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INTERVENTIONAL RADIOLOGY

CASE REPORT

Stent graft closure of a high flow splenorenal shunt after liver transplantation

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ABSTRACT

We describe a patient after liver transplantation with a pre-existing surgical splenorenal shunt close to the confluence of the splenic and superior mesenteric veins and a wide, short communication between the splenic and renal veins. To close the shunt, an inferior vena cava filter was inserted in the shunt and a vascular plug was placed in the splenic vein inside the filter. When this failed to stop the flow through the shunt, a covered stent was deployed at the superior mesenteric vein-portal vein junction.

Key words: • *interventional radiology* • *liver transplantation* • *splenorenal shunt*

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Portal hypertension can be effectively reduced by the surgical creation of a portosystemic shunt. However, in patients after liver transplantation, a preexisting portosystemic shunt may steal the portal blood flow, predisposing the patient to liver dysfunction and even to portal vein thrombosis (1). Moreover, alternate outflow due to a large, active portosystemic shunt has been linked to hepatic encephalopathy (2). Thus, surgical portosystemic shunts must be occluded during the transplantation procedure or soon thereafter. We describe the use of a stent graft to occlude a symptomatic surgical portosystemic shunt in a patient after orthotopic liver transplantation.

Case report

A 27-year-old woman was referred to our angiography unit 10 days after orthotopic liver transplantation for treatment of a high flow splenorenal shunt that caused mild disturbances in liver function. The shunt had been identified by findings of a markedly enlarged left renal vein and suprarenal inferior vena cava (IVC) on computed tomography (CT) with contrast medium (Fig. 1), performed as part of the routine pre-transplantation evaluation. The patient reported that the shunt had been surgically created during her childhood in another country. It had been unaccessable for closure during the transplant surgery because of the presence of extensive adhesions.

Informed consent was obtained from the patient before the procedure. Owing to the absence of anatomical surgical details, in order to gain access to the shunt, we opted for a retrograde approach from the right femoral vein through the left renal vein into the splenic vein. A 4 F C1 catheter (Terumo, Japan) and a 0.035 inch glidewire (Terumo, Japan) were used. A dilated left renal vein with rapid flow to the IVC was noted, but flow into the portal vein was not demonstrated with several injections of contrast medium (Fig. 2). Vigorous attempts to reach the portal vein from the splenic vein using different catheters were unsuccessful. To reduce the risk of contrast-medium-induced nephropathy, we decided to cannulate the portal vein transhepatically in another session. Under fluoroscopic guidance, and after administration of IV sedation, we accessed the right portal vein via the right liver lobe using a 21 G needle (Cook, Bloomington, Indiana, USA) and a Neff set (Cook, Bloomington, Indiana, USA), as in percutaneous transhepatic cholangiography. A 4 F Bernstein catheter (AngioDynamics, New York, USA) over a 0.035 inch glidewire (Terumo, Japan) was used to negotiate into the main portal vein. Direct portography revealed hepatofugal flow toward a splenorenal shunt and into the left renal vein (Fig. 3).

Considering the wide and short communication between the splenic and renal veins, and in order to prevent migration of the embolizing material (Amplatzer vascular plug), we decided to use an IVC filter as a barrier. An ALN IVC filter (ALN Implants Chirurgicaux, France) was introduced

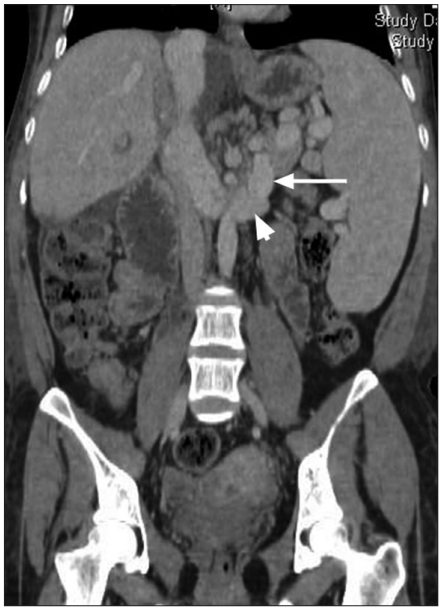

Figure 1. Coronal reconstruction abdominal CT reveals splenomegaly and enlarged splenic vein *(long arrow)*, left renal vein *(short arrow)*, and suprarenal IVC.

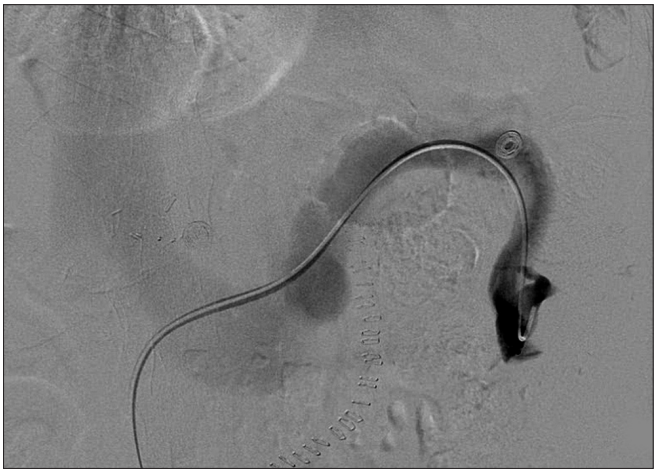

Figure 2. Contrast injection with the catheter positioned in the splenic vein demonstrates rapid flow through the wide patent splenorenal shunt without opacification of the portal vein.

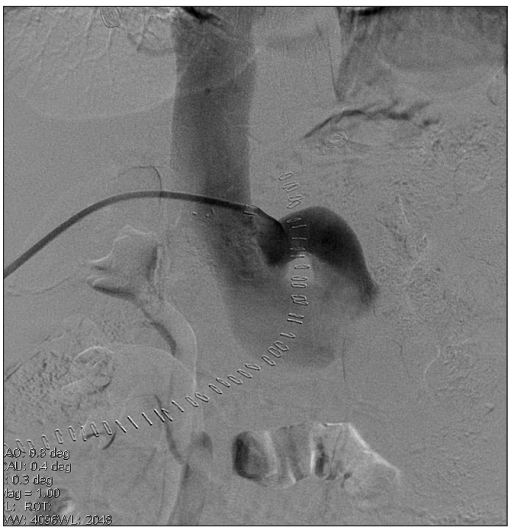

Figure 3. Transhepatic direct portography shows hepatofugal flow into the IVC through the splenorenal shunt.

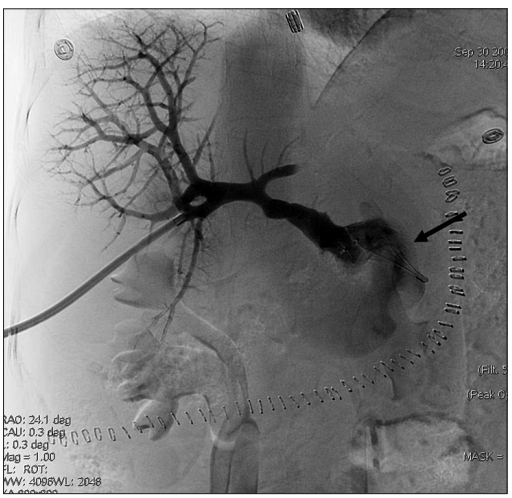

Figure 4. Steal effect of the shunt is still seen after deployment of the IVC filter *(arrow)* and Amplatzer occluder.

through the existing transhepatic access and precisely positioned and deployed in the splenorenal shunt, with its tip directed toward the bloodstream into the left renal vein. This was followed by the deployment of a 16 mm Amplatzer vascular plug (AGA Medical Corporation, Plymouth, Minnesota, USA) in the proximal splenic vein inside the IVC filter. About ten minutes post deployment venography revealed existence of the hepatofugal flow (Fig. 4). Because of the shunt's proximity to the superior mesenteric vein (SMV) confluence, there was no room for an additional occluder device. To ensure its patency and to consider additional coil embolizations through the stent struts, the SMV was cannulated from the portal vein, and a 14 x 60 mm Smart bare stent (Cordis, Miami Lakes, Florida, USA) was deployed along the junction of the SMV and main portal vein. However, because hepatofugal high flow was still evident without change in the shunt flow, and in order to reduce the radiation and the risk of contrast nephropathy, we decided not to deploy coils through the stent and exclude the shunt from the portal flow by inserting a covered stent into the proximal SMV extending into the portal vein. A 13.5 x 56 mm Fluency stent graft (Bard, Angiomed GmbH, Germany) was deployed inside the previously inserted bare stent. This effectively separated the flow in the SMV and portal vein from the splenic vein and splenorenal shunt. Antegrade hepatopetal flow was immediately demonstrated through the portal vein. The IVC filter and Amplatzer vascular plug were left in the previous position (Fig. 5).

At the end of the procedure, complete transparenchymal tract embolization was performed with gelatin sponge pledges in order to prevent hemorrhagic complications.

The patient tolerated the procedures well.

Doppler ultrasound (US) examination performed the next day showed preservation of the hepatopetal flow in

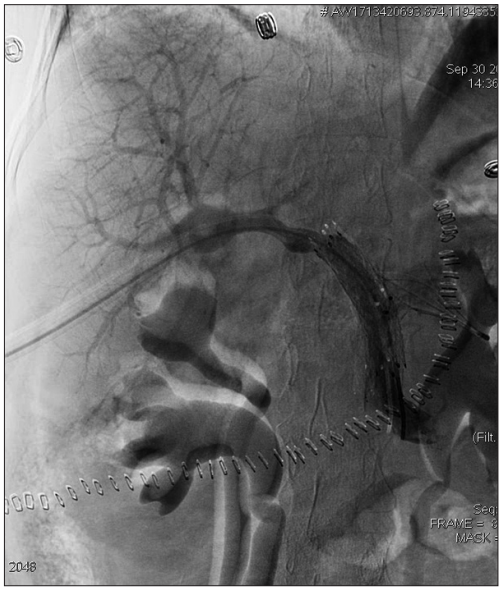

Figure 5. Angiogram obtained after covered stent graft placement demonstrates reversal of the flow to the normal direction, from the SMV into the portal vein (hepatopetal flow).

the portal vein. We decided to suffice with Doppler US examination and not perform CT angiography or angiography in the follow-up period to spare radiation and risk of contrast induced nephropathy and to use these modalities only if the Doppler pattern will change or the ammonia levels will rise.

Discussion

There are two available means of splenorenal shunt occlusion: surgical ligation and embolization. Surgical ligation is a complex procedure associated with high morbidity and mortality (3, 4), although it may be indicated in a few carefully selected patients (5). Percutaneous approaches are less invasive, and they have been shown to increase portal pressure, improve portal flow to the liver, and decrease encephalopathy (5). Embolization, however, has hardly been used for surgical shunts. Most of the reports involved spontaneous splenorenal shunts in which the distal splenic vein was usually connected to the left renal vein, and the shunt was long and tortuous (4, 6). In such cases, there is enough room for balloon-occluded retrograde transvenous obliteration with ethanolamine oleate (7), embolization with coils or detachable balloons (4), or transhepatic splenic vein embolization, which preserves the splenorenal shunt and prevents retrograde flow to the shunt from the SMV (8–10).

By contrast, in the present case, the splenorenal shunt had been created surgically close to the confluence of the splenic vein and the SMV. Therefore, we were unable to perform splenic vein embolization proximal to the shunt. At the same time, given the wide and short communication with rapid flow through it, embolic materials or coils could not be safely placed. Therefore, we used an IVC filter that served as a scaffold and safety net for delivery of the embolization device. This technique has been described by others for embolization of the left superior vena cava (11, 12) and large gastric varices (13). However, in a notable modification, we used an Amplatzer vascular plug to reduce the number of coils required for subsequent embolization. When Amplatzer/filter embolization failed to block the flow through the shunt, and in order to protect the SMV patency, we inserted a covered stent at the SMV-portal vein junction, effectively occluding the flow through the splenorenal shunt from the SMV. This procedure is similar to splenic vein embolization in terms of blood flow redirection although the closure is more permanent compared to coils where recanalization may occur. In order to reduce the dangerous risk of stent graft occlusion, life-long anticoagulation therapy should be started immediately after the procedure. The presence of a filter and Amplatzer plug in the shunt may cause its closure later on. Although covered stents have been applied to occlude peripheral arteriovenous fistulas (14), to the best of our knowledge, their use for portosystemic shunt occlusion has not been described previously. In conclusion, high flow shunts, especially with short necks, are challenging to treat percutaneously using conventional embolization tools. Success was achieved only with the use of a covered stent.

References

1. Margarit C, La´zaro JL, Charco R, et al. Liver transplantation in patients with splenorenal shunts: intraoperative flow measurements to indicate shunt occlusion. Liver Transpl Surg 1999; 5:35–39.
2. Blei AT, Cordoba J. Practice Parameters Committee of the American College of Gastroenterology. Hepatic encephalopathy. Am J Gastroenterol 2001; 96:1968–1976.
3. Hanna SS, Smith RS 3rd, Henderson JM, et al. Reversal of hepatic encephalopathy after occlusion of total portosystemic shunts. Am J Surg 1981; 142:285–289.
4. Uflacker R, Silva Ade O, d'Albuquerque LA, et al. Chronic portosystemic encephalopathy: embolization of portosystemic shunts. Radiology 1987; 165:721–725.
5. Henderson JM. Treatment of post-shunt portal systemic encephalopathy by embolization of the shunt. Hepatology 1989; 9:164–165.
6. Potts JR 3rd, Henderson JM, Millikan WJ Jr, Sones P, et al. Restoration of portal venous perfusion and reversal of encephalopathy by balloon occlusion of portal systemic shunt. Gastroenterology 1984; 87:208–212.
7. Numata K, Tanaka K, Kiba T, et al. Use of balloon-occluded retrograde transvenous obliteration with ethanolamine oleate for the treatment of hepatic encephalopathy in a cirrhotic patient with a large spontaneous splenorenal shunt. J Gastroenterol 1998; 33:424–427.
8. Zamora CA, Sugimoto K, Tsurusaki M, et al. Portosplenic blood flow separation in a patient with portosystemic encephalopathy and a spontaneous splenorenal shunt. J Vasc Interv Radiol 2004; 15:875–879.
9. Mezawa S, Homma H, Akiyama T, et al. Selective embolization of the splenic vein in patients with hepatic encephalopathy and splenorenal shunt. J Vasc Interv Radiol 2004; 15:1475–1481.
10. Nakai M, Sato M, Maedac Y, et al. Transhepatic splenic vein embolization during temporary balloon occlusion of a spontaneous portosystemic shunt for chronic portosystemic encephalopathy. Eur J Radiol 2006; 60:23–27.
11. Heng JT, De Giovanni JV. Occlusion of persistent left superior vena cava to unroofed coronary sinus using vena cava filter and coils. Heart 1997; 77:579–580.
12. Maheshwari S, Pollak J, Hellenbrand WE. Transcatheter closure of an anomalous venous connection by a novel method. Cathet Cardiovasc Diagn 1998; 45:269–271.
13. Ford JM, Shah H, Stecker MS, Namyslowski J. Embolization of large gastric varices using vena cava filter and coils. Cardiovasc Intervent Radiol 2004; 27:366–369.
14. Ruebben A, Tettoni S, Muratore P, et al. Arteriovenous fistulas induced by femoral arterial catheterization: percutaneous treatment. Radiology 1998; 209:729–734.