infarction, with a greater degree of infarction resulting in a more durable response (3).

Although complications of UAE for adenomyosis can be similar to those of UAE for leiomyomas, expulsion of diffuse adenomyosis, unlike tumors, is considered uncommon because it is an infiltrative process. In the case described here, the patient had diffuse adenomyosis involving the entire uterus. She reported continued pelvic pain and vaginal discharge despite empiric antibiotic therapy, and, even though there was partial expulsion of a large necrotic soft-tissue mass, follow-up imaging demonstrated residual retained products within the uterine cavity. As a result, dilation and suction curettage under US guidance was performed to remove the remainder of necrotic material from the cavity by suction.

In conclusion, the present case illustrates a rare occurrence of cavitation and successful expulsion of diffuse adenomyosis after UAE. The patient presented with postembolization fever and foul vaginal discharge, with imaging demonstrating necrotic contents in the uterus. The patient was initially treated conservatively with antibiotic therapy, resulting in expulsion of necrotic adenomyosis along with transvaginal evacuation of the necrotic tissue, with resolution of symptoms.

REFERENCES


Endovascular Venous Outflow Redirection in Failing Arteriovenous Hemodialysis Access Using a Combination of Covered and Interwoven Nitinol Stents

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Editor:

Stenosis or occlusion of the venous outflow is a frequent cause of hemodialysis access failure. Here is reported a case of an arteriovenous graft (AVG) with a long outflow occlusion that was treated by redirection of flow to a patent vessel. Various similar percutaneous techniques have been described for outflow redirection (1), but the present report describes a transcollateral approach in which a covered stent reinforced by an interwoven stent was used. Approval from the institutional board review was not required for this report.

A 78-year-old woman with end-stage renal disease secondary to nephroangiosclerosis presented with an acute occlusion of a left brachial artery–medial cubital vein forearm looped access. After successful endovascular pharmacomechanical thrombectomy of the graft, conventional angiography showed a long chronic occlusion of the cephalic vein. The AVG drained through underdeveloped collateral vessels of the antecubital fossa, one of which drained directly into a large and patent basilic vein (Fig 1a,b). After a discussion with the vascular surgeon, considering the advanced age of the patient and the presence of comorbidities, endovascular treatment was chosen. In case of an unsuccessful procedure, a surgical option with the creation of a brachial artery–axillary vein looped access would still be left open.

Under sedation and local anesthesia, through a 6-F sheath inserted into the arterial limb of the graft and oriented toward the venous anastomosis, the small tortuous collateral vein and the basilic vein were catheterized, and 2 self-expandable covered VIABAHN Endoprostheses (6 mm × 50 mm and 7 mm × 50 mm; WL Gore & Associates, Flagstaff, Arizona) were successively deployed from the end of the prosthetic looped graft to the basilic vein with an overlap of 2 cm. The stents were postdilated with a 6-mm × 40-mm noncompliant Conquest balloon (Bard, Tempe, Arizona; Fig 1c), with no residual stenosis, allowing efficient subsequent dialysis. However, 9 days later, the patient presented with complete thrombosis of the surgically placed graft extending into the stents. A radiograph of the AVG demonstrated a kink of the covered stent related to the tortuosity of the collateral vein (Fig 1d). After a second pharmacomechanical thrombectomy and predilation, the covered stents were relined with a 6.5-mm × 80-mm interwoven Supera stent (Abbott Vascular, Santa Clara, California; Fig 2). Final angiographic appearance showed resolution of the kink with the combined endoprosthesis. The patient was prescribed dual antiplatelet therapy with acetylsalicylic acid and
clopidogrel. Doppler ultrasound 12 months after the procedure showed patency of the stents. Blood flow rate was measured at >1,000 mL/min, allowing efficient dialysis, and no further intervention was needed. Although transient discomfort was described by the patient during the collateral vein angioplasty and stent placement, no symptoms were reported afterward.

Redirection of venous outflow to a larger patent vessel via a transcollateral approach allows the maintenance of arteriovenous access functionality without surgical repeat intervention in selected situations in which patency of the failing access is maintained by collateral vessels. Special attention should be paid to prohibit further surgical options in good surgical candidates. After cannulation of the selected collateral vessel, deployment of a covered stent and postdilation allowed the rupture of the collateral vein, enabling subsequent complete expansion of the stent without extravasation of blood. However, because of the

Figure 1. (a) Angiography after pharmacomechanical thrombectomy shows the arterial limb (black arrowhead) and the venous limb (white arrowhead) of the AVG. The cephalic vein shows a long occlusion (black arrow). The AVG remained patent secondary to the presence of a small tortuous collateral vein of the antecubital fossa (white arrow) draining into a large basilic vein. A venous pseudoaneurysm (asterisk) is seen at the venous anastomosis. (b) Angiography of AVG outflow after thrombectomy demonstrates a patent basilic vein (arrowhead) and the absence of opacification of the cephalic vein secondary to occlusion. (c) Completion angiography after covered stents were placed shows a patent outflow of the arteriovenous access through the basilic vein (arrow), with exclusion of the venous pseudoaneurysm. (d) Radiography of the forearm after early reocclusion of the AVG shows a kink in the proximal covered stent (arrow).

Figure 2. Nonsubtracted (a) and subtracted (b) angiography after a second pharmacomechanical thrombectomy and after realignment of the covered stents with an interwoven nitinol stent shows resolution of the kink with the combined endoprosthesis (arrows, a,b).
tortuosity of the collateral path, radial force of the covered stent alone was insufficient to straighten the tract. The kink observed in the covered stent at this region of high mechanical forces might have contributed to the early thrombosis of the graft. A bench test was performed to reproduce the coaxial stent system ex vivo (Fig 3).

The interwoven nitinol Supera stent is an uncovered stent with high radial strength that shows great flexibility and high resistance to fracture compared with standard nitinol stents (2). Although there are no studies directly comparing these 2 stents in a clinical setting, the Supera stent compares favorably with the VIABAHN Endoprosthesis, including in terms of fracture rates, in comparable studies in the femoropopliteal anatomic segment (2). In a recent biomechanical study (3), the Supera stent showed higher radial stiffness than the VIABAHN device when high radial compression was applied. Although all the stents studied, including the VIABAHN, were able to be compressed such that less than 40% of their initial cross-sectional area remained open, the Supera stent was compressed to only 81% of its initial area before the force reached the limit of the test (3). The Supera stent also exhibited higher resistance to torsion than the VIABAHN Endoprosthesis. Thomas et al (4) recently reported promising results with the use of Supera stents to treat juxtaanastomotic stenosis in radiocephalic arteriovenous fistulae. Primary patency rates at 6 and 12 months were 92.5% and 59.8%, respectively, with respective assisted primary patency rates of 97.5% and 92.9% (4). To increase the radial strength of the covered stent alone in the kinked area, an interwoven nitinol stent was deployed inside the VIABAHN device, combining the advantage of both stents and creating a flexible and kink-resistant covered endoprosthesis.

Appropriate size matching between the Supera and VIABAHN devices is challenging. Previous studies (3) have shown that the Supera stent is extremely sensitive to axial elongation, which may significantly reduce radial strength and clinical efficacy of the device. Consequently, special attention should be paid to undersize the Supera device in regard to the VIABAHN device to prevent its elongation. In the case described here, a 6.5-mm Supera stent was deployed in 2 successive VIABAHN devices, one 6 mm and one 7 mm, which is a matching size that could predispose to elongation of the interwoven nitinol inside the smaller VIABAHN device. The bench test shown in Figure 3 shows the combination of a Supera stent with a VIABAHN Endoprosthesis with a 0.5-mm-larger outer diameter. At this matching size, the deployment of the Supera device is

Figure 3. (a,b) Bench test shows a 5 × 150-mm VIABAHN stent bent by bringing together the extremities of the endoprosthesis, producing a kink in the middle of the stent (arrow, a). (c,d) Bench test of a 4.5 × 60-mm Supera stent deployed inside a 5 × 150-mm VIABAHN device. The same applied bending force produced no stenosis. (e,f) Even after increasing the force applied to the middle of the stent by decreasing the radius of curvature, no kink or stenosis was induced in the combined stents.
optimal because the nominal diameter can be reached, given that the VIABAHN stent is fully opened after a proper dilation at a 1:1 ratio compared with the reference vessel before the deployment of the interwoven nitinol stent, and an adequate apposition between stents is achieved.

Endovascular redirection of venous outflow in failing arteriovenous access secondary to long draining vein occlusion is a treatment option to avoid surgical repeat intervention in selected patients. This technique with a transcollateral approach is an alternative to other previously described techniques. The reinforcement of a covered self-expandable stent with an interwoven nitinol stent is feasible and allows a more flexible endoprosthesis. This technique combines the advantages of a covered stent, meaning the complete expansion of the prosthesis without extravasation of blood, with the flexibility and high radial strength of the interwoven nitinol stent, which is important in a high-mechanical-stress area like the elbow joint.

REFERENCES

Repeat Balloon-Occluded Retrograde Transvenous Obliteration for Recurrent Gastric Varices via the Left Inferior Phrenic Vein

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Figure E1 can be found by accessing the online version of this article on www.jvir.org and clicking on the Supplemental Material tab.

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Editor:
Balloon-occluded retrograde transvenous obliteration (BRTO) is an effective treatment for gastric varices (GVs) (1–3). Although the recurrence rate of GVs and variceal bleeding after BRTO is low (1,2), management of recurrent GVs is controversial, and retreatment can be challenging because of the altered hemodynamics of draining pathways from the GVs after a prior BRTO. This case report describes a successful repeat BRTO for recurrent GVs via the inferior phrenic vein (IPV) using a microballoon and a coaxial microcatheter.

A written informed consent for this treatment was obtained from the patient. Institutional review board approval was waived for this case report. A 71-year-old woman with non-B, non-C liver cirrhosis had undergone BRTO via the gastrorenal (GR) shunt 3 years ago. Gastrointestinal endoscopy demonstrated recurrence of GVs. The GVs developed gradually, and contrast-enhanced computed tomography (CT) revealed GVs with no recanalization of the GR shunt and a small-diameter draining pathway of the left IPV from the GVs to the inferior vena cava (Fig 1a, b). The left IPV existed as a fine drainage route from the GVs in the first BRTO and had developed according to GV recurrence.

A 4-F shepherd hook catheter was advanced into the splenic artery to perform transarterial splenoportography for hemodynamic and anatomic evaluation of the GVs (Fig E1 [available online on the article’s Supplemental Material page at www.jvir.org]). Next, a 5-F sheath (Super Arrow-Flex sheath; Teleflex Inc., Wayne, Pennsylvania) was inserted via the right femoral vein. A 5-F guiding catheter (Abguide; Medikit Co., Ltd., Tokyo, Japan) was inserted into the left IPV. However, because of the small diameter of the proximal left IPV, the guiding catheter could not be advanced any farther. A 2.8-F microballoon catheter with 0.027-inch inner diameter (Pinnacle Blue 27; Tokai Medical Products, Inc., Aichi, Japan) and a 0.014-inch micro–guide wire (CHIKAI V; Asahi Intecc Co., Ltd., Aichi, Japan) were advanced into the transverse part of the IPV. CO2 balloon-occluded retrograde transvenous venography (BRTV) was performed via a manual injection of 10 mL CO2. This partially demonstrated the GVs, even though the GVs were not visualized by BRTV with iodine contrast medium; only branches of the IPV were visualized. After coil embolization of the branches, including the pericardial vein, collateral drainage veins still remained. Therefore, the microballoon system comprising the microballoon catheter and a coaxial 1.9-F nontapered microcatheter (Carnelian Marvel NT; Tokai Medical Products, Inc.) was advanced into the ascending part of the IPV using the microballoon as an anchor (Fig 2) to perform selective BRTO.

CO2 BRTV from the ascending part of the IPV allowed good visualization from the GVs to the portal vein (Fig 3), which could not be visualized using iodine contrast medium because of the dorsal draining collateral veins. As foam sclerosant has a similar distribution to CO2 (4), BRTO was performed using sclerosing foam, which was prepared by mixing 2 mL of 3% polidocanol (Polidocasklerol; Zeria Pharmaceutical Co., Ltd., Tokyo, Japan) and 6 mL of air.