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Laparoscopic distal pancreatectomy for benign or borderline malignant pancreatic tumors

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Original Article

ABSTRACT

Background/Aims: Laparoscopic distal pancreatectomy (LDP) for benign conditions is increasingly performed. But, there are few limited studies about the outcomes of the laparoscopic surgery compared with open surgery. The aim of this study was to evaluate the clinical outcomes of LDP and compare it to that of open distal pancreatectomy (ODP).

Materials and Methods: From July 2007 to February 2012, 60 consecutive patients (41 LDP patients and 19 ODP patients) who underwent elective distal pancreatectomy with an apparent diagnosis of benign or borderline malignant tumor were recruited into the current study.

Results: There were no significant differences in operation time, transfusion, intravenous patient-controlled analgesia (IV-PCA) duration, pancreatic fistula, mortality, and recurrence between the two groups. Compared to ODP, LDP had lower blood loss (272.7±134.8 vs. 476.9±140.8 ml; p=0.002), shorter time to first flatus (2.4±0.5 vs. 4.0±1.5 days; p=0.003), earlier time to oral intake (3.4±1.6 vs. 5.4±1.9 days; p=0.013), and shorter postoperative hospital stay (9.4±6.9 vs. 17.0±6.7 days; p=0.043).

Conclusion: LDP is a safe procedure and should be considered as a standard treatment option for benign or borderline malignant pancreatic tumors.

Keywords: Pancreas, distal pancreatectomy, laparoscopic distal pancreatectomy

INTRODUCTION

Since the introduction of minimally invasive surgery, laparoscopic surgery has been widely performed (1). But, it is not usually accepted as a treatment of choice for pancreatic tumors because of long learning curve, long operation time, and technical difficulties such as organ accessibility and major vessel proximity (2,3). With the advancement of laparoscopic techniques and instruments, laparoscopic distal pancreatectomy (LDP) has become an increasingly used procedure because of its technical simplicity due to the absence of numerous anastomoses (4). Although prospective randomized controlled studies are lacking, many reports documented the feasibility and safety of LDP (1-7). Since the July 2007, we have performed LDP for pancreatic body and tail lesions of benign or borderline malignant tumors. This study aimed to investigate the clinical outcomes and to evaluate safety and efficacy of LDP compared with open distal pancreatectomy (ODP) in patients with a benign or borderline malignant pancreatic tumor.

MATERIALS AND METHODS

After Institutional Review Board approval, from July 2007 to February 2012, 60 consecutive patients who underwent elective distal pancreatectomy with an apparent diagnosis of benign or borderline malignant tumor were recruited into the current study. Preoperatively, ultrasonography (USG), computed tomography (CT), and magnetic resonance imaging (MRI) including magnetic resonance cholangiopancreatography (MRCP) were routinely performed for the diagnosis of pancreatic benign or borderline malignant lesion. 41 patients underwent LDP (study cohort) and 19 patients underwent ODP (control cohort). All 41 patients who underwent LDP were completed laparoscopically without conversion and 19 ODPs were performed in

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patients who refused LDP. Retrospectively, the medical records were analyzed and compared between two groups for clinicopathologic characteristics such as gender, age, body mass index (BMI), tumor size, spleen preservation rate, postoperative final pathology, and follow-up assessment. In addition, the operative outcomes such as operation time, blood loss, transfusion requirement, return to normal bowel movement, return to adequate oral intake, duration of intravenous patient-controlled analgesia (IV-PCA) system, length of hospital stay, pancreatic fistula rate, overall postoperative mortality, and recurrence rate were compared between two groups. According to the International Study Group of Pancreatic Fistula (ISGPF) criteria, pancreatic fistula was defined as any measurable drainage from an operatively placed drain on or after postoperative day 3, with an amylase content greater than 3 times the upper limit of normal serum amylase level (8).

Operating procedure

Laparoscopic distal pancreatectomy procedure

After general anesthesia the patient was placed in a right semilateral decubitus position. Under preparing and drapping in the usual sterile manner, the surgeon, the camera assistant, and the scrub nurse were positioned to the right side of the patient, and the first assistant stood to the left side of the patient. A 12 mm balloon trocar (telescope route) was first inserted through an infraumbilical minilaparotomy wound and pneumoperitoneum (12 mm Hg) was achieved by CO_2 insufflation. Under the laparoscopy-providing vision, three other trocars were inserted into the following locations: the epigastrium (5 mm) for the left hand of the surgeon; the midclavicular line below the costal arch (12 mm) for the right hand of the surgeon; the left flank (5 mm) for assistance (Figure 1).

The gastrocolic ligament was divided for entrance to the pancreas using harmonic scalpel® (Ethicon, Cincinnati, OH, USA) and electrocautery. Laparoscopic ultrasonography probe was used through a 12-mm trocar and applied directly to the anterior surface of the pancreas to confirm the location of the tumor and identify its relationship to the splenic vessels. In spleen preserving distal pancreatectomy, the inferior border of the pancreas was mobilized until the posterior surface of the pancreas was fully visualized. After careful dissection of the splenic vessels from pancreas, the pancreas was transected 1 to 2 cm proximal to the tumor using an endo-GIA stapler (Ethicon, Cincinnati, OH, USA). In en block distal pancreatectomy with splenectomy, splenic vessels were ligated with hem-o-lok® (Teleflex, Research Triangle Park, NC, USA) and separated from the pancreas. The specimen was then placed in a Lap. Bag® (SJM, Paju, Korea) and removed through a minimally extended umbilical port incision. Two closed suction drains were placed in the splenic fossa next to the remnant pancreas.

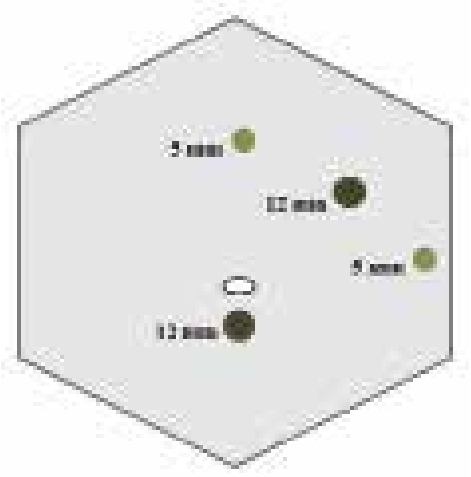

Figure 1. Trocar placement for laparoscopic distal pancreatectomy

Open distal pancreatectomy procedure

Open distal pancreatectomy was performed using a conventional method. The patient was placed in the supine position, and a midline incision was made in the upper abdominal region. Pancreatic resection was performed using a blade and electrocautery. The main pancreatic duct was ligated with 4-0 black silk, and the pancreatic stump underwent multiple suture ligation with 2-0 black silk. Two closed suction drains were left in the pancreatic bed.

Statistical analysis

Datas are presented as the mean±standard deviation. Comparisons among the groups were performed using the Mann-Whitney U test or chi-square test where appropriate. Statistical evaluation was performed using the SPSS 14.0 (SPSS Inc, Chicago, IL, USA) program for Windows. P-value < 0.05 was considered statistically significant.

RESULTS

The clinicopathologic characteristics of LDP group

During the study period, 60 patients underwent elective distal pancreatectomy for benign or borderline malignant tumors at our institution. Among the 60 patients, 41 (68.3%) patients underwent LDP (Table 1). There were 32 (78.0%) women and 9 (22.0%) man with a mean age of 38.2±13.9 years. The most com-

Table 1. Clinical characteristics of the patients

	LDP (n=41)	OPD (n=19)	p value
Sex (male : female)	9 : 32	6 : 13	0.156
Age (years)	38.2±13.9	49.3±17.0	0.101
BMI (kg/ m2)	23.0±3.6	22.3±4.8	0.838
Tumor size (mm)	40.8±31.9	53.5±30.6	0.579
Spleen preservation (%)	8 (19.5)	5 (26.3)	0.642
Follow-up period (months)	22.9±10.4	19.6±11.1	0.693

LDP: laparoscopic distal pancreatectomy; ODP: open distal pancreatectomy; BMI: body mass index

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mon presentation was incidental finding (n=35, 85.3%), followed by abdominal discomfort (n=4, 9.8%), and abdominal mass (n=2, 4.9%). The tumors that had no symptoms (incidental finding) were detected by routine health checkup. All 41 patients who underwent LDP were completed laparoscopically without conversion, and the rate of spleen preservation was 19.5% (n=8). The tumors were located in the body (n=17, 41.5%) and tail (n=24, 58.5%) of the pancreas, and the mean tumor size was 40.8±31.9 mm. The mean operation time was 194.6±49.4 min, and the mean blood loss was 272.7±134.8 ml. The final histopathological diagnoses included 19 patients had mucinous cystadenoma, 11 patients had serous cystadenoma, 5 patients had solid pseudopapillary tumor, 3 patients had intraductal papillary mucinous tumor (pathologically, all of 3 patients had borderline malignancy type and resection margin was free of tumor), 2 patient had endocrine tumor, and 1 patient had lymphangioma (Table 2). 10 patients (24.4%) developed pancreatic fistula (grade A=6, grade B=4) according to the definition of ISGPF and all patients were recovered with conservative management. The mean length of postoperative hospital stay was 9.4±6.9 days, and the mean follow-up period was 22.9±10.4 months. All 41 patients were alive and disease-free.

Perioperative outcomes compared with ODP group

The mean operation time of the LDP group was 194.6±49.4 min, and that of the ODP group was 183.2±42.9, the difference not being statistically significant. The estimated mean blood loss was lower in the LDP group (272.7±134.8 ml) than in the ODP group (476.9±140.8 ml) (p=0.002). 3 LDP patients (7.1%) required transfusion, and 1 ODP patient (5.3%) required transfusion (p=0.907). The mean time to normal bowel movement of the LDP group was significantly shorter than that of the ODP group (2.4±0.5 vs. 4.0±1.5 days; p=0.003). Also, the mean time to adequate oral intake in the LDP group was earlier than in the ODP group (3.4±1.6 vs. 5.4±1.9 days; p=0.013). An IV-PCA system was used to control the pain after operation for all patients. Between two groups, there was no difference in the mean using period of IV-PCA system (3.1±1.0 vs. 4.1±2.1 days; p=0.164). The mean hospitalization period of the LDP group was 9.4±6.9 days, and that of the ODP group was 17.0±6.7 days, which was significantly longer (p=0.043). No statistical difference was observed in the rate of the pancreatic fistula, mortality, and recurrence (Table 3).

DISCUSSION

Since the first description of LDP in the porcine model by Soper et al. in 1994 (9), LDP has been increasingly reported in the literature (1-8). The safety and efficacy of LDP compared with ODP has yet to be determined in a prospective randomized controlled study. But, most of the single-institution cohorts and multi-institution series have reported that LDP can be performed with morbidity and mortality rates those of ODP and with the added benefit of shorter hospital stays (1-7,10). In the current study, the absence of significant differences in the analysis of pathologic and clinical details suggests that our two groups were relatively similar in their preoperative condition (Table 1, 2). And, our study also supports the safety of LDP because we found no differences in perioperative morbidity and mortality compared with ODP (Table 3).

Pancreatic fistula is a most serious complication in all pancreatic surgeries. The incidence of pancreatic fistula rates after LDP has been reported to range from 0% to 33% (1-7). Previous studies showed no difference in pancreatic fistula between the LDP and ODP groups (4-6). In the current study, pancreatic fistula occured in 10 (24.4%) LDP patients (grade A=6, grade B=4) and in 4 (21.1%) ODP patients (grade A=3, grade B=1). There was no statistically significant difference in fistula rate between two groups. And, all of the patients with pancreatic fistula were recovered with conservative management.

In LDP, there have been many reports describing the usefulness of a stapler transection for the pancreas as a simple, quick, and secure method of closure of the proximal pancreas (11). So, in our institute, stapling technique has been routinely performed for the management of pancreatic remnant stump in LDP. Use of a stapling technique has been reported as protective (11) and causal (12) in the rate of fistula formation. Although the

Table 2. Final histopathological diagnosis after operation

	LDP (n=41)	OPD (n=19)
Serous cystadenoma	11	3
Mucinous cystadenoma	19	6
Intraductal papillary mucinous tumor	3	1
Solid pseudopapillary tumor	5	2
Endocrine tumor	2	2
Pseudocyst	0	3
Lymphangioma	1	1
Retention cyst	0	1

LDP: laparoscopic distal pancreatectomy; ODP: open distal pancreatectomy

Table 3. Perioperative outcomes

	LDP (n=41)	OPD (n=19)	p-value
Operation time (min)	194.6±49.4	183.2±42.9	0.210
Blood loss (ml)	272.7±134.8	476.9±140.8	0.002
Transfusion: n (%)	3 (7.1)	1 (5.3)	0.907
Time to first flatus (days)	2.4±0.5	4.0±1.5	0.003
Time to oral intake (days)	3.4±1.6	5.4±1.9	0.013
IV-PCA duration (days)	3.1±1.0	4.1±2.1	0.164
Postoperative hospital stay (days)	9.4±6.9	17.0±6.7	0.043
Pancreatic fistula: n (%)	10 (24.4)	4 (21.1)	0.615
Mortality: n (%)	0 (0.0)	0 (0.0)	NS
Recurrence: n (%)	0 (0.0)	0 (0.0)	NS

LDP: laparoscopic distal pancreatectomy; ODP: open distal pancreatectomy

incidence of pancreatic fistula does not appear to be affected by LDP or ODP, further study is necessary to evaluate the factors associated with the pancreatic fistula development in LDP.

The more rapid recovery and shorter postoperative hospital stays are often cited as the primary advantages of the laparoscopic approach (7). In our study, when compared to ODP group, the LDP group had statistically significant shorter postoperative hospital stays with earlier recovery of bowel function and shorter time to oral intake.

There are limited reports of patients undergoing laparoscopic pancreatectomy for pancreatic cancer (13). Especially, in pancreatic tail cancer, local fibrosis and inflammation incited by the tumor make mobilization difficult, and the laparoscopic approach may not allow sufficient regional dissection to perform an oncologically sound operation (5). So, major concerns remain about whether the laparoscopic approach is oncologically adequate, allowing tumor free margins and sufficient lymph node dissection (14). Kooby et al. (13) suggested that LDP is an acceptable approach for resection of pancreatic ductal adenocarcinoma of the left pancreas in selected patients. But, a prospective randomized controlled study is the only definitive means to address this question.

As knowledge about the immunologic role of the spleen increases, efforts have been made to preserve the spleen (4). But, the role of splenic preservation in distal pancreatectomy remains controversial. Benoist et al. (15) reported that distal pancreatectomy with splenic preservation was associated with increased perioperative complications when compared to distal panceatectomy with splenctomy. Other authors, also, noted that splenic preservation is more difficult, takes more time, and increases blood loss (16,17). But, Shoup et al. (18) concluded that spleen preserving distal pancreatectomy can be performed safely with decreased perioperative morbidity. In LDP, Fernández-Cruz et al. (19) noted significantly higher morbidity after LDP with splenic preservation compared to LDP with splenectomy. But, other studies reported that there were no differences in major complications (4-6). The rate of spleen preservation in LDP has been reported to range from 15% to 61% (2-7). LDP with spleen preservation is a technically feasible, but further study comparing LDP and ODP with spleen preservation is necessary. Two techniques have been used in spleen preservation in LDP. With the one technique, the splenic vessels are preserved by dividing small vessels between the splenic vessels and the pancreas (7). This approach needs more advanced skills and longer operation time. With the other technique, spleen can be preserved by preserving the short gastric vessels while dividing the splenic artery and vein (Warshaw's technique) (20). Although this approach is not difficult and needs shorter operation time, sometimes several short gastric vessels must be divided to achieve adequate laparoscopic visualization of the distal pancreas (7). This technique may result in splenic infarction and abscess due to insufficient blood supply to the spleen (4). In our study, spleen preservation was performed in 8 LDP patients (19.5%) and in 5 ODP patients (26.3%). The splenic vessels were preserved in all patients.

The results of this study show that LPD in patients with a benign or borderline malignant tumor of the pancreas is a safe and effective procedure, with similar perioperative outcomes compared with ODP. In addition, LDP is associated with shorter postoperative hospital stays with earlier recovery of bowel function and shorter time to oral intake. On the basis of our results and considering the general advantages of laparoscopic surgery, LDP in benign or borderline malignant tumor of the pancreas should be considered as a standard treatment option. But, further evaluation is needed to determine the safety and efficacy of LDP for pancreatic cancer.

Conflict of Interest: No conflict of interest was declared by the authors.

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