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Balloon-occluded retrograde transvenous obliteration for a portosystemic shunt after pediatric living-donor liver transplantation ☆

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Abstract Portosystemic shunts may cause steal phenomenon after liver transplantation, which can lead to graft loss without proper management. Portal vein stenosis is one of the causes for the occurrence of portosystemic shunts after liver transplantation. Recently, new interventional radiologic techniques have been developed in the field of liver transplantation. Balloon-occluded retrograde transvenous obliteration (B-RTO) is a novel interventional technique for gastric varices and portosystemic shunts and also is effective for increasing portal vein flow. We herein report a pediatric case of portal vein stenosis with a large shunt successfully treated with a combination of balloon dilatation and B-RTO. If enlarged collateral vessels cause steal phenomenon, then B-RTO should be considered as an additional therapy.

A portosystemic shunt generally occurs in cirrhotic patients and is rarely reported after liver transplantation. However, a portosystemic shunt can occur after pediatric liver transplantation because of congenital malformation or postoperative formation [1]. The presence of large collateral vessels may cause the steal phenomenon, which can lead to graft atrophy and failure [2]. There have so far been few reports of interventional radiology in pediatric liver transplant patients with large portosystemic shunts. The recent development of interventional radiology has allowed for the development of new applications for the treatment of vascular and biliary complications after pediatric liver transplantation [3].

This report presents a pediatric case of portal vein stenosis with a large portosystemic shunt, which was

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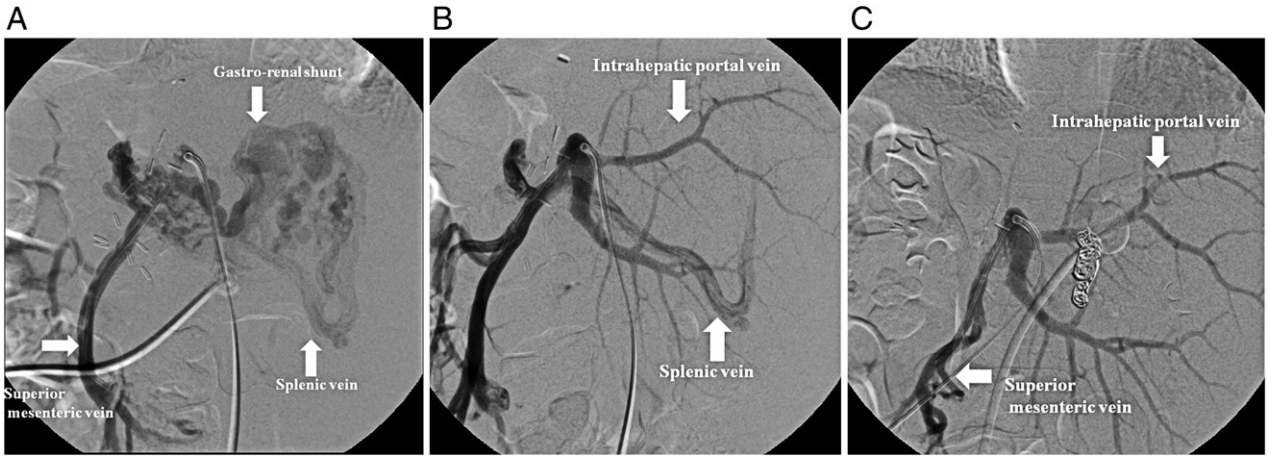

Fig. 1 Portography from the superior mesenteric vein. A, Portography before balloon dilatation showed hepatofugal flow of the splenic vein without visualizing the intrahepatic portal vein. B, Portography after balloon dilatation visualized the intrahepatic portal vein but showed hepatofugal flow of the splenic vein. C, Portography after B-RTO provided good visualization of the intrahepatic portal vein without demonstrating the splenic vein.

successfully treated with balloon-occluded retrograde transvenous obliteration (B-RTO). The case was a 2-year-old boy who underwent living-donor liver transplantation at 6 months of age with a paternal left lateral segment graft owing to liver cirrhosis of unknown etiology. The postoperative course was uneventful; however, his platelet count gradually decreased to $5 \times 10^4/\mu L$, and his serum ammonia level increased to 130 $\mu g/dL$ at 2.5 years of age. Liver function tests were normal (total bilirubin, 0.79 mg/dL; aspartate aminotransferase, 48 IU/L; alanine aminotransferase, 17 IU/L). A graft liver biopsy showed no evidence of rejection, cholangitis, or fibrosis. Doppler ultrasonography showed the flow volume of the graft portal vein to decrease to 45 mL/min. Abdominal computed tomography revealed portal vein stenosis with portosystemic shunting, which was not detected in the pretransplant evaluation. Hyperammonemia persisted despite treatment with protein restriction and medication, and interventional radiologic treatment was therefore indicated. Percutaneous transhepatic portography revealed portal vein stenosis (pressure gradient, 6 mm Hg) with a significant gastrorenal shunt (Figs. 1A and 2A). Although the intrahepatic portal vein could be visualized after the successful balloon dilatation of the stenotic portal vein, portography showed a hepatofugal flow of the splenic vein owing to the flow going into the remnant gastrorenal shunt (Figs. 1B and 2B). Theoretically, treating the portal vein stenosis should have resolved the issue and decompressed the shunt. Balloon-occluded retrograde transvenous obliteration was initiated to increase the portal flow by occluding the gastrorenal shunt after balloon dilatation. The balloon catheter was inserted into the gastrorenal shunt via the right femoral vein, and 5% ethanolamine oleate with iopamidol (total, 7 mL, 0.5 mL/kg) was injected into

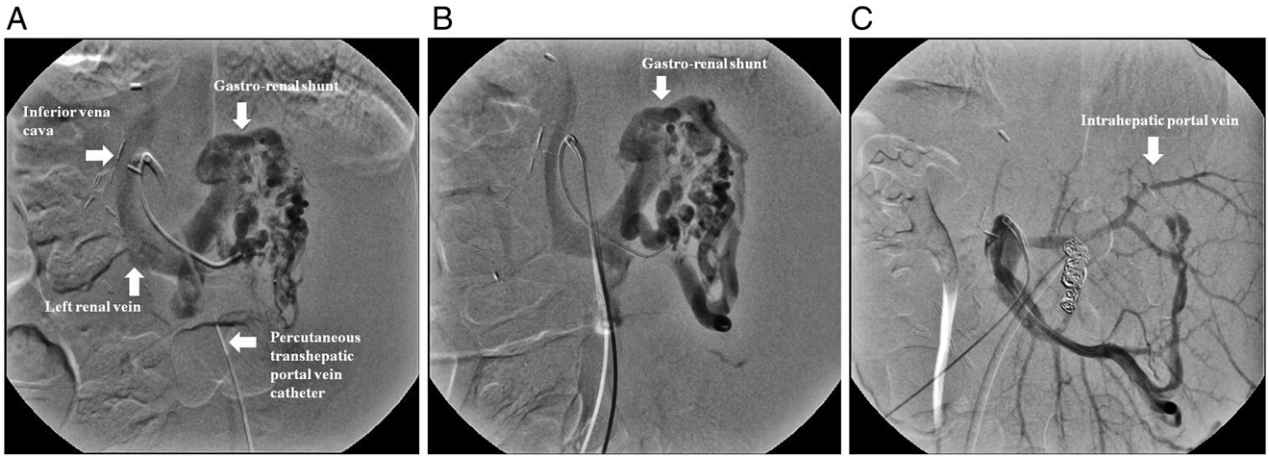

Fig. 2 Portography from the splenic vein. A, Portography before balloon dilatation showed a large gastrorenal shunt draining into the left renal vein without visualizing the intrahepatic portal vein. B, Portography after balloon dilatation also showed a large gastrorenal shunt without visualizing the intrahepatic portal vein. C, Portography after B-RTO showed hepatopetal flow of the splenic vein without visualizing the gastrorenal shunt.