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Percutaneous Direct Puncture of Retropancreatic Splenic Vein and Portal Thrombectomy in a Patient With Liver Transplantation and Simultaneous Splenectomy

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Abstract. Portal vein thrombosis following liver transplantation is generally managed by endovascular treatment. Although several techniques are available for portal venous access, trans-splenic access is of interest because it avoids damage to the liver graft. However, the spleen cannot be punctured to access the portal vein after splenectomy. We herein report a case of portal vein thrombosis following living donor liver transplantation with simultaneous splenectomy successfully treated by percutaneous intervention with direct puncture of the retropancreatic splenic vein. The splenic vein was punctured under computed tomography guidance in the prone position. Portal venography revealed a contrast defect due to a thrombus in the extrahepatic to intrahepatic portal vein. The portal vein was reopened after thrombectomy, and the portal vein thrombosis did not recur for 2 y. The technique and advantages of our approach are described.

Portal vein thrombosis (PVT) following living donor liver transplantation (LDLT) reportedly occurs at an incidence of 3.5% and is more common in the early post-transplant period.[1] Conventional methods of portal venous access, including percutaneous transhepatic approaches and transmesenteric antegrade access, are widely selected for radiological interventions. However, they have several limitations, such as graft injury and the requirement for laparotomy.[2-5] Percutaneous trans-splenic venous access is an alternative approach to accessing the portal vein that can be applied in patients with massive ascites without injuring the graft. However, in Asian countries where LDLT has been developed, left lobe graft is often the first choice for donor safety, and splenectomy is performed if necessary. In such cases, splenic puncture is not possible, and the postoperative portal vein approach is limited. We herein report a case of percutaneous direct puncture of a retropancreatic splenic vein and portal thrombectomy after LDLT with simultaneous splenectomy.

CASE DESCRIPTION

A 54-y-old man with decompensated liver cirrhosis due to hepatitis virus C infection was referred to our hospital for evaluation of indication for LT. His body mass index was 29.4, model for end-stage liver disease score was 17, and Child-Pugh score was 12. The computed tomography (CT) scan showed a small amount of ascites, recanalization of the umbilical vein, spleno-renal shunt, and esophageal varices as signs of portal hypertension. The intrahepatic portal vein was narrowed, but no portal vein thrombus was observed. The patient's wife was the living donor (54-y-old, no previous medical history, no abnormal findings, body mass index 29.0) and donated a right lobe graft with an estimated graft volume to recipient's standard liver volume (GV/SLV) of 55.7%. In vascular reconstruction, the donor right hepatic vein and the recipient right

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hepatic vein were anastomosed first. V5 and V8 were made into a common trunk using a vascular graft taken from the recipient portal umbilicus and then anastomosed with the recipient middle hepatic vein. The donor right portal vein was anastomosed to the recipient main portal vein by an end-to-end fashion. Because there was adequate cuff of portal vein before the bifurcation of anterior and posterior portal veins, venoplasty was not required. The donor right hepatic artery was anastomosed to the recipient right hepatic artery under the microscope. Duct-to-duct anastomosis was performed for biliary reconstruction. A biliary splint (2 mm, chloride vinyl tube) was placed beyond the anastomosis, and the splint was externalized through the upper edge of the duodenum with a Witzel-type fistula. Because the preoperative platelet count was low (28 000/μL), simultaneous splenectomy was also performed as per institutional protocol. The operation time was 905 min; the blood loss was 5692 g. Actual graft weight was 763 g, and the graft-to-recipient weight ratio was 0.93. The early postoperative course was uneventful. We performed ultrasonography twice a day during the first 2 wks after LT. The study showed a patent portal vein, and the velocity was about 30 to 35 cm/s. However, on postoperative day 35, CT for routine follow-up at 1 mo postoperatively showed an extensive thrombus of the intrahepatic and extrahepatic portal vein (Figure 1A and B). The hepatobiliary enzymes were normal; however, the tacrolimus trough value was elevated, which was thought to reflect impaired liver function due to PVT. The thrombus extended from the extrahepatic portal vein to both the anterior and posterior section branches. The transhepatic retrograde approach was deemed inappropriate because it required multiple punctures. In such cases, we prefer to use the percutaneous trans-splenic approach, which facilitates an antegrade approach and allows for continuous anticoagulation with sheath placement; in this case, however, the patient was status after splenectomy. Fortunately, the splenic vein was open with a sufficient diameter, so we performed a percutaneous intervention by directly puncturing the retropancreatic splenic vein.

The patient was placed in the prone position. After administration of local anesthesia, the retropancreatic splenic vein was punctured directly with a 21-gauge needle (Elaster; Hakko, Chikuma, Japan) under CT guidance via a transretroperitoneal approach, and a 4-Fr vascular sheath (Slit Super-Sheath; Medikit, Tokyo, Japan) was placed in the splenic vein (Figure 2A). After advancing a 0.035-inch hydrophilic wire (Radifocus Guidewire M; Terumo, Tokyo, Japan), the sheath was changed to an 8-Fr vascular sheath (Slit Super-Sheath; Medikit). Portal venography revealed a contrast defect due to a thrombus in the extrahepatic to intrahepatic portal vein. The collateral vessels via the left gastric vein were clearly delineated (Figure 2B). A 6-Fr long guiding sheath (Destination; Terumo) was inserted to the portal vein, and the thrombus was aspirated manually. After the thrombectomy, the portal vein was reopened, and the collateral vessels were obscured (Figure 2C). The vascular sheath was left in the splenic vein, and 60 000 units of urokinase were infused from this site for 7 d to dissolve the residual clot. A second intervention was performed 10 d after the initial treatment. Portal vein angiography showed poor delineation of the anterior segment branches, and thrombus aspiration was added. The puncture tracts were embolized with N-butyl-2-cyanoacrylate (NBCA). At the time of sheath removal, a 10-mm Amplatzer Vascular Plug II (St. Jude Medical, Saint Paul, MN) was deployed at the puncture site of the splenic vein to prevent NBCA from flowing into the portal side. After the treatment, warfarin was administered. An X-ray image the day after the initial treatment revealed left pneumothorax, which was thought to be an asymptomatic complication of the puncture. The pneumothorax was drained through a catheter for 7 d. No intervention-related bleeding complications occurred. CT examination 7 d after the second intervention confirmed maintenance of the PVT disappearance. At discharge, anticoagulant was changed from warfarin to edoxaban. At the time of this writing (2 y since LDLT), the PVT has not recurred under the anticoagulant therapy, and the patient maintains good liver function (Figure 3).

DISCUSSION

We have herein reported the first successful case of direct percutaneous puncture of the retropancreatic splenic vein to access the portal vein and treat a post-LDLT PVT. PVT after liver transplantation occurs in approximately 1% to 3% of patients, and the frequency is reportedly higher in LDLT recipients.[6] The most common cause is anastomotic flexion or stenosis. Previous reports also indicated that a smaller liver graft size, preexisting PVT, and use of either jump or interposition venous grafts for portal vein reconstruction are associated with a higher risk.[1] Percutaneous thrombolysis associated with stent placement is often the treatment of choice. Although the transhepatic approach is a widely used technique, it requires puncturing the liver graft, increasing the risk of intrahepatic pseudoaneurysm and subcapsular hematoma. If the portal vein is collapsed because of portal vein stenosis or thrombus or if a large amount of ascites is present, puncture itself becomes difficult.[3,7] The

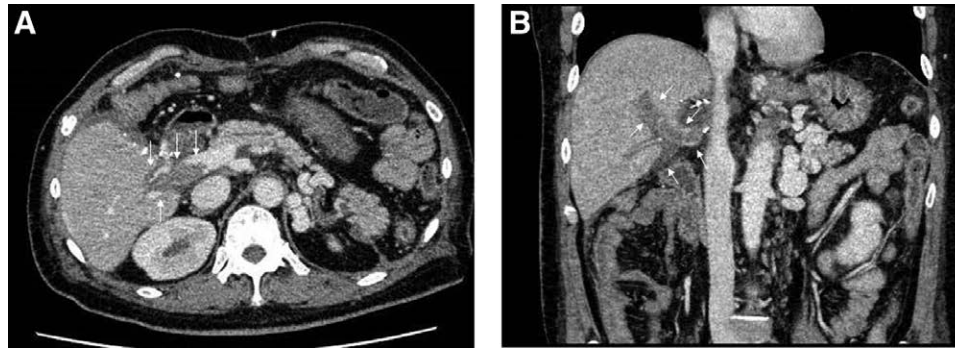

FIGURE 1. Computed tomography image showed portal vein thrombosis. A and B, Diffuse portal vein thrombus was present from the extrahepatic to the intrahepatic portal vein (arrow).

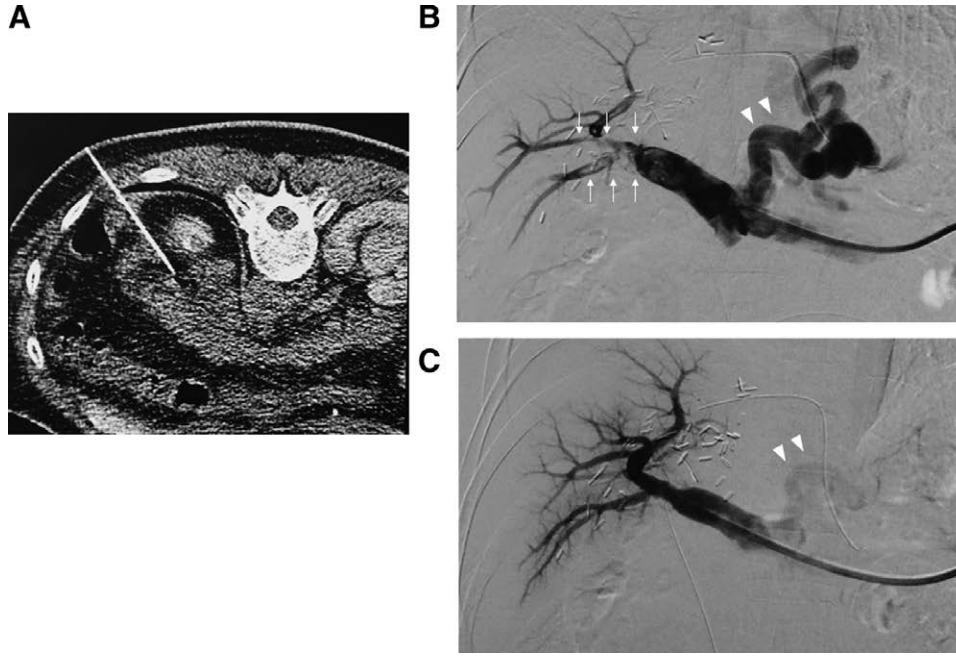

FIGURE 2. Portal vein thrombectomy by percutaneous intervention with direct puncture of the retropancreatic splenic vein. A, Trans-splenic venous access by direct puncture of the splenic vein under computed tomography guidance was applied in the prone position. B, Splenic venogram via trans-splenic venous access showed portal vein thrombosis (arrow) and strong visualization of the collateral vein via the left gastric vein (arrowhead). C, After the thrombectomy, the portal vein was reopened, and the collateral vessels were obscured (arrowhead).

FIGURE 3. Computed tomography image at 2 y after LDLT showed good patency of the portal vein. LDLT, living donor liver transplantation.

transmesenteric antegrade access is another option, but it requires laparotomy, cannulation to small vessels, and difficulty in continuous drug administration. In contrast, trans-splenic access is an alternative for percutaneous portal vein access without injuring the liver graft. This method, first reported in 1951,[8,9] was initially considered to be associated with a high risk of hemorrhagic complications because of the abundant blood flow to the spleen. However, recent studies have demonstrated an equivalent rate of bleeding complications compared with the transhepatic approach.[3,10,11] Other complications associated with puncture of the splenic vein include pneumothorax, which we also experienced, and pancreatitis associated with manipulation, which should be carefully monitored. Abdominal pain and fever have been reported as other minor complications, but both can be managed conservatively.[12]

We started performing trans-splenic portal venous access in 2019 and have applied it for posttransplant portal venous complications. This approach provides us the following advantages: better visualization of the portal vein and collateral vessels, direct approach to the PVT, and better removal and aspiration of the PVT from an antegrade approach, as described in previous reports.[12,13] Although the transmesenteric approach with mini-laparotomy also provides antegrade access, thrombolytic therapy cannot be continued with the sheath in place, as in the present case.

In LDLT, simultaneous splenectomy is often performed to regulate portal flow, increase the postoperative platelet count, and regulate the immune status in ABO-incompatible cases.[14,15] In our institution, we have determined 2 indications for splenectomy. One is for patients with platelet counts <50 000/μL due to hypersplenism. The other is portal modulation in the case of small for size graft. When the donor age is >50 y and GV/SLV is <40%, portal vein pressure is measured intraoperatively and splenectomy is performed if it exceeds 20 cm H_2O. Even for posttransplant PVT in patients who have undergone splenectomy, direct puncture of the retropancreatic splenic vein as described in the present report allows an approach similar to the trans-splenic approach without damaging the graft or requiring laparotomy. It is important whether there is a route for percutaneous access to the retropancreatic splenic vein under echo or CT guidance and whether the splenic vein is still patent.

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