JCTEI
JOURNAL OF CLINICAL TRIALS AND EXPERIMENTAL INVESTIGATIONS
Year: 2023 Volume: 2 Issue: 2

ORIGINAL ARTICLE

10.5281/zenodo.8140758

Vascular resection and reconstruction in pancreatic tumors pancreatic tumors

Ahmet Türkoğlu[1] - Abdullah Oğuz[2] - Gizem Yaman[3] - İbrahim Halil Öcal[4] - Mesut Gül[5]

1. Rumeli University, Department of General Surgery, Istanbul, Turkey.
2. Dicle University Medical Faculty, Department of General Surgery, Diyarbakır, Turkey.
3. Bitlis State Hospital, Department of General Surgery, Bitlis, Turkey.
4. Adıyaman Training and Research Hospital, Department of General Surgery, Adıyaman, Turkey..
5. Medical Point Hospital, Department of General Surgery, Gaziantep, Turkey.

Correspondence
Ahmet Türkoğlu, Rumeli University, Istanbul, Turkey.

e-mail
ahmetturkoglu04@gmail.com

Received: 20 March 2023
Revised: 10 April 2023
Accepted: 15 April 2023
Published: 27 June 2023

Keywords
⇨ Neoplasms
⇨ Pancreatic- Procedure
⇨ Vascular Surgical- Negative Surgical Margins

ORCID ID of the author(s):
AT: 0000-0003-1048-4304
AO: 0000-0002-8711-8110
GY: 0000-0001-6374-2536
İHÖ: 0000-0003-1100-1036
MG: 0000-0001-5270-7161

Abstract

Objective: We aimed to to present our patients who underwent pancreaticoduodectomy with vascular resection and reconstruction for borderline pancreatic tumor.

Materials and methods: The retrospective study included six patients undergoing pancreaticoduodenectomy with portal vein resection due to locally advanced disease over a 2- year period. Demographic characteristics, symptoms, imaging findings, exploration findings of surgery, types of resections, perioperative complications, postoperative hospital stay were recorded.

Results: The patients were cosisted of 2 females and 4 males. Tumor location was in the head of the pancreas in 4 (66.7%) patients and in the body in 2 (33.3%) patients. Vasculary reconstruction was achieved by end-to-end anastomosis in 2 (33.3%) and primary closure in 4 (66.7%) cases. The hospital stay of the patients was 11 to 35 days. Intraoperative and postoperative blood product transfusion was not required in 3 of the cases. One patient was reoperated on the second postoperative day due to bleeding in the gastroduodenal anostomosis line and the bleeding was controlled. None of the patients developed pancreatic fistula.

Conclusions: In cases of pancreatic cancer with vascular invasion, vascular resection-reconstruction is inevitable to provide a negative surgical margin. Vascular resection and reconstruction can be performed safely similar to standard pancreatic surgery.

Main Points:

1. Surgical resection with a negative margin is the only curative option for patients with pancreatic cancer.
2. Vascular invasion used to be an indicator of unresectability for pancreatic cancer years ago.
3. Pancreaticoduodenectomy with vascular reconstruction for borderline pancreatic tumors have been shown to be safe to provide a negative surgical margin.

Cite as: Türkoğlu A, Oğuz A, Yaman G, Öcal İH, Gül M. Vascular resection and reconstruction in pancreatic tumors pancreatic tumors. J Clin Trials Exp Investig. 2023;2(2):100-104.

Introduction

Pancreatic cancer is the fourth most common cause of cancer death in the western world. During diagnosis, less than 20% of these patients have a resectable tumor. Remote organ metastasis is present in approximately 2/3 of unresectable cases (1). The most important predictor of survival is negative surgical margin (2). Pancreatic cancer is often extended to the retroperitoneal region invading major structures such as Portal Vein (PV), Superior Mesenteric Artery (SMA), and Superior Mesenteric Vein (SMV) (1,2). Pancreatic tumor with PV/SMV invasion that allowing for resection and reconstruction and/or invading SMA less than 180 degrees with no distant metastasis is called borderline resectable tumor (2). Surgery is the only curative treatment for these patients and the only way to achieve a negative surgical margin is vascular resection and reconstruction. Pancreaticoduodectomy with vascular reconstruction (PDVR) for borderline tumors have been shown to be safe to provide a negative surgical margin in several case series (3).

While vascular invasion used to be an indicator of unresectability for pancreatic cancer years ago, the development of vascular reconstruction techniques and neoadjuvant therapy caused vascular invasion to be considered resectable. The degree of vascular invasion and the absence of distant metastasis in multidetector Multidetector Computed Tomography (CT) images are the most important criteria for predicting the resectability of pancreatic cancer (2).

In this study, we aimed to present our patients with pancreatic tumor who underwent vascular resection and reconstruction.

Materials and methods

The retrospective study included six patients undergoing pancreaticoduodenectomy with portal vein resection (PVR) due to locally advanced disease performed over a 2-year period. Demographic characteristics, symptoms, imaging findings, exploration findings of surgery, types of resections, perioperative complications, postoperative hospital stay were recorded. All the patients underwent a dynamic triphasic computed tomography preoperatively. All patients were discussed at oncology board including surgeons, oncologists, radiologists and histopathologists, prior to definite decision for surgery. The institutional etical board approved the study. In cases with a mass in the head of the pancreas, we perform standard pancreaticoduodenectomy including antrectomy. The pancreaticojejunal anastomosis is performed by a duct to mucosa anastomosis. The biliojejunal anastomosis was performed by 4–0 or 5–0 continue PDS sutures. Subtotal pancreatectomy was performed in the cases with pancreatic body masses.

Portal vein resection technique

PVR was performed in all cases those have signs of invasion of the portal venous wall in imaging methods or intra-operative exploration. In the cases those tumor invasion of the vessel wall were more than 90 ° the circumference, the invaded vein segment was resected completely. Otherwise the invaded segment was resected in an elliptic manner and reconstructed by primary closure. Reconstruction of the portal ends was performed by means of a continuous running 6–0 polypropylene suture tension-fre anastomosis (Figure 1). No artificial grafts was needed for reconstruction. Intraabdominal drains were used routinely in all patients.

Results

The patients were cosisted of 2 females and 4 males with a median age of 63 (range, 58 to 77). Tumor location was in the head of the pancreas in 4 (66.7%) patients and in the body in 2 (33.3%) patients. Of

Table 1. Comparison of Vascular Findings in Preoperative Imaging Methods and Intraoperative Vascular Findings

	Vascular Findings in Preoperative Images	Vascular Findings in Surgical Exploration
Case 1	No vascular invasion	SMV invasion
Case 2	SMV invasion	SMV invasion
Case 3	Suspicious SMV invasion	SMV invasion
Case 4	No vascular invasion	PV invasion
Case 5	PV invasion	PV invasion
Case 6	PV invasion	PV invasion

SMV: Superior Mesenteric Vein, SV: Splenic Vein, PV: Portal Vein

Table 2. General Features

	IOBR (U)	POBR (U)	Duration of surgery (minute)	eoperation	Hospital stay (day)	Surgical site
Case 1	3	0	425	No	11	negative
Case 2	1	1	480	No	11	negative
Case 3	3	3	396	Yes*	35	positive
Case 4	0	0	435	No	26	negative
Case 5	0	0	363	No	16	negative
Case 6	0	0	360	No	15	negative

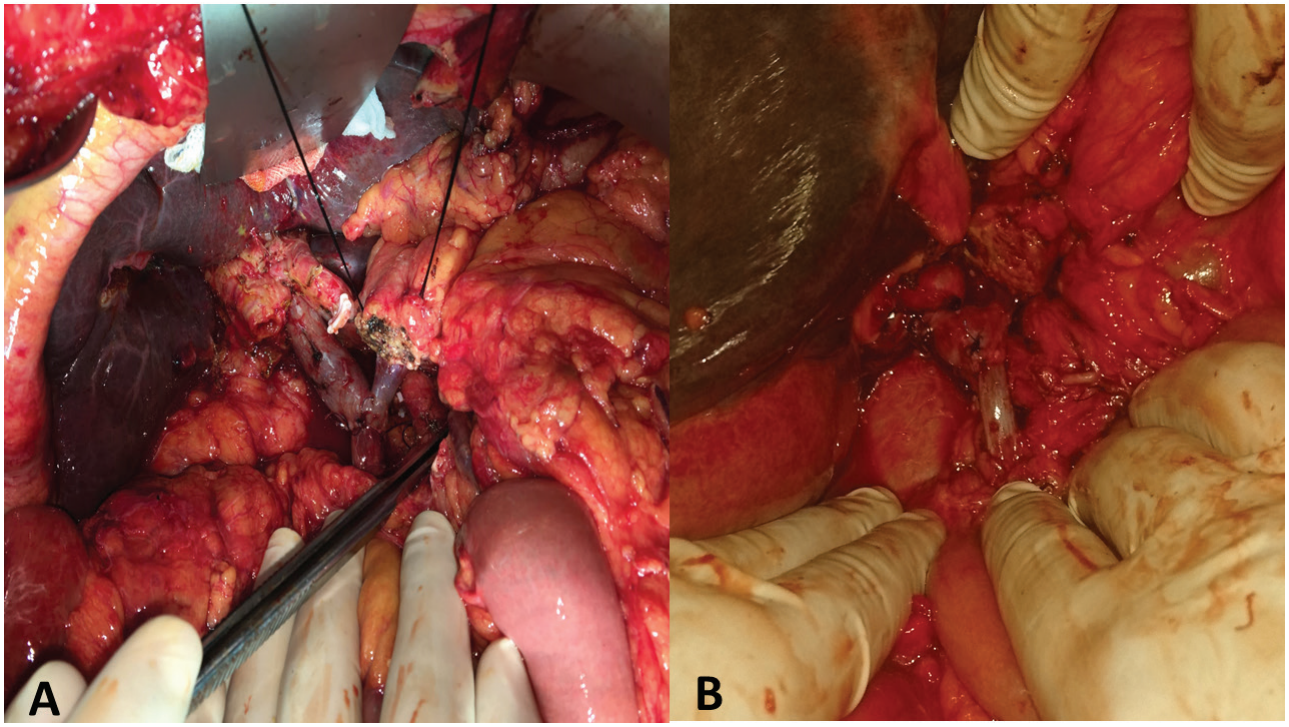
IOBR: Intraoperative blood replacement, POBR: Postoperative blood replacement, min: minute

*Due to bleeding in the gastoduodenal anostomosis line

Table 3. Classification of venous resection and reconstruction methods in pancreatic cancer

Type I	Partial venous excision and primary closure
Type II	Partial venous excision and closure by patch venoplasty
Type III	Segmental venous resection and primary veno-venous anastomosis
Type IV	Segmental venous resection and interposed venous conduit and at least 2 anastomoses.

Figure 1. A. Intraoperative image of anastomosis of Portal vein after resection. **B.** Intraoperative image of portal vein primary closure after wedge resection



these, 4 (66.7%) patients underwent PDVR, 2 (33.3%) underwent distal pancreatectomy (DP). Splenectomy, left surrenalectony and partial duodenectomy was also needed in two patients who underwent DP. Vascular invasion involved SMV in 3 (50%), PV in 1(16.7%) and SMV-PV biffurcation in 2 (33.3%) cases. Vasculary reconstruction was achieved by end-to-end anastomosis in 2 (33.3%) and primary closure in 4(66.7) cases. The demographics and surgery-related characteristics are presented in Table 1. The hospital stay of the patients was 11 to 35 days. Intraoperative and postoperative blood product transfusion was not required in 3 of the cases. One patient was reoperated on the second postoperative day due to bleeding in the gastoduodenal anostomosis line and the bleeding was controlled. Hospitalization of this patient was prolonged because of pulmonary and wound problems. None of the patients developed pancreatic fistula. General characteristics related to the operation are given in Table 2.

Discussion

Surgical resection is the only curative option for patients with pancreatic cancer. SMV, PV invasion is no longer a contraindication to pancreatic cancer. PDVR was first described by SMV resection-reconstruction in 1951 by Moore et al. After 1990's, an increasing number of reports demonstrated that extended pancreatic cancer surgery showed no significant increase in complication or mortality rates compared with standardized pancreatic cancer cases. On the other hand, there was no significant difference also in terms of patient survival. In 2004, Tseng et al found no significant difference between the survival rates of patients undergoing pancreaticoduodenectomy (PD) and PDVR. Yekebes et al found that postoperative morbidity and mortality rates between PD and PDVR were similar (3,4). SMV/PV and/or SV en-block resection-reconstruction is required in locally advanced pancreatic cancer with circumferential venous invasion to provide a negative surgical margin. On the other hand, wedge resection of the vein wall with primary closure or patch closure may be sufficient in partial wall invasion cases (5,6). The surgical margins were negative in all our patients. Vasculary reconstruction was achieved by end-to-end anastomosis in 2 and primary closure in 4 cases.

No pancreatic fistula developed in any of our patients. One patient was reoperated on the second postoperative day due to bleeding in the gastoduodenal anostomosis line. In a retrospective study conducted by Fuhrman et al (8), operation time, intraoperative blood loss and perioperative transfusion requirement increased in patients requiring venous resection. However, Ouaissi et al (9) found no significant difference between patients who underwent vascular resection along with pancreatic resection and those who didn't, with respect to postoperative complications such as bleeding, pancreatic fistula, and delayed gastric emptying. Martin et al (7) reported that PDVR prolonged the operation time and increased the risk of major complications compared to PD. However, the rate of pancreatic specific complications did not increase.

Since the tumor invasion length was less than 2cm in our two patients, we performed segmental resection and end-to-end anastomosis. In the other four patients, since the tumor infiltration was less than 90°, reconstruction with primary closure was achieved after partial venous wall excision. In the consensus of the International Study Group of Pancreatic Surgery (ISGPS), reconstruction options for borderline resectable pancreatic cancer after venous resection were classified into 4 types (Table 3) (10). In a study published in 2018, Zhang et al stated that primary closure with partial venous excision or patch closure is safer if PV / SMV infiltration is less than 90 °. On the other hand, they stated that in the cases that PV/SMV invasion is more than 90 °; segmental resection and venovenous anastomosis is appropriate if the invasion length is less than 2cm, though end-to-end venous anastomosis would not be a good choice due to high tension if venous invasion length is more than 2 cm. For some invasions in some special localizations such as SMV-PV-SV confluence, it is recommended to use the allogeneic vein or otogenic renal vein graft for venous reconstruction (11).

In conclusion, the survival in patients with pancreatic cancer is low. Surgical resection with negative margin is the best option to ensure cure. In cases of pancreatic cancer with vascular invasion, vascular resection-reconstruction is inevitable to provide a negative surgical margin. Vascular resection and reconstruction can be performed safely similar to standard pancreatic surgery.

Conclusions

Prune belly syndrome is a congenital multifactorial disease, the diagnosis at the prenatal stage seems to be a particularly urgent task. Indications and timing of kidney transplant are determined by the initial state

and the rate of decline in renal function. In our opinion, the main task is to distinguish PBS from other causes of megacystis at the prenatal stage, the normalization of the urodynamics of the lower urinary tract in the shortest possible time to slow down the loss of renal function and to prevent the decline in graft function. It is obvious that extraurogenital clinical manifestations of the syndrome aggravate the patient's condition and require a staged surgical correction of defects, but they do not generally affect the indications for renal replacement therapy.

Conflict of interest:

The authors report no conflict of interest.

Funding source:

No

Ethical approval: This study was prepared in accordance with the Declaration of Helsinki.

Acknowledgment:

No

Peer-review:

Externally. Evaluated by independent reviewers working in at least two different institutions appointed by the field editor.

Author Contribution:

Research concept and design: AT, GY
Data analysis and interpretation: AT, AO, GY, IHO
Collection and/or assembly of data: AT, AO, GY
Writing the article: AT, IHO, GY, AO, MG
Critical revision of the article: AO, MG, IHO
Final approval of the article: AT, MG

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