WHAT WOULD YOU DO?

Challenging Cases in Dialysis Access

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CASE 1: SYMPTOMATIC THORACIC CENTRAL VEIN OBSTRUCTION ON THE SAME SIDE AS THE HEMODIALYSIS AVF

Case Presentation

A 60-year-old man with end-stage renal disease has a right brachiocephalic arteriovenous fistula (AVF) and has developed right arm swelling (Figure 1). He is right handed and is disabled due to swelling. His right upper arm circumference is 28 mm greater than his left, and there is no left arm swelling.

His AVF has a blood flow of 1,250 mL/min as measured by Transonic hemodialysis monitor (Transonic) and is still being used for dialysis, although cannulation is reported to be difficult due to swelling.

The swelling has worsened over the past 3 months. He can no longer swim or use his right arm to brush his teeth due to swelling.

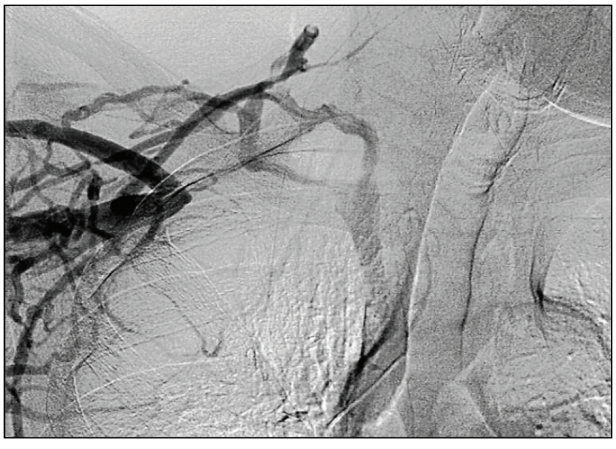

Figure 1

Dr. Dolmatch: What is your first attempt to treat this patient's problem (eg, flow reduction, recanalization with a catheter and Glidewire [Terumo Interventional Systems])?

Dr. Haskal: Given decades of experience and ongoing enhancements of our available tools, my approach has both codified and evolved. With this type of chronic occlusion, the plan would be to cross it and place a stent. As for all the obscure symptoms, such as unilateral or bilateral tinnitus, facial and neck pressure, headaches, and brain fog, without knowing the patient, one can't assess improvement. These symptoms are often overlooked but debilitating aspects of superior vena cava (SVC) syndrome (in the case the occlusions are much more extensive than just the right side). I always photograph the affected limb and the patient's face for the medical records and follow-up assessments.

For the first attempt, I approach from the upper arm using bi- and triaxial systems: a long braided 6-F sheath that will reach the obstruction, an angled 4- to 5-F catheter, and a hydrophilic wire, all manipulated under a roadmap. This can and does work—with patience, persistence, and a little tolerance for being extravascular with the guidewire. For an occlusion this long, I would be unlikely to bother with any sharp tools at this point, whether they are straight or shaped ends of 0.018-inch wires, needles, and so on. If the efforts fail or the time and setting are unsuitable for the next stage, I'll discuss that with the patient and plan for a quick return for stage 2 with a potential overnight stay—the consent is more extensive.

Dr. Hohmann: First, I would look at the left side to fully discuss the options and plan for future access. My first attempt would be to recanalize the occlusion with standard techniques. I would also consider decompressing the outlet with clavicle removal or first rib resection to avoid early recurrence if I was able to cross the occlusion.

Dr. Balamuthusamy: I plan for an access and groin approach in patients with venous hypertension and central venous occlusion. I would approach the stenosis from the fistula and advance to the occlusion at the subclavian vein using a Flexor 7-F sheath (Cook Medical). I would then obtain images from at least two angles to assess the outflow. I would use an angiographic catheter and try to cross the lesion with a 0.035-inch Roadrunner guidewire (Cook Medical). If this fails, I would choose a 4- to 6-g–tip, 0.014-inch guidewire with a Rubicon support catheter (Boston Scientific Corporation) and attempt to cross the lesion. If this strategy fails, I would access the right common femoral vein and advance the sheath to the innominate vein. I would use the same tools to see if I can cross the central vein occlusion. I've had reasonable success in crossing lesions using this technique. Once I cross, I would do serial angioplasties and deploy a balloon-expandable covered stent.

Dr. Dolmatch: The first attempt does not succeed. What would you try next (eg, Hero graft [Merit Medical Systems, Inc.], sharp recanalization with back end of wire or needle)?

Dr. Hohmann: My next step would be to place a Hero graft. The venogram suggests patency of the brachiocephalic vein with a draining vein from the neck. According to the instructions for use, the Hero outflow component should be placed in the internal jugular vein, but we have had success placing it in any vein that drains to the right atrium. In general, if you can get the wire there, you can get the outflow component there.

Dr. Haskal: A second attempt means a reiterated discussion of risks, including major and life-threatening complications related to uncontrolled hemorrhage or injury to adjacent structures. This obstruction might be ≥ 5 cm long. I've shifted from sharp recanalizations (using sheathed 60-cm, 21-gauge Chiba needles) advanced from the arm to the routine use of a radiofrequency wire. This tool has dramatically enhanced my abilities—I've used it for extrahepatic biliary reconstructions, retroperitoneal extravascular venous procedures, and recanalization of long occluded stents. A femoral 70- to 90-cm, 7-F sheath catheter is placed at the apex of the occlusion, potentially lead by a large snare. Under roadmap, these are butted up against the most cephalic aspect of the occlusion—we don't yet understand its nature and extent from the single image. Thereafter, the similar arm catheters are positioned at their respective occlusion, and the C-arm is rotated to best assess the maximal distance between them as well as the best working angles. Importantly, the radiofrequency wire is guided by a directional/deflectable sheath. This essential tool is used to point the wire. Equally important is understanding that the radiofrequency wire is not activated across the entire occlusion but only in tiny brief bursts to allow nonpowered, nonenergized recanalization. The wire will burn through a lot of dangerous structures if blindly activated.

In some cases, I map the aorta and great vessels from a previous CT or magnetic resonance and fuse them in our Siemens workstation onto the fluoroscopic screen so that I can aim to avoid them during these efforts. Once across, the wire is snared and exteriorized through the groin. I will dilate the path with successive small balloons, beginning with 3 mm. I'm looking for atypical pain and sudden changes in heart rate, signs of extravasation, or traversing nontarget organs. When recanalizing long SVC occlusions, I've used transthoracic ultrasound and injected saline or self-made microbubbles through a tract sheath to determine whether I've traversed the pericardium, a potentially lethal complication. The femoral sheath is always butted up against the "tract," ready for instant tamponade with transfemoral balloons—that is, "kissing sheaths" from above and below at all times. After dilation to approximately 10 mm, the tract is measured for length and stents are chosen. The left brachiocephalic vein cannot be jailed by a stent. The choice of a bare or covered stent is the final decision. With these techniques, I've been painstakingly but routinely successful with safe recanalizations of very long, daunting, old occlusions in the chest.

Dr. Balamuthusamy: If the access and groin approach fails, I would opt for sharp recanalization using the back end of the wire; I tend to do this from a groin approach. I prefer to not use the access approach, as it's a high-pressure system. I have also found that engaging the left innominate (contralateral patent innominate) vein and using a C3 catheter pullback technique are useful to engage the fibrous stalk of the occlusion. If these techniques fail, I would recommend flow reduction surgery with ligation of any veins with retrograde flow to the hand. I have not seen much success in patients who have undergone radiofrequency recanalization.

Dr. Dolmatch: The second attempt is not successful. What is your third intervention (eg, Hero graft, ligation after new AVF on the opposite side, radiofrequency wire recanalization)?

Dr. Balamuthusamy: If the venous hypertension persists despite flow reduction, I would recommend ligation of the access and plan for an access in the other side. If the patient has a need for continued use of the other arm for fine motor skills, I would recommend a Hero graft on the same side, but I would first insert a tunneled dialysis catheter and then give time for the swelling to abate before sending the patient for Hero graft surgery.

Dr. Hohmann: An alternative approach if you could not gain wire access from the neck would be an inside-out approach, which would appear to be quite favorable based on the venogram.

Dr. Haskal: I'm counting on success, but if the second attempt efforts fail, then we plan for a contralateral AVF or arteriovenous grafts and ligating or endovascularly occluding the right arm fistula—that's a real disappointment.

CASE 2: JUXTA-ANASTOMOTIC STENOSIS

Case Presentation

A 74-year-old man had a left radiocephalic AVF created in June 2017. Access flow in September 2017 was 480 mL/min. Cannulation was initiated in November 2017. Plain old balloon angioplasty (POBA) was performed in January 2018 and again in March 2018 due to difficulties with cannulation. Access flow was 390 and 410 mL/min on those two visits, respectively, and the rest of the access is well dilated (Figure 2).

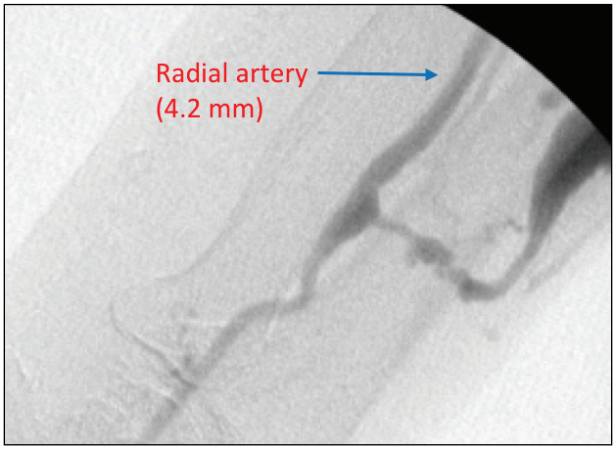

Figure 2

Dr. Balamuthusamy: How would you approach your intervention—radial artery or fistula retrograde approach?

Dr. Hohmann: I would definitely approach this from the radial artery. I find it quite useful in justa-anastomotic stenosis of radiocephalic, brachiocephalic, and brachiobasilic AVFs. The rooms are set up better for this approach, and I believe it also limits radiation exposure.

Dr. Haskal: I have no qualms with the advocates of radial artery approaches for imaging. That said, I'm proud to be the dinosaur. I assess the fistula with detailed sonography to assess the anastomosis and help guide the puncture site and perform all imaging from an intrafistula approach. I do have qualms with some who have suggested that all interventions should be performed from the radial artery approach. Complications have been reported, going back to early arterial articles by Manninen. I don't see any reason to increase the arterial risk by the tiniest degree for convenience in patients with fragile, calcified arteries due to secondary hyperparathyroidism or diabetes. I speak as one who routinely uses radial access for many arterial procedures and has used transjugular approaches to fistulas.

Dr. Balamuthusamy: If POBA was considered, how would you size your balloon?

Dr. Haskal: I'm reminded of the old adage, "A radiologist with a ruler in hand is a dangerous person." I'll start with a smaller and short balloon, dilate under roadmap guidance, and use the "fit" of the balloon (and the results) to choose the next size up if need be. This patient has a long stenosis that seems a bit more prone to adventure. Often, I approach these with a 4- or 5-F retrograde sheath and a 0.018-inch guidewire system, with the guidewire placed retrograde into the proximal brachial artery. Heparin is available if needed.

Dr. Hohmann: The sizing here can be tricky. I like to look at the hood of the anastomosis to determine the minimal diameter I will accept. I would start with 4 mm and then proceed to 6 mm if possible.

Dr. Balamuthusamy: What would be an acceptable outcome for percutaneous intervention?

Dr. Haskal: A lumen that might approach nearly two-thirds of the diameter of the conical aspect of the adjacent mature outflow vein, a suitable result on physical examination, and, in this setting, I prefer to take a second look

at least 5 to 10 minutes later—a good time to take ones' gloves off, sign some electronic orders, and then reglove and recheck for recoil and an adequate result.

Dr. Hohmann: I would like to see < 10% residual stenosis and 12 months free from reintervention. This is a lesion that will likely recur.

Dr. Balamuthusamy: Would you consider using a drug-coated balloon (DCB) or a stent graft?

Dr. Hohmann: A DCB (perhaps after a cutting balloon to ensure full contact with drug) would be a nice approach. I would avoid a stent graft in this area, as it would limit future surgical options. This is just not a good spot for it.

Dr. Haskal: I have a low threshold for a DCB here, so yes, I'll definitely use one. I'm not using stent grafts "around the turn," and it is a radical-appearing and provocative question. There is an article in press and accepted to *Journal of Interventional Radiology* that describes expanded polytetrafluoroethylene stent grafts placed from the proximal artery around the anastomosis into the AVF, jailing the downstream artery. It's a small and provocative series. I'm interested to see whether it'll spur careful study, replication, and/or outrage from readers.

Dr. Balamuthusamy: When would you consider surgical revision?

Dr. Hohmann: If the lesion recurred again in a few months, then I think surgical revision should be the next step. It only requires a small incision and has nice durability.

Dr. Haskal: If I achieve improvement in function as demonstrated by immediate physical examination and evidence of improved dialysis, then I would be encouraged to plan a short-term return for repeated intervention to best ensure durable enlargement of that segment. Surgical revision would be the fallback if angioplasty does not positively progress in a timely manner. Vague plans and weak follow-up translate to prolonged catheter use and a patient's time spent in access limbo. We all must aim higher.

SUMMARY

The lesion was approached from the fistula with a 5-F sheath, crossed with catheter support using a 0.014-inch wire, and angioplasty was performed with a 4- X 40-mm semicompliant balloon and then with a 5- X 40-mm DCB. Postprocedure sonographic flow was 650 mL/min. Follow-up access ultrasound 2 months later demonstrated an access flow of 630 mL/min. No reinterventions were needed for any clinical indications at the 2-month evaluation. I agree with not stenting the lesion. I prefer to continue angioplasty with a DCB if reasonable outcomes can be accomplished to sustain dialysis without requiring more than two reinterventions a year. I reserve arterial cannulations for nonmature, poorly dilated fistulas or if I cannot cross the lesion from the access approach. ■

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