Hepatic Vein Anchor-Wire Technique to Prevent Stent Migration During Inferior Vena Cava Stenting for Budd-Chiari Syndrome

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ABSTRACT: Inferior vena cava (IVC) stenting in patients suffering from Budd-Chiari syndrome (BCS) is sometimes complicated by stent migration or misplacement. Here, we describe a novel stent anchoring technique to prevent this complication while using balloon-mounted Palmaz stent for angioplasty of short-segment stenosis in the IVC.

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Key words: Budd-Chiari syndrome, inferior vena cava stenting, anchor-wire technique, stent migration, stent misplacement

Budd-Chiari syndrome (BCS) is a constellation of signs and symptoms arising out of hepatic venous outflow obstruction at the level of the hepatic veins (HVs) and/or inferior vena cava (IVC) resulting in hepatic congestion and portal hypertension. Percutaneous transluminal angioplasty ± stenting for BCS relieves the venous congestion by dilating the stenosed HVs and/or IVC. Here, we describe the technique of anchoring the IVC stent with a hepatic vein wire to prevent periprocedural stent migration during IVC stenting for BCS.

Case Report

A 38-year-old male presented with complaints of abdominal distention, bilateral pedal edema, and engorged veins over the abdominal wall for the past 3 years. The patient denied any history of gastrointestinal bleed, blood transfusion, icterus, dyspnea, or altered sensorium. He was a non-addict and denied any intravenous drug abuse. Ultrasonography revealed hepatomegaly with caudate lobe hypertrophy, ascites and dilated hepatic veins, with abrupt narrowing of the suprahepatic IVC. An upper gastrointestinal endoscopy showed esophageal varices, while magnetic resonance venography confirmed suprahepatic constriction of the IVC due to a web with normal ostium of the draining hepatic veins. The investigations, including liver function tests, thrombophilia tests, and viral serology, were normal. With the diagnosis of idiopathic BCS, an IVC angioplasty was planned; accordingly, the right femoral vein was accessed with an 8 Fr sheath. Venography revealed tight stenosis in the suprahepatic IVC with streaky antegrade flow and dilated prestenotic IVC and HV (Figure 1A). The lesion was crossed with a 0.014˝ hydrophilic guidewire and a pressure gradient of 25 mm Hg was measured across the stenosis. The patient was then given 5000 units of unfractionated heparin and the lesion was serially dilated with 5 x 40 mm and 8 x 30 mm Aviator Plus angioplasty balloons (Cordis Corporation) (Figure 1B). After dilatation, the gradient reduced but persisted, so it was decided to stent the lesion (Figure 1C). Accordingly, the 0.014˝ wire was exchanged with a 0.035˝ x 260 cm Amplatz wire and the 8 Fr sheath was replaced by a 14 Fr Mullins sheath (Cook Group, Inc). Then, a 5 Fr Judkins right (JR) guiding catheter was taken through the Mullins sheath (parallel to the 0.035˝ guidewire) and placed in the dilated HV (Figure 2A). Through this 5 Fr JR guiding catheter, a 0.025˝ stainless-steel Torayguide guidewire with spring coil (Toray) was placed deep into the dilated hepatic vein and the JR guiding catheter was removed. Next, a 14 x 40 mm stainless-steel Palmaz stent (Johnson & Johnson) was taken and the stiff proximal end of the Torayguide was passed over the 0.035˝ Amplatz wire until the spring coil of the Torayguide was in the HV restricted forward motion of the stent (Figure 2C). Under venographic guidance for the correct location, the stent was deployed at nominal 6 atm (Figure 3A). Following deployment of the stent, its ends were funneled with a 20 x 20 mm peripheral ATLAS balloon (Bard). The stent-balloon assembly was then advanced over the 0.035˝ Amplatz wire until the spring coil of the Torayguide in the HV restricted forward motion of the stent (Figure 2C). Under venographic guidance for the correct location, the stent was deployed at nominal 6 atm (Figure 3A). Following deployment of the stent, its ends were funneled with a 20 x 20 mm peripheral ATLAS balloon (Bard) at nominal 6 atm so as to prevent delayed migration also (Figure 3B). The gradient between right atrium and IVC completely abolished. Finally, the anchor Torayguide was removed and a repeat venogram revealed <10% residual stenosis (Figure 3C). Postoperatively, ascites and abdominal wall collaterals completely regressed by the second postoperative day and the patient was discharged with an international normalized ratio of 2.70 on warfarin.

Discussion

Percutaneous transluminal angioplasty ± stenting has emerged as a definitive alternative to surgery for membranous or short-segment occlusion of HV/IVC with good results. Self-expandable stents (Wallstent, Memotherm) and balloon-expandable stents (Palmaz) have been used successfully to treat patients with symptomatic IVC stenosis or occlusion.1,2 One specific complication that plagues endovascular IVC stenting is stent migration or misplacement that can arise either
perioperatively or even in the late postoperative period. Once misplaced or migrated, there are numerous case reports and series related to the description of techniques utilizing nitinol snare, balloon assistance, or biopsy forceps to retrieve these stents. However, all the retrieval techniques have the potential hazard of causing intimal damage, a dissection, or vessel perforation. One case report describes the use of a percutaneous anchor T-fastener delivery needle during the IVC stenting for BCS; otherwise, there is no other description to prevent periprocedural IVC stent migration. Anchor-wire technique is described for

Figure 1. (A) Inferior vena cava (IVC) angiogram showing focal tight stenosis in the suprahepatic portion with dilated hepatic vein and prestenotic dilated IVC. (B) The lesion crossed with 0.014˝ hydrophilic guidewire and dilated with 5 x 40 mm balloon at high pressure (black arrow). (C) Post balloon dilatation result with residual stenosis (black arrow). The outline of the IVC is highlighted. RA = right atrium; RV = right ventricle.

Figure 2. (A) Demonstrating the first step in hepatic vein anchor wire technique with placement of 5 Fr JR guiding catheter in dilated hepatic vein (broken black arrow) through 14 Fr Mullins sheath (solid black arrow). Note the parallel placed 0.035˝ guidewire (broken white arrow). (B) Illustrating the tailing of balloon-mounted Palmaz stent (white arrow) at its proximal strut with stiff end of Torayguide guidewire (black arrow). (C) The stent-balloon assembly advanced for deployment until the spring coil of the guidewire acting as an anchor (black arrow) in the hepatic vein stopped any forward motion of the stent.
correct aorto-ostial and renal ostial stenting. A recent article also describes the use of anchor-wire technique for pediatric congenital heart disease interventions. However, the technique has never been described to prevent IVC stent migration. Unlike in the coronary arteries, where it is the cardiac motion that tends to interfere with exact placement of the stent, in the stenting at the IVC-right atrium (RA) junction it is the respiratory motion that can cause misplacement. In fact, while the stent delivery system is stationary, the movement of the diaphragm also carries the IVC-RA junction with it. While deploying the stent, it appears easier to instruct the patient to stop breathing for a while and to quickly deploy the stent in the suprahepatic IVC; however, the procedure may take longer than usual due to a bigger balloon used during deployment. Furthermore, an involuntary act like sneezing, coughing, or hiccuping during stent deployment has far more potential to misplace a stent at this location than at any other location. Following stent deployment, its ends were funneled with 20 x 20 mm balloon so as to prevent delayed migration. In this case, the hepatic vein Torayguide guidewire anchor was held throughout the procedure and was pulled only when convincing angiographic and hemodynamic results were seen. We specifically chose the Torayguide because the distal spring coil offered extra support in the hepatic vein, while the proximal stiff 0.025˝ stainless-steel shaft could be tailed easily through the distal stent strut of the Palmaz stent, which has good radial strength. The Torayguide also gave better tactile feedback related to stent movement than any other angioplasty wire. Further endovascular procedures utilizing hepatic vein anchor-wire technique would help in understanding the drawbacks of this technique. Use of this technique while using premounted stent-balloon system, during endovascular management of complex IVC stenosis complicating orthotopic liver transplantation, or for secondary BCS remains to be tested.

**Conclusion**

To the best of our knowledge, this is the first case report describing the use of hepatic vein anchor-wire technique to prevent IVC stent migration. Whether the same can be applied to prevent stent migration during superior vena caval (SVC) stenting for SVC syndrome by placing an anchor in the innominate vein leaves ample space for future testing of this concept.

**References**


