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The falciform ligament as a graft for portal–superior mesenteric vein reconstruction in pancreatectomy

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ABSTRACT

Background: Tumor invasion or adherence to the portal vein–superior mesenteric vein (PV/SMV) may be encountered during pancreatic surgery. In such cases, venous resection and reconstruction might be required for complete resection of the tumor. We report an innovative technique in which the graft for PV/SMV reconstruction was made with the falciform ligament.

Methods: Between May 2011 and July 2016, PV/SMV reconstruction with a falciform ligament graft was performed in 10 cases during pancreatectomy. Among these cases, including six cases with a patch graft and four cases with a conduit graft. Retrospective reviews of medical records and radiologic studies were performed.

Results: Ten patients with pancreatobiliary cancer underwent *en bloc* tumor resection with concurrent PV/SMV resection and reconstruction with a falciform ligament graft. There were six males and four females, and the mean age was 65.3 ± 9.4 (48-80) y. Using Doppler ultrasound examination, all 10 grafts were shown to be patent at postoperative 2 wk. However, occlusion was found in one case with conduit graft and stenosis in the other three cases with conduit graft using enhanced computed tomography at postoperative 2 mo. Complete patency was shown in three of six cases with patch graft and stenosis in the other three cases at 2 mo after the operation. Although occlusion or stenosis of the grafts was observed, no severe adverse events occurred, and normal liver function was discovered in all 10 cases at postoperative 2 mo.

Conclusions: Falciform ligament grafts might be considered for reconstruction of PV/SMV in the absence of appropriate vascular grafts.

Introduction

Tumor invasion or adherence to the portal vein–superior mesenteric vein (PV/SMV) may be encountered during pancreatic surgery. In such cases, venous resection and reconstruction might be required for complete resection of the tumor. Current evidence suggests that pancreaticoduodenectomy (PD) with PV/SMV resection could provide an acceptable survival benefit to patients with pancreatic malignancy with involvement of these vascular

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structures.[1-4] Such resections often require end-to-end reconstruction of the PV/SMV or reconstruction with an interposition graft to restore continuity. Various grafts such as the great saphenous vein,[5] femoral vein,[6] external iliac vein,[7] jugular vein,[8] left renal vein,[9] right ovarian vein graft,[10] umbilical vein patch,[11] parietal peritoneum,[12] allogeneic vein graft,[13] and polytetrafluoroethylene (PTFE)[14] have been described. The decision to choose an individual graft depends on availability of the graft, individual expertise, and patient factors. Herein, we report an innovative technique in which the interposition graft is created from the falciform ligament.

Patients and methods

Patients

Between May 2011 and July 2016, 10 patients with pancreatobiliary cancer underwent *en bloc* tumor resection with concurrent PV/SMV resection and reconstruction with a falciform ligament graft in our department. The algorithm for patients with pancreatectomy is shown in Figure 1. Retrospective review of medical records and radiologic studies was performed. Data including baseline demographics, clinical characteristics, operative details, and postoperative vascular patency were collected. The study was approved by the Institutional Ethical Review Board of China-Japan Friendship Hospital.

Surgical procedure

Preoperative computed tomography (CT) scans were reviewed to analyze the involved veins and the extent of involved segments. The PV/SMV was dissected, and the extent of venous invasion was determined during surgery. The "superior mesenteric artery first" technique[15] was used for all cases with PV/SMV invasion except one. All veins draining into the affected segment, such as the PV, SMV, splenic vein, inferior mesenteric vein and left gastric veins, were controlled with clamps, and an *en bloc* tumor resection with the involved vascular segment was performed. The grafts used were tailored according to the extent of venous resection. The reconstruction method consisted of a patch graft or interposition graft created from the falciform ligament. Patch grafts were used in cases where only partial circumference of the vein was resected, whereas interposition grafts were used to replace PV/SMV segments >3 cm. Venous resection and reconstructions were performed according to standard vascular techniques.[16] All patients provided an intraoperative frozen section and were confirmed as margin-free (R0).

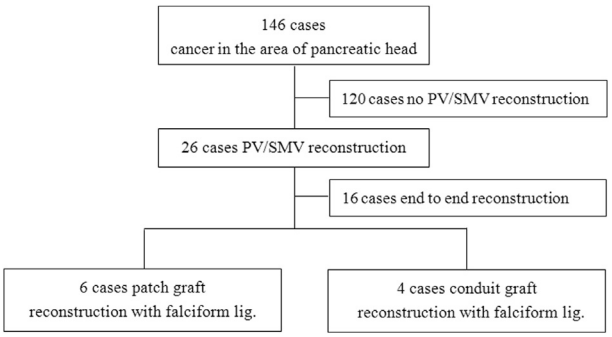

Fig. 1 – The algorithm for patients with pancreatectomy.

Falciform ligamental graft preparation

At the time of laparotomy, the extent of PV/SMV involvement was determined by intraoperative ultrasound and operative dissection. In cases where the involvement was less than half the circumference of the vein or <2 cm in length, a partial venous wall resection was carried out, and the defect was reconstructed using a 2 × 2 cm falciform ligament patch stored in saline. When the involved PV/SMV was more than half of the circumference of the vein or >3 cm in length, an interposition graft made from a 3 × 3 cm falciform ligament rolled into a cylindrical shape over a drainage tube using a continuous 5.0 prolene suture was used (Fig. 2). The graft was used as a conduit in four patients and as a patch in six patients (Fig. 3).

Postoperative treatment and follow-up

Patients did not receive conventional anticoagulant therapy after vein resection and reconstruction in our study. The PV blood flow was evaluated 2 wk after surgery using Doppler ultrasound. The condition of blood vessels was evaluated 2 mo after surgery by abdominal-enhanced CT. Graft patency was deemed adequate if normal hilar portal blood flow was demonstrated along with normal liver function regardless of any anatomical graft stenosis. If hilar portal blood flow was reduced in the presence of abnormal liver function tests, the graft was deemed a failure. The definition of postoperative complications was adopted from the International Study Group of Pancreatic Surgery[17] and Dindo *et al.*'s classification.[18] The date of last follow-up was December 2015.

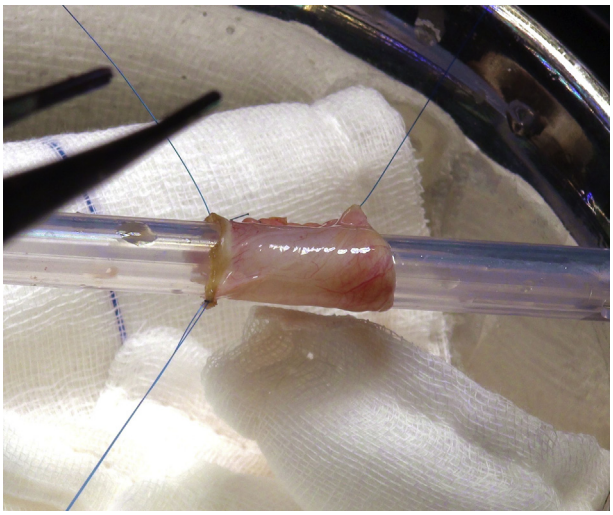

Fig. 2 – Interposition conduit graft made from the falciform ligament.