Retrospective Clinical Research Report

Journal of INTERNATIONAL MEDICAL RESEARCH

Journal of International Medical Research
49(12) 1–9

DOI: 10.1177/03000605211063098
journals.sagepub.com/home/imr
SAGE

Analysis of safety and efficacy of laparoscopic distal pancreatectomy in the treatment of left pancreatic malignant tumors

Tang Hao, Jiang Shiming and Chen Yong

Abstract

Objective: Distal pancreatectomy is the most extensive operation to treat malignant tumors of the left pancreas; however, malignant pancreatic tumors are prone to early invasion and metastasis.

Methods: The clinical data of 80 patients undergoing surgical treatment for malignant tumors of the pancreatic body or tail from January 2013 to December 2017 were retrospectively analyzed. The main clinical variables were compared between patients undergoing laparoscopic distal pancreatectomy (LDP) vs. open distal pancreatectomy (ODP).

Results: There were no significant differences in general patient characteristics, complications, and postoperative survival ($\chi^2 = 0.09$) between the groups. The operation time in the LDP group was significantly longer than that in the ODP group; however, the LDP group was superior to the ODP group regarding the length of postoperative hospital stay, diet recovery, and rectal exhaust and ambulation times.

Conclusion: LDP is a safe and feasible treatment for left pancreatic malignancies, with the same surgical efficacy as ODP. LDP also has the advantages of minimally invasive surgery, such as minimal trauma and enhanced recovery after surgery.

Keywords

Left pancreas, pancreatic neoplasm, laparoscopic left pancreatectomy, safe and effective, fast recovery, minimally invasive surgery

Date received: 29 August 2021; accepted: 9 November 2021

Hepatobiliary Surgery, the First Affiliated Hospital of Chongqing Medical University, Chongqing, China

Corresponding author:
Chen Yong, Hepatobiliary and Pancreatic Surgery, the First Affiliated Hospital of Chongqing Medical University, No. 1 Youyi Road, Yuzhong District, Chongqing 400010, China.
Email: chenyong61@126.com

Introduction

Distal pancreatectomy (DP) is the main treatment for pancreatic body and tail tumors. Previously, DP was performed most often as open surgery.[1] With recent rapid developments in laparoscopy, some pancreatic surgeries have been completed using this approach. However, pancreatic malignancies are prone to invade surrounding organs and blood vessels, and these malignancies are also prone to early nerve invasion and lymph node metastasis. Therefore, the surgical resection and long-term survival rates with pancreatic malignancies are relatively low.[2] To improve the resection and long-term survival rates, scholars have performed various surgical approaches for left pancreatic tumors. However, laparoscopic resection of left pancreatic malignancies remains controversial, and whether the safety and efficacy of minimally invasive left pancreatic surgery and open surgery are comparable is questionable.[3,4]

In this study, we retrospectively analyzed the case data of patients undergoing laparoscopic DP (LDP) and open DP (ODP), and compared the short- and long-term clinical effects to evaluate the safety, feasibility, and clinical efficacy of LDP.

Materials and methods

Ethics statement

Because this was a retrospective study, and patient privacy was maintained, ethics committee approval was not required in our institution. Written informed consent was obtained from all patients to use their data in this study.

Case selection

Between January 2013 and December 2017, 41 LDPs and 46 ODPs were performed, excluding "postoperative medical examinations suggesting benign cases" (3 cases of LDP and 2 cases of ODP) and "transition-opening abdominal cases" (2 cases, with a transition rate of 4.1%).

Surgical procedure

With further understanding of the immune and hematopoietic functions of the spleen and advancements in surgical techniques, many surgeons have completed spleen-preserving DP (SPDP).[5,6] However, the vast majority of patients with pancreatic cancer are diagnosed with splenic invasion,[7] and it is difficult to clean the lymph nodes of groups 9, 10, 11, and 18 during SPDP.[8] Currently, our hospital performs DP combined with splenectomy for patients with pancreatic body and tail malignant tumors. The standard lymphadenectomy range for pancreatic body and tail cancer resection is as follows: splenic hilar lymph nodes (No. 10), splenic artery lymph nodes (No. 11), and pancreatic lymph nodes (No. 18). For those whose lesions are located in the pancreatic body, the lymph nodes around the abdominal arterial trunk can be cleaned (No. 9).

LDP procedure: The patient is placed in a supine position with the trocars positioned in a "V" shape. During laparoscopy, the parenchymal organs and omentum are carefully examined to rule out cancer metastasis. Separate the ligaments of the stomach and colon to explore the pancreas and masses with an ultrasonic knife. Next, the gastrosplenic and gastrocolic ligaments are cut to expose the pancreatic body. Separate the splenic arteriovenous anastomosis and clip it with a Hem-o-lok clip (Weck Surgical Instruments, Teleflex Medical, Durham, NC, USA) or 4-0 Prolene suture (Ethicon Inc., Somerville, NJ, USA). Stapler closure is then used to cut the pancreatic tissue >1 cm from the pancreatic tumor. If there is persistent bleeding from the pancreatic stump, suture

and apply compression. Gradually separate the pancreas with an ultrasonic knife along the back of the pancreas. The short gastric vessel above the spleen is severed, and after the splenogastric, splenophrenic, and splenocolic ligaments are gradually dissected, the left pancreas and spleen are completely removed. After inspecting the operative area for hemostasis, an abdominal drain is placed over the sectioned pancreas.

ODP procedure: Enter the abdomen with an L-shaped incision in the upper left abdomen or a median incision. The remainder of the surgical procedures are the same as those for LDP.

Postoperative management

The postoperative treatment of the two groups of patients was basically the same. Amylase concentration in the drainage fluid was measured every other day after surgery. Somatostatin was routinely used to inhibit pancreatin, and omeprazole was used to prevent stress ulcers. If there was no obvious bleeding in the stomach, the gastric tube was removed within 1 to 2 days to maintain a liquid diet. The abdominal drain was removed when the amylase concentration in the drainage fluid was <125 U/L and the volume was <30 mL/day. Postoperative complications were graded I to V according to the Clavien–Dindo grading system.[9] Fistula-related complications were assessed using the pancreatic fistula criteria established by the International Study Group of Pancreatic Surgery (ISGPS) in 2016.[10–12]

Statistical analysis

We collected the patients' baseline data, and operative and postoperative outcomes, namely age, sex, body mass index (BMI), performance status (Karnofsky score), American Society of Anesthesiologists (ASA) classification, New York Heart Association (NYHA) score, and pancreatic duct width. The intraoperative outcomes were intraoperative blood loss, intraoperative blood transfusion, and operation time. The postoperative outcomes were pathology parameters (histopathological diagnosis, resection margins, number of lymph nodes retrieved, tumor-positive lymph nodes retrieved), rectal exhaust time, time to diet recovery, length of postoperative hospital stay, time to resuming ambulation, intensive care unit admission, postoperative complications (postoperative pancreatic fistula (POPF), postpancreatectomy hemorrhage, delayed gastric emptying, and surgical site infection), and mortality within 30 days. The definitions of POPF, delayed gastric emptying, and postpancreatectomy hemorrhage were in accordance with the definitions of the ISGPS.[2,11,12]

Categorical variables were expressed as numbers and percentages, and statistical analysis was performed using analysis of variance and Fisher's exact tests. Continuous variables were expressed as median or mean $\pm$ standard deviation ($x \pm s$), and statistical analysis was performed using the t test. The Kaplan–Meier method was used for survival analysis and to create the survival curve. All statistical analyses were performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA), and $P < 0.05$ was considered statistically significant. The reporting of this study conforms to the STROBE guidelines.[13]

Results

Patient information

Eighty patients were enrolled in the study (36 in the LDP group and 44 in the ODP group). Patients in the LDP group and the ODP group were comparable regarding age, sex, BMI, admission symptoms, ASA score, comorbidities, pancreatic duct diameter, and tumor size (Table 1).

Table 1. Comparison of the general characteristic data between the two groups of patients.

	LDP, n (%)	ODP, n (%)	*P*-value
Age, years, mean ± SD	58.6 ± 11.5	58.7 ± 10.5	0.81
Female	13 (36.1)	17 (38.6)	0.82
BMI, kg/m^2, mean ± SD	21.8 ± 2.4	22.0 ± 2.4	0.98
ASA, mean ± SD	2.2 ± 0.7	2.3 ± 0.7	0.20
Pancreatic duct diameter, mm, mean ± SD	4.5 ± 1.9	4.7 ± 1.9	0.74
Admission symptoms			0.84
Epigastric pain	8 (22.2)	11 (25.0)	
Jaundice	20 (55.6)	21 (47.7)	
Epigastric pain with jaundice	5 (13.9)	9 (20.5)	
Other	3 (8.3)	3 (6.8)	
Comorbidities	22 (61.1)	29 (65.9)	0.66
Tumor size, cm, mean ± SD	2.7 ± 0.9	3.0 ± 0.8	0.27
Pancreatic texture			0.18
Soft	13 (36.1)	15 (27.8)	
Hard	13 (36.1)	30 (55.6)	
Moderate	10 (27.8)	9 (16.7)	
Prior abdominal surgery	10 (27.8)	16 (36.4)	0.41

LDP, laparoscopic distal pancreatectomy; ODP, open distal pancreatectomy; SD, standard deviation; BMI, body mass index; ASA, American Society of Anesthesiologists.

Surgical information

LDP surgery time was significantly longer than for ODP (411.0 minutes vs. 355.8 minutes, respectively; $P < 0.05$). However, there was no statistical difference regarding the amount of blood loss, number of blood transfusions, and the number of dissected lymph nodes between the two groups (Table 2). The mean ± standard deviation number of dissected lymph nodes in the ODP group was 8.4 ± 5.8, and the proportion of positive lymph nodes was 31.8%. The mean ± standard deviation number of dissected lymph nodes in the LDP group was 8.7 ± 6, and the proportion of positive lymph nodes was 33.3%. The tumor-metastasis-node (TMN) staging (according to the American Joint Committee on Cancer (AJCC) 8th edition staging system) and the R0 resection rates were not statistically different between the groups (Table 3).

Postoperative recovery

The intensive care unit admission rate in the LDP group was significantly lower vs. the ODP group (10/36 vs. 30/44, respectively; $P < 0.01$). In addition, patients in the LDP group had shorter rectal exhaust times (1.6 days vs. 3.2 days, respectively; $P < 0.01$), and time to diet recovery (2.6 days vs. 3.2 days, respectively; $P < 0.01$). Patients in the LDP group had shorter ambulation times (4.0 days vs. 6.3 days, respectively; $P < 0.01$) than the ODP group, and postoperative hospital stay was significantly shorter (7.9 days vs. 11.5 days, respectively; $P < 0.01$). In contrast, there was no significant difference between the groups regarding postpancreatectomy hemorrhage, postoperative pancreatic fistula, postoperative peritonitis, postoperative pneumonia, unexpected second surgery, and short-term mortality (within 30 days) after surgery (Table 3). There was only

Table 2. Comparison of the intraoperative and postoperative data and pathological staging between the two groups of patients.

	LDP, n (%)	ODP, n (%)	*P*-value
Operation time, minutes, mean ± SD	411.0 ± 106.2	355.8 ± 72.7	<0.05
Intraoperative blood loss, mL, mean ± SD	294.4 ± 247.5	338.6 ± 230.0	0.41
Intraoperative blood transfusion	6 (16.7)	10 (22.7)	0.5
Lymph nodes retrieved, mean ± SD	8.7 ± 6	8.4 ± 5.8	0.83
TNM staging			0.79
T1N0M0	9 (25.0)	10 (22.7)	
T2N0M0	15 (41.7)	20 (45.5)	
T1N1M0	6 (16.7)	4 (9.1)	
T2N1M0	4 (11.1)	8 (18.2)	
T3N1M0	2 (5.6)	2 (4.6)	
Positive lymph nodes (%)	33.3	31.8	0.89
Positive resection margins	4 (11.1)	4 (18.2)	0.76

LDP, laparoscopic distal pancreatectomy; ODP, open distal pancreatectomy; SD, standard deviation; TNM, tumor-node-metastasis.

one case of Clavien–Dindo complications grade ≥III, and no statistical difference in the Clavien–Dindo complications between the groups. Additionally, the proportion of positive margins in the LDP group and the ODP group was basically the same (88.9% vs. 90.9%, respectively; $P < 0.05$).

Six patients were lost to follow-up (namely, four in the ODP group and two in the LDP group), with a total loss to follow-up rate of 7.5%. The median follow-up time was 44 months (95% confidence interval (CI) = 32.5–55.5). The median survival time for all patients was 24 months (95% CI = 20.2–27.8). The median survival time of the patients in the ODP group was 21 months (95% CI = 18.8–23.2), and the median survival time of the patients in the LDP group was 24 months (95% CI = 20.8–27.2). Using the log-rank test, no statistically significant differences in long-term mortality was found between the groups ($\chi^2 = 0.09$) (Figure 1).

Discussion

After several years of progress, LDP has been performed for symptomatic benign and premalignant disease of the pancreatic body or tail, and is now gradually being used in the treatment of malignant tumors of the left pancreas. DP remains a major abdominal operation associated with a 30% to 50% risk of complications and 1% to 4% risk of death.[14] As more and more cases of left pancreatic malignancies are treated with LDP, some scholars dispute the therapeutic effect and safety of LDP.[15–17] There are currently several reports comparing ODP and LDP.[16,18–21] LDP has the advantages of less intraoperative bleeding, faster postoperative recovery, and shorter average postoperative hospital stay. In addition, no significant differences in postoperative complications, postoperative pancreatic fistula, and short-term curative effects (R0 resection and lymph node removal) have been reported between LDP and ODP. However, the overall number of cases in previous studies is small, and there is a lack of prospective or large-scale case–control studies.[17,22,23]

In this study, 36 cases of LDP and 44 cases of ODP were compared in the treatment of distal pancreatic malignant tumors

Table 3. Comparison of the postoperative conditions between the two groups of patients.

	LDP, n (%)	ODP, n (%)	*P*-value
Intensive care unit admission	10 (27.8)	11.5 (2.7)	<0.01
Rectal exhaust time, days, mean ± SD	1.6 ± 0.8	3.2 ± 1.1	<0.01
Diet recovery time, days, mean ± SD	2.6 ± 0.8	4.1 ± 1.1	<0.01
Ambulation time, days, mean ± SD	4.0 ± 1.2	6.3 ± 1.5	<0.01
Postoperative hospital stay, days, mean ± SD	7.9 ± 1.4	11.5 ± 2.7	<0.01
Postpancreatectomy hemorrhage	3 (8.3)	3 (6.8)	0.70
Grade A	1 (2.7)	2 (4.5)	
Grade B	1 (2.7)	1 (2.2)	
Grade C	1 (2.7)	0	
Postoperative pancreatic fistula	8 (22.2)	9 (20.5)	0.71
Biochemical leak	6 (16.6)	7 (15.9)	
Grade B	1 (2.8)	2 (4.5)	
Grade C	1 (2.8)	0	
Delayed gastric emptying	4 (11.1)	5 (11.3)	0.99
Grade A	2 (5.6)	3 (6.8)	
Grade B	2 (5.6)	2 (4.5)	
Grade C	0	0	
Postoperative peritonitis	3 (8.3)	5 (11.4)	0.65
Postoperative pneumonia	5 (13.9)	8 (18.2)	0.60
Unexpected second surgery	1 (2.7)	1 (2.2)	0.89
Mortality within 30 days	0	1 (2.2)	0.36
Clavien–Dindo complications			0.50
Grade I	33 (91.7)	39 (88.6)	
Grade II	2 (5.6)	4 (9.1)	
Grade III	1 (2.7)	0	
Grade IV	0	0	
Grade V	0	1 (2.2)	

LDP, laparoscopic distal pancreatectomy; ODP, open distal pancreatectomy; SD, standard deviation.

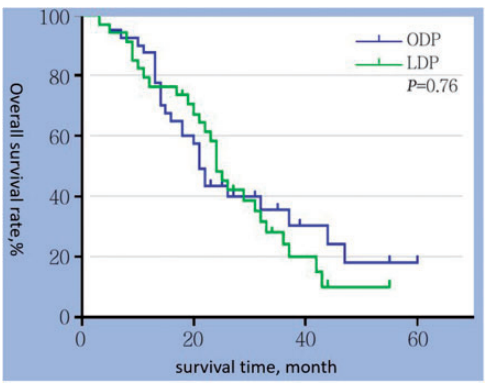

Figure 1. Postoperative survival curves for the two groups of patients.
LDP, laparoscopic distal pancreatectomy; ODP, open distal pancreatectomy.

regarding surgical efficacy and curative effects. We found that the average operation time for LDP was significantly longer than that of ODP (411.0 minutes vs. 355.8 minutes, respectively; $P < 0.05$). This may be related to the short experience with, and the difficulty of, laparoscopic pancreatic surgery. The learning curve of laparoscopic pancreatic surgery also affects the average operation time. However, LDP was associated with shorter postoperative hospital stay (7.9 days vs. 11.5 days; $P < 0.01$), fewer intensive care unit admissions (10/36 vs. 30/44; $P < 0.01$), and earlier rectal exhaust (1.6 days vs. 3.2 days; $P < 0.01$) and ambulation times (4.0 days

vs. 6.3 days; $P < 0.01$) compared with ODP, respectively. In 2019, Van Hilst et al. performed a propensity-score-matched study of LDP vs. ODP involving 1212 patients in 34 medical centers in 11 countries.[18] The authors found that the median blood loss (200 mL vs. 300 mL; $P = 0.001$) and hospital stay (8 days vs. 9 days; $P < 0.001$) during laparoscopic surgery were significantly reduced compared with open surgery, respectively.[18,19] In the current study, the hospital stay after laparoscopic surgery (7.9 days vs. 11.5 days; $P < 0.05$) was significantly shorter than that of open surgery, respectively, confirming that minimally invasive surgery has the inherent advantage of fast recovery. There was only one case of Clavien–Dindo complications grade $\geq$III, and no statistical difference in the Clavien–Dindo complications per classification grade, postoperative complication rates, and postoperative pancreatic fistula rate between the two groups. This shows that LDP is safe and feasible to treat distal pancreatic malignancies. LDP also has the advantages of minimally invasive surgery, such as less trauma to the abdominal wall and rapid postoperative recovery.

Ensuring negative margins is the only way to cure pancreatic malignancies. In this study, the proportion of positive margins in the LDP group and the ODP group was basically the same (88.9% vs. 90.9%, respectively; $P < 0.05$), which was consistent with most international studies. In a multicenter controlled study, Sharpe et al. reported a review of the National Cancer Database in the United States. Of the 769 patients with distal pancreatic ductal adenomas, 144 had undergone LDP. The LDP group had a higher proportion of negative margins than the ODP group, but the tumor diameter in the LDP group was smaller than that in the ODP group.[20] In addition, the study indicated that LDP is more frequently performed in large medical teaching institutions.

In the 2020 ISGPS expert consensus, the standard lymph node dissection for distal pancreatic cancer is defined as splenic hilar lymph nodes (group 10), splenic artery lymph nodes (group 11), and subpancreatic lymph nodes (group 18). When the tumor is confined to the pancreatic body, lymph nodes around the abdominal trunk can be removed (group 9).[24] The number of lymph nodes removed in the LDP and ODP groups in a study by Shin et al.[21] was 12 and 10, respectively. In the current study, the mean $\pm$ standard deviation number of dissected lymph nodes in the ODP group was 8.4 ± 5.8, and the proportion of positive lymph nodes was 31.8%. The mean $\pm$ standard deviation number of dissected lymph nodes in the LDP group was 8.7 ± 6, and the proportion of positive lymph nodes was 33.3%. There was no statistical difference between the groups. Additionally, our results showed that there was no significant difference in the median survival time after LDP or ODP (24 months vs. 21 months, respectively; $\chi^2 = 0.09$).

Conclusion

ODP and LDP were used to treat distal pancreatic malignancies, with the same surgical expectations and positive margins, and we found no significant difference in the median survival time between the groups. In addition, LDP is safe and feasible for the treatment of distal pancreatic malignant tumors, and LDP has the advantages of minimally invasive surgery, such as minimal abdominal wall trauma and fast postoperative recovery. However, this study is limited by the retrospective design and small sample size. To obtain the most accurate research results and verify our results, multicenter, prospective, randomized controlled studies are needed.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ORCID iD

Tang Hao https://orcid.org/0000-0001-5291-7521

References

1. Tzeng CW, Fleming JB, Lee JE, et al. Yield of clinical and radiographic surveillance in patients with resected pancreatic adenocarcinoma following multimodal therapy. *HPB (Oxford)* 2012; 14: 365–372.
2. Pereira FL, Vasques FT, Moricz A, et al. Correlation analysis between post-pancreatoduodenectomy pancreatic fistula and pancreatic histology. *Rev Col Bras Cir* 2012; 39: 41–47.
3. Huang L, Jansen L, Balavarca Y, et al. Stratified survival of resected and overall pancreatic cancer patients in Europe and the USA in the early twenty-first century: a large, international population-based study. *BMC Med* 2018; 16: 125.
4. Kimura W, Yano M, Sugawara S, et al. Spleen-preserving distal pancreatectomy with conservation of the splenic artery and vein: techniques and its significance. *J Hepatobiliary Pancreat Sci* 2010; 17: 813–823.
5. Kim EY, You YK, Kim DG, et al. Dual-incision laparoscopic spleen-preserving distal pancreatectomy: merits compared to the conventional method. *J Gastrointest Surg* 2019; 23: 1384–1391.
6. Jain G, Chakravartty S and Patel AG. Spleen-preserving distal pancreatectomy with and without splenic vessel ligation: a systematic review. *HPB (Oxford)* 2013; 15: 403–410.
7. Adam JP, Jacquin A, Laurent C, et al. Laparoscopic spleen-preserving distal pancreatectomy: splenic vessel preservation compared with the Warshaw technique. *JAMA Surg* 2013; 148: 246–252.
8. Morales-Oyarvide V, Rubinson DA, Dunne RF, et al. Lymph node metastases in resected pancreatic ductal adenocarcinoma: predictors of disease recurrence and survival. *Br J Cancer* 2017; 117: 1874–1882.
9. Bolliger M, Kroehnert JA, Molineus F, et al. Experiences with the standardized classification of surgical complications (Clavien-Dindo) in general surgery patients. *Eur Surg* 2018; 50: 256–261.
10. Neeman U, Lahat G, Goykhman Y, et al. Prognostic significance of pancreatic fistula and postoperative complications after pancreaticoduodenectomy in patients with pancreatic ductal adenocarcinoma. *Surgeon* 2020; 18: 24–30.
11. Wente MN, Bassi C, Dervenis C, et al. Delayed gastric emptying (DGE) after pancreatic surgery: a suggested definition by the International Study Group of Pancreatic Surgery (ISGPS). *Surgery* 2007; 142: 761–768.
12. Wente MN, Veit JA, Bassi C, et al. Postpancreatectomy hemorrhage (PPH): an International Study Group of Pancreatic Surgery (ISGPS) definition. *Surgery* 2007; 142: 20–25.
13. Von Elm E, Altman DG, Egger M, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Ann Intern Med* 2007; 147: 573–577.
14. Grossman JG, Fields RC, Hawkins WG, et al. Single institution results of radical antegrade modular pancreatosplenectomy for adenocarcinoma of the body and tail of pancreas in 78 patients. *J Hepatobiliary Pancreat Sci* 2016; 23: 432–441.
15. Dokmak S, Fteriche FS, Meniconi RL, et al. Pancreatic fistula following laparoscopic distal pancreatectomy is probably unrelated to the stapler size but to the drainage modality and significantly decreased with a small suction drain. *Langenbecks Arch Surg* 2019; 404: 203–212.
16. Gavriilidis P, Roberts KJ and Sutcliffe RP. Comparison of robotic vs laparoscopic vs open distal pancreatectomy. A systematic

review and network meta-analysis. *HPB (Oxford)* 2019; 21: 1268–1276.
17. Alfieri S, Boggi U, Butturini G, et al. Full robotic distal pancreatectomy: safety and feasibility analysis of a multicenter cohort of 236 patients. *Surg Innov* 2020; 27: 11–18.
18. Van Hilst J, De Rooij T, Klompmaker S, et al. Minimally invasive versus open distal pancreatectomy for ductal adenocarcinoma (DIPLOMA): a pan-European propensity score matched study. *Ann Surg* 2019; 269: 10–17.
19. De Rooij T, Van Hilst J, Van Santvoort H, et al. Minimally invasive versus open distal pancreatectomy (LEOPARD): a multicenter patient-blinded randomized controlled trial. *Ann Surg* 2019; 269: 2–9.
20. Sharpe SM, Talamonti MS, Wang E, et al. The laparoscopic approach to distal pancreatectomy for ductal adenocarcinoma results in shorter lengths of stay without compromising oncologic outcomes. *Am J Surg* 2015; 209: 557–563.
21. Shin SH, Kim SC, Song KB, et al. A comparative study of laparoscopic vs. open distal pancreatectomy for left-sided ductal adenocarcinoma: a propensity score-matched analysis. *J Am Coll Surg* 2015; 220: 177–185.
22. Parikh PY and Lillemoe KD. Surgical management of pancreatic cancer–distal pancreatectomy. *Semin Oncol* 2015; 42: 110–122.
23. Katz MH, Pisters PW, Evans DB, et al. Borderline resectable pancreatic cancer: the importance of this emerging stage of disease. *J Am Coll Surg* 2008; 206: 833–846.
24. Miao Y, Lu Z, Yeo CJ, et al. Management of the pancreatic transection plane after left (distal) pancreatectomy: expert consensus guidelines by the International Study Group of Pancreatic Surgery (ISGPS). *Surgery* 2020; 168: 72–84.