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Pancreas Transplantation With Portal-Enteric Drainage for Patients With Endocrine and Exocrine Insufficiency From Extensive Pancreatic Resection

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Abstract: Although the primary indication for pancreas transplantation is type I diabetes, a small number of patients requires pancreas transplantation to manage combined endocrine and exocrine insufficiency that develops after extensive native pancreatic resection. The objective of this case report was to describe the operative and clinical course in 3 such patients and present an alternative technical approach.

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Although the primary indication for pancreas transplantation is type I diabetes, a smaller number of patients undergo pancreas transplantation for pancreatogenic diabetes that develops after extensive native pancreatic resection. In the largest reported experience, Gruessner and colleagues[1-3] at the University of Minnesota demonstrated that pancreas transplantation is an effective treatment for patients who had lost native pancreas function after total pancreatectomy for chronic pancreatitis. In this series, the pancreas graft was implanted in a retroperitoneal position in the pelvis. Systemic venous drainage was used in all cases and bladder exocrine drainage in most cases.

In the present report, we describe an alternative technical approach for these complex patients and demonstrate the feasibility of implanting the pancreas graft with portal venous-enteric drainage. This approach has not been previously described in this population, most likely due to assumptions regarding the technical difficulty of achieving portal drainage in patients with previous pancreatectomy. We aim to highlight some technical considerations and provide an overview of the clinical course of 3 such patients.

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CASE DESCRIPTION

Patient 1

History

The patient is a 61-year-old man who had previously undergone pancreaticoduodenectomy for presumed pancreatic malignancy several years before. The final pathology from the Whipple specimen demonstrated a biliary stricture secondary to chronic pancreatitis with no evidence of malignancy. Within a year of the pancreaticoduodenectomy, he developed brittle insulin-dependent diabetes and pancreatic exocrine insufficiency requiring pancreatic enzyme replacement. Several years later, he also developed end-stage renal disease requiring hemodialysis. A kidney biopsy demonstrated chronic tubulointerstitial changes, but no specific etiology was identified. He was subsequently evaluated by our program for consideration of simultaneous pancreas-kidney transplant and found to be a suitable candidate.

Operative Course

He was explored through his previous midline laparotomy, and a lysis of adhesions was performed to clarify his gastrointestinal anatomy. The neoduodenum and gastrojejunostomy were identified. The extraperitoneal space was developed on the left side, and the kidney was implanted in the left iliac fossa in standard fashion. For the pancreas implant, the superior mesenteric vein (SMV) was exposed by lifting the transverse mesocolon, splaying out the root of the small bowel mesentery, and dissecting to the right of the superior mesenteric artery pulse. The anterior and lateral aspects of the SMV were exposed for several centimeters to facilitate placement of a partially occlusive Satinsky clamp. An arterial jump graft originating from the recipient right common iliac artery was prepared (donor iliac artery conduit) and tunneled through a window in the mesentery of the ileum. The venous anastomosis was performed between graft portal vein and recipient SMV in end-to-side fashion. The arterial anastomosis was performed between pancreatic Y-graft and the arterial jump graft arising from right common iliac artery (Figure 1). Enteric drainage was performed by side-to-side anastomosis between graft duodenum and recipient terminal ileum.

Postoperative Course

The patient's early course was notable for a return to the operating room for evacuation of hematoma and ligation of a bleeding vessel in tail of pancreas graft. After the reexploration, his postoperative course was unremarkable with immediate kidney and pancreas graft function. Induction immunosuppression consisted of thymoglobulin at 5 mg/kg. Maintenance immunosuppression consisted of tacrolimus, mycophenolate mofetil, and prednisone. At the time of discharge, the patient was insulin-independent and free of pancreatic exocrine enzyme replacement. At 1 year follow-up, blood glucose and serum creatinine were within normal range, and the patient remained free of exogenous pancreatic enzyme replacement.

Patient 2

History

The patient is an 18-year-old man who had previously undergone total pancreatectomy and splenectomy several years before due to severe pancreatic crush injury in a motor vehicle accident. He also suffered bilateral renal artery transection resulting in irreversible renal ischemia. Due to these traumatic injuries, he required hemodialysis and developed brittle diabetes with the need for pancreatic enzyme replacement. After completing evaluation by our program, he was listed for simultaneous pancreas-kidney transplant.

Operative Course

The patient underwent relaparotomy via midline incision. A significant lysis of adhesions was necessary to define his gastrointestinal anatomy, and ultimately the hepaticojejunostomy and gastrojejunostomy were identified. The extraperitoneal space was developed on the left side, and the kidney was implanted in the left iliac fossa in standard fashion. The pancreas implant technique was identical to that described in case 1. Enteric drainage was performed by side-to-side anastomosis between graft duodenum and recipient jejunum approximately 50 cm downstream from the gastrojejunostomy.

Postoperative Course

The patient's course was uncomplicated, with immediate kidney and pancreas graft function. Induction immunosuppression consisted of thymoglobulin at 5 mg/kg. Maintenance immunosuppression consisted of tacrolimus, mycophenolate mofetil, and prednisone. At the time of discharge, the patient was insulin-independent and no longer required pancreatic exocrine enzyme replacement.

Patient 3

History

The patient is a 54-year-old man who had previously undergone extensive pancreatic necrosectomy for pancreatic necrosis (near total gland involvement) from acute pancreatitis of unknown etiology (Figure 2). During the prolonged hospitalization that followed, he developed brittle diabetes with a daily insulin requirement of 90 units and pancreatic exocrine insufficiency requiring pancreatic enzyme replacement. After completing transplant evaluation at our center, he was listed for pancreas transplant alone.

Operative Course

A lysis of adhesions was performed to clarify his anatomy. The pancreas graft implantation was identical to cases 1 and 2 (Figure 3), with the exception being that the donor innominate artery was used as conduit for the arterial jump graft. Enteric drainage was performed by side-to-side anastomosis

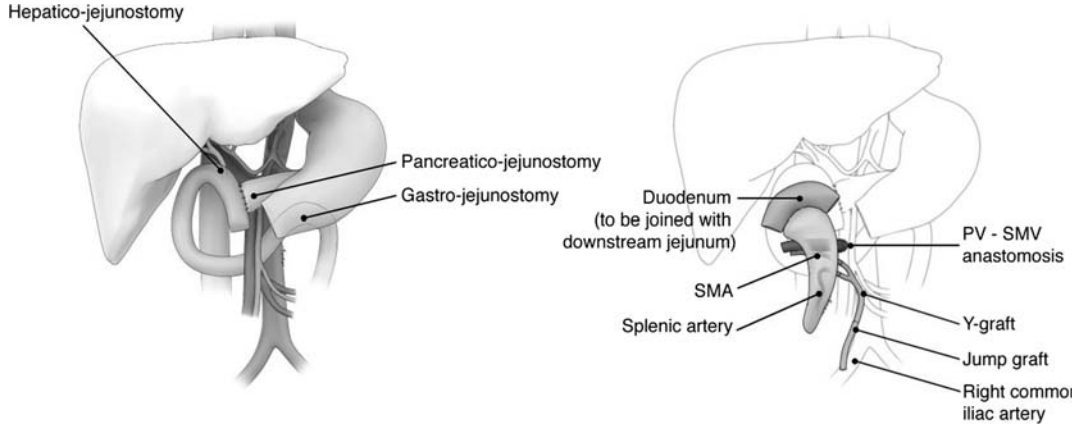

FIGURE 1. Pancreas implantation in a patient with previous pancreaticoduodenectomy for benign biliary stricture.

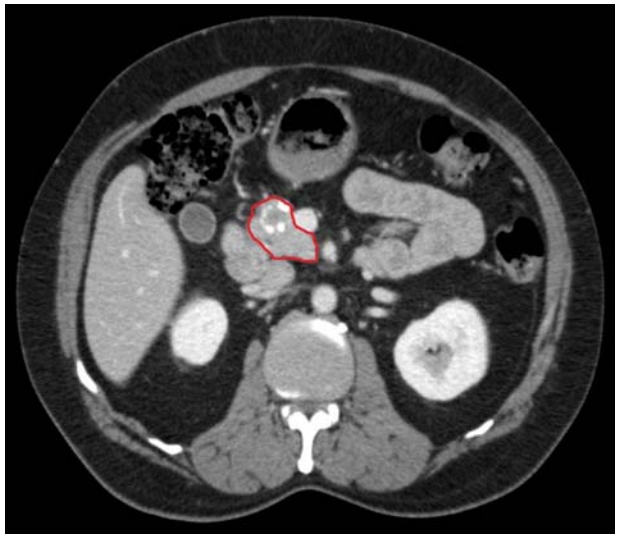

FIGURE 2. Remnant pancreatic tissue after pancreatic necrosectomy.

between graft duodenum and recipient jejunum (approximately 50 cm from ligament of Treitz).

Postoperative Course

His postoperative course was uncomplicated with immediate pancreas graft function. Induction immunosuppression consisted of thymoglobulin at 5 mg/kg. Maintenance immunosuppression consisted of tacrolimus, mycophenolate mofetil, and prednisone. At the time of discharge, the patient was insulin-independent and no longer required pancreatic exocrine enzyme replacement. At 2-month follow-up, blood glucose was in normal range, and he remained free of exogenous pancreatic enzyme replacement.

DISCUSSION

Pancreas transplantation is typically performed for type I diabetes. A less common indication is for the treatment of endocrine and exocrine insufficiency, resulting from extensive resection of the native pancreas. The largest experience in this context comes from the University of Minnesota in a cohort of 18 patients who underwent pancreas transplantation after previous total pancreatectomy for chronic pancreatitis.[1-3] Pancreas transplantation effectively resolved diabetes with favorable graft and patient survival rates. Resolution of exocrine insufficiency was also observed in the subset of patients who underwent enteric drainage, although most were bladder drained in this series. In all cases, the pancreas graft was implanted in the pelvis with systemic venous drainage.[1-3]

In the current report, we describe an alternative technical approach in which portal drainage was performed in patients with prior extensive native pancreatic resection. In all 3 cases, despite previous extensive upper abdominal surgery, the root of the small bowel mesentery was readily accessible, and SMV dissection was straightforward. To address exocrine insufficiency, we performed enteric drainage using a side-to-side anastomosis between graft duodenum and recipient small intestine. In all 3 cases, pancreas transplantation successfully restored both endocrine and exocrine function, allowing complete cessation of exogenous insulin and pancreatic enzyme replacement therapy (Table 1). We believe enteric drainage should be prioritized for this patient population and can be readily achieved with either portal or systemic venous drainage.

Although we have presented 3 unusual pancreas transplants with portal venous drainage, in general, we tend to favor systemic drainage considering the overall equivalence in endocrine and immunologic outcomes.[4-8] In most patients, systemic drainage is technically simpler and avoids the potential pitfall of recipient SMV and portal vein thrombosis associated with portal drainage. For exocrine drainage, we favor enteric (most frequently Roux-en-Y reconstruction) over bladder drainage to avoid the complications of metabolic acidosis, dehydration, urinary tract infection, and cystitis associated with bladder drainage.[4,5,9] In the absence of urinary amylase monitoring, we assess pancreas graft rejection by routine measurement of blood glucose and serum amylase levels. Percutaneous graft biopsy is performed as needed based on clinical parameters.

Although not performed as frequently in the current era, we believe that the portal drainage technique remains a useful tool in the armamentarium of the pancreas transplant surgeon and may be advantageous in certain clinical scenarios. One such setting is in the obese recipient, where accessing the distal inferior vena cava/iliac vein for performance of the venous anastomosis can be technically difficult due to the depth of these structures. Another scenario favoring portal drainage is in a patient with distal inferior vena cava or iliac vein thrombosis related to complications from previous kidney transplantation. In our estimation, unusual clinical challenges highlight the importance of maintaining a flexible mindset and tailoring the approach to the needs of the individual patient. Clinical training of transplant surgeons should incorporate both portal and systemic venous drainage techniques to build a versatile skill set.

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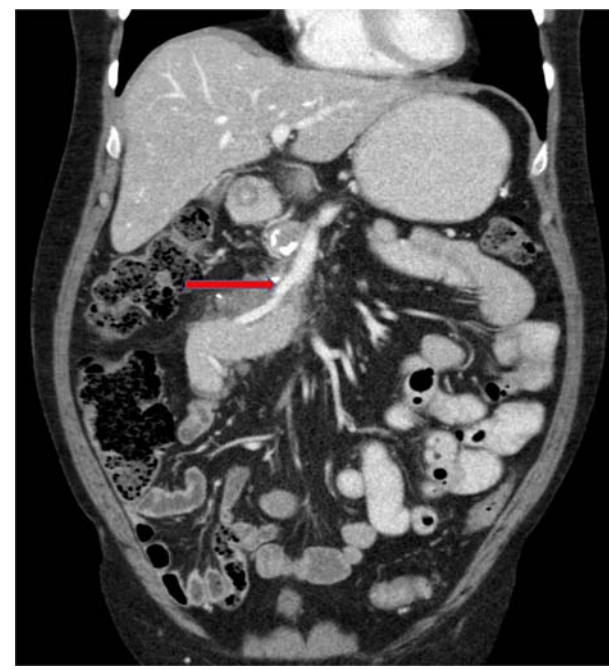

FIGURE 3. Pancreas graft with venous drainage into the SMV.

TABLE 1.

Insulin and pancreatic exocrine replacement, pretransplant and posttransplant

Patient	Insulin (pretransplant)	Exocrine replacement (pretransplant)	Insulin (posttransplant)	Exocrine replacement (posttransplant)
1	20 units/d	Creon, 2 capsules with meals	Nil	Nil
2	30-35 units/d	Creon, 2-3 capsules with meals	Nil	Nil
3	85 units/d	Creon, 3 capsules with meals	Nil	Nil

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