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Outcomes of pancreaticoduodenectomy with venous resection: a single center experience with 11 cases

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ABSTRACT

Aim: To perform a retrospective evaluation of the morbidity and mortality rates and reliability of venous resection with pancreaticoduodenectomy (PD) procedures in our clinic.

Material and Method: The records of 11 patients who underwent PD with venous resection between May 2016 and May 2021 in the Eskişehir Osmangazi University Faculty of Medicine Department of General Surgery were analyzed retrospectively.

Results: Eleven patients (five women and six men) were included. The patients' mean age was 64.09±9.27 years (range 47-78). Four (36.36%) patients underwent type 1 reconstruction, one (9.09%) type 2 reconstruction, five (45.45%) type 3 reconstruction and one (9.09%) type 4 reconstruction. Eight (72.73%) patients experienced venous invasion according to the histopathology reports. Mean time between diagnosis and surgery was 14.91±11.33 days, and the mean follow-up time was 17.64±13.31 months. Grade C pancreatic fistula was observed in one (9.09%) patient, who died on the 17th postoperative day. No patients experienced recurrence or metastasis during surveillance.

Conclusion: Pancreaticoduodenectomy with venous resection-reconstruction is safe and the only curative option in patients with pancreatic cancer and venous invasion.

Keywords: Pancreaticoduodenectomy with venous resection, portal vein resection, pancreaticoduodenectomy

INTRODUCTION

Pancreaticoduodenectomy (PD) is a complex, high-risk surgical procedure. The best operative mortality rates and long-term outcomes are reported from high-volume centers (1, 2). The mean operative time for the PD procedure is 5.5 hours, mean blood loss is 350 mL, and operative mortality is less than 4% in experienced centers (3).

Venous resection is not performed in most PD procedures. Venous involvement was at one time a relative contraindication for curative resection. However, experience with vein resection in hepatobiliary surgery began to emerge a few decades ago. Results following the perioperative period results were similar in PDs with venous resection, and venous resection procedures became more practicable (4).

One of the leading case reports concerning PD with venous resection was published in 1951 (5). Those surgeons observed invasion of the tumor to the lateral wall of the superior mesenteric vein (SMV) during surgery and performed segmental SMV resection end-to-end anastomosis. Numerous resection-reconstruction methods were subsequently described, and various inferences were drawn. These include the arguments for different reconstruction techniques, and the potential benefit of superior mesenteric artery (SMA) clamping, splenic vein (SV) preservation or ligation, and intraoperative heparin and postoperative anticoagulant use.

In the 1970s, Fortner drew greater attention to vascular resection during pancreatic surgery. (6). During those years, however, the method was not widely

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accepted due to the high morbidity and mortality of PD with vascular resection. However, as advances were made in preoperative evaluation, surgical technique, postoperative management, and anesthesia an extensive body of literature has emerged on this topic over the past three decades. PD with venous resection is now recognized as a frequently applied approach in high-volume centers.

The purpose of this study is to evaluate the results of PD with venous resection performed in our clinic and to compare our surgical results with other series in the literature in terms of mortality, morbidity, and safety.

MATERIAL AND METHOD

The study was carried out with the permission of the Eskişehir Osmangazi University Faculty of Medicine Ethical Committee (Date: 01.06.2021, Decision no: 02). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

The data for 11 patients who underwent PD with venous resection between 01.05.2016 and 01.05.2021 in the Osmangazi Medicine Faculty General Surgery Department, Turkey, were subjected to analysis. Demographic characteristics, date of diagnosis, date of recurrence, follow-up period, histopathological features of the specimen, tumor localization, preoperative imaging reports, resectability status (6), neoadjuvant therapy status, preoperative clinical TNM stage (7), characteristics of surgical intervention, vascular resection type (8), and postoperative complications were recorded for all patients (**Table**).

Table. Summary of patients' and tumor characteristics

Age	64.09±9.27 (47-78)
Gender	
Female	5 (45.45%)
Male	6 (54.55%)
Type of reconstruction	
Type 1	4 (36.36%)
Type 2	1 (9.09%)
Type 3	5 (45.45%)
Type 4	1 (9.09%)
Invasion (histopathology)	8 (72.73%)
Follow-up time, months	17.64±13.31 (1-40)
Status	
Exitus	1 (9.09%)
Alive	10 (90.91%)
Recurrence	0 (0.00%)
Metastasis	0 (0.00%)
Diagnosis	
Exocrine pancreas adenocarcinoma	11 (100.00%)
Differentiation	
Poor	2 (18.18%)
Moderate	6 (54.55%)
Good	3 (27.27%)
Stage	
Stage IA	0 (0.00%)
Stage IB	4 (36.36%)
Stage IIA	0 (0.00%)
Stage IIB	5 (45.45%)
Stage III	2 (18.18%)
Stage IV	0 (0.00%)
Location	
Head	11 (100.00%)
Tumor size, mm	32.27±9.67 (22-50)
Number of lymph nodes	23.18±14.52 (9-61)
Number of metastatic lymph nodes	3.82±5.08 (0-17)
Extracapsular invasion	3 (27.27%)
Resectability	
Resectable	2 (18.18%)
Borderline	9 (81.82%)
Unresectable	0 (0.00%)
Perineural invasion	9 (81.82%)
Lymphovascular invasion	9 (81.82%)
Resection margin	
R0	9 (81.82%)
R1	2 (18.18%)
R2	0 (0.00%)
Surgical margin type	
Negative	9 (81.82%)
Pancreatic parenchyma	0 (0.00%)
Choledocal	0 (0.00%)
Retropancreatic	2 (18.18%)
Choledocal and pancreatic parenchyma	0 (0.00%)
Pancreaticojejunostomy type	
Ducto-jejunostomy	11 (100.00%)
Gastrojejunostomy type	
Simple gastrojejunostomy + Braun anastomosis	11 (100.00%)
Pylorus	
Not-preserved	11 (100.00%)
Preserved	0 (0.00%)
Neoadjuvant chemotherapy	2 (18.18%)
Neoadjuvant radiotherapy	0 (0.00%)
Adjuvant chemotherapy	9 (81.82%)
Adjuvant radiotherapy	7 (63.64%)
Length of stay in hospital, days	12.18±5.25 (4-21)
Leakage	
None	10 (90.91%)
Biochemical	0 (0.00%)
Macroscopic	1 (9.09%)
Fistula	
None	10 (90.91%)
Grade A	0 (0.00%)
Grade B	0 (0.00%)
Grade C	1 (9.09%)
Surgical site infection	2 (18.18%)
DGE	2 (18.18%)
Clavien-Dindo classification	
No complication	7 (63.64%)
Grade I	0 (0.00%)
Grade II	3 (27.27%)
Grade III	0 (0.00%)
Grade IV	0 (0.00%)
Grade V	1 (9.09%)
Preoperative endoscopic retrograde cholangiopancreatography	1 (9.09%)
Preoperative stenting	1 (9.09%)
Intraoperative blood loss	322.73±90.45 (200-450)

Data are presented as mean±standard deviation (minimum-maximum) for continuous variables and as frequency (percentage) for categorical variables

Statistical Analysis

Statistical analysis of this study were performed on SPSS version 25.0 software (SPSS Inc., Chicago, IL, USA). Data are presented as mean±standard deviation, and as frequency values for categorical variables. Data concerning surgical treatment results are presented in tables in percentage form.

Technical Details

Computed tomography (CT) was used for staging in the preoperative period. Magnetic resonance imaging (MRI) and positron emission tomography (PET) were also applied in some cases with suspected metastasis on CT images.

No patient underwent pylorus-sparing surgery. Regional lymph nodes, hepatoduodenal ligament, celiac axis (CA), and SMA were routinely dissected. The para-aortic area was dissected in cases with suspected metastasis at imaging. En-bloc resection and reconstruction were performed in cases with obvious portomesenteric venous invasion at preoperative imaging and in the intraoperative period. However, tangential resection-venorrhaphy or reconstruction with a patch was performed for tumors invading the right axis of the portal vein (PV) or the SMV. Primary anastomosis was employed in cases in which segmental venous resection was performed due to invasion. However, reconstruction was performed with a cadaveric iliac vein graft in one case in which tension-free anastomosis was not possible despite maximum mobilization.

Postoperative complications were classified according to the Clavien-Dindo system. Patients with suitable performance status received adjuvant chemoradiotherapy after the operation. CA.199 levels and abdominal CT scans for recurrence/distant metastasis were employed during follow-up.

RESULTS

Eleven patients (five female and six male) with a mean age of 64.09±9.27 years (range 47-78) were included in the study. Four (36.36%) patients underwent type 1 reconstruction, one (9.09%) type 2 reconstruction, five (45.45%) type 3 reconstruction, and one (9.09%) type 4 reconstruction. Pathology reports identified venous invasion in eight (72.73%) patients. Mean time between diagnosis and surgery was 14.91±11.33 (range 2-36) days, and the mean follow-up time was 17.64±13.31 (1-40) months. One (9.09%) patient died on the 17th postoperative day due to grade C pancreaticojejunostomy leak. No recurrence or metastasis were observed during surveillance.

Exocrine pancreas ductal adenocarcinoma (PDAC) was diagnosed in all patients. The most common tumor stage was IIB (45.45%). The tumor was in the head of the pancreas in all cases. Mean tumor size was 32.27±9.67 (range 22-50) mm. Three (27.27%) patients exhibited extracapsular invasion, and nine (81.82%) perineural and lymphovascular invasion. The resection margin was R1 in two (18.18%) cases, both of which were retropancreatic. Ducto-jejunostomy and simple gastrojejunostomy + Braun anastomosis were performed on all patients. The pylorus was not preserved in any patient.

Two (18.18%) patients received neoadjuvant chemotherapy, nine (81.82%) received adjuvant chemotherapy, and seven (63.64%) received adjuvant radiotherapy. Macroscopic leakage and grade C fistula were present in one (9.09%) case (this patient was exitus). Two (18.18%) patients experienced postoperative surgical site infection and two (18.18%) delayed gastric emptying (DGE). Three (27.27%) patients had grade II complications. One (9.09%) patient underwent preoperative endoscopic retrograde cholangiopancreatography (ERCP) and stent. Mean intraoperative blood loss was 322.73±90.45 (range 200-450) ml.

DISCUSSION

The purpose of this study was to conduct a retrospective evaluation of the morbidity-mortality rates and reliability of venous resection with PD procedures performed in our clinic. PDAC has a very poor prognosis, and the only curative therapeutic option is currently surgical resection. The addition of venous resection in addition to standard PD in some cases with venous involvement provides R0 resection with advanced dissection of the peripancreatic vessels and peripancreatic fatty tissue.

Recent reports have shown that venous resection is safe as a therapeutic option in borderline resectable pancreatic cancer (9-11). Xie et al. (11) showed that patients undergoing radical resection of PDAC and PV resection exhibited significantly improved survival compared to those undergoing chemotherapy or palliative surgical procedures alone..

Resection margin is one of the most important prognostic factors in surgically treated PDAC. (12). The aim of PV-SMV resection is to achieve negative resection margins in patients with suspected PV-SMV invasion. The reported R0 resection rate ranges from 49% to 87.5% (13, 14). The R0 rate in the present study was 81.8%. The residual tumor was in the retropancreatic area in all our patients with a positive resection margin (18.2%).

The reported rate of venous invasion detected at pathological examination after venous resection in the literature is between 3% and 80%. (15-24). The figure in the present study was 72.7%.

There are two types of venous resection, partial and segmental, involving various reconstruction techniques, including venorrhaphy, patch repair, end-to-end anastomosis, and autologous or prosthetic interposition graft (8). All exhibit similar results in terms of patency (14, 25). We performed partial vein resection on five of our patients and segmental vein resection on six. Similarly to the majority of previously published series, we performed four types of venous resection (13, 26, 27). However, our segmental resection rate was higher (45.4%) than that in previous series. This is probably attributable to the experience and orientation of the surgical team.

In our study, intraoperative blood loss was calculated as 322.73±90.45 ml. Intraoperative transfusion was not employed in any case.

Long-term postoperative anticoagulation is recommended only for patients with prosthetic grafts and those with PV thrombosis (13). No prosthetic graft was employed in any patient in the present study, and oral anticoagulant use was not required.

All patients in our study underwent wirsungojejunostomy. The pylorus sparing method was not employed in any case.

The patients were followed-up for an average of 17.64±13.31 months, during which no recurrence was detected. One (9.09%) patient died on the 17th postoperative day due to grade C pancreaticojejunostomy leak. No other mortality was observed during follow-up.

CONCLUSION

In conclusion, the results of this study show that venous resection with PD is associated with acceptable morbidity and mortality rates. PD with venous resection/reconstruction is safe and the only available option for curative treatment in patients with pancreatic cancer and venous invasion.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Osmangazi University Non-interventional Clinical Research Ethics Committee (Date: 01.06.2021, Decision No: 02).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients**.**

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