Endovascular treatment of a large iatrogenic popliteal arteriovenous fistula

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ABSTRACT
A 40-year-old man presented with years of progressive leg swelling and venous varicosities. Lower limb computed tomography angiography and subsequent digital subtraction angiography demonstrated a large popliteal arteriovenous fistula (AVF). This was treated successfully by endovascular technique with a Viabahn stent (W. L. Gore & Associates, Flagstaff, Ariz) in the popliteal artery to exclude the AVF. AVFs of this size and chronicity are rare, and this case demonstrates a successful endovascular method of treatment. (J Vasc Surg Cases and Innovative Techniques 2020;6:129-32.)

Keywords: Arteriovenous fistula; Popliteal stent; Iatrogenic vascular injury

An arteriovenous fistula (AVF) is an abnormal communication between an artery and a vein, resulting in pressurization of the venous circulation and increases in size and flow of both vessel systems. AVFs have an important therapeutic use in hemodialysis access but can also be pathologic. Here we present the case of an uncommonly large and chronic AVF in the popliteal fossa, probably secondary to previous knee surgery. Written consent has been given by the patient for publication of this case report.

CASE REPORT
A 40-year-old man presented with many years of progressive left lower limb swelling and heaviness with associated venous varicosities. His only significant medical background was that of open left knee surgery approximately 20 years earlier for a ligamentous injury. The exact orthopedic operative intervention at the time is uncertain. Clinical lower limb vascular examination demonstrated easily palpable left lower limb pulses with bruits and thrills in the popliteal fossa and overlying the dorsalis pedis and posterior tibialis pulses. On the left, the thigh was 2 to 3 cm larger and the calf 4 to 6 cm larger (Fig 1).

Subsequent lower limb computed tomography angiography demonstrated features consistent with a large popliteal AVF (Fig 2). There was arterial and venous dilatation. The superficial femoral artery measured up to 15 mm and the popliteal vein 22 mm (compared with 11 mm on the contralateral side). There were associated large varicosities as a consequence of the likely chronic nature of the fistula. The origin of the fistula was presumed to be secondary to the previous operative trauma.

Digital subtraction angiography confirmed a large AVF between the popliteal artery and vein (Fig 3; Video 1). An antegrade puncture of the left common femoral artery was performed, and a 5F diagnostic catheter was advanced into the proximal popliteal artery. Multiple angiographic runs in multiple projections were performed to localize the site of fistulization. Because of the large amount of flow into the venous system through the fistula, runoff imaging was possible only when a 5F over-the-wire Fogarty catheter was used to exclude flow through the AVF (Fig 4; Video 2).

The patient was returned to the operating room at a later date after the decision was made to proceed with endovascular repair. Antegrade access with an 8F sheath was established after preclosure with a single Perclose ProGlide (Abbott Vascular, Santa Clara, Calif). The native popliteal artery measured 6.6 mm above and 6.5 mm below the fistulous connection on digital subtraction angiography calibrated to a measuring caliper. After the administration of 5000 units of intravenous heparin, an 8 × 50-mm Viabahn covered stent (W. L. Gore & Associates, Flagstaff, Ariz) was used to exclude the AVF (Fig 5). The patient was commenced on clopidogrel for stent patency and a limited period of therapeutic anticoagulation with warfarin postoperatively to prevent deep venous thrombosis in light of the physiologically significant reduction of flow in the deep veins after exclusion of the fistula.

There were no perioperative complications, and at 1 month, the patient reported significant reduction in left leg size and congestive symptoms although the ipsilateral calf remained 2 to 3 cm larger in circumference. Surveillance ultrasound and ankle-brachial indices were performed to monitor stent patency at 1 month and 3 months postoperatively and then every 6 months thereafter. At 18 months after operation, the stent remained patent and the AVF excluded (Fig 6). The superficial femoral artery remains dilated at up to 15 mm in diameter. Warfarin was discontinued at 9 months after operation, and the patient was continued on indefinite dual antiplatelet therapy.
DISCUSSION

AVFs of the lower extremity are uncommon, particularly of the size and chronicity reported here. Causes are primarily traumatic or iatrogenic, but spontaneous cases due to aneurysmal dilation from Marfan disease, human immunodeficiency virus arteritis, and unknown causes have also been reported. Complications without repair may include symptoms of venous congestion with subsequent venous ulceration, venous thromboembolism, arterial steal, and high-output cardiac failure.

Surgical options include open surgical repair, endovascular repair, and a combination of open surgery and endovascular techniques. It was the authors’ opinion to undertake endovascular repair because of the large and multiple arterialized varicosities in the popliteal fossa. Endovascular options include covered stent, coil embolization, and insertion of vascular plugs. It was the authors’ preferred option to proceed to covered stent alone because of the anatomic configuration in this case.

Long-term outcomes of open vs endovascular repair can only be extrapolated from popliteal aneurysm studies. A meta-analysis of 4880 cases from 14 mostly observational studies showed improved primary patency for open repair (88.3% vs 71.2% at 1 year, 79.4% vs 68.2% at 3 years), but there were no differences for secondary patency rates (92.3% vs 86.3% at 1 year, 86.6% vs 80% at 3 years). Endovascular repair had fewer wound complications and shorter length of hospital stay.

CONCLUSIONS

Open repair was considered in this case, but the scarring from previous surgery and numerous dilated and pressurized venous varicosities would have significantly complicated the dissection and increased the bleeding risk. Now that the fistula has been excluded by stenting and the venous system is depressurized, open bypass remains a feasible and safer option in the event of stent occlusion.
Fig 3. Digital subtraction angiography of popliteal artery showing large arteriovenous fistula (AVF) and flow into popliteal vein.

Fig 4. Digital subtraction angiography of the below-knee runoff vessels with temporary occlusion of flow through the arteriovenous fistula (AVF) using a Fogarty balloon.

Fig 5. Digital subtraction angiography after stenting showing exclusion of the arteriovenous fistula (AVF) in anteroposterior (A) and lateral (B) views.

Fig 6. Postoperative ultrasound surveillance images of the mid-superficial femoral artery and the popliteal artery stent. The waveform in both is high resistance and triphasic, suggesting exclusion of the fistula and patency of the stent.
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