

# Posttraumatic popliteal pseudoaneurysm associated with arteriovenous fistula – case report and literature review

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**Abstract.** Introduction: Lower limb vascular injuries secondary to penetrating or blunt traumas can cause the formation of arteriovenous fistula with serious immediate complications (e.g. limb ischemia, amputation) or late complications (e.g. pseudoaneurysms, congestive heart failure). Pseudoaneurysms are pseudo tumoral formations, made up of a wall of conjunctive tissue, with or without endothelium, the other structural elements of the arterial wall being absent. Early diagnosis and the surgical treatment of pseudoaneurysm is imperious with the purpose of minimizing the morbidity rate. Case presentation: We describe a 25-year-old male patient which presented at admission varicose veins and oedema of left limb with a pulsatile mass in the popliteal region, with a scar at this level, following a puncture penetrating wound trauma 2 years ago. The patient's history and physical examination raised the suspicion of an arteriovenous fistula with a popliteal pseudoaneurysm, but the final diagnosis was determined after performing Duplex imaging and angiography. Surgical treatment consisted of eradicating the arteriovenous communication with restoring popliteal arterial and venous vascular continuity. There were no intra or postoperative complications and the evolution was uneventful. Conclusions: Duplex imaging together with arteriography or CT angiography should be considered for every patient with a puncture penetrating wound in the proximity of large vessels. In the present case, the arteriovenous fistula was not diagnosed immediately post-trauma, and the patient subsequently presented for examination with symptoms of chronic venous insufficiency. Therefore, both vascular imaging and clinical examination are of great importance in detecting the arteriovenous fistula and the late complication, the pseudoaneurysm.

**Key Words:** popliteal pseudoaneurysm, arteriovenous fistula, trauma, chronic venous insufficiency

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## Introduction

Traumatic arteriovenous fistula (FAV) is a rare condition and it is considered a potential complication of any penetrating injury followed by iatrogenic injuries and blunt trauma. For example, 6 (2.3%) of 256 cases among civilian vascular injuries were associated with FAV in a review by Patman et al. Popliteal FAV occur in 16% of all traumatic fistulas. The first case was described by the anatomist William Hunter, in 1757, and further information regarding the management of a traumatic FAV was given by the vast experience in conflict areas during World War II and the Vietnam War (Nagpal et al 2008).

Holman stated that blood, like flowing water, has an inherent and natural tendency to follow the path of least resistance, referring to the FAV as an abnormal connection between a high-pressure, high-resistance arterial system and a low-pressure, low-resistance, and high-capacity venous system. Because of

the low resistance, blood preferentially flows through the fistula rather than through the normal capillary bed (Huang et al 2005). A traumatic FAV can remain completely asymptomatic with minimal manifestations, while only approximately 2% of all post-traumatic FAV resolve spontaneously.

Our aim is to present the particular surgical treatment of a popliteal pseudoaneurysm (PSA) associated with FAV, which consisted of eradicating the arteriovenous communication with restoring popliteal arterial and venous vascular continuity.

The incidence of PSA of the popliteal artery is as yet not reported in the literature. Delayed or incorrect diagnosis of the popliteal PSA, without treatment, may lead in the evolution to varying complications: distal oedema of the extremity, acute hemorrhage by rupture, distal emboli, nerve palsy, acute ischemia or acute venous thrombosis of the popliteal vein, and may require amputation of the affected limb (Yousuf et al 2013).

## Case presentation

A 25 years old man presented in our service with swelling, varicosities and signs of chronic venous insufficiency of the left limb. He reported having a puncture trauma in the popliteal region 2 years before, after jumping over a barbed wire fence. At that moment he went to the emergency room and had his wound dressed, followed by a compression bandage, but without any further investigations. The symptoms of swollen and tense leg appeared few months after the injury, and now, after the appearance of the varicose veins he decided to seek medical advice because of the worsening of the symptoms. There were no signs of ischemia, claudication or congestive heart failure. Clinical examination of the left leg revealed a pulsatile mass in the popliteal region, with a palpable thrill, without pain on pressure. On auscultation, bruit was heard over the tumor site. Varicose veins of the left thigh and calf, size difference between the two legs, and a post traumatic scar behind the knee were noted. A Doppler ultrasound examination revealed a distal popliteal arteriovenous fistula with intra fistula systolic velocities of 300 cm/sec and popliteal vein ectasia of 3 cm. The arteriography (AGF) demonstrated the existence of a PSA with a communication between the left popliteal artery and vein (FAV).

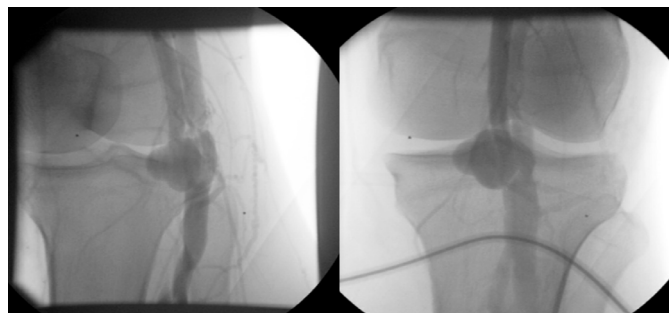


Fig. 1 Angiography revealed communication between the popliteal artery and vein, with aneurysmal dilatation

Magnetic resonance angiography (MRA) showed normal filling of the abdominal aorta, iliac arteries, femoral arteries, popliteal artery, up to the popliteal articular interline, under which there was a 28/20 mm pseudoaneurysmal dilatation, and also early venous filling of profunda femoral vein and the distal segment of the inferior vena cava (IVC).

MRA showed superficial and deep venous dilatation and early venous filling respectively early filling of the IVC.

## Results

Surgery was the treatment chosen in this case, because embolization was not feasible for the dimensions of the PSA, and endovascular services were not available and affordable.

With the patient placed prone, under spinal anesthesia, a “lazy S” incision is placed for the posterior approach of the popliteal artery, starting on the medial side of the distal part of the thigh, and ending on the lateral side of the proximal part of the calf. The proximal popliteal artery and aneurysm were identified by palpation. Both proximal popliteal vein and artery were isolated with conventional silicone rubber vessel loops. The tibial nerve was identified and preserved. The dissection was continued distally over the anterior surface of the aneurysm, and distal popliteal artery was circumferentially controlled. The aneurysm sac

was opened after obtaining proximal and distal control. The fistula with a diameter of 1.5 cm was identified and disconnected. Whether to use graft interposition was decided intraoperatively. The available vascular graft was the contralateral saphenous vein and polytetrafluoroethylene (PTFE), but using it was questionable, because of the possible prosthetic graft complications: graft occlusion, late graft thrombosis, or graft infection (in a young patient that was only 25 years old).

It has been decided to restore the circulation by using the PSA wall in order to close the popliteal vein on one side, and to perform an enlargement angioplasty of the tibial-fibular trunk and anterior tibial artery on the other side, with Polypropylene 5/0. To avoid stenosis after suturing the artery, by creating a decreased outflow, the artery communication was extended distally by a longitudinal arteriotomy to the anterior wall of the tibial-fibular trunk and anterior tibial artery. The new anterior and posterior arterial walls were sutured, resulting in a wider arterial lumen.

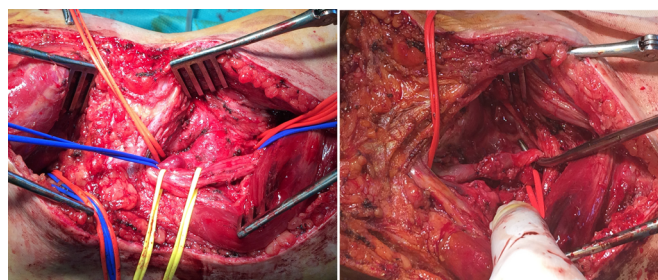


Fig. 3a) Popliteal artery PSA and 3b) the suture of the anterior and posterior wall, resulting in a wider arterial lumen

Postoperatively, the patient was treated with continuous IV infusion with heparin and afterwards, Acenocumarol was administered for 3 months as oral anticoagulant. The patient was discharged after 7 days. Ultrasound scan performed at 1, 3, and 6 months after the surgery showed no signs of deep venous thrombosis and no relapse. There were no postoperative complications, and the recovery was uneventful.

## Discussions

Popliteal arterial injury is the second most common arterial injury in the lower limb, accounting for approximately 30% of lower extremity arterial injuries. Mullenix et al identified 1395 popliteal arterial injuries among the 1,130,000 patients in the USA National Trauma Data Bank, for an incidence < 0.2% (Mullenix et al 2006).

PSA and FAV are additional complications of popliteal artery injury and, if left untreated, may ultimately lead to amputation. Historically, these injuries have led to high rates of amputation and, although improved, amputation rates continue to be estimated as high as 15%. Rates of limb loss are higher among patients who sustained blunt trauma, patients with fractures or dislocations, complex soft tissue injuries and nerve injuries. Posttraumatic FAV are not a rare event in military facilities during periods of armed conflicts, but are seldom seen in the civilian health care system.

Reporting to the literature data, it is generally recognized that PSA most commonly result from catheterization of an artery (most frequently the common femoral artery during angiographic procedures). Other causes include: a slow anastomotic leak

in arterial bypass grafts and dialysis access fistula, arterial wall infections, following an overaggressive endarterectomy, intravenous drug abuse, blunt trauma, penetrating injury and following traumatic fracture, fracture fixation and joint replacement surgery (Hafez et al 2001).

Both FAV and PSA have been documented to delay diagnosis after injury. In a review of patients with PSA following gunshot injuries, Ozisik et al found the median delay of presentation to be 75 days. Another study of 49 patients with FAV reported a delay in diagnosis of up to two years. These complications usually arise from penetrating injuries but may also result from blunt trauma (Ozisik et al 2003).

In a reported series of 202 traumatic FAV, Robbs et al noted that only 1% of FAV were due to blunt trauma, while penetrating trauma, stab wounds, and gunshot wounds accounted for the vast majority of these lesions (63% and 26%, respectively). Significant lower extremity FAVs that are not treated or do not resolve spontaneously may present months to years later with venous hypertension marked by limb edema, stasis dermatitis, and venous ulceration. There is evidence to suggest that all symptomatic as well as asymptomatic popliteal PSA above 2 cm in diameter should be surgically treated (Robbs et al 1994). Nowadays, the diagnosis of an FAV can be made using Duplex and color Doppler ultrasonography, angiography, computed tomography angiography (CTA) and MRA.

Although angiography has been the most used diagnostic technique, it has been suggested that CTA may be superior to angiography as the preliminary diagnostic tool (Busquets et al 2004; Miller-Thomas et al 2005).

Treatment options of a traumatic FAV include surgery (ligation of the fistula, the use of graft interposition), endovascular techniques with stent placement and embolization for FAV of smaller vessels. In the majority of cases, surgery is the first option of treatment, mainly because of the non-availability and high costs of endovascular services (Reuben et al 2007, Spirito et al 2007). In a reported series of 30 cases of traumatic FAVs, 11 were treated with graft interposition, 7 had FAV ligation, 5 with lateral suture, end-to-end anastomosis in 6 cases, and only one patient had an endovascular stent placed (Yousuf et al 2013).

In our case, the presence of the FAV for two years after the penetrating injury led to the PSA formation and growing, which needed surgical treatment.

Surgical interventions through an open posterior approach aim for separation of the arterial and the venous system. The effects of a fistula and how it is tolerated depend on two factors: the size and the duration of the shunt (Ilijevski et al 2002).

We must remark our particular surgical solution using the PSA wall in order to close the popliteal vein on one side, and to perform an enlargement angioplasty of the tibial-fibular trunk and anterior tibial artery on the other side. In that way we avoided using synthetic grafts, which have had possible complications (graft occlusion, late graft thrombosis or graft infection) in a young patient.

Endovascular techniques have been described and proven effective in the treatment of iatrogenic AVF, with the use of covered stent or metallic coils and thrombin. It may play an even larger role in patients who are poor operative candidates or in re-operative procedure (Megalopoulos et al 2007).

Popliteal artery trauma is a potentially devastating injury to the lower extremity with substantial associated morbidity, which emphasize the importance of the chosen subject. PSA and FAV formation are complications of arterial injury that often present in a delayed fashion (Arthurs et al 2007).

Nevertheless, the formation of combined venous PSA and FAV after a penetrating injury after jumping over a barbed wire fence is extremely rare. To our knowledge this is the first case with such an etiology reported.

Surgical treatment should be performed as soon as possible since surgical procedures are easier in early stages; moreover, there is no scar tissue, no collateral circulation and no modified anatomy to complicate the dissection. Additionally, surgery prevents PSA formation, increased level of hemorrhage and later complications (Saint-Lèbes et al 2013; Hartung et al 2004).

## Conclusions

This case report highlights the importance of the early diagnosis and management of the pseudoaneurysm and arteriovenous fistula, especially near major vessels, thus preventing subsequent complications.

Careful clinical examination is of great importance and the patient's history should be reviewed with utmost attention. Duplex scanning, with angiography or computed tomography angiography, when needed, should be performed routinely for every patient presenting with a popliteal penetrating trauma.

Conventional open repair is still a good therapeutic option and it is recommended to healthy and/or young patients and to patients whose lesions or anatomy is unsuitable for endovascular repair.

## List of abbreviations

AGF – arteriography; CTA – computed tomography angiography; FAV – arteriovenous fistula; IVC – inferior vena cava; MRA - magnetic resonance angiography; PSA – pseudoaneurysm; PTFE - polytetrafluoroethylene

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**Citation** Coman HF, Stancu B, Mihaileanu F, Ciocan R, Popa SL, Andercou O, Gherman CD. Posttraumatic popliteal pseudoaneurysm associated with arteriovenous fistula – case report and literature review. *HVM Bioflux* 2024;16(1):1-4.

**Editor** Antonia Macarie

**Received** 27 January 2024

**Accepted** 25 March 2024

**Published Online** 15 May 2024

**Funding** None reported.

**Conflicts/  
Competing  
Interests** None reported.