Successful Treatment of a Chronic Venous Ulcer Caused by an Undiagnosed Arteriovenous Fistula

A Case Report

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Abstract: This case report presents a 53-year-old male patient with a chronic venous ulcer (CVU) on his left lower limb that persisted for over 10 years despite various treatments. The patient had a history of a gunshot wound to the left femoral area 12 years prior. Despite regular follow-ups and multiple interventions, including debridement and split-thickness skin grafting, the ulcer showed poor healing. Further diagnostic imaging, including angiography and computed tomography, revealed an previously undiagnosed arteriovenous fistula (AVF) at the left external iliac artery and femoral artery level. The patient underwent a minimally invasive endovascular intervention involving percutaneous transluminal angioplasty and stent graft placement. This approach successfully closed the AVF, significantly reducing venous hypertension and promoting wound healing. One month after operation, the CVU showed complete healing without recurrence. This case underscores the importance of considering AVFs in the differential diagnosis of CVUs, especially in patients with a history of trauma or surgery. It also highlights the effectiveness of endovascular techniques in treating complex vascular anomalies and their associated complications.

Key Words: arteriovenous fistula, chronic venous ulcer, posttraumatic vascular injury, endovascular stent graft, venous hypertension, lower extremity wound healing

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Chronic venous ulcers (CVUs) are a serious complication of chronic venous illness, characterized by persistent venous hypertension that causes nonhealing ulcers in the lower limbs. These ulcers are the result of complicated pathophysiological mechanisms that include venous reflux, inflammation, and microcirculation alterations.[1,2] Compression therapy,[3] refined wound care, and surgeries[4] are the primary management strategies. Greater saphenous reflux is typically treated with minimally invasive methods such as radiofrequency ablation and endovenous laser ablation, which close the vein through heat, and foam sclerotherapy, which collapses the vein using a sclerosant; these methods are preferred over traditional surgery due to their high efficacy, low complication rates, and shorter recovery times[5,6]; ambulatory phlebectomy may be used alongside these treatments to remove visible varicose veins, enhancing patient outcomes.[5,6] However, high recurrence rates of CVUs with significant impacts on quality of life make the management a remarkable clinical challenge.[7,8]

However, some pelvic disorders, such as pelvic vein thrombosis,[9] iliac vein obstruction and/or inferior vena cava,[10] or external constriction of the iliac vein by a uterine myoma,[11] can cause venous ulcers in the leg due to interruption of blood flow. We present a rare case of artery-venous fistula (AVF) of the left external iliac artery following trauma, with significant hemodynamic alterations and nonhealed chronic venous insufficiency. The wound has healed following percutaneous transluminal angioplasty with stent implantation. This case study emphasizes the need of identifying and treating AVF in CVU patients.

CASE PRESENTATION

A 53-year-old male patient with a history of hypertension, infective endocarditis, atrial fibrillation, and severe tricuspid regurgitation presented with a CVU on his left lower limb. The ulcer had persisted for more than 10 years, despite various treatments. The left lower pretibial ulcer was characterized by thickened, leathery skin with scaling and mottled hyperpigmentation around the ankle and lower calf. The ulcer bed appears to have areas of granulation tissue interspersed with yellowish slough (Fig. 1). The surrounding skin shows signs of chronic venous hypertension, including hyperpigmentation, lipodermatosclerosis, and scaling. The edges of the ulcer are raised and irregular, indicative of the chronic nature of the wound.

Reviewing the patient's medical history, he had sustained a gunshot wound to the left femoral area, which resulted in a disruption of the left femoral artery that was repaired 12 years before his initial presentation at our cardiovascular surgery clinic in April 2003. The initial examination detected a bruit and thrill over the inguinal ligament area. An artery Doppler revealed common femoral artery stenosis, prompting the recommendation for regular follow-up. However, we lost track of him until March 2004, when he presented with left lower extremity swelling and received a diagnosis of deep vein thrombosis (DVT). He was prescribed warfarin and had regular follow-ups at our cardiovascular clinic for DVT and atrial fibrillation, but the left lower leg edema persisted. He then continued to follow up regularly at our cardiovascular clinics.

In 2021, 17 years after the initial presentation, the patient visited our plastic clinic with a small left lower pretibial wound that had been present for 5 months, along with varicose veins. Despite various wound dressing methods, compression bandages, and oral antibiotics, the pretibial wound progressed to a larger ulcer with moderate serous discharge. A duplex ultrasound showed a DVT in the left leg, and venography revealed a decrease in the deep vein flow and the left iliac vein in the lower left limb, along with a lot of superficial vein drainage and

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FIGURE 1. Persistent left pretibial chronic venous ulcer.

collateral formation. Pelvic computed tomography (CT) showed no opacification of the left popliteal and superficial femoral veins, consistent with DVT. The patient underwent surgeries that included debridement and split-thickness skin graft (STSG) on the left lower leg wounds, in addition to anticoagulant use. However, although the STSG had taken well after the operation, a recurrent pretibial venous ulcer progressed months later with poor healing and increasing in size of the months. Then the patient lost follow-up in our clinic.

In January 2024, the patient visited our plastic clinic for treatment of the persistent left pretibial CVU. The patient underwent left saphenous vein endovascular laser ablation to treat the venous reflux, which was identified by the Doppler. Despite a decrease in fluid discharge from the wound bed, the wound is still unable to heal. In April, an angiography showed early opacification of engorged and dilated pelvic veins, which pointed to an AVF at the level of the left external iliac artery (Fig. 2). The contrast medium can be seen flowing from the arterial system directly into the venous system at an abnormal location, indicating the presence of an AVF. The image also shows the tortuosity and increased diameter of the affected veins, further supporting the diagnosis of chronic venous hypertension secondary to the AVF. Further abdominal CT angiography (CTA) confirmed the presence and location of the AVF at the left external iliac artery/femoral artery level, with the affected vessels appearing dilated and show early contrast enhancement (Figs. 3). The patient then underwent percutaneous transluminal angioplasty, and placement of a stent graft between the left external iliac artery and the common femoral artery was done to bypass the fistula. Contrast medium can be seen flowing through the stent graft, confirming its patency and the successful exclusion of the AVF (Fig. 4). One month after operation, the wound became drier and healed quickly without discharge. The wound bed appears to be completely epithelialized, with no visible areas of granulation tissue or slough. The surrounding skin shows significant reduction in edema and inflammation. While some residual hyperpigmentation is still visible, the overall appearance of the leg is markedly improved (Fig. 5).

DISCUSSION

AVF is a rare but significant vascular anomaly that can arise from congenital factors, trauma, or surgical procedures. These fistulas result in abnormal connections between the artery and vein, leading to substantial hemodynamic changes such as venous hypertension and chronic venous insufficiency. The formation of an AVF disrupts normal hemodynamics by allowing high-pressure arterial blood to flow directly into the low-pressure venous system. This shunting increases venous pressure and volume, causing venous hypertension and congestion. The resultant venous hypertension leads to venous dilation, valvular incompetence, and chronic venous insufficiency. These changes impair microcirculation and tissue oxygenation, promoting the development of chronic ulcers.[12,13] Blood diversion from its normal arterial route through the AVF, known as the "steal phenomenon," exacerbates distal ischemia and ulcer formation.[14] One of the severe complications

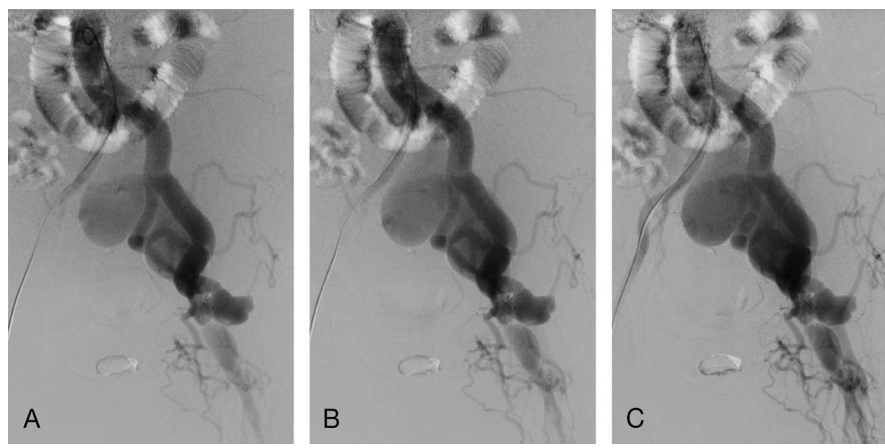

FIGURE 2. An angiography reveals the early opacification of engorged pelvic veins, a sign of an AVF. The contrast medium flows from the arterial system directly into the venous system at an abnormal location, as shown in the consecutive views from A to C of this figure.

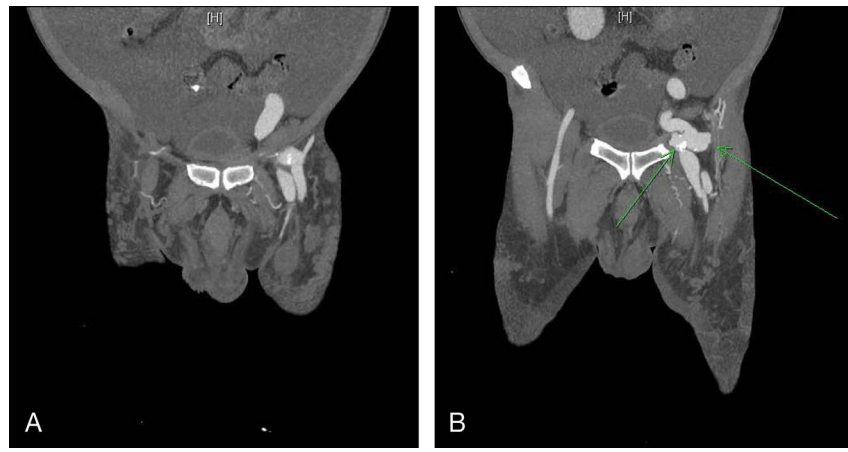

FIGURE 3. Abdominal CT angiography confirms the AVF at the left external iliac artery/femoral artery level. A, The cross-sectional image of the lower abdomen and pelvic region provides detailed anatomical information about the AVF. B, An abnormal communication (green arrow lines) between the left external iliac artery and the adjacent vein was found, with the affected vessels appearing dilated and showing early contrast enhancement.

associated with unrecognized or untreated AVF is the development of CVUs.[12,15–18]

While CVUs caused by AVFs are relatively uncommon, several noteworthy cases in medical literature highlight their diverse origins and presentations. AVFs can arise from penetrating injuries like gunshot or stab wounds, or iatrogenic procedures.[14,19,20] A venous ulcer on the hand resulted from iatrogenic AVFs secondary to a brachio-basilic AVF for hemodialysis.[18] Rerkasem et al[15] reported a 35-year-old man with a stab wound near the medial malleolus 20 years ago who had recurrent foot ulcers. Angiography revealed a fistula between the left posterior tibial artery and vein. Ligation of the artery led to ulcer healing. Similarly, Suknaic et al[19] described a 29-year-old male patient with an gunshot injury to the thigh 18 years ago. He developed a chronic ulcer, and angiography showed a large AVF between the superficial femoral artery and vein. Surgical repair with a saphenous vein graft healed the ulcer within a month. Rasool et al[18] reported a 52-year-old female undergoing hemodialysis with a weeping hand ulcer. CTA revealed an AVF causing venous hypertension. Transvenous embolization healed the ulcer in one month. Additionally, Rabellino et al[12] described a 56-year-old male patient with a tibial fracture 34 years ago who developed a leg ulcer due to an AVF between the posterior tibial artery and vein. Endovascular stent-graft treatment led to total healing in 3 months. These cases highlight the need to consider AVFs in diagnosing CVU, especially when the patient had a trauma history, and the importance of treating AVFs to promote healing.

Diagnosing AVFs involves clinical evaluation and imaging techniques. The clinical presentation of AVF-induced ulcers includes persistent pain, swelling, and ulceration in the affected area, often following trauma or surgery.[18] Physical examination may reveal palpable thrills, continuous murmurs, and visible pulsations at the AVF site, along with signs of venous hypertension such as dilated veins, stasis dermatitis, and lipodermatosclerosis.[2,21] Additionally, the Nicoladoni-Branham sign may also be observed, which involves a heart rate decrease upon manual compression of the AVF.[14] The comprehensive diagnostic workup may include a Doppler ultrasound, pelvic CT, angiography, or CTA of the lower extremities to provide comprehensive visualization of vascular structures. Doppler ultrasonography is a noninvasive first-line tool to detect abnormal blood flow indicative of an AVF. However,

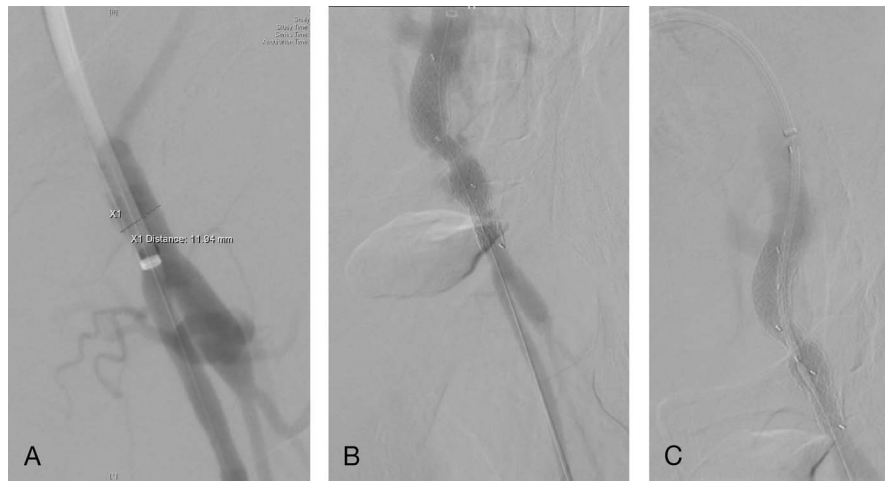

FIGURE 4. Percutaneous transluminal angioplasty and stent graft placement. A, The guide wire and catheter used during the procedure are shown. B, The stent graft appears as a tubular, radio-opaque structure within the vessel lumen. C, The image shows a stent graft in place, bridging the abnormal communication between the left external iliac artery and the adjacent vein, with contrast medium seen flowing through the stent graft, confirming its patency and the successful exclusion of the AVF.

FIGURE 5. Complete healing of the wound at 1 month after the operation.

detailed imaging is often necessary for precise localization and treatment planning. Furthermore, triggered noncontrast-enhanced magnetic resonance angiography (TRANCE-MRI) has proven valuable with high accuracy, especially for patients with renal insufficiency.[22]

The primary treatment goal for AVF-induced chronic ulcers is to alleviate venous hypertension by closing the abnormal vascular connection. Surgical repair is well-established, involving direct closure of the fistula and vessel reconstruction. A study found that a venous ulcer healed successfully after open surgery to fix a femoral AVF. The ulcer was fully healed in 1 month, and there was no sign of it coming back after a year.[14] Endovascular techniques have recently come up with minimally invasive options like stent-graft placement and embolization. These are especially helpful for people who are high-risk for surgery or who have complex fistulas. Rabellino et al[12] described a successful endovascular repair using a stent-graft, which led to complete ulcer healing and maintained vessel patency. Similarly, Rasool et al[18] reported the successful use of transvenous embolization to treat a venous ulcer secondary to a hemodialysis AVF, resulting in complete ulcer healing within 4 weeks. This presented case aligns with the aforementioned studies, achieving complete healing of the CVU after endovascular stent placement.

This case underscores the complexity of managing CVUs,[23] especially the necessity to identify any underlying vascular anomalies such as AVF. The patient's prolonged venous ulceration, despite standard wound care and multiple surgeries, highlights the need for thorough diagnostic evaluation and early consideration of undiagnosed AVF, particularly with a history of trauma or surgery. Seeing that the diagnosis of an existed AVF may not be difficult with the advent of various imaging modality, the identification and treatment of the AVF were crucial for achieving wound healing.

CONCLUSIONS

This case report highlights the critical importance of considering AVFs in the differential diagnosis of CVUs, particularly in patients with a history of trauma or vascular procedures. The successful treatment of a long-standing CVU through the diagnosis and endovascular repair of an underlying AVF underscores the need for thorough vascular evaluation in recalcitrant cases. This case also emphasizes the value of imaging and minimally invasive endovascular interventions in managing the patients with challenging CVUs.

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