Portal Vein Pull-Through Technique and Thrombectomy for Extensive Portal Vein Thrombosis

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ABSTRACT

Background. Herein, a different technique is presented describing complete dissection of the entire portal vein (PV), superior mesenteric vein (SMV), and splenic vein, thus enabling a complete thrombectomy without the risk of uncontrolled hemorrhage due to blind thrombectomy.

Methods. In cases where a thrombectomy would not be an option because of extensive thrombosis involving the confluence of the PV and SMV, small branches of the SMV, including the inferior mesenteric vein, were divided. Both the SMV and splenic vein were encircled separately. Then, the side branches of the PV above the pancreas, left gastric vein on the left side, and superior pancreatoduodenal vein on the right side were divided. The lateral and posterior part of the PV were dissected within the pancreas both from above and below, allowing the main PV completely free from attachments. At this point, the splenic vein and SMV were clamped, and the main PV was divided above the pancreas and then pulled back through the pancreatic tunnel. The thrombus was easily dissected of the vein under direct visualization, and afterward the PV was redirected to its original position. Then, the liver transplant was carried out in a regular fashion.

Results. This technique was applied to 2 patients. The first was a 43-year-old man who underwent a right lobe living donor liver transplant because of hepatitis B virus−related cirrhosis. The patient is still alive and well with stable liver function after 15 years of follow-up. The second was a 69-year-old woman who underwent a right lobe living donor liver transplant because of hepatitis C virus and hepatocellular carcinoma. She survived the procedure and her liver function was entirely normal afterward. She died of pneumonia and sepsis 5 months after transplant.

Conclusions. This technique enables complete dissection of the entire PV, SMV, and splenic vein. Thus, complete thrombectomy under direct visualization without the risk of uncontrolled hemorrhage can be performed.

PORTAL vein thrombosis (PVT), once considered to be a contraindication for liver transplant, is no longer accepted as an exclusion criterion. The incidence is between 5% and 26%, and almost half of the cases are diagnosed intraoperatively during the liver transplant procedure [1,2]. Removal of the thrombus via endovenectomy (thrombectomy) is the most used method; there are various methods described to ensure adequate portal flow to the transplanted liver [3−5].

In cases when thrombectomy is not efficient or cannot be used, vascular interposition grafts may be used between the recipient's mesenteric vessels (mainly the superior mesenteric vein [SMV]) and the graft portal vein (PV) [6,7].

The enlarged coronary vein or other collateral vessels in the hepatoduodenal ligament can also be used as an inflow in certain cases with or without conduits [8−10]. When the portal

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flow cannot be established because of total splanchnic thrombosis, then cavoportal hemitransposition or renoportal anastomosis can be used to restore blood flow to the transplanted liver [11−14]. These 2 techniques may lack the advantage of relieving portal hypertension directly, and persistent portal hypertension may complicate the postoperative course.

The last option might be multivisceral transplant to overcome the problem of diffuse portomesenteric thrombosis [15,16].

Herein, we describe a different technique using complete dissection of the entire PV, SMV, and splenic vein, and then pulling the PV through the pancreatic tunnel in the caudal direction. This maneuver enables a complete thrombectomy without the risk of tearing apart the PV or its branches and uncontrolled hemorrhage due to blind thrombectomy.

MATERIALS AND METHODS

Surgical Technique

The hepatoduodenal ligament dissection is carried out in a regular fashion, and the PV, hepatic artery, and common bile duct are encircled. The soft tissue around the PV is cleared and the PV is dissected in cephalad and caudal directions to ensure enough control for thrombectomy. In cases where a thrombectomy would not be an option because of extensive thrombosis involving the confluence of the PV and SMV, the gastrocolic ligament is taken down and then the SMV is dissected underneath the pancreas. The distal part of the SMV is checked for thrombus. If the blood flow is considered to be sufficient, then this vessel is dissected and encircled for a jump graft placement as a conduit for the graft liver above the pancreas. After dissecting the SMV, the anteroposterior inferior pancreaticoduodenal vein (Henle trunk) and inferior mesenteric vein are tied off and divided and the SMV and splenic vein are encircled separately (Fig 1). The tunnel between the pancreas and PV is dissected and the superior part of the main PV is freed from the pancreas, allowing the tunnel to connect the superior and inferior edges of the pancreas. Then, the side branches of the PV above the pancreas, left gastric vein (coronary vein), right gastric vein (pyloric vein), and posterior superior pancreatoduodenal vein are tied off and divided. Then, the lateral and posterior part of the PV is dissected within the pancreas both from above and below. Finally, the main PV is completely freed from the attachments and branches. At this point, the splenic vein and SMV is clamped and the main PV is divided right at the bifurcation of the right and left PV branches and then pulled back through the pancreatic tunnel. The thrombus is easily dissected off the vein with sharp dissection under direct visualization; afterward, the PV is reintroduced to its original position (Figs 2-4). Then, the liver transplant is continued anastomosing the main PV of the recipient and PV of the graft (Fig 5).

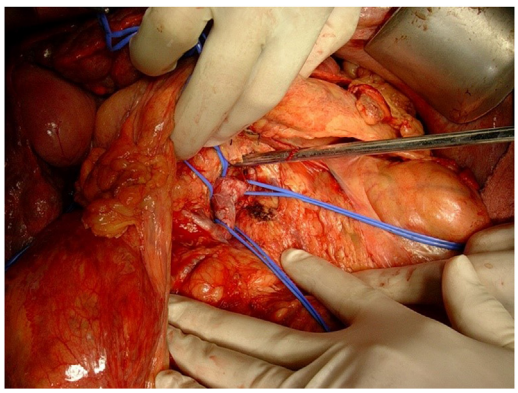

Fig 1. Dissection of the infrapancreatic portal venous structures prior to anhepatic phase. Main portal vein, superior mesenteric vein, and splenic vein are encircled by vessel loops. The inferior mesenteric vein is tied off and divided; Henle trunk has not been tied off and divided yet.

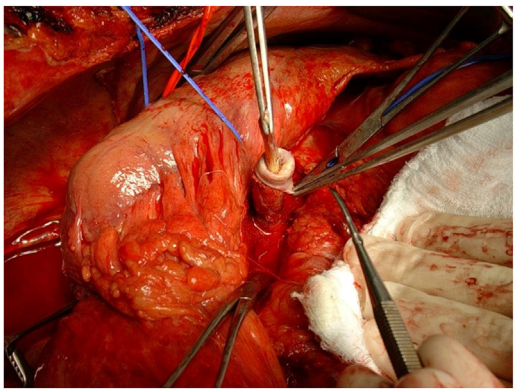

Fig 2. Thrombectomy under direct visualization in the anhepatic phase. The main portal vein is cut in the hepatic hilum and pulled back through the pancreatic tunnel, whereas the superior mesenteric vein and splenic vein are clamped.

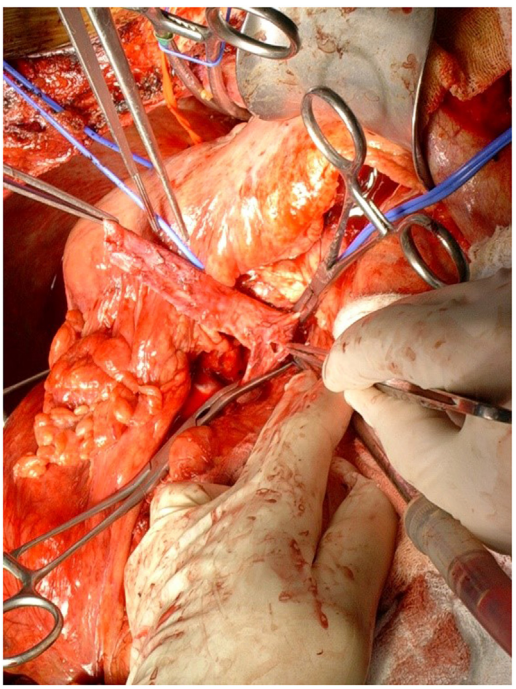

Fig 3. Main portal vein after the thrombectomy is completed. Note the small tear on the confluence of the superior mesenteric vein and splenic vein.

Fig 4. Nine-cm–long fibrotic chronic portal vein thrombus.

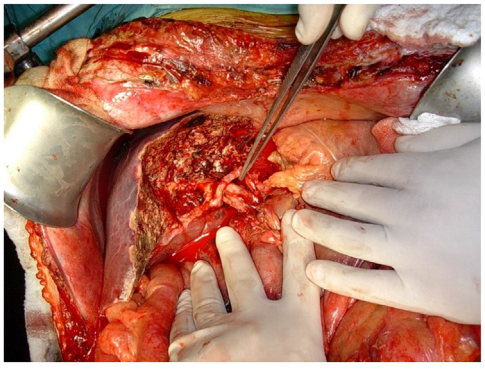

Fig 5. After the vascular anastomoses are completed and the graft is reperfused. The portal vein anastomosis is performed after the vein is brought back to its original position.

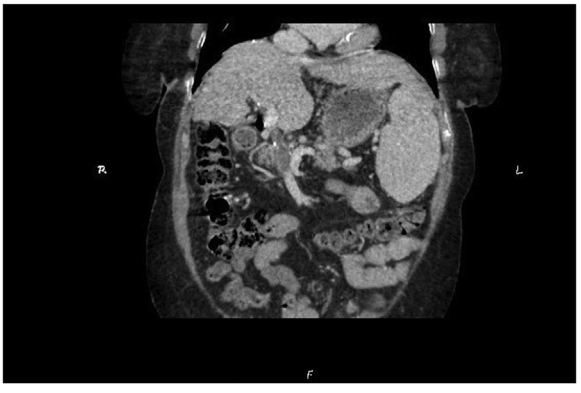

Fig 6. Computed tomography appearance of the thrombosed portal vein in the preoperative period.

RESULTS

This technique was applied in 2 patients both having grade III thrombus according to the Yerdel classification [6,9]. One of the patients is a 43-year-old man who underwent right lobe living donor liver transplant because of hepatitis B virus–related cirrhosis with a Model for End-Stage Liver Disease score of 20. The patient is still alive and well with stable liver function after 15 years of follow-up. The other patient was 69-year-old woman who underwent right lobe living donor liver transplant because of hepatitis C virus and hepatocellular carcinoma with a Model for End-Stage Liver Disease score of 16. This patient survived the transplant procedure and liver function was entirely normal afterward. She was discharged home on postoperative day 57, and the hospital stay was prolonged because of complications of chronic obstructive pulmonary disease. She died of pneumonia and sepsis 5 months after the transplant from chronic lung problems. Both patients were administered low-dose salicylate in the early postoperative period after the platelet count raised above 100.000/mm^3. Neither PV thrombosis nor vascular complications of any type developed in the follow-up period in both patients (Figs 6 and 7).

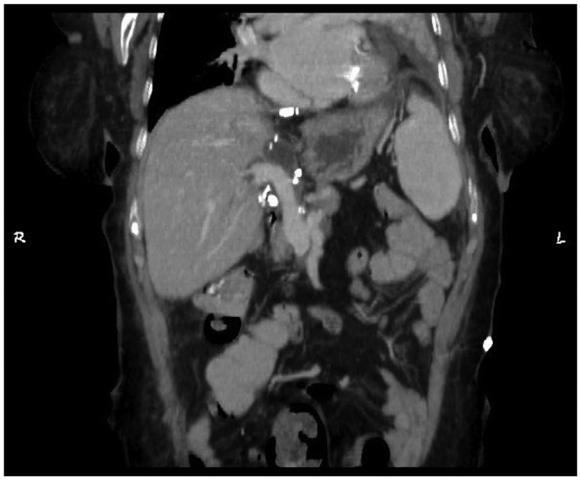

Fig 7. Computed tomography demonstrating patent portal vein 40 days after transplant.

DISCUSSION

Portal vein thrombosis is an independent risk factor for the survival and graft failure after LT because adequate portal flow to the allograft liver is an essential factor for the success of liver transplant [1,17]. Intraoperative management of PVT might be challenging, and surgeons should keep alternative approaches in their armamentarium.

Thrombectomy or endovenectomy is the first choice in all patients presenting with PVT, and a regular porta-portal anastomosis can easily be performed without significant impact on the outcome in most patients. However, for some complex PVT cases, redirecting the portal flow into the graft can be difficult. The literature suggests if simple thrombectomy is not efficient, SMV can be used through a jump graft for the inflow [8,9,10]. Another alternative to restore the portal flow can be using large collaterals such as the coronary vein, but the reports using collateral vessels are limited to case reports or small size case series with heterogeneous results and outcomes [8–10].

When no vessel is appropriate for portal influx in patients with diffuse portomesenteric thrombosis, the vessels not belonging to the portal venous system can be used. Renoportal

anastomosis seems to be effective in cases with a pre-existing either spontaneous or surgical splenorenal shunt. This technique has inferior results in patients without a splenorenal shunt. Cavoportal hemitransposition has higher morbidity and mortality than renoportal anastomosis [4,10]. Both techniques are considered nonphysiological, with the risk of persistent portal hypertension in the postoperative period.

Portal vein arterialization was used as a salvage method and is no longer considered as an alternative approach because of unacceptable mortality rates.

Multivisceral transplant replacing the entire splanchnic venous system is the last option for cases with diffuse portomesenteric thrombosis. This approach is very rarely used by a few experienced centers, and additional risks of the intestinal component outweigh the benefits.

Herein, a new technique is described which was performed in 2 patients. The described technique not only enables total vascular control before the thrombectomy attempt, but also prevents the possible necessity of pancreatic transection for vein repair, which is reported in the literature in case of uncontrolled hemorrhage during thrombectomy [1].

This technique allows practitioners to avoid the need for a vascular conduit, but also prevents potentially uncontrolled hemorrhage due to blind thrombectomy in long-segment diffuse PVT, as seen in Yerdel class III and IV cases. However, endovenectomy should be the treatment of choice in more conventional PVT cases, such as Yerdel class I and II. Although this technique seems to be superior to using a jump graft above the pancreas, hazardous dissection of the PV within the pancreatic groove due to excessive collaterals may limit its use. In such cases, using a jump graft would be considered as a safer alternative.

Often, extensive portal venous thrombosis is the only reason for a patient to be denied liver transplant; hence, complete dissection of the PV within the pancreas and applying the pull-through technique should be in the armamentarium of a liver transplant surgeon.

DATA AVAILABILITY

Data will be made available on request.

DISCLOSURE

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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