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CASE REPORT

Parallel TIPS for Treatment of Refractory Ascites and Hepatic Hydrothorax

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Introduction

The development of medically refractory ascites portends a grim prognosis for patients with liver cirrhosis, and is associated with median survival of six months and marked impairment of quality of life [1–3]. Hepatic hydrothorax is a sequela of cirrhotic ascites in which fluid moves into the pleural space via diaphragmatic defects [4]. Transjugular intrahepatic portosystemic shunt (TIPS) creation is a safe and accepted treatment for both refractory ascites and hepatic hydrothorax, and has been shown to prolong survival [5] and achieve low (approximately 25–30 %) recurrence [5, 6]. For patients who fail to respond to TIPS, treatment options comprise orthotopic liver transplantation (OLT) for cure and serial large-volume paracentesis (LVP) or thoracentesis for symptomatic relief [7–9]. The former is limited by the scarcity of donor organs and the latter is an inconvenient approach associated with high recurrence and no survival benefit [2, 5]. Placement of a second parallel TIPS has been used to achieve clinically meaningful portosystemic pressure gradient (PSG) reduction in the setting of variceal hemorrhage [10]. However, formal descriptions of this technique in the treatment of intractable ascites and hepatic hydrothorax are lacking. Herein, we present two cases in which ascites and hydrothorax refractory to both medical treatment and primary TIPS improved markedly after creation of a parallel TIPS.

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Case Reports

Institutional review board approval is not required for single retrospective case studies at the authors' institution.

Case 1

A 58-year-old man with a six-year history of viral and alcoholic cirrhosis presented with bilateral lower extremity edema. He began dietary sodium restriction and treatment with low-dose furosemide (20 mg per day). However, he returned after four months complaining of progressive abdominal distention, pain, and a 25 lb weight gain over a period of 3 weeks. He underwent LVP and was started on spironolactone (100 mg per day) and an increased dose of furosemide (40 mg per day). Nonetheless, the patient's ascites continued to worsen, necessitating biweekly and eventually weekly LVP procedures. His medications were increased again to 60 mg daily furosemide and 150 mg daily spironolactone. Four months later, he was diagnosed with acute kidney injury and the diuretics were discontinued. At this point, given the persistence and severity of his ascites, and his intolerance of medical therapy, the patient was referred to interventional radiology (IR) for TIPS placement. Evaluation for OLT was also initiated at the same time. At the time of TIPS, the patient was Child–Pugh class B with a model for end stage liver disease (MELD) score of 13 (total bilirubin = 1.5 mg/dL, serum

creatinine = 1.3 mg/dL, international normalized ratio or INR = 1.3).

The technique for TIPS creation has been described elsewhere [11]. The right portal vein was accessed via the right hepatic vein and a 10 mm × 8 cm Viatorr (W. L. Gore and Associates, Flagstaff, AZ, USA) covered stent graft was deployed (Fig. 1). The stent was dilated by use of an 8 mm balloon, after which the PSG—measured from the portal vein to the right atrium, a widely utilized and supported method [12]—decreased from 25 to 9 mm Hg. After the procedure, the patient was monitored for four days and was subsequently discharged with no evidence of hepatic encephalopathy. Despite TIPS, the ascites failed to improve; the patient received one LVP before hospital discharge and three more in the following week. He then continued to require weekly LVP procedures, removing an average of 9 L at each session. Diuretics (furosemide 40 mg per day and spironolactone 50 mg per day) were restarted at low doses, but did not help. Because of the persistent ascites, TIPS venography was performed 2.5 months after initial placement to assess shunt patency, and revealed no evidence of shunt stenosis, although the PSG was elevated to 18 mm Hg (Fig. 2). After empiric balloon dilation to 10 mm, the PSG fell to 12 mm Hg. Despite shunt optimization, the patient continued to require weekly LVP procedures with removal of 8–10 L each time. Two months later, the shunt remained patent on ultrasound imaging, yet the ascites remained. Given the severity of the patient's symptoms and the absence of primary stent dysfunction, the decision was made to pursue further portosystemic decompression with a second TIPS.

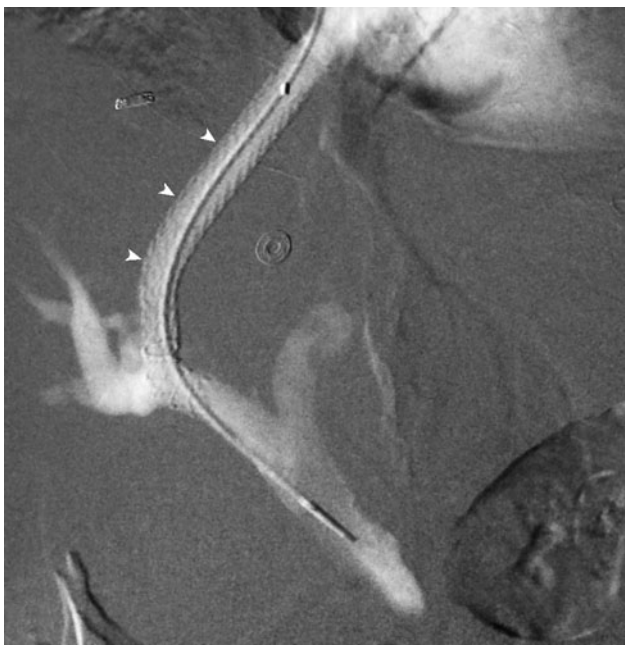

Fig. 1 Venogram performed after right hepatic vein to right portal vein TIPS creation shows widely patent shunt (*arrowheads*)

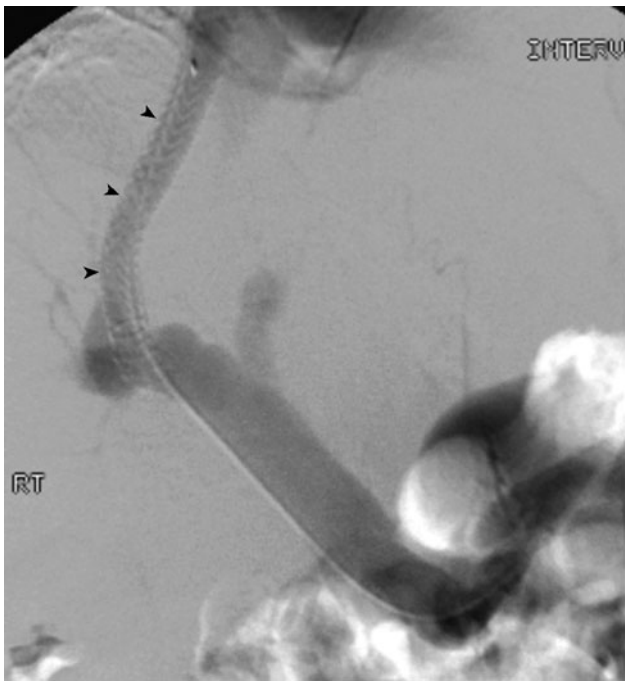

Fig. 2 Venogram performed 2.5 months after primary TIPS creation demonstrates preserved shunt patency (*arrowheads*)

For parallel TIPS creation, the left portal vein was accessed via the middle hepatic vein and a 10 mm × 6 cm Viatorr covered stent graft was deployed. The stent was dilated by use of an 8 mm balloon and the PSG decreased from 14 to 7 mm Hg (Fig. 3). The patient tolerated the procedure well, and was discharged from the hospital 2 days later after an uneventful recovery. No evidence of hepatic decompensation (total bilirubin = 2.2 mg/dL, INR = 1.6) or hepatic encephalopathy was observed, and his renal function was normal (creatinine = 0.8 mg/dL). With the patient maintained on low-dose diuretics (furosemide 40 mg per day and spironolactone 50 mg per day), placement of the second TIPS produced an effective response: frequency of paracentesis procedures (from weekly to biweekly) and fluid volume removed (average 9 L to average 5 L) immediately improved. Moreover, the patient, who was markedly fluid-overloaded before parallel TIPS insertion (with significant peripheral edema), diuresed significantly and lost 40 lbs in fluid weight (275–235 lbs.) over the course of 3 months after parallel TIPS. At three-month follow-up, the patient remains improved, continues to diurese, and has nominal distortion of liver function from baseline (total bilirubin = 2.4 mg/dL, INR = 1.7).

Fig. 3 Venogram performed after parallel TIPS creation shows patent right hepatic vein to right portal vein (*white arrowheads*) and middle hepatic vein to left portal vein (*black arrowheads*) shunts

Fig. 4 Venogram performed after right hepatic vein to right portal vein TIPS creation shows widely patent shunt (*arrowheads*). Patient coronary vein subsequently embolized

Case 2

A 58-year-old man with a four-year history of cryptogenic cirrhosis was referred for management of his liver disease. The patient had a history of mild to moderate abdominal ascites, which was effectively stabilized with dietary sodium restriction and diuretic medications, including spironolactone (300 mg per day) and furosemide (80 mg twice daily). Despite medical control of his ascites, the patient progressively developed a large right-sided pleural effusion compatible with hepatic hydrothorax. Although thoracentesis drainage was performed, fluid re-accumulation required additional drainage procedures; thoracenteses were initially needed sporadically, but became necessary on an increasingly frequent basis until the patient was undergoing removal of 2–4 L of fluid every 3–5 days within three months of initial development. At this point, given the protraction and severity of his hepatic hydrothorax, the patient was referred to IR for TIPS placement. At the time of TIPS, the patient was Child–Pugh class B with a MELD score of 19 (total bilirubin = 1.7 mg/dL, serum creatinine = 1.7 mg/dL, international normalized ratio or INR = 1.6).

For TIPS creation, the right portal vein was accessed via the right hepatic vein and a 10 mm × 8 cm Viatorr covered stent graft was deployed (Fig. 4). The stent was dilated by use of an 8 mm balloon, after which the PSG decreased from 24 to 10 mm Hg. After the procedure, the patient was monitored for two days and was subsequently discharged with normal renal function (creatinine = 1.3 mg/dL) and no evidence of hepatic encephalopathy. Despite TIPS, the hepatic hydrothorax failed to improve; the patient continued to require thoracentesis procedures every three days, removing an average of 3 L at each session. Because of the persistent hepatic hydrothorax, TIPS venography was performed two months after initial placement to assess shunt patency. This study revealed no evidence of shunt stenosis, although the PSG was elevated to 21 mm Hg. Given the persistence of the patient's symptoms and the absence of primary stent dysfunction, the decision was made to pursue further portosystemic decompression with a second TIPS three days later.

For parallel TIPS creation, the left portal vein was accessed via the middle hepatic vein and a 10 mm × 6 cm Viatorr covered stent graft was deployed. The stent was dilated by use of an 8 mm balloon and the PSG decreased from 22 to 7 mm Hg (Fig. 5). The patient tolerated the procedure well, and was discharged from the hospital three days later with normal renal function (creatinine = 1.1 mg/dL) after an uneventful recovery. No evidence of hepatic encephalopathy was observed. Placement of the second TIPS produced a dramatic response: two thoracentesis procedures were required within two weeks of parallel TIPS insertion, but the patient subsequently had no further pleural fluid accumulation and required no additional thoracentesis procedures thereafter. At two-month follow-up, the patient

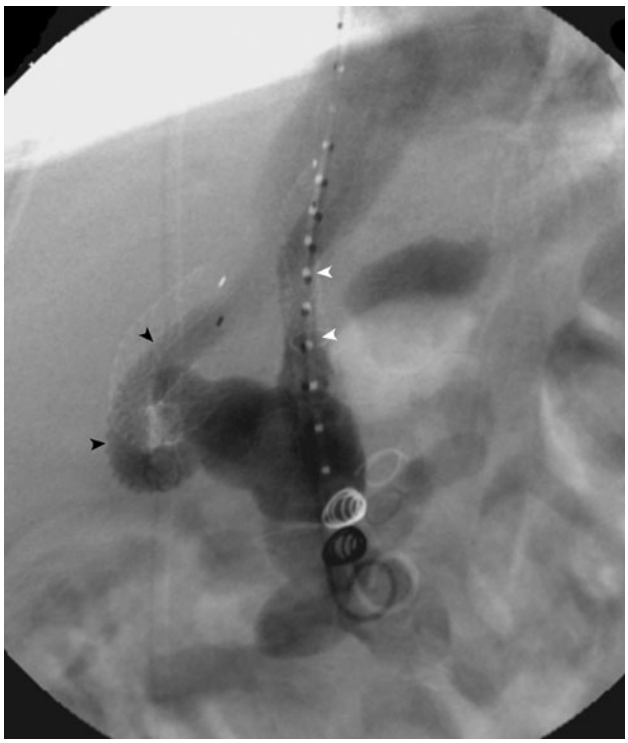

Fig. 5 Venogram performed after parallel TIPS creation shows patent right hepatic vein to right portal vein (*black arrowheads*) and middle hepatic vein to left portal vein (*white arrowheads*) shunts

remained improved, with nominal distortion of liver function from baseline (total bilirubin = 2.5 mg/dL, INR = 1.5). Unfortunately, the patient expired three months after parallel TIPS creation because of complications arising from an incarcerated umbilical hernia.

Discussion

Medically refractory ascites is associated with a high burden of morbidity and mortality in cirrhotic patients, and is a leading indication for TIPS creation [8, 13]. Hepatic hydrothorax may complicate cirrhotic ascites via fluid shifts from the peritoneal space into the pleural cavity through diaphragmatic defects [4]. By diverting portal venous flow into the systemic circulation, TIPS acts to decompress the portal venous system, increase effective circulatory blood volume, and curtail excess renal sodium reabsorption. Its efficacy is reflected in the extent of PSG reduction. Successful PSG reduction is achieved in more than 90 % of cases, however efficacy ranges from 38 to 84 % for ascites and 68–82 % for hepatic hydrothorax [9]; recurrence occurs in up to 30 % of cases [5, 6]. Stent dysfunction is a common cause of disease recurrence and is typically because of occlusion or stenosis [14]. In the absence of dysfunction, recurrence after TIPS may be the result of insufficient PSG reduction. The American Association for the Study of Liver Diseases (AASLD) recommends PSG reduction below 8 mm Hg, although the optimum threshold for clinical success remains a matter of contention [1, 15]. In the cases herein, initial post-TIPS PSGs of 9–11 mm Hg (which increased to 14–21 mm Hg without shunt dysfunction) proved insufficient for ascites control, whereas subsequent further reduction to 7 mm Hg with parallel TIPS produced an effective response consisting of reduction in paracentesis frequency and fluid volume removed, and marked diuresis and weight loss for the ascites patient, and complete resolution of pleural fluid for the hepatic hydrothorax patient. These differences resulted in perceptible quality of life improvement for our patients.

The parallel TIPS technique has previously been used for treatment of variceal bleeding. In 1992, Haskal et al. [10] reported their experience with parallel Wallstents (Boston Scientific, Natick, MA, USA) for ten patients with variceal hemorrhage. In that study, placement of parallel TIPS proved highly effective in achieving adequate portal decompression; an elevated mean PSG of 19.1 mm Hg after primary TIPS was reduced to 12.5 mm Hg after second parallel TIPS creation. While these results pertain to the setting of variceal hemorrhage, extrapolation to the ascites and hepatic hydrothorax populations may be reasonable. Addition of a parallel TIPS increases the volumetric flow of blood from the portal venous system into the systemic circulation [10] and thus affords portal venous pressure reduction, abating such downstream effects as splanchnic arterial vasodilation, reduction in effective arterial blood volume, activation of vasoconstrictor and antinatriuretic systems, and sodium retention, all of which lead to ascites formation [16]. Interestingly, parallel shunts may have a greater potential role in the covered stent era of TIPS: whereas bare metal Wallstents were amenable to over dilation to increase shunt diameter in the setting of inadequate portal decompression, Viatorr stent grafts are not expandable beyond their nominal diameter, necessitating additional TIPS placement for further portal pressure reduction.

Covered stent grafts are now routinely utilized in clinical TIPS practice, and afford increased patency at the expense of higher rates of hepatic decompensation and encephalopathy [10, 17]. As such, IR operators should be aware of the nontrivial risks associated with aggressive PSG reduction, such as may potentially occur in placement of a parallel TIPS. In addition to the well-described relationship between encephalopathy and the degree of portosystemic shunting, a recent report found a threefold increase in mortality with PSG reduction below 8 mm Hg, and another investigation noted that PSG reduction below 5 mm Hg was associated with increased medical

complications [15, 18, 19]. While placement of two sequential shunts may result in significant PSG reduction, this stepwise approach has an advantage over initial creation of one large caliber TIPS, namely retention of the possibility of closure of one shunt should encephalopathy become clinically problematic [10] (although this benefit is tempered by recent development of various shunt diameter reduction techniques). In our ascites case, the patient's history of hepatic encephalopathy had already prompted careful monitoring and prophylactic lactulose treatment against encephalopathy—measures that are paramount for all patients undergoing parallel TIPS.

In summary, the use of parallel TIPS for the treatment of ascites and hepatic hydrothorax may achieve clinically meaningful PSG reduction in cases that are refractory to both medical therapy and primary TIPS creation which does not achieve adequate PSG reduction. Larger series with long-term follow-up are required to further characterize the safety and efficacy of this technique.

Conflict of interest None.

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