A case of external iliac arteriovenous fistula and high-output cardiac failure after endovenous laser treatment of great saphenous vein

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Valvular incompetence in the great saphenous vein (GSV) is the most common cause of superficial venous insufficiency and symptomatic varicose vein development. Recently, less invasive modalities such as foam sclerotherapy, radiofrequency ablation (RFA), and endovenous laser treatment (EVLT) have gained popularity in the treatment of saphenofemoral junction and saphenous truncal incompetence over the traditional approach of surgical ligation and stripping. Here, we present the case of a 32-year-old woman who underwent EVLT and was diagnosed subsequently with ipsilateral external iliac arteriovenous (AV) fistula and high-output cardiac failure. She was stabilized medically and treated surgically with a covered stent placed in the external iliac artery with complete resolution of the fistula and cardiac failure. We reviewed the literature and discuss the complications of AV fistulae after EVLT. (J Vasc Surg 2010;51:715-9.)

CASE REPORT

A 32-year-old woman without a significant medical history presented to her local emergency department with the primary complaint of severe left leg swelling, shortness of breath, and mild abdominal distension, which had been worsening over a 3-week period after a left great saphenous vein (GSV) endovenous laser treatment (EVLT) at an outside facility. On physical examination, she was found to have a mild tachycardia with a systolic cardiac murmur and decreased breath sounds at the right lung base. Significant left leg edema was additionally noted with palpable pedal pulses. On further examination, a coarse systolic-diastolic bruit was heard at the left groin. A computerized tomography scan of the abdomen and pelvis was performed which demonstrated an arteriovenous (AV) fistula at the level of the left external iliac artery and vein (Fig 1, A, C) as well as a distal fistulous connection in the left groin (Fig 1, D). In addition, findings of hepatomegaly with a heterogeneous “nutmeg” appearance, right pleural effusion, an enlarged inferior vena-cava, and ascites were present, consistent with high-output cardiac failure (Fig 1, A, B). The patient was transferred to our tertiary care center for further evaluation and treatment. Bilateral lower extremity venous duplex scan studies were performed on transfer and showed no evidence of deep venous thrombosis (DVT).

Once the patient was found to be hemodynamically stable, she was taken to the operating room for a definitive repair. Arterial tracings obtained prior to incision displayed a classic pulsus bisferiens pattern (Fig 2, C) consistent with the known high-output cardiac state. We made a vertical incision in the left groin overlying an area of the palpable thrill. We occluded the common femoral artery proximally and determined that the thrill persisted in the common femoral vein confirming the additional proximal AV connection at the external iliac artery and vein. After intravenous administration of heparin, we separated the common femoral artery and vein demonstrating a small fistula, which we repaired primarily. We then placed a 4F sheath in the common femoral artery and performed a diagnostic angiogram of the left iliac and common femoral arteries which demonstrated the AV fistula at the distal portion of the external iliac artery at or just above the inguinal ligament (Fig 2, A). We believed an open repair would involve an extensive dissection with mobilization of the inguinal ligament resulting in significant morbidity to the patient. Therefore, we decided to proceed with obliteration of the fistula with a flexible covered stent (Viabahn; W.L. Gore Co, Flagstaff, Ariz). We measured the diameters of the external iliac artery proximal and distal to the fistula to be approximately 10.5 mm and 9.5 mm, respectively. We deployed two Viabahn stents (11 mm by 5 cm and 10 mm by 5 mm) just above the inguinal ligament with an overlap of 2 cm effectively obliterating the AV fistula, which had an opening of 10 to 15 mm. The overlapping areas were dilated with 9-mm and 10-mm balloons resulting in a widely patent external iliac artery with no evidence of a fistula (Fig 2, B). Repeat assessment of arterial tracings revealed a restoration to a normal waveform with single anacrotic rise and dicrotic notch (Fig 2, D).

The patient tolerated the procedure well and was subsequently transferred to the floor whereupon she experienced immediate improvement of all preoperative symptoms. After 1 month, a repeat computed tomography scan of the abdomen and pelvis confirmed obliteration of AV fistulae (Fig 3, B-D) with interval resolution of the previously noted hepatic congestion, right pleural effusion, and ascites (Fig 3, A). The patient has remained asymptomatic in the subsequent follow-up visits.

DISCUSSION

The GSV is the major vein of the superficial venous system, and reflux within this vessel is the most common
Fig 1. Abdominal and pelvic computed tomography scan. A, Axial scan of the abdomen demonstrating significant hepatomegaly, ascites, and inferior vena cava dilatation. B, The arterial-phase demonstrates early venous opacification indicating arteriovenous (AV) communication at the level of the external iliac artery and vein. C and D, Distal venous opacification on arterial phase consistent with AV fistula at the level of the common femoral vein and artery.

Fig 2. A, Angiogram with identification of arteriovenous (AV) fistula at level of external iliac artery and vein. B, Arterial tracing demonstrating a characteristic double-peaking during the systolic phase or pulsus bisferiens seen commonly in patients with aortic insufficiency, hypertrophic cardiomyopathy, and high-output cardiac failure. C, Angiogram performed following obliteration of fistula with deployment of Viabahn stents. D, Arterial tracing following obliteration of the AV fistulae resulting in a normal waveform.
abnormality in the majority of cases of superficial venous insufficiency with symptomatic varicose vein development. The prevalence of symptomatic varicosities can be as high as 15% of men and 25% of women in the general population.1-3 Novel and less invasive approaches have recently been applied in the treatment of saphenofemoral junction (SFJ) and saphenous truncal incompetence, which attempt to improve on the traditional approach of surgical ligation and stripping. The EVLT, first approved by the US Food and Drug Administration in 2002, represents one such less invasive option in the treatment of GSV reflux, with comparable or lower recurrence rates in comparison to the more invasive ligation and stripping procedures.3,4 The procedure involves introduction of an intraluminal sheath catheter under ultrasound scan-guidance into the GSV above the knee utilizing the Seldinger technique with advancement to a location, ideally several millimeters distal to the junction of the GSV and inferior epigastric vein, in close proximity to the SFJ. Many practitioners believe that by maintaining an initial sheath position distal to the inferior epigastric vein prior to ablation, flow is preserved within the SFJ, thus reducing the incidence of thrombus extension into the common femoral vein.1 Furthermore, the bare-tipped laser fiber must be located by ultrasound scan to be distal to the inferior epigastric vein before advancing through the sheath with retraction of the sheath to expose the fiber tip within the vein lumen. Laser sources which fall within the hemoglobin-absorbing wavelengths of 810 nm, 940 nm, and 980 nm, or the water/collagen-absorbing wavelengths of 1054 nm and 1320 nm are utilized to produce short energy bursts with intravascular blood evenly distributing thermal damage to the endothelial and subendothelial layers.3,5-7

While thermal exposure in EVLT does result in diminution of vein diameters secondary to fibrosis and remodeling of the vessel wall,2,8 the primary mechanism of GSV occlusion is through the formation of thrombus.3 This technique differs from radiofrequency ablation (RFA), which has been suggested to cause a more significant intimal injury and denaturation of mural tissues in addition to a smaller degree of thrombus formation and resorption.9,10 During EVLT, the application of tumescent anesthesia increases treatment efficacy both by reducing vein diameters while protecting the surrounding tissues and overlying epidermis from thermal damage.3 Collateral damage is reduced through the application of a pulsed laser that delivers 12-14 watts of power and is continuously withdrawn at a pullback rate of 1 cm/5 seconds. This method delivers 60-70 J/cm to the vessel lumen, resulting in complete occlusion while minimizing injury to surrounding tissues. Of note, intermittent or delayed pullback techniques have been shown to increase collateral tissue damage with greater likelihood of nerve injury, cutaneous burns, and creation of AV fistulae in association with surrounding arterial branches.11

With the exception of mild limb discomfort, bruising, and/or palpable induration at the treatment site, very few complications have been reported as the result of EVLT.

**Fig 3.** A, Computed tomography scan of abdomen showing resolution of hepatomegaly, ascites, and dilatation of inferior vena cava. B-D, Computed tomography scan confirming resolution of AV fistulae with arterial dilatation evident at level of covered stents.
when tumescent anesthesia is utilized.\textsuperscript{3} Risk of postprocedure DVT in a number of reported studies defined as a tail of thrombus extending into the femoral vein varies from 0\% to 7.7\% with higher rates observed in studies in which patients underwent general or spinal anesthesia.\textsuperscript{1,12} A rarer complication with two documented cases in the literature is the development of an AV fistula after EVLT, both involving the less saphenous vein (LSV).\textsuperscript{11,13} In these cases, the fistulae remained largely asymptomatic from a systemic standpoint with 1 patient experiencing only localized tightness and discomfort at the popliteal fossa and the second patient describing a sensation of lower extremity “heaviness.” The fistulae identified were between the LSV and the superficial sural artery in the first patient and between the genicular branches of the popliteal artery and vein in the second patient. The fistula in the first patient was treated successfully with coil embolization and the second patient with proximal and distal arterial ligation. Neither patient experienced additional complications. The authors postulated several causes for AV fistula formation including slow and unsafe pullback rates, vessel injury during injection of tumescent anesthesia, or vessel perforation during advancement of a stiff laser fiber.\textsuperscript{11,13}

To our best knowledge, we are the first to report a case of external iliac AV fistula development and resulting high-output cardiac failure after EVLT. Fistula creation in this instance may be attributed to a number of possibilities, with the most likely cause due to perforation of the iliac and femoral veins by a stiff guidewire or sheath and/or laser fiber advanced proximal to the SFJ. We believe that the critical step of locating the fiber tip distal to the inferior epigastric vein may have been compromised in this patient and that the tip was most likely in the external iliac vein when the treatment began. In addition, vessel injury and collateral tissue damage could result in an AV fistula formation if slow and unsafe pullback rate is utilized, which may have occurred in this patient in conjunction with a poorly placed laser fiber. Therefore, in rare patients presenting with the signs and symptoms of high-output cardiac failure after venous ablation, physical examination and appropriate radiologic studies should be obtained to rule out iatrogenic AV fistula formation. Once the diagnosis of a fistula is made, rapid resolution of left ventricular dilatation and underlying cardiac dysfunction should follow a repair in the operating room.

Finally, the application of endovascular therapies in patients presenting with traumatic vascular injury has become more common over the past decade. With the first endovascular case recorded in the National Trauma Database (NTDB) in 1997, a fourfold increase was observed in the interval between 2000 and 2003.\textsuperscript{14} The application of stenting techniques to treat less severe injuries in the hemodynamically stable patient has been demonstrated to achieve shorter lengths of stay with improved survival.\textsuperscript{14,15} The advantages of covered stents include diagnostic and therapeutic interventions in the same setting and access to difficult anatomic locations in which proximal and distal control in an open fashion would be problematic, as was the case in this patient. The disadvantages include stent fracture/occlusion and inability to determine concomitant venous and nerve injury. However, we\textsuperscript{16} and others\textsuperscript{17-20} have recently reported results comparable to open repair with the more flexible covered stent — Viabahn (also known as Hemobahn) graft — in the treatment of popliteal artery aneurysms. While we did use Viabahn grafts in this patient placing them above the inguinal ligament, we believe that extension of any stent or covered stent into the common femoral artery should be avoided especially in young patients.

**AUTHOR CONTRIBUTIONS**

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**REFERENCES**


