39. Bausch D, Keck T: *Minimally invasive pancreatic tumor surgery: Oncological safety and surgical feasibility*. Chirurg, 2014; 8: 683-88. doi: 10.1007/s00104-014-2755-5.

40. Tol JA, Gouma DJ, Bassi C, Dervenis C. et al.: *International Study Group on Pancreatic Surgery; Definition of a standard lymphadenectomy in surgery for pancreatic ductal adenocarcinoma: A consensus statement by the International Study Group on Pancreatic Surgery (ISGPS)*. Surgery, 2014; 3:591-600.

41. Ialongo P, Milella M, Pascazio B, et al.: *Laparoscopic management of pancreatic cancer. Our experience.* Ann Ital Chir, 2015; 86:518-23.

42. Zhao G, Hu M, Liu R, Zhao Z, Li C, Wang F, Zhou H, Wang X: *Single-port retroperitone-oscopic pancreatectomy: preliminary results from the first 3 patients.* J Clin Gastroenterol, 2014; 6:559-62. doi: 10.1097/MCG.0000000000000077.

43. Srikanth G, Shetty N, Dubey D: *Single incision laparoscopic distal pancreatectomy with splenectomy for neuroendocrine tumor of the tail of pancreas.* J Minim Access Surg, 2013; 3:132-35. doi: 10.4103/0972-9941.115377.

44. Suman P, Rutledge J, Yiengpruksawan A: *Robotic distal pancreatectomy.* JSLS , 2013; 4: 627-35. doi: 10.4293/ 108680813X13794522667409.

45. Zhan Q, Deng XX, Han B, Liu Q, Shen BY, Peng CH, Li HW: *Robotic-assisted pancreatic resection: a report of 47 cases.* Int J Med Robot, 2013; 1:44-51. doi: 10.1002/rcs.1475.