Vascular and Endovascular Surgery
2022, Vol. 0(0) 1–4

DOI: 10.1177/15385744221077557
journals.sagepub.com/home/ves
SAGE

Endovascular Repair of a Spontaneous Popliteal Arteriovenous Fistula Associated With a Venous Aneurysm

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Abstract

Popliteal arteriovenous fistulae (PAF) are anomalous communications between the arterial and venous systems of the lower extremity. They are usually secondary to trauma and are rarely associated with additional vascular defects. The coexistence of a PAF and a venous aneurysm is rare and usually occurs in patients with connective tissue disorders. Evidence regarding the management of this type of anomaly is scarce. However, both open and endovascular approaches seem feasible alternatives for treating this condition. Here, we describe a spontaneous popliteal arteriovenous fistula associated with a venous aneurysm in a 42-year-old male patient who presented with a popliteal mass. Satisfactory endovascular closure of the fistula and exclusion of the venous aneurysm were achieved using an Amplatzer™ Vascular Plug II.

Keywords

venous aneurysm, spontaneous arteriovenous fistula, endovascular management, popliteal vessels

Introduction

Popliteal arteriovenous fistulae (PAF) are anomalous communications between the arterial and venous systems of the lower extremity. Acquired fistulae are the most frequent, usually secondary to direct trauma to the knee caused by firearms injuries, stab wounds, or surgical procedures. On the other hand, spontaneous PAF are extremely rare, with only a few cases reported.[1-3]

Venous aneurysms are relatively uncommon and usually have an indolent course. However, due to the disturbance of normal blood flow, popliteal venous aneurysms can lead to potentially life-threatening conditions, including recurrent pulmonary embolisms.

The association between PAF and a venous aneurysm is infrequent, and the few reported cases have been described after trauma or in patients with concomitant connective tissue abnormalities such as Marfan syndrome.[4]

Prompt diagnosis and treatment of PAF are important to reduce the risk of deep vein thrombosis, post-thrombotic syndrome, distal embolization, limb loss, and pulmonary embolism, especially if in association with a venous aneurysm.[4,5]

Here, we report the case of a spontaneous arteriovenous fistula associated with a venous aneurysm in a patient without previous history of trauma or connective tissue disorders. We will discuss its etiologies and the evidence regarding endovascular management for this condition.

Case Report

A 42-year-old male presented to the outpatient clinic with a 1-month history of a right popliteal bulge and mild exercise-induced pain. The patient began an unsupervised, high-intensity exercise routine 3 years before this consultation. Otherwise, medical history was noncontributory. Physical examination

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Figure 1. Right popliteal mass without evidence of scarring, erythema, or any signs suggestive of trauma.

showed a right pulsatile popliteal bulge associated with a thrill in continuous doppler, grade 1 edema, and no skin changes or pulses alterations (Figure 1).

An extra-institutional ultrasound duplex revealed post-thrombotic changes of the popliteal vein distal to the adductor canal (thickening of the venous walls) plus dilation of the tibial vein. A computed tomography angiography showed an arteriovenous fistula arising from the second portion of the right popliteal artery (inflow), associated with an aneurysmatic dilation of the proximal popliteal venous portion (outflow) with a diameter of approximately 22 mm and significant calcification of its posterior aspect (Figure 2). The proximal venous system, including the proximal femoral vein, was not visualized. These findings pointed towards a congenital or idiopathic fistula worsened by exercise.

Endovascular management was performed under general anesthesia in a hybrid operating room due to the possibility of conversion to open surgery. A guide catheter was inserted through the left femoral artery, and it was advanced through the right femoral artery via the iliac bifurcation. Intraoperative angiogram of the popliteal artery was performed to identify the popliteal arteriovenous fistula's location, anatomy, and characteristics (Figure 3A). A hydrophilic support guide was inserted. The fistulous tract was cannulated, and the Amplatzer™ Vascular Plug II was positioned and released into the fistula trajectory from the artery to the venous aneurysm. A second intraoperative angiogram showed a well-positioned device and no compromise of the popliteal artery (Figure 3B). A femoral percutaneous closure with ProGlide™ was done. Correct hemostasia was achieved, without signs of hematoma, blood loss, or other intraoperative complications.

On the post-operatory, the patient received analgesia, antiplatelet therapy, and anticoagulation, 6-hours after the procedure. He was discharged 24-hours after surgery. At 6-months follow-up, the patient showed a satisfactory evolution and significant improvement in exercise tolerance.

Discussion

Spontaneous PAF associated with venous aneurysms are extremely rare. Some case reports have been published, but the evidence regarding this pathology is scarce.[6,7] Therefore, diagnosis and management are mainly based on the surgeon's experience, available resources, and the patient desires when this condition is identified.

In this clinical case, the venous system proximal to the PAF was not visualized in the computed tomography angiography or intraoperative angiogram. In a patient without a previous history of trauma, surgical procedures, or any trigger other than exercise, the most plausible explanation for this phenomenon is a congenital or idiopathic popliteal arteriovenous fistula, with obliteration or atresia of the proximal venous segments.

We hypothesize that the pressure gradient between the arterial and the venous system, associated with the low elasticity of the venous walls, could explain the appearance of the venous popliteal aneurysm. Additionally, the hemodynamic changes that exercise imply in blood pressure and flow may be one of the triggers leading to the growth of the venous aneurysm and the appearance of physical limitation in our patient.

Different open surgical approaches, including aneurysmectomy with lateral venorrhaphy and aneurysm resection with interposition vein graft, have been described to manage PAF.[6,8] Most patients are managed through open approaches with relatively good outcomes.

Endovascular approaches have also been described in the setting of traumatic and iatrogenic PAF. Nevertheless, unlike our case, the endovascular approach described is based on the placement of a stent, followed by the inflation of a balloon and the subsequent exclusion of the venous aneurysm.[9,10]

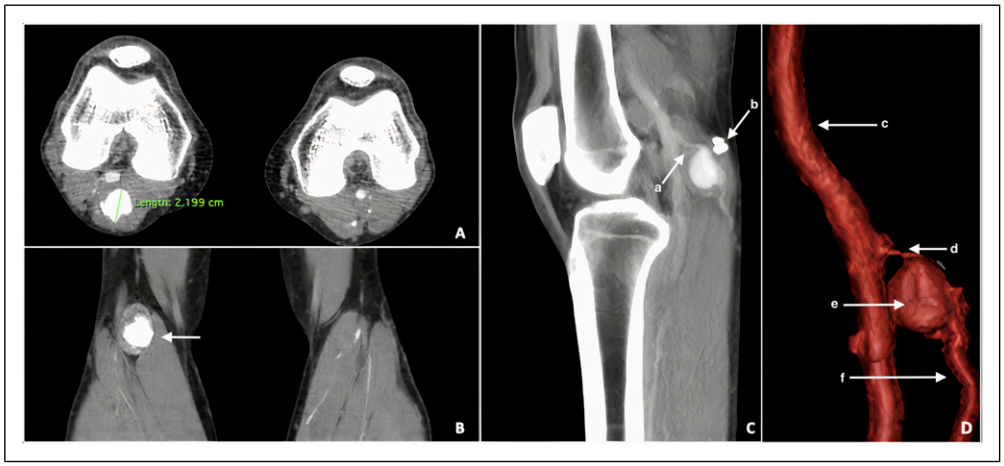

Figure 2. Preoperative Computed Tomography Angiography. (A and B) Axial and coronal images at the level of the popliteal fossa. The venous aneurysm is shown, with an anteroposterior diameter of approximately 22 mm (C). Sagittal images show the arteriovenous fistula [a] and the venous aneurysm with calcification of its posterior aspect [b]. The proximal portion of the venous system was not visualized. (D) 3D reconstruction showing the popliteal artery [c], arteriovenous fistula [d], venous aneurysm [e], and the distal popliteal vein [f].

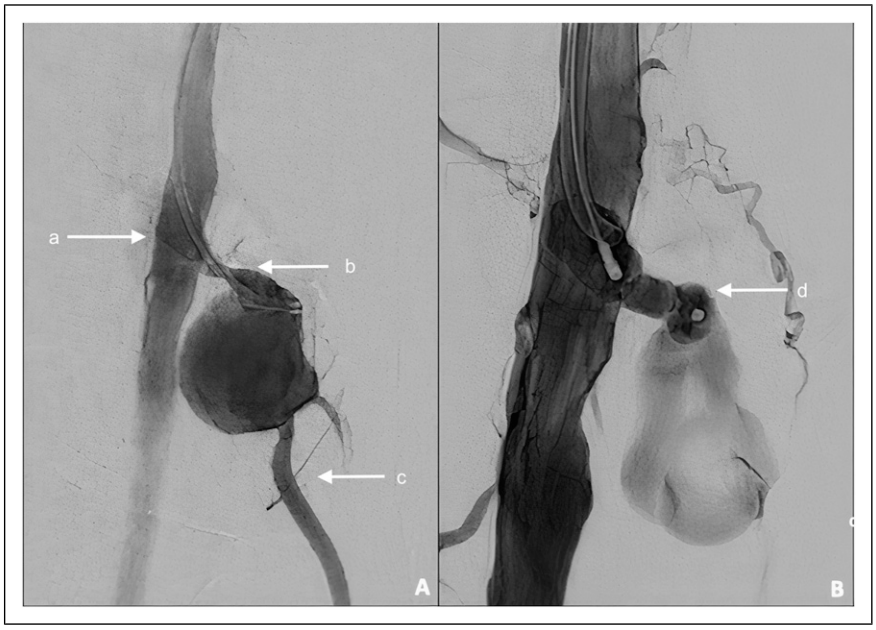

Figure 3. Intraoperative Angiogram. (A) Portion 2 (P2) of the popliteal artery [a], popliteal arteriovenous fistula associated with a venous aneurysm [b]. The proximal venous system was not visualized. (B) Amplatzer™ Vascular Plug II is adequately positioned in the fistulous tract [c], with complete exclusion of the venous aneurysm and patency of the arterial system.

An endovascular approach was selected in our patient for several reasons. Most importantly, the patient's young age and active lifestyle made us incline to this approach. Aesthetic advantages and the reduced need for prolonged analgesia compared to an open approach were also considered. The Amplatzer™ Vascular Plug II was used due to its ability to adapt to the vessel anatomy with a low risk of migration, ensuring a complete closure of the arteriovenous fistula while maintaining the arterial patency.

Conclusion

Spontaneous PAF must be suspected in patients presenting with a popliteal pulsatile bulge. A prompt diagnosis and adequate surgical planning are critical. Endovascular management is a viable option to treat PAF and can prevent catastrophic complications and improve patients' quality of life. The use of embolic devices to occlude the AVF itself appear to be safe and effective alternative to stents.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethical Approval

Institutional Ethical Committee of Fundación Cardioinfantil-Instituto de Cardiología approved this case report (Ref Number: No. 47-2020).

Informed Consent

Written informed consent for publication was obtained from the patient for this case report.

Drugs and Devices

Amplatzer™ Vascular Plug II and ProGlide™ (Abbot, Minneapolis, Minnesota, United States of America) devices were used to carry out the surgical procedure.

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