

# Portal Vein Recanalization and Transjugular Intrahepatic Portosystemic Shunt Creation for Chronic Portal Vein Thrombosis: Technical Considerations

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Portal vein thrombosis (PVT) is common in cirrhotic patients and presents a challenge at the time of transplant. Owing to the increased posttransplant morbidity and mortality associated with complete PVT, the presence of PVT is a relative contraindication to liver transplantation at many centers. Our group began performing portal vein (PV) recanalization and transjugular intrahepatic portosystemic shunt placement (PVR-TIPS) several years ago to optimize the transplant candidacy of patients with PVT. The procedure has evolved to include transsplenic access to assist with recanalization, which is now our preferred method due to its technical success without significant added morbidity. Here, we describe in detail our approach to PVR-TIPS with a focus on the transsplenic method. The procedure was attempted in 61 patients and was technically successful in 60 patients (98%). After transitioning to transsplenic access to assist with recanalization, the technical success rate has improved to 100%. The recanalized portal vein and TIPS have maintained patency during follow-up, or to the time of transplant, in 55 patients (92%) with a mean follow-up of 16.7 months. In total, 23 patients (38%) have undergone transplant, all of whom received a physiologic anastomosis (end-to-end anastomosis in 22 of 23 patients, 96%). PVR-TIPS placement should be considered as an option for patients with chronic PVT in need of transplantation. Transsplenic access makes the procedure technically straightforward and should be considered as the primary method for recanalization.

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## Introduction

Portal vein thrombosis (PVT) is common in cirrhotic patients, contributes to liver decompensation, and can worsen the sequelae of portal hypertension. In patients

who underwent transplant, complete PVT is associated with increased intraoperative and postoperative morbidity and mortality.<sup>1-4</sup> Analysis of the UNOS registry and the Scientific Registry of Transplant Recipient database has shown complete PVT to be an independent risk factor for increased 1 year mortality following liver transplantation.<sup>5,6</sup>

Surgical techniques for the management of PVT at the time of transplant can be divided into those that restore physiologic portal inflow and those that provide non-physiologic flow. Physiologic techniques include eversion thrombectomy (leading to an end-to-end anastomosis), interposition grafts, and mesoportal jump grafts. When these techniques are not possible, surgical options include caval hemitransposition, renoportal anastomosis, and

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portal vein (PV) arterialization. However, these nonphysiologic techniques are associated with significantly increased morbidity and mortality.<sup>7-10</sup> Because of this increase in morbidity and mortality, complete PVT remains a relative contraindication to transplant at many centers.

Several years ago, our group began performing PV recanalization (PVR) and transjugular intrahepatic portosystemic shunt (TIPS) placement in patients with chronic PVT as a way to improve their transplant candidacy.<sup>11</sup> We have performed the procedure in 60 patients; our methods for PVR-TIPS have evolved to include transsplenic access that is now our preferred method for PV recanalization.<sup>12</sup>

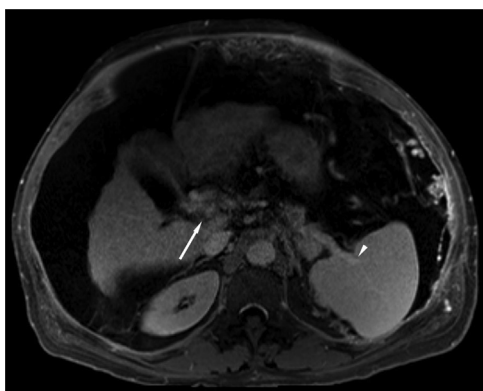
Herein, we describe the preoperative workup, technical details of the procedure, and the expected outcomes performing PV recanalization and TIPS placement in patients with chronic obliterative PVT.

## Technical Considerations

### Patient Selection and Preoperative Planning

Complete PVT is a relative contraindication to liver transplantation at our center. Patients with PVT who are in need of a liver transplant are reviewed at a weekly multidisciplinary conference attended by interventional radiology, hepatology, and transplant surgery. All patients have a preprocedure multiphase contrast-enhanced computed tomography or magnetic resonance imaging to assess the degree of PVT, presence of cavernoma, the patency of the mesenteric veins, and importantly, the patency and anatomy of the splenic vein if considering transsplenic recanalization (Fig. 1).

Laboratory values are reviewed, including basic chemistries, complete blood count, liver function tests, and coagulation studies. A model for end-stage liver disease (MELD) score is calculated to assess the preprocedure risk of undergoing a TIPS procedure.<sup>13</sup> As most patients are undergoing PVR-TIPS to enhance transplant candidacy,



**Figure 1** A 65-year-old man with hepatitis C cirrhosis. Axial contrast-enhanced MRI performed for transplant planning shows absence of a patent portal vein and extensive cavernoma (arrow). An intraparenchymal splenic vein branch is also identified (arrowheads) that directly leads to the main splenic vein, making it a good choice for transsplenic access. MRI, magnetic resonance imaging.

when the model for end-stage liver disease score is high (> 18), we ensure that the transplant workup is complete, and they are ready to be listed in the event of postprocedure hepatic decompensation. An echocardiogram is performed and cardiac clearance is obtained if the echocardiogram is abnormal or if there is a significant history of heart disease. The patient is seen in IR clinic to discuss the procedure and the added risks involved with the techniques required for PV recanalization.

### PVR-TIPS Procedure

At our center, all TIPS procedures are performed under general anesthesia. In addition to the right neck, the entire upper abdomen is sterilely prepped in anticipation of requiring either transsplenic or transhepatic access to assist with recanalization. If the patient has ascites or a pleural effusion, paracentesis or thoracentesis is usually not performed unless the anesthesiology team has difficulty ventilating the patient.

The right internal jugular vein is accessed in the standard fashion using ultrasound guidance. A 10 French TIPS sheath is placed into the right atrium, and a pressure measurement is obtained. The right or middle hepatic vein is accessed using either an angled-tip or reverse-curve catheter, and the sheath is advanced into the hepatic vein. Wedged venography is performed in the AP projection using 20 mL of nonionic contrast diluted with saline to 60 mL to confirm the presence of PVT and to assess the patency of intrahepatic portal branches (Fig. 2).

In our experience, using transsplenic access for PV recanalization is technically easier than a transhepatic approach, and therefore it is now our preferred method. Careful review of the preoperative imaging is essential to find the intraparenchymal splenic vein branch that has the most direct route into the main splenic vein (Fig. 3A). Using ultrasound guidance, a long 21-G needle is advanced into the intraparenchymal splenic vein branch, and venography is performed through the needle to assure



**Figure 2** Wedged portal venogram performed from the right hepatic vein in the RAO 30 projection confirms the absence of the main portal vein and extensive cavernous transformation (arrow). Note the patency of intrahepatic portal branches (arrowheads).

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