Longitudinal Stent Fracture and Migration of a Stent Fragment Complicating Treatment of Hepatic Vein Stenosis after Orthotopic Liver Transplantation

Brian W. Goelitz, M.D.,¹ and Michael Darcy, M.D.¹

ABSTRACT

We report a case of inferior vena cava (IVC) stent placement complicated by longitudinal stent fracture and migration of a stent fragment to the right pulmonary artery 2 years after initial placement. During attempted stenting of a hepatic venous anastomotic stenosis following orthotopic liver transplantation, a Palmaz P308 stent (Cordis International, Miami, FL) migrated and was redeployed into the IVC. Two years later, the patient had recurrent ascites and liver failure. Chest radiograph showed the Palmaz P308 stent had fractured longitudinally with a fragment in the right interlobular pulmonary artery. Half of the stent remained in the IVC. Mild stenosis was noted in the IVC where the stent was deployed. Overdilation of stents may be associated with stent fracture and should be performed with caution.

KEYWORDS: Stent fracture, migration, Palmaz P308 stent

Objectives: Upon completion of this article, the reader should understand the long-term risk of over-dilated stents.

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We report a case of inferior vena cava (IVC) stent placement complicated by longitudinal stent fracture and migration of a stent fragment to the right pulmonary artery 2 years after initial placement. No reports of longitudinal fracture and migration of an IVC stent could be found in the literature.

CASE REPORT

A 48-year-old man with hepatitis C cirrhosis and hepatocellular carcinoma treated with transarterial chemoembolization subsequently underwent orthotopic liver transplantation (OLT) in October 2002. The patient did well for 2 years following the transplant.

¹Interventional Radiology, Mallinckrodt Institute of Radiology, Washington University in St. Louis, St. Louis, Missouri.

Address for correspondence and reprint requests: Michael Darcy, M.D., Chief, Interventional Radiology, Mallinckrodt Institute of Radiology, Washington University in St. Louis, 510 S. Kingshighway Blvd., St. Louis, MO 63110.

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Then he presented in September 2004 with a 1-month history of worsening abdominal distention. He also noted worsening dyspnea on exertion, decreased appetite, and back pain. A transjugular liver biopsy and hepatic venous pressure measurements were performed on September 13. A significant stenosis was noted at the suprahepatic venous anastomosis with a 14 mm Hg pressure gradient. The patient returned 2 days later for balloon angioplasty and stent placement. Transjugular hepatic venography was repeated that confirmed stenosis at the suprahepatic venous anastomosis (Fig. 1). Balloon angioplasty with a 12-mm Powerflex P3 balloon (Cordis International, Miami, FL) and a 14-mm XXL balloon (Boston Scientific, Natick, MA) resulted in no significant visual or hemodynamic change across the stenosis. At this point, the sheath was exchanged for a long 9F sheath, which was positioned within the hepatic vein. A Palmaz P308 stent (Cordis International, Miami, FL) was then hand-mounted on the 12-mm Powerflex balloon. The stent was successfully deployed across the stenosis (Fig. 2). However, the stent appeared to be slightly longer than desired, so the 14-mm XXL balloon was then advanced into the stent for additional dilation. When positioning the 14-mm balloon in the stent, the stent dislodged toward the right atrium. It was then decided to reposition the stent in a safe location in the IVC. The stent was advanced into the IVC below the anastomosis and subsequently dilated with an 18-mm balloon in the IVC. Inferior venacavogram showed the stent to be in a secure position (Fig. 3). An 8-mm Palmaz Genesis stent (Cordis, Miami, FL) was then mounted on a 14-mm XXL balloon and deployed across the suprahepatic anastomosis. This was dilated with a 16-mm balloon. Repeat venography and pressure measurements demonstrated mild narrowing at the caudal end of the stent. Another 8-mm Genesis stent was mounted on a 14-mm XXL balloon and deployed in the more caudal aspect of the hepatic vein. This was also

Figure 1 Hepatic venogram with suprahepatic anastomotic stenosis.

Figure 2 Successful stent placement across suprahepatic anastomosis with no residual stenosis. However, the stent is a little long, extending close to the right atrium.

dilated with a 16-mm balloon. Follow-up venography demonstrated no residual stenosis and a pressure gradient of 4 mm Hg. The patient did well postprocedure and was discharged 1 day later after stopping his diuretics.

In June 2006, the patient returned with recurrent ascites and liver failure. A chest radiograph on admission to the hospital showed what appeared to be a stent fragment in the right interlobular pulmonary artery

Figure 3 Palmaz P308 stent deployed in the inferior vena cava (IVC) and dilated with a 18-mm balloon. The stent is intact and slightly oversized relative to the IVC. Note the safety wire across the suprahepatic stenosis.

Figure 4 Magnified chest radiograph taken 2 years after stent placement. Stent fragment is lodged in right interlobular pulmonary artery. The patient had no cardiac or chest complaints.

(Fig. 4). At that time, a transjugular liver biopsy and hepatic vein pressure measurement were requested. Stenosis within the existing hepatic vein stents was discovered. Angioplasty was performed in the stent across the suprahepatic venous anastomosis with resolution of the pressure gradient across the stent. A fragment of the fractured Palmaz stent remained in the IVC (Fig. 5). Fluoroscopic spot images also show the fragment in the right interlobular pulmonary artery (Fig. 6).

Figure 5 Fluoroscopic spot image shows remaining stent fragment in the inferior vena cava caudal to the hepatic vein stents.

Figure 6 Fluoroscopic spot image showing stent fragment in right interlobular pulmonary artery.

Carbon dioxide inferior venacavogram demonstrated mild narrowing of the IVC below the anastomosis where the stent had been placed. The IVC was patent. Fluoroscopic inspection confirmed the migrated fragment in the pulmonary artery. Given the shape of the fragment, it was felt that an attempt at retrieval would be likely to cause damage to the pulmonary artery or tricuspid valve. In addition, the patient had no pulmonary symptoms to warrant a retrieval attempt. The patient did well post-procedure with improvement in clinical symptoms.

DISCUSSION

Following liver transplantation, anastomotic complications are a major cause of morbidity and organ failure. Hepatic vein-caval anastomotic stenosis may be related to donor/recipient size discrepancy, a suture line stenosis, or abnormal angulation between the hepatic vein and IVC.^{1,2} The clinical presentation of hepatic vein stenosis or stenosis at the hepatic venocaval anastomosis includes ascites, abdominal pain, lower extremity edema, development or recurrence of varices (gastric or esophageal), liver function test abnormalities, or pleural effusion.^{3,4}

Anastomotic stenosis following OLT requires surgical and endovascular collaboration. Recently, endovascular techniques have become recognized as the primary modality for treating anastomotic complications following organ transplantation.^{5,6} Percutaneous transluminal angioplasty alone was unsuccessful in our case; thus it was decided to stent the stenosis. The consensus is that 7 to 10 mm Hg represents a significant hemodynamic gradient across hepatic venocaval anastomosis.⁷ Patients with hepatic venocaval anastomotic strictures who are treated with stent placement show improvement in clinical symptoms and liver function tests within 2 weeks.^{1,6}

However, there are potential complications to stent placement for treatment of hepatic vein-caval

stenosis, including reports of symptomatic and asymptomatic stent migration.⁸ Slonim et al⁹ described their experience with misplacement or migration of Palmaz and Wallstents (Boston Scientific, Natick, MA). They found that repositioning or removal of dislodged or migrated Palmaz or Wallstents was successful in 96% of cases. Similarly, in our case, the migration was successfully managed by redeployment into the IVC. Given the fluctuation in size of the IVC, it is recommended to oversize the stent by at least 2 mm relative to the apparent diameter of the IVC.¹⁰ The stent in our case was oversized, and although it did not migrate initially, it did ultimately fracture and a fragment migrated. The exact time course of when the fracture occurred is not known because no interval imaging studies were performed between initial placement and the discovery 2 years later. We could find no report in the literature of this type of longitudinal stent fracture following successful deployment.

Follow-up inferior vena cavogram demonstrates that despite stent fracture, only a mild stenosis in the IVC was noted. The IVC remained patent. The patient had no respiratory or cardiac symptoms to suggest hemodynamic compromise with the fragment in the pulmonary artery. Given the lack of symptoms and the location of the stent fragment in the right interlobular pulmonary artery, no intervention to retrieve the fragment is planned at this time. Although this case supports the recommendation for deploying migrated or dislodged stents into safe locations, it also demonstrates that overdilation may be associated with stent fracture and should be done with caution.

REFERENCES

1. Ko GY, Sung KB, Yoon HK, et al. Endovascular treatment of hepatic venous outflow obstruction after living-donor liver transplantation. *J Vasc Interv Radiol* 2002;13:591-599
2. Kerlan RK, LaBerge JM. Liver transplantation: associated interventions. In: Baum S, Pentecost MJ, eds. *Abrams' Angiography Interventional Radiology*. 2nd ed. Philadelphia: Lippincott Williams & Wilkins; 2006:560-580
3. Egawa H, Tanaka K, Uemoto S, et al. Relieve of hepatic vein stenosis by balloon PTA after living-related donor liver transplantation. *Clin Transplant* 1993;7:306-311
4. Zajko AB, Claus D, Clapuyt P, et al. Obstruction to hepatic venous drainage after liver transplantation: treatment with balloon PTA. *Radiology* 1989;170:763-765
5. Borsa JJ, Daly CP, Fontaine AB, et al. Treatment of IVC anastomotic stenosis with the Wallstent endoprosthesis after OLT. *J Vasc Interv Radiol* 1999;10:17-22
6. Weeks SM, Gerber DA, Jaques P, et al. Primary Gianturco stent placement for IVC abnormalities following liver transplantation. *J Vasc Interv Radiol* 2000;11:177-187
7. Ducerf C, Rode A, Adham M, et al. Hepatic outflow study after piggyback liver transplantation. *Surgery* 1996;120:484-487
8. Sehgal M, Brown DB, Picus D. Aortoatrial fistula complicating transjugular intrahepatic portosystemic shunt by protrusion of a stent into the right atrium: radiologic/pathologic correlation. *J Vasc Interv Radiol* 2002;13:409-412
9. Slonim SM, Dake MD, Razavi MK, et al. Management of misplaced or migrated endovascular stents. *J Vasc Interv Radiol* 1999;10:851-859
10. Guimaraes M, Uflacker R, Schonholz C, et al. Stent migration complicating treatment of inferior vena cava stenosis after orthotopic liver transplantation. *J Vasc Interv Radiol* 2005;16:1247-1252