Original Article

Surgical Outcomes of Open and Laparoscopic Left Sided Pancreatectomy: The 6-year Ramathibodi Experience

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Objective: Laparoscopic distal pancreatectomy (LDP) has been introduced in Ramathibodi Hospital since 2010 and continuously performed up to the present time. Nevertheless, there were no data or study for LDP in Thailand. The aim of this study was to compare surgical outcomes of LDP with open distal pancreatectomy (ODP) in the past 6-year Ramathibodi Hospital experience.

Materials and Methods: In this retrospective study, 49 patients who underwent left sided pancreatectomy at Ramathibodi Hospital from January 2012 to May 2018 were recruited. The patients were classified into 2 groups, open and laparoscopy. The clinicopathological data, intraoperative and postoperative outcomes were collected.

Results: In 49 patients, 26 (53.1%) patients were classified into open group and 23 (46.9%) patients into laparoscopic group. There was no mortality in any patients. The conversion rate was 8%. There were 2 (4%) patients with pancreatic ductal adenocarcinoma (PDAC) and 25 (51%) patients of pancreatic cystic tumor. The overall complication was 61.5% in open group and 65.2% in laparoscopy (p = 0.632). The post-operative pancreatic fistula (POPF) was 50.0% in open group and 47.8% in laparoscopy (p = 0.879) as well as in POPF-required intervention which was 7.7% in open group and 13.0% in laparoscopy (p = 0.264). The mean blood loss was 598.0 mL in open group and 302.7 mL in laparoscopy (p = 0.050). Whereas the mean operative time was 252.3 minutes in open group and 255.0 minutes in laparoscopy (p = 0.920) and the mean length of hospital stay was 15.6 days in open group and 11.8 days in laparoscopy (p = 0.302).

Conclusion: Left-sided pancreatectomy in Ramathibodi Hospital was a safe and effective procedure but still having a high rate of complication. LDP and ODP were not found different in terms of complication, operative time and POPF.

Keywords: Pancreatectomy, Distal pancreatectomy, Laparoscopy, Pancreas

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Laparoscopic distal pancreatectomy (LDP) was first reported in 1999 by Gagner[(1)] and has become widely acceptable for treatment benign and malignant lesions on left sided pancreas[(2)]. In high experienced centers, many studies and meta-analysis were reported on better achievement of LDP surgical outcomes including blood loss, length of hospital stay and still morbidities, mortalities and oncological outcomes were found the same as those of ODP[(3)]. LDP has been introduced in Ramathibodi Hospital since 2010 and continuously performed up to the present time. Since there were no data or study for LDP in Thailand, the present study aimed to compare surgical outcomes of LDP with those of open distal pancreatectomy (ODP) in the past 6-year Ramathibodi Hospital experience.

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Materials and Methods

Data collections

In this retrospective study, 96 patients who underwent left-sided pancreatectomy as well as distal pancreatectomy, enucleation and central pancreatectomy at Ramathibodi Hospital from January 2012 to May 2018 were recruited. Patients who underwent pancreatectomy from traumatic injury were excluded. From 96 patients, the 14 patients were excluded due to lack of satisfactory information and 33 patients were excluded due to undergoing left sided pancreatectomy with extended organ resection including colectomy, hepatectomy, gastrectomy (Figure 1). Electronic medical records were reviewed for the 49 remaining patients. The clinicopathological data, intraoperative and postoperative outcomes were collected and analyzed. Four surgeons performed LDP and open distal pancreatectomy (ODP) and another 1 surgeon preformed only ODP.

Definition

The postoperative pancreatic fistula (POPF) was

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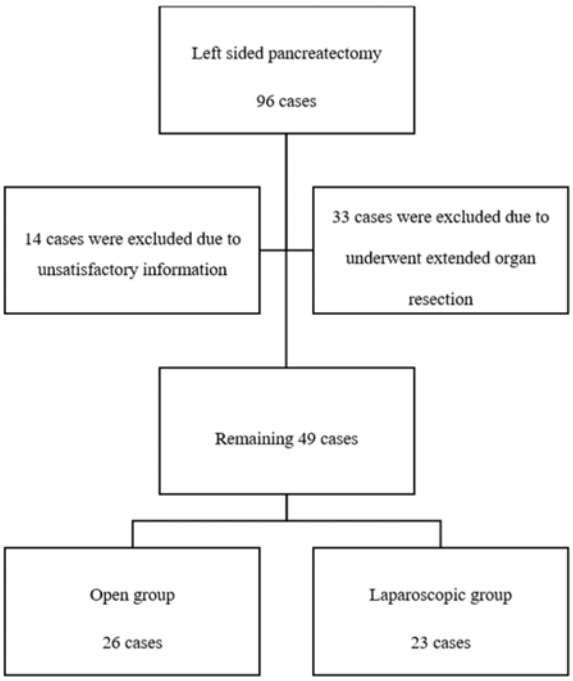

Figure 1. Patient disposition.

defined by an increased drain-amylase level more than 3 times of upper normal limit of serum amylase and grading of POPF was classified according to International Study Group on Pancreatic Surgery (ISGPS) 2016 definition[4]. Postoperative pancreatectomy hemorrhage (PPH), postoperative chyle leakage and postoperative delayed gastric emptying (DGE) were graded and defined as stated by ISPGS definition[5-7]. The Dindo-Clavien grading system was applied to assess the surgical complication[8]. With reference to the Dindo-Clavien classification of surgical complications, grades 3 to 5 were referred as major complications. The R1 resection margin was defined as margin <0.1 cm from histological examination. Laparoscopic attempt with conversion to open was classified to open group. Pancreatic texture was defined from tactile and visual sensation by surgeon. Transection level of pancreas was identified by postoperative computer tomography (CT) or magnetic resonance imaging (MRI), pancreatic tail resection line was defined as imaginary line of left sided to the aorta.

Surgical procedure

The determination of whether the choice to perform laparoscopic or open technique was decided according to the surgeon preference. Spleen preserving distal pancreatectomy was chosen as the first choice for benign cases in the patients whose tumor is not located close to splenic vessel and no inflammation was found around the tumor. For LDP, pancreatic stump was managed by endo-stapler with or without hand-sewn re-enforcement. Prolong peri-firing compression technique, pre-firing compression for 3 minutes and post-firing compression for 2 minutes by Endo-stapler, was used since 2017[9]. Fibrin sealant was used depending on surgeon preference.

Statistical analysis

Statistical analysis was calculated by SPSS software version 18 (SPSS Inc., Chicago, IL). Variables were compared by using χ^2 tests and independent samples t-tests. Differences were considered significant at a p-value of <0.05. Univariate and multivariate logistic regression analysis was calculated by stepwise technique.

Results

Patient characteristics

From the total of 49 patients, 26 (53.1%) patients were classified into open group and 23 (46.9%) patients into laparoscopic group. In 25 attempted laparoscopic cases, 2 (8%) patients were converted to open group because of bleeding from splenic vein. There was no difference for diagnosis but low incidence (2 from 49 cases) of pancreatic ductal adenocarcinoma (PDAC) and high incidence of pancreatic cystic tumor (25 from 49 cases) in this study. There was no difference in age, BMI, clinical presentation, American Society of Anesthesiologists score (ASA), pancreatic texture, tumor size and length of resected specimen (Table 1).

Operative details

There was no difference in type of operation. Distal pancreatectomy with spleen preservation was more performed in LDP group (52.2% versus 23.2, p = 0.289). Pancreatic stump closure was more performed with stapler in laparoscopic group, 14 (60.8%) versus 3 (11.5%) p<0.001. There was a higher rate of using prolong peri-firing compression technique in laparoscopic group, 4 (17.4%) cases in laparoscopy versus 0 case in open group (p = 0.023). And there were no differences in fibrin sealant usage and level of transection (Table 2).

Operative outcomes

There was no mortality in any of the 49 patients. There were no significant differences in overall complications between open and laparoscopic group, 61.5% versus 65.2% p = 0.632, respectively. And no significant differences in major complication were found between open and laparoscopic group, 26.9% versus 13.0% p = 0.259, respectively. The trend toward higher blood loss in open group was found but not statistically significant, 598.0 versus 302.7 p = 0.050. There were no differences in terms of clinically relevant POPF between open and laparoscopic group, 50% versus 47.8% p = 0.879, respectively. Regarding the POPF-required intervention, no differences between open and laparoscopic group were observed, 7.7% versus 13.0% p = 0.264, respectively. There were no differences in delayed gastric emptying and 30-day readmission. No PPH in all 49 patients. There were 2 cases of chyle leakage (grade B) of all the patients. The soft diet starting date was not found different between open and laparoscopic group, day 4.2 versus

Table 1. Patient characteristics

	Pancreatectomy		*p*-value
	Open n = 26	Laparoscopy n = 23	
Gender, n (%)			0.532
Male	8 (30.8)	6 (26.1)	
Female	18 (69.2)	17 (73.9)	
Age (years), mean (SD)	51 (16.8)	51 (16.7)	0.965
Albumin (g/L), mean (SD)	38.2 (4.7)	38.8 (2.9)	0.605
BMI (kg/m^2), mean (SD)	25.0 (3.9)	24.4 (4.2)	0.580
Presentation, n (%)			0.267
Asymptomatic	7 (26.9)	13 (56.5)	
Abd. pain	11 (42.3)	5 (26.1)	
Abd. mass	1 (3.8)	1 (4.3)	
Pancreatitis	1 (3.8)	0	
Hypoglycemia	4 (15.4)	2 (8.7)	
Others	2 (7.7)	2 (8.7)	
Pathological diagnosis			0.409
Pancreatic ductal adenocarcinoma	2 (7.7)	0	
Intraductal papillary mucinous neoplasm	2 (7.7)	2 (8.7)	
Mucinous cystic neoplasm	2 (7.7)	4 (17.4)	
Serous cystic neoplasm	6 (23.1)	6 (26.1)	
Solid pseudopapillary epithelial neoplasm	2 (7.7)	3 (13.0)	
Pancreatic neuroendocrine tumor	7 (26.9)	4 (17.4)	
Pseudocyst	3 (11.5)	0	
Others	2 (7.7)	4 (17.4)	
ASA, n (%)			0.748
Class I	1 (3.8)	2 (8.7)	
Class II	17 (65.4)	13 (56.5)	
Class III	8 (30.8)	8 (34.8)	
Pancreatic texture, n (%)			0.135
Soft	16 (61.5)	20 (87.0)	
Tumor size (cm), mean (SD)	4.8 (3.6)	4.6 (2.2)	0.856
Length of specimen (cm), mean (SD)	9.6 (2.8)	9.4 (3.1)	0.849

BMI = body mass index; Abd. = abdominal; ASA = American Society of Anesthesiologists

day 3.7 $p = 0.439$, respectively. The length of hospital stay was no different between open and laparoscopic group, 15.6 day versus 11.8 $p = 0.302$, respectively. The operative time, drain removal date, surgical margin and surgical margin showed no differences (Table 3).

Univariate and multivariate analysis

Uni- and multi-variate analysis was used to analyze risk factors of POPF. For univariate analysis, BMI ≥27 kg/m^2 was only one variable related to POPF ($p = 0.100$) (Table 4). And due to small sample size, multivariate analysis cannot be applied.

Discussion

Due to the 2017-European consensus, LDP was safe and technically feasible for the treatment of benign and malignant pancreatic lesions located in the body and tail[10]. Nowadays, more than 30 studies have been were published that reflecting the trend of LDP has been accepted in worldwide[3,11]. Pancreatectomy procedure is a volume-outcome relationships[12]. Ramathibodi Hospital has performed at least more than 30 cases of pancreato-duodenectomy a year[13]. However, the experienced in LDP was still limited. To the best of our knowledge, this has been the first study conducted on LDP in Thailand. From the randomized study, LDP could reduce blood loss when compared to OPD (150 ml versus 400 ml)[14]. Meanwhile the present study, showed no differences in terms of blood loss between LDP and ODP, and blood loss in LDP was higher than the previous randomized study. This might be because of having less experienced in LDP and still climbing in the learning curve. In addition, the surgeons experience in LDP was varied, ranging from the minimum of 1 case to the maximum of 13 cases. With regard to the learning curve for LDP, to reduce complication, blood loss and operative time, 15 to 17 cases should be performed[15,16]. Moreover, in LDP group, clinically relevant POPF rate was 47.8% which was higher when compared to previous study (15 to 39%)[14,17]. But in the present study, only 13% (3 from 23 cases) required intervention including percutaneous drainage or endoscopic

Table 2. Operative details

	Pancreatectomy		*p*-value
	Open n = 26	Laparoscopy n = 23	
Pancreatic operation, n (%)			0.289
Enucleation	1 (3.8)	1 (4.3)	
Central pancreatectomy	1 (3.8)	0	
Distal pancreatectomy with spleen preservation	6 (23.2)	12 (52.2)	
Distal pancreatosplenectomy	17 (65.4)	10 (43.5)	
Radical antegrade modular pancreatosplenectomy	1 (3.8)	0	
Stump management, n (%)			<0.001
Stapler	3 (11.5)	14 (60.8)	
Stapler + Hand sewn	10 (38.5)	8 (34.8)	
Hand sewn	13 (50.0)	1 (4.4)	
Fibrin sealant, n (%)	1 (3.8)	4 (17.4)	0.105
Prolong peri-firing compression, n (%)	0	4 (17.4)	0.026
Level of resection, n (%)			0.404
Neck, body	20 (76.9)	16 (69.6)	
Tail	6 (23.1)	7 (30.4)	

drainage. Most of POPF were asymptomatic grade B which prolonged drain catheter more than 3 weeks (mean of drain removal at postoperative day 22). Part of this incident might be from the fact that we don't have the same drain management protocol. Some surgeons removed the drain when its content was less than 5 to 10 ml/day, whereas some gradually shortened the drain every 2 to 4 days after the content was less than 5 to 10 ml/day, some surgeons waited until there was no drain content. Another parameter which increased rate of POPF in this study was having few cases of PDAC (3 cases) and high number in benign cases. According to large retrospective study, neuroendocrine and nonmalignant pathology were significant risk factors of POPF[17]. Because of PDAC could induce fibrosis or pancreatitis due to pancreatic duct obstruction which made pancreatic texture more firm or harder. Therefore, the risk of POPF would be reduced[18]. In terms of risk of POPF, this study showed no differences in POPF rate between LDP and ODP which was consistent with the previous studies[3,10,14].

Few studies reported BMI >27 to 30 kg/m^2 was associated with an increased risk of POPF[19,20]. Moreover, the study on visceral fat evaluation revealed that the higher amount of visceral fat was related to POPF[21]. High amount of BMI has not only increased technically difficulty in surgery, but also been correlated with the increase in pancreatic fat infiltration and decrease in pancreatic fibrosis. This factor has been made pancreas soft and led to POPF[22]. The present study revealed that high BMI patients (≥27 kg/m^2) was related to POPF (p = 0.100). That could indirectly reflect that technically difficult case in heavier patients was a risk factor of POPF. In terms of soft diet starting, there were no differences in starting soft diet between open and laparoscopy because both open and laparoscopy groups have the same dietary protocol. In terms of length of hospital stay, there was a trend towards longer hospital stay in OPD, 15.6 days versus 11.8 days, although there was no significance of this difference. Moreover, length of hospital stay in LDP group was longer when compared to western country (6 days)[14]. In our opinion, this might be because of enhanced recovery program wasn't applied to all cases in this study and culture of Thai patients who preferred to stay in hospital until they were sure to go home safely including having stitches out or drain removal before being discharged which was the same compared to other countries in Asia region[23,24]. Normally, pain and daily life activity time were lower in laparoscopy group but this study could not show those variables due to the limitation of retrospective study.

Conclusion

Left-sided pancreatectomy in Ramathibodi Hospital was a safe and effective procedure but still having a high rate of complications. LDP and ODP were not found different in terms of complications, operative time and POPF.

What is already known on this topic?

Many studies and meta-analysis were reported on better achievement of laparoscopic distal pancreatectomy surgical outcomes including blood loss, length of hospital stay and still morbidities, mortalities and oncological outcomes were found the same as those of open distal pancreatectomy.

What this study adds?

Distal pancreatectomy in Ramathibodi Hospital was a safe and effective procedure but still having a high rate of asymptomatic pancreatic fistula. Laparoscopy and open distal pancreatectomy were not found different in terms of

Table 3. Operative outcomes

	Pancreatectomy		*p*-value
	Open n = 26	Laparoscopy n = 23	
Complication, n (%)	16 (61.5)	15 (65.2)	0.632
Major complication, n (%)	7 (26.9)	3 (13.0)	0.259
Clavian-Dindo, n (%)			0.089
Grade I	4 (15.4)	7 (30.4%)	
Grade II	5 (19.2)	5 (21.7%)	
Grade IIIa	6 (23.1)	0	
Grade IIIb	1 (3.8)	3 (13.0%)	
POPF, n (%)			0.773
Biochemical leakage	7 (26.9)	7 (30.4%)	
Grade B	12 (46.2)	11 (47.8%)	
Grade C	1 (3.8)	0	
Clinically relevant POPF, n (%)	13 (50.0)	11 (47.8%)	0.879
POPF required intervention, n (%)	2 (7.7)	3 (13.0%)	0.264
Chyle leakage, n (%)	1 (3.8)	1 (4.3%)	0.904
DGE, n (%)			0.646
Grade A	1 (3.8)	1 (4.3%)	
Grade B	1 (3.8)	0	
30-day readmission, n (%)	1 (3.8)	4 (17.4%)	0.118
Blood loss (mL), mean (SD)	598.0 (643.1)	302.7 (346.5)	0.050
Blood transfusion, n (%)	4 (15.4)	5 (21.7%)	0.516
Blood transfusion (unit), mean (SD)	0.4 (0.8)	0.3 (0.6)	0.900
Operative time (min), mean (SD)	252.3 (112.4)	255.0 (58.0)	0.920
Hospital stay (days), mean (SD)	15.6 (12.3)	11.8 (12.5)	0.302
Soft diet starting (days), mean (SD)	4.2 (2.9)	3.7 (1.6)	0.439
Drain removal (days), mean (SD)	27.7 (24.1)	23.4 (17.5)	0.489
Margin, n (%)			0.353
R0	25 (96.2)	23 (100%)	
R1	1 (3.8)	0	
R2	0	0	
LN harvesting (n), mean (SD)	4.5	1.3	0.077

POPF = postoperative pancreatic fistula; DGE = delayed gastric emptying; LN = lymph node

complication, operative time and POPF.

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Potential conflicts of interest

The authors declare no conflict of interest.

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Table 4. Univariate analysis of clinically relevant POPF

	Clinically relevant POPF		*p*-value
	No n = 25	Yes n = 24	
BMI ≥27 kg/m^2	5 (20.0%)	10 (41.7%)	0.100
Tumor size ≥10 cm	3 (13.0%)	1 (4.2%)	0.276
Operative time ≥210 min	15 (60.0%)	19 (79.2%)	0.146
Level of resection			>0.990
Neck or body	18 (75.0%)	18 (75.0%)	
Blood transfusion	5 (20.0%)	4 (16.7%)	0.763
Blood loss ≥200 mL	19 (79.2%)	15 (62.5%)	0.204
Soft pancreatic texture	20 (87.0%)	16 (76.2%)	0.355
Stump management			0.423
Stapler	9 (39.1%)	6 (25.0%)	
Stapler + Hand sewn	9 (39.1%)	9 (37.5%)	
Hand sewn	5 (21.7%)	9 (37.5%)	
Surgical technique			0.879
Open	13 (52.0%)	13 (54.2%)	
Laparoscopy	12 (48.0%)	11 (45.8%)	

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