

## **Traumatic arteriovenous fistula: clinical aspects and surgery**

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**Abstract:** Arteriovenous fistula is a direct communication between artery and vein, without transition to the capillaries. AVF is acute or could be chronic and diagnosis delayed years after the traumatism. Clinical findings are often enough to determine diagnosis, with pulsatile mass, systole-diastolic machinery murmur and trill. The etiologies are penetrating injury, but the cause is often iatrogenic. In this series, two cases are due to stab vascular wound, two others are iatrogenic, and the last was a gunshot wound. Surgical care associated arterial repair, venous repair and closure of the abnormal communication. The arterial direct repair, the vein graft or prosthetic placement are indicated for AVF of the major vessels. The arterial ligation is strictly reserved to collateral or secondary arteries. Surgery is still a good and safe option for the care of chronic arteriovenous fistula, with good outcomes.

**Keywords:** chronic arteriovenous fistula, surgery.

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### **INTRODUCTION**

Arteriovenous fistula is a direct communication between artery and vein, without transition to the capillaries. The first description has been done by William Hunter in 1787 [1]. Traumatic arteriovenous fistulas (AVF) are due to severe vascular injuries inducing communication between an artery and a vein. AVF is acute or could be chronic and diagnosis delayed years after the traumatism. Clinical findings are often enough to determine diagnosis, with pulsatile mass, systole-diastolic machinery murmur and trill. Duplex ultrasound and CT angiography or conventional arteriography could be performed for better imaging before surgical care. The management of the traumatic AVF treatment calls open surgery and nowadays endovascular intervention. Authors described 6 cases of post-traumatic chronic AVF, which underwent open surgery, and assess their early results.

### **CASE REPORTS**

#### **Case 1:**

A 20 years old man admitted for a pulsatile right brachial mass, growing for 3 months and secondary to an accidental stab wound at work. The clinical examination found a mid-brachial pulsatile tumefaction with thrill and systole-diastolic murmur. He also presented a stabbing scare over the mass. The distal pulse was present. Duplex ultrasound showed a false aneurysm with arterial filling and venous drainage. CT angiography showed an AVF between humeral artery and vein. He underwent open surgery and had direct closure of the fistula by running stitches for both vessels. The post-operative period was free of events.

#### **Case 2:**

A 4 years old boy admitted for a swollen left thigh due to domestic accident with stab wound a month earlier.

Clinical examination found a pulsatile mass with thrill and systole-diastolic murmur in the superior third of the left thigh. He had a stabbing scare over the tumefaction. The distal pulse was present. The duplex ultrasound showed a big false aneurysm with AVF between superficial femoral artery and vein. After exposure and opening of the false aneurysm we found 3 orifices: 2 for proximal and distal segment of the artery and 1 for lateral wound of the vein. The femoral vein was closed by direct suture and termino-terminal anastomosis was done for femoral artery. The post-operative period was free of events.

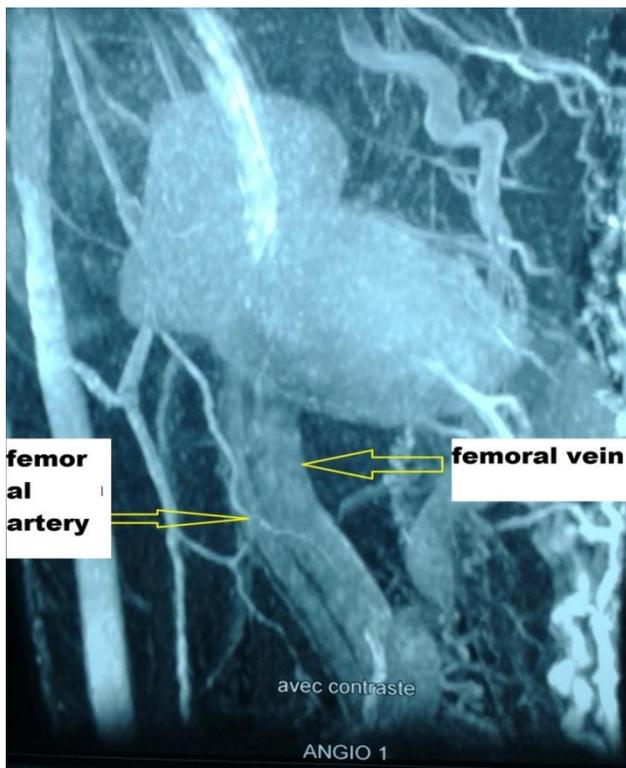
#### **Case 3:**

A 38 years old gentleman admitted 14 months after a gunshot for a swollen left lower limb, a permanent pain and a mass on the left thigh, with significant limitation of the movements. Clinical examination found a significant edema of the hole left lower limb with pulsatile mass of the distal third of the thigh (image 1), with thrill, and murmur. A shot scare was found over the tumefaction. The distal pulse was present. Duplex ultrasound found a 20cm arteriovenous aneurysm with thrombus. The CT scan confirmed the gigantism arteriovenous false aneurysm, with dilated femoral vein (image 2, 3). The surgical access exposed an aneurysm. In the aneurysm sac, the distal superficial femoral artery was completely sectioned and the 2 extremities were filling the mass which was drained over a lateral wound of the femoral vein (image 4).

After excision of the superior part of the sac, a venous graft was placed between the 2 extremities of the femoral artery. Then the femoral vein was directly repaired by running stitches. It's permitted complete healing without recurrence (image 5). The post-operative period was free of events.



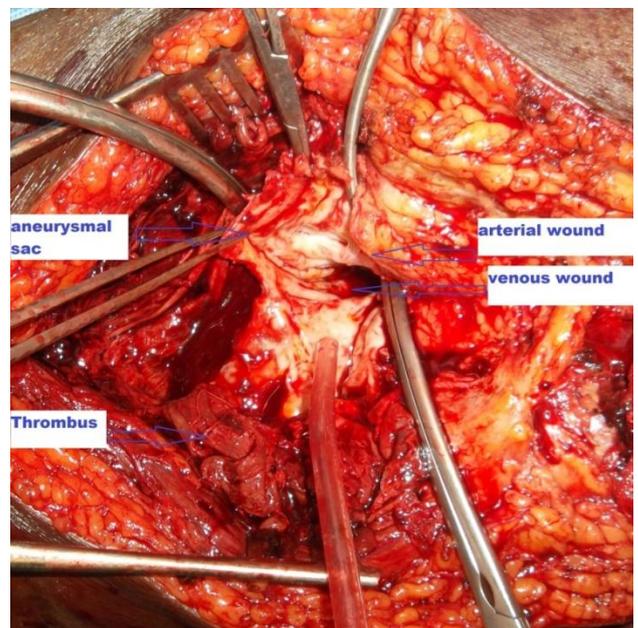
**Fig 1: A chronic AVF after gunshot wound inducing a swollen lower limb**



**Fig 2: CT scan of giant femoral AVF with dilated venous system**



**Fig 3: CT scan of AVF showing communication between femoral artery and vein**



**Fig 4: Operative view of aneurysmal femoral AVF showing artery and venous wound**



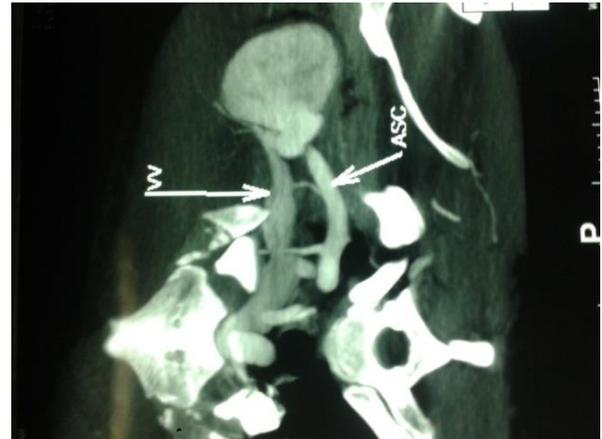
**Fig 5: Post-operative Angiography after surgery of femoral AVF**

**Case 4:**

A 27 old man was admitted with a subclavian pulsatile mass after a stab wound 2 months ago. The clinical examination found a 10cm subclavian pulsatile mass, with thrill and murmur. A 2 cm scare was on the top of the mass. The distal pulse was present. Duplex ultrasound showed an AVF with pseudo aneurysm of the subclavian vessels. CT scan confirmed the arteriovenous subclavian pseudo aneurysm with thrombus (images 6, 7). Over subclavian access, the aneurysmal sac was open showing the two artery segments and the vein filling the aneurysmal mass. The surgical care was a lateral direct repair of the subclavian vein, and interposition of prosthetic graft between the 2 artery segments. Redo intervention has been done 2 hours later for hemostasis. From there post-operative period was free of new events.



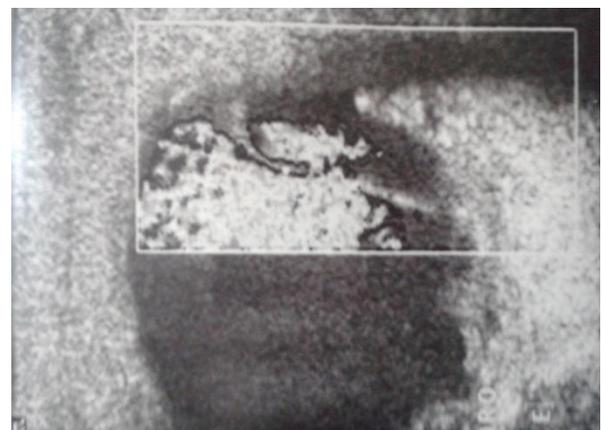
**Fig 6: CT scan of aneurysmal subclavian AVF**



**Fig 7: CT scan of sub clavian AVF with communication between artery and vein**

**Case 5:**

A 58 years old gentleman in end-stage renal failure presented with a tumefaction of the left groin resulting from a placement of hemodialysis catheter 5 months ago. The clinical examination found a 12 cm mass of the groin with pulsations, thrill and murmur. A 0.5 cm scare was found on top of the tumefaction. The distal pulse was present. The ultrasound scan showed a pseudo aneurysm with arteriovenous communication between common femoral artery and common femoral vein (image 8). For surgical care a direct closure was done on both vessels. In early post-operative period a groin hematoma was diagnosed and surgically evacuated with hemostasis. The evolution was good.



**Fig 8: Duplex scan of femoral AVT fistula**

### Case 6:

An 18 years old female admitted for left groin pulsatile mass present for 3 months, after placement of femoral catheter for hemodialysis. She had a groin pulsatile tumefaction of the groin with thrill and systole-diastolic murmur (image 9). Skin ulceration was found on top of the mass. The Duplex scan showed a pseudo aneurysm with AVF between common femoral artery and vein. The CT angiography confirmed the AVF with thrombus into the aneurysm sac. The surgical care was done with direct closure of both vessels by running stitches. In the post-operative period an infection of the operative wound occurred. She had re-intervention for debridement and drainage which allow a good evolution.



**Fig 9: Groin mass of chronic femoral AVF after placement of hemodialysis catheter**

### DISCUSSION

Traumatic AVF expose patients to several early or late complications, which are local or general. Acute AVF occurs in the first hours after traumatism, but chronic AVF could appear several years later [2, 3]. The etiologies are penetrating injury, but the cause is often iatrogenic [4, 5]. The great frequency of iatrogenic causes is due to development of percutaneous vascular interventions. Iatrogenic causes of AVF are more frequent with the development of endovascular interventions [6]. Many AVF are post-traumatic (Figure 1) and often iatrogenic due to the fast-growing number of invasive procedures [7].

In this series, two cases are due to stab vascular wound, two others are iatrogenic, and the last was a gunshot wound. In this study stab wounds were treated earlier in primary care hospitals without good exploration of the wounds. The medical staff should pay better attention to stab wound, by exploring rigorously the probably vascular injuries to avoid chronic AVF or pseudo-aneurysms. Clinical signs have often been reported to be misleading in the diagnosis of nearly one-half of all AVFs [8]. Clinical signs of chronic AVF are pulsatile mass and thrill associated to path gnomonic systole-diastolic murmur. They have

been observed in all patients of this series. Beside this symptomatology, in literature some others signs are described: edema, ischemic signs, and pulsatile varicose veins [9].

In chronic AVF, there is a development of a mass which is aneurysmal. It could grow as any aneurysm even though the fistula is occluded [10]. Doppler ultrasound is a good exam to diagnose AVF, by showing elevation of velocity in the artery, and arteriovenous communication [11]. Computed tomographic and magnetic resonance angiography can provide good images of the anatomy of the arteriovenous communication, typically with early contrast filling in the vein during the arterial phase [12]. All the patients had CT angioscan or magnetic resonance angiography. Those exams allow exploration of the fistula and its relations to others organs [13].

Serious complications such as fistula rupture, neuropathy, distal embolism and thrombosis can also occur frequently in AVF evolution. In the case of longstanding fistula, cardiac overload develops, which may lead to cardiac failure and endocarditic [14]. These complications are rare and dramatic.

Three therapeutic attitudes are possible for AVF: observance, surgical care or endovascular interventions. The first attitude should be exceptional, and reserved to parenchyma AVF (renal, hepatic) and the cases of high risk patients [8]. Post-traumatic fistulas should be surgically repaired as soon as possible [15]. Otherwise they lead to chronic grave complications. Surgical care associated arterial repair, venous repair and closure of the abnormal communication. Open surgical repair of these lesions can be challenging due to the elevated venous pressure and surrounding inflammation [2]. Surgery is still a good option for the treatment of chronic AVF. The arterial direct repair, the vein graft or prosthetic placement are indicated for AVF of the major vessels. The arterial ligation is strictly reserved to collateral or secondary arteries.

Endovascular interventions are now widely used for the care of AVF [16, 17]. The use of covered stents or end luminal grafts permits the restoration of arterial circulation and the closure of the arteriovenous communication. As percutaneous interventions the morbidity is lower. They preserve from injuries of the nerves or the vessels which could occur in open surgery, as well significant infection.

### CONCLUSION

Unsuspected artery injuries lead to chronic complications like chronic AVF. Pulsatile aneurysmal mass with thrill and machinery murmur is most seen aspect. Endovascular interventions are already widely used, but Surgery is still a good and safe option for the

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care of chronic arteriovenous fistula, with good outcomes.

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