Radiology Case Reports 15 (2020) 615–623

Available online at www.sciencedirect.com

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journal homepage: www.elsevier.com/locate/radcr

Case Report

Endovascular transsplenic recanalization with angioplasty and stenting of an occluded main portal vein in an adult liver transplant recipient

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ARTICLE INFO

Article history:
Received 30 January 2020
Revised 21 February 2020
Accepted 22 February 2020

Keywords:
Liver transplant recipient
Main portal vein occlusion
Recanalization
Splenorenal venous shunt
Thrombosis
Transsplenic

ABSTRACT

Endovascular transshepatic access has limitations that can be exacerbated in the post-transplantation setting. Although several techniques are available for portal venous system catheterization, the transsplenic approach offers a direct pathway for accessing the portal venous system, as well as associated varices or shunts, while avoiding potential injury to the liver transplant. The purpose of this report is to present the diagnostic and interventional management of main portal vein occlusion in a 56-year-old female after liver transplantation. Endovascular transsplenic recanalization with stenting and shunt embolization is a viable method for treatment of main portal vein thrombosis in an adult liver transplant recipient.

Introduction

Portal vein thrombosis (PVT) is a known complication of cirrhosis, and PVT and portosystemic shunts have been associated with increased liver transplant operative time, morbidity, and mortality [1–5]. Reduced portal venous flow and increased intrahepatic vascular resistance are considered important risk factors of PVT for both the native cirrhotic liver and the posttransplant liver [6–8]. Transhepatic access has several limitations, often exacerbated in the posttransplantation setting, which include altered anatomy, postoperative fibrosis, hematoma, and ascites, difficult vascular access routes secondary to stenotic, occluded, or collapsed portal vein branches, and liver graft injury in the form of intrahepatic pseudoaneurysm and subcapsular hematoma [9].

Acknowledgments: None.
Conflicts of interest: The authors declare that they have no conflict of interest.
Consent: Informed consent was obtained from the patient for presentation of this report.
Ethics approval: Institutional Review Board approval was not required for preparation.
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https://doi.org/10.1016/j.radcr.2020.02.026

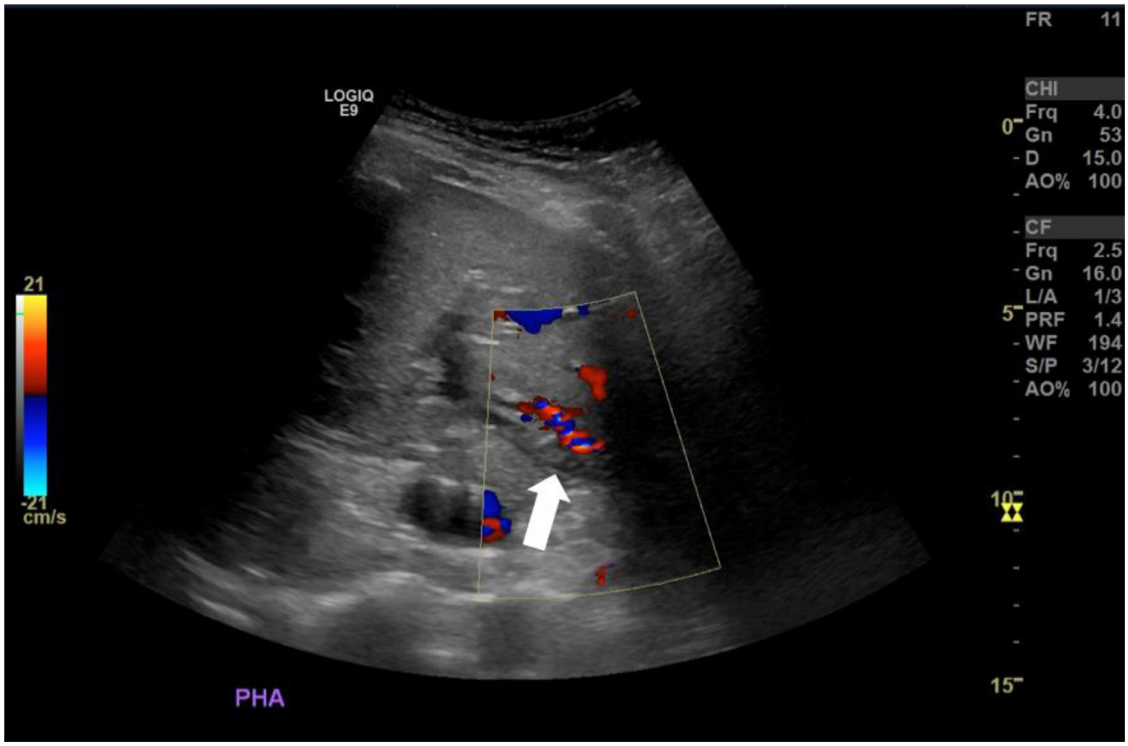

Fig. 1 – Liver ultrasound on postoperative day 20 demonstrates complete main portal vein occlusion (arrow).

Although several techniques are available for portal venous system catheterization, the transsplenic approach offers a direct pathway for accessing the portal venous system, as well as associated varices or shunts, while avoiding potential injury to the liver transplant that can occur with transhepatic or transjugular approaches. While transsplenic interventional access is an established procedure, the approach itself offers utilization beyond stenting [9–12]. Transsplenic recanalization of an occluded portal vein via angioplasty and stenting with shunt embolization may be a safe and effective treatment alternative in adult liver transplant recipients.

Case report

A 56-year-old female with a medical history of Sjogren's syndrome, cirrhosis, and hepatocellular carcinoma (downstaged with liver-directed therapy) underwent an orthotopic liver transplantation with native hepatectomy, duct-to-duct biliary reconstruction, and allograft cholecystectomy. Serial ultrasounds in the immediate postoperative period showed a patent portal venous system with normal velocities. On postoperative day 20, the patient demonstrated global hepatic decompensation and an abrupt increase in liver function tests, increasing aspartate aminotransferase/alanine aminotransferase from 174/162 units/L to 2971/2212 units/L. Follow-up liver ultrasound demonstrated abnormal heterogeneous echotexture within the main portal vein consistent with main portal vein thrombosis (Fig. 1).

After multidisciplinary review and discussion, the decision was made to proceed with transsplenic recanalization and splenorenal shunt embolization. The patient was placed under general anesthesia and access to the splenic vein was performed during 30 seconds of prolong breath-hold using a 21G micropuncture needle under ultrasound guidance. A 6-French sheath was positioned in the splenic vein. Venography demonstrated complete occlusion of the transplant portal vein and associated large diameter portosystemic shunt (Fig. 2). The thrombus was focal without evidence of other intrahepatic filling defects. The occluded portal vein was traversed with a 5-French angled catheter and glidewire. Percutaneous transluminal angioplasty of the main portal vein with a 6 × 40 mm balloon was performed with improved flow and no evidence of residual stenosis/irregularity of the vein. Subsequent placement of a Luminexx 10 × 40 mm self-expanding stent with postdilation with an 8 mm balloon was performed. Post-stent placement venography demonstrated improved blood flow through the main portal vein without residual stenosis, as well as widely patent flow through the left and right portal and intrahepatic veins without evidence of portal venous thrombus (Fig. 3).

Persistent competitive flow was noted in the large splenorenal venous shunt (Fig. 4). The shunt was catheterized and a 6-French sheath was advanced into the shunt. The splenorenal venous shunt was embolized with multiple 0.035 10-mm Nester coils (Figure 5). Postembolization venography demonstrated decreased flow within the shunt (Figure 6). Under ultrasound and fluoroscopic guidance, the transplenic tract was embolized with a single 0.35 4-mm Nester coil. Procedure time was approximately 120 minutes from positioning

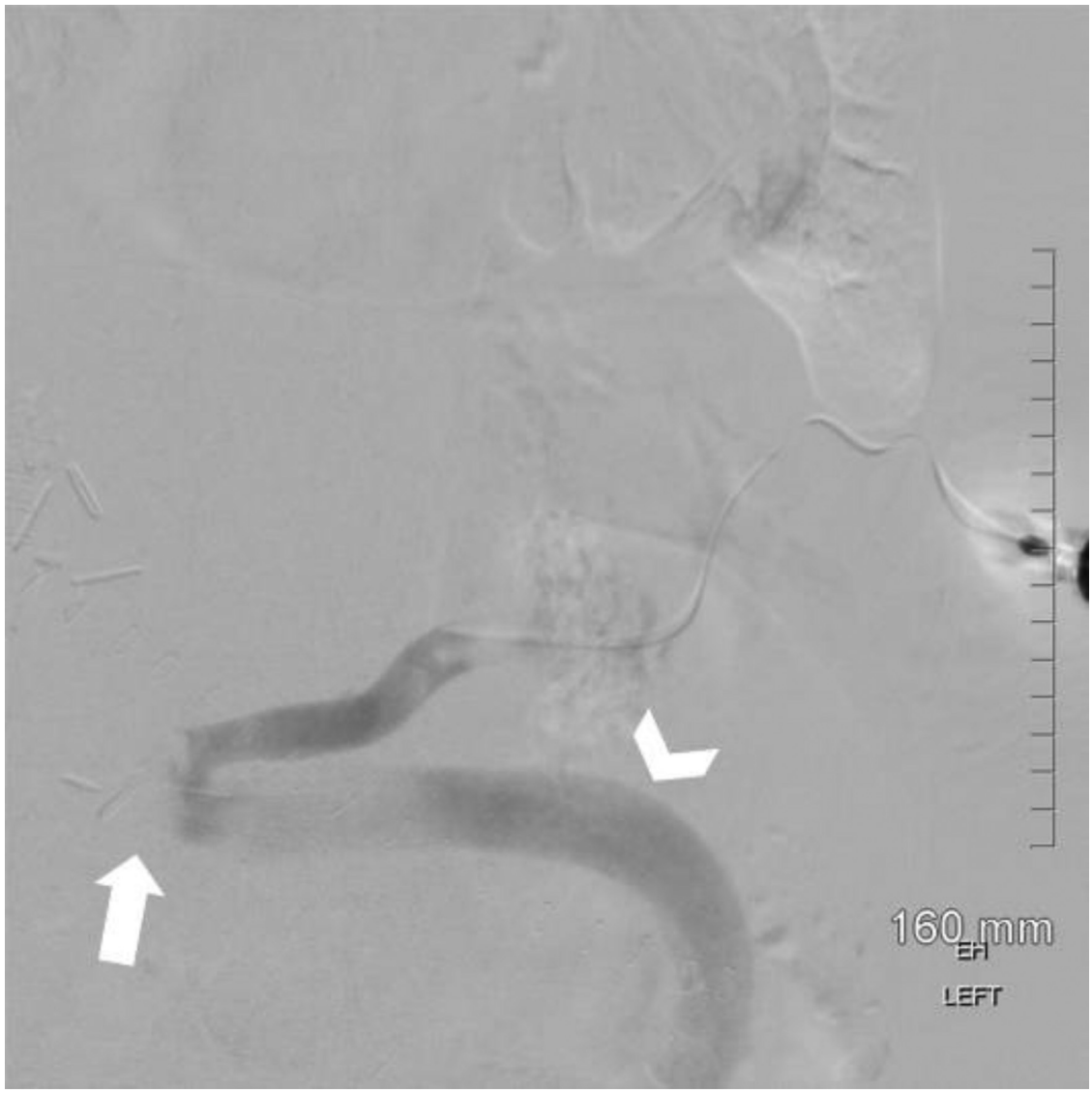

Fig. 2 – Splenic venography demonstrates complete occlusion of the transplant main portal vein (arrow) with associated large diameter portosystemic shunt (arrowhead).

to extubation and included 26.4 minutes of fluoroscopy. There were no postprocedural complications.

Postintervention day 1 and day 14 liver ultrasounds demonstrated a widely patent portal venous system with portal stent placement and appropriate blood flow velocities (Fig. 7). The patient's liver function tests returned to baseline approximately 4 days postmain portal vein recanalization, stent placement, and portosystemic shunt embolization. 3- and 6-month interval follow-up demonstrated patent hepatic vasculature with expected postoperative finding. Routine liver function tests dating up to 6 months remained within normal limits.

Discussion

Transsplenic access for portal vein intervention is controversial. Studies have deemed the route a safe approach with very low complication rates, primarily from perisplenic hematoma [13–15], while others have reported various transfusion rates following embolization [11,14,16]. This report highlights the value of the transsplenic approach for posttransplant portal intervention. The procedure was technically challenging and required careful precision and coordination. Techniques learned and applied from other aspects of interventional radiology contributed to the overall success of the approach.

In adult cirrhotic patients, the spleen is often enlarged, which can facilitate safe ultrasound-guided micropuncture access. Percutaneous transsplenic access in patients with splenomegaly has been demonstrated to be feasible and relatively safe in postliver transplantation recipients [9]. Our patient's spleen was normal in size, which is often the case in patients with cirrhosis and large splenorenal shunts. Careful ultrasound-guided technique with a micropuncture needle and prolonged breath-hold from our anesthesia team facilitated safe access.

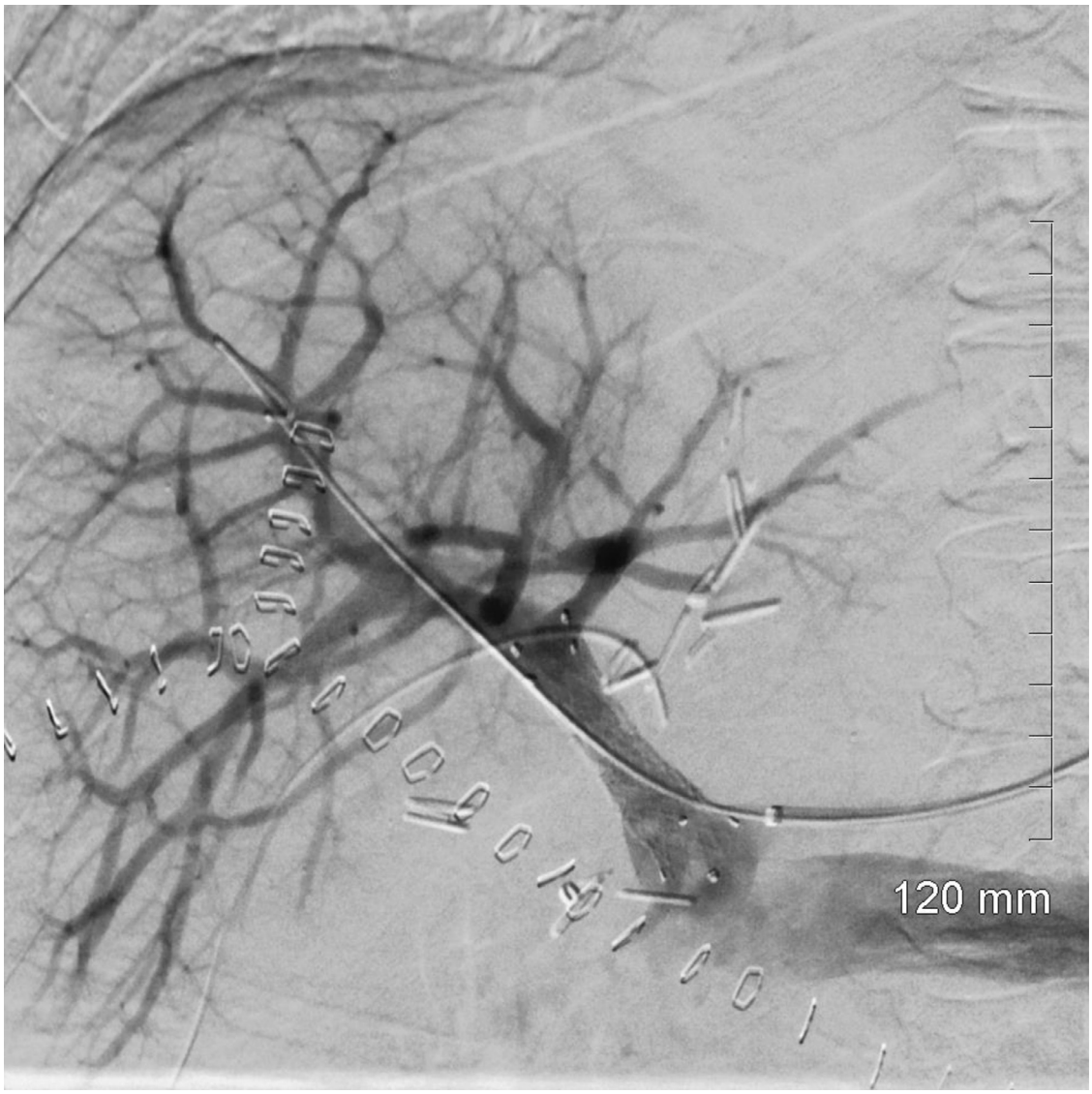

Fig. 3 – Poststent placement venography demonstrates improved blood flow through the main portal, left and right portal, and intrahepatic veins, without evidence of portal venous thrombus or residual stenosis. There remains persistent opacification of the large portosystemic shunt.

Ohm et al assessed the safety and efficacy of transhepatic and transsplenic access in postliver transplantation patients that demonstrated decreased portal venous inflow. Stenosis was generally defined as >50% portal vein diameter narrowing relative to the adjacent normal extrahepatic portal vein as diagnosed on noncontrast computed tomography. Of the 18 patients in the study, 8 underwent a percutaneous transhepatic approach while 10 underwent a transsplenic approach. Both approaches resulted in comparable successful outcomes and were deemed to be effective in the treatment of stenosis [9].

While less common than adults, portal vein thrombosis occurs in approximately 3.7% of pediatric liver transplant recipients [17]. Chick et al demonstrated endovascular transsplenic recanalization and stenting of the main portal vein with jejunal variceal embolization in a single pediatric liver transplant recipient [10]. Chu et al described attempted percutaneous transsplenic portal vein recanalization in 3 patients with a transplanted liver. Failure to traverse the occluded main portal vein was observed in 2 patients that had chronic occlusion, defined as greater than 1 year. The last (pediatric) patient had acute main portal vein occlusion 2 days postoperatively. Successful percutaneous transsplenic portal vein recanalization was achieved via guide-wire and catheter passage through the thrombosis, repeated aspiration, and thrombolysis by urokinase and balloon angioplasty [12].

Additionally, this report raises the question as to the appropriate setting and timing of embolization of large portosystemic shunts to optimize portal venous flow to the allograft. Portosystemic shunts have been identified on computed tomography scans in 64% of posttransplant recipients after 1 year and are presumably subclinical [18]. However, portal vein

Fig. 4 – Venography demonstrates a splenorenal shunt (arrow), along with a mildly dilated inferior vena cava (*) and left renal vein (^).

flow at the time of transplant has been shown to predict allograft and patient survival [19]. Several authors have promoted occlusion of portosystemic shunts to prevent portal vein steal from the liver transplant [19–22].

Kim et al reported 19 living donor liver transplant recipients who underwent portosystemic shunt embolization intraoperatively or in the immediate post-operative period. Technical success was achieved in 17 cases and resulted in improved portal inflow to the graft. Two technical failures were due to massive shunts, and both patients died of liver failure within 3 months [22]. Ikegami et al demonstrated an increase in portal vein flow after interruption of portosystemic shunts 10 mm or greater in diameter which translated to improved posttransplant outcomes [21]. Transcatheter embolization of large portosystemic shunts in the preoperative or immediate postoperative period can mitigate portal venous steal after liver transplant, and further investigation of the appropriate application of this technique is warranted.

Our report presents the diagnostic and interventional management of main portal vein occlusion after adult liver transplantation. Endovascular transsplenic recanalization with stenting and shunt embolization is a viable method for treatment of main portal vein thrombosis in an adult liver transplant recipient. A transsplenic approach can be an effective alternative to a transhepatic approach in the setting of post-liver transplantation portal vein complications.

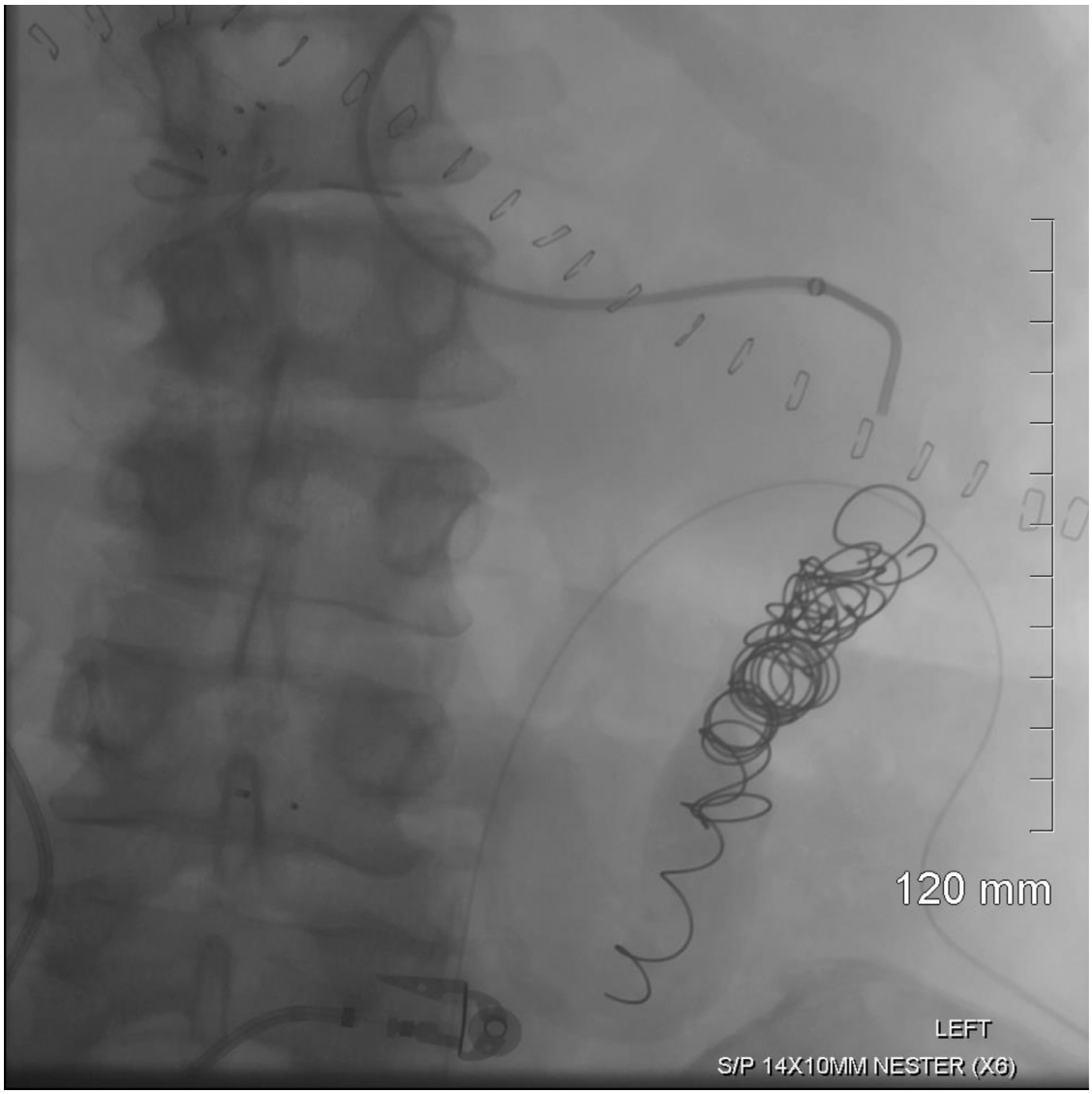

Fig. 5 – Venography depicts multiple coils used to embolize the splenorenal shunt after main portal vein recanalization.

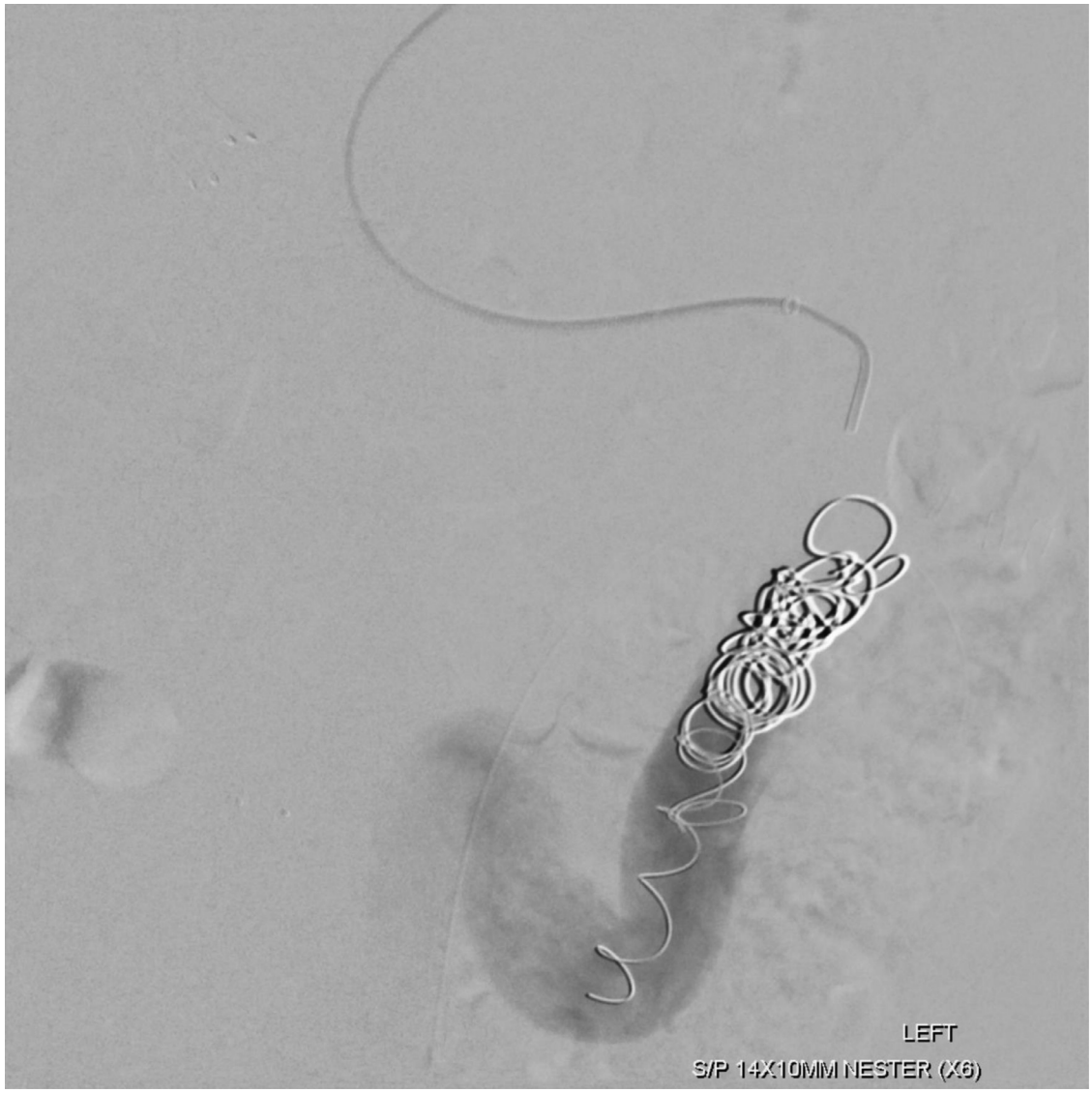

Fig. 6 – Venography demonstrates decreased splenorenal shunt flow after coil embolization.

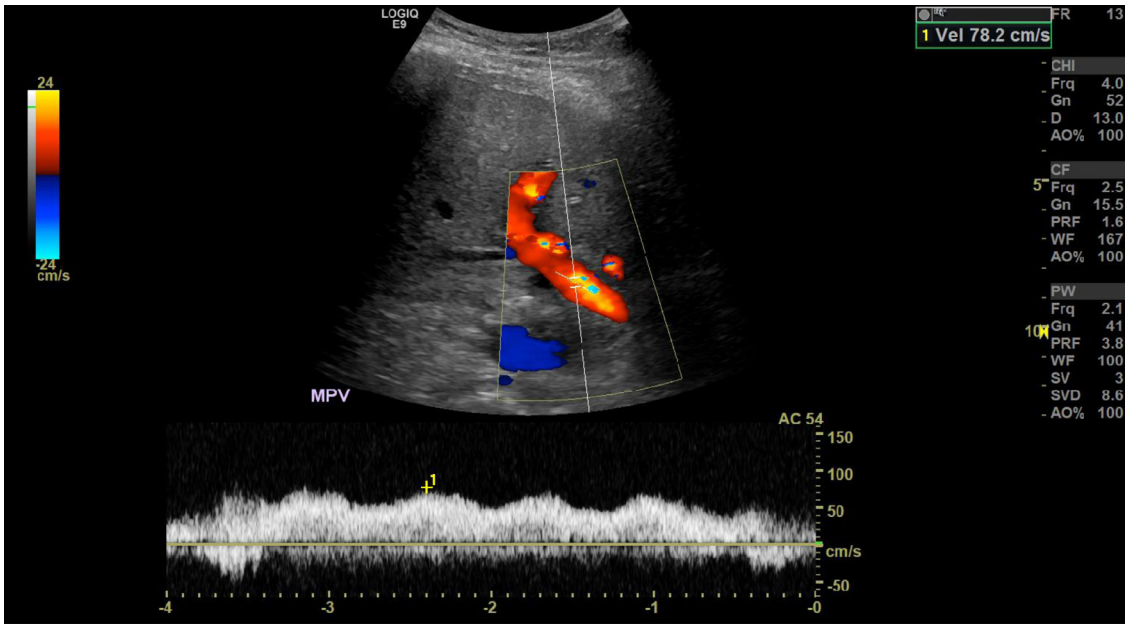

Fig. 7 – Liver ultrasound on post-interventional day 1 demonstrates a widely patent portal venous system after portal stent placement. Doppler and waveform analysis demonstrates improved hepatopetal flow velocities.

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