» Case Report «

Iatrogenic Arteriovenous Fistula as a Cause for Leg Ulcers: A Case Report

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An 80-year-old man presented with painful leg ulceration due to steal phenomenon from a groin arteriovenous fistula (AVF) 10 years following a coronary angiogram. The diagnosis of the AVF was confirmed by duplex examination of the groin vessels which demonstrated characteristic flow pattern in the femoral arterial and venous system. Angiography further confirmed the site of the fistulous communication and this was managed by a covered stent graft. We discuss the incidence of AVF, risk factors for its development, relevant diagnostic investigations and management options along with strategies to reduce the incidence of AVF following percutaneous punctures.

Key words: arteriovenous fistula, duplex, leg ulcers, percutaneous puncture

INTRODUCTION

Arteriovenous fistulae are an abnormal communication between the artery and vein arising commonly following penetrating injury such as percutaneous arterial or venous punctures and after open surgical interventions.¹⁾ They are encountered in the groin due to frequent use of the femoral artery and vein for diagnostic and interventional radiological procedures such as coronary and peripheral angiography.

In the acute phase, arteriovenous fistulae are commonly associated with localized symptoms such as haematoma and bruising. However, they may remain totally asymptomatic and present in the long term with chronic limb oedema, aneurysmal degeneration of the arterial tree and high output cardiac failure. This case report dis-

cusses a unique case of an arteriovenous fistula in the groin in a patient presenting with painful lower limb ulcerations, which has not been reported in the literature previously. The investigations leading to confirmation of the diagnosis and the subsequent management of the fistula are also discussed along with a brief review of the literature.

CASE REPORT

An 80 year old male patient presented to the vascular clinic with a two-year history of painful right leg ulcers, which were resistant to healing by a conservative dressing regime. There was no history of trauma prior to the onset of ulcerations and there were no medical risk factors for peripheral arterial disease. However, he had undergone a coronary angiogram via the right femoral artery puncture over 10 years ago. The procedure was uncomplicated with no immediate complications recorded.

The clinical examination revealed superficial ulcerations in the right lower calf area with varicose veins in the long saphenous vein distribution. There was a palpable right femoral pulse with absent popliteal and foot pulses. However, the left lower limb had a full complement of femoral and distal pulses. In addition; on auscultation, a bruit was audible in the right groin.

Subsequently, the patient underwent a duplex scan of

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Fig. 1 AVF between the Right profunda artery and common femoral vein.

AVF, arteriovenous fistula

Fig. 2 Left retrograde intra-arterial digital subtraction angiography.

AVF, arteriovenous fistula

the right lower limb. The right common femoral and profunda artery demonstrated loss of triphasic flow with continuous forward flow in diastole with no reversal of flow in diastole. In addition, an arteriovenous fistula with a high velocity jet stream of blood was visualized between the profunda femoris artery and common femoral vein (**Fig. 1**).

To delineate the anatomy and assess suitability for endovascular intervention, the patient underwent a retrograde intra-arterial digital subtraction angiogram via left femoral puncture using a 6 Fr vascular sheath and pigtail

catheter. This demonstrated early contrast filling of the right iliac venous system, suggesting a communication between the arterial and venous system (**Fig. 2**). In addition, selective cannulation of the right profunda and superficial femoral arteries revealed two separate fistulae originating from the superficial femoral artery and profunda femoris artery, both communicating with the common femoral vein. After an initial diagnostic angiography, a 7 Fr guiding sheath (Destination Guiding sheath, Terumo, Europe) was introduced via the left common femoral artery and placed across the aortic bifurcation to the right external iliac artery by the up and over approach. Selective angiography revealed two separate fistulae originating from the superficial femoral artery and profunda femoris artery, both communicating with the common femoral vein. A bolus of 3000 iu of heparin was administered via the sheath. With road-map assistance, the superficial femoral artery was catheterized using an angled hydrophilic guidewire (Standard Glidewire®, Terumo Medical Corporation) and exchanged for a 0.035 inch stiff guide wire (Amplatz Super Stiff, Boston Scientific, USA) over a straight exchange catheter. After calibrating the vessel diameter and using road-map guidance, a 4 to 9-mm Jomed covered stent (Jomed, Rangendingen, Netherlands) mounted on a 6 mm balloon was accurately deployed across the arteriovenous fistula (AVF). The profunda femoris artery was next cannulated and a 4 to 9-mm Jomed covered stent (Jomed, Rangendingen, Netherlands) on a 5-mm balloon was deployed over the AVF defect in the profunda femoris artery. A final check angiography confirmed a satisfactory position of the stents with exclusion of both fistulae (**Fig. 3**). A vascular closure device (6 Fr Angio-Seal™, St Jude Medical) was used to seal the left femoral artery puncture site. These were amenable to endovascular treatment by placing a covered stent over the fistulous defect and thus avoiding an open surgical procedure (**Fig. 3**). The patient was subsequently discharged on the second day following the procedure with no immediate complications. There was a significant improvement in the right leg ulcerations on subsequent review in the vascular clinic with an ankle brachial pressure index of 0.8 from a pre intervention recording of 0.37.

DISCUSSION

Arteriovenous fistula occur following penetrating injuries such as percutaneous interventions, surgical procedures and venous catheterization although they can

Fig. 3 Stents deployed in the right profunda and superficial femoral artery.

rarely present after blunt trauma.²⁾ The overall incidence of arteriovenous fistula following percutaneous femoral puncture for cardiac catheterization is 1%.³⁾ The risk factors for arteriovenous fistula formation following percutaneous femoral puncture from multivariate analysis were use of anticoagulation, arterial hypertension, female gender, puncture of superficial femoral or profunda artery and left groin puncture.^{4, 5)}

AVF may be relatively asymptomatic with bruising and small haematomas in the acute phase attributed to the percutaneous intervention. However chronic arteriovenous fistula may present with symptoms of intermittent claudication due to the steal phenomenon. Iliac and femoral artery aneurysms occur due to increased flow of blood through the arterial tree due to short circuiting of the blood. Venous hypertension and high output cardiac failure are also a consequence of this increased handling of high-volume blood flow.^{2, 6)}

The diagnosis of arteriovenous fistula is by clinical findings of bruit in conjunction with corroborating history. However, a bruit may not always be detected clinically, especially when the arteriovenous fistula is deep within the tissues. Due to the steal phenomenon, blood flow to the extremities may be compromised, as evidenced by reduced or absent distal peripheral pulses. Patients may present with intermittent claudication. Although critical limb ischaemia, resulting in ischaemic ulceration is possible with a significant steal, this has not been reported in the literature previously.

Duplex imaging is diagnostic for arteriovenous fistula and offers the advantage of a non-invasive investigation.

The waveform is characteristically high volume, monophasic with turbulence and the jet stream, visualized by the color aliasing. It gives dynamic information of the site of the arteriovenous fistula in addition to the grade of steal into the venous system. It is a diagnostic investigation for peripheral arteriovenous fistula. Intra-arterial digital subtraction angiography has the advantage of high specificity and helps localize the arteriovenous fistula by selective cannulation of the vessel.

The management of arteriovenous fistula is multimodal. Non-invasive management with manual pressure applied using an ultrasound probe or simple prolonged bandaging have been proven to be effective and economical.^{7, 8)} One third of all arteriovenous fistula close spontaneously in one year, and hence, there is some evidence to manage asymptomatic arteriovenous fistula conservatively by a wait and watch policy before initiating any treatment.⁴⁾

Endovascular techniques have the advantage of being a minimally invasive intervention with reduced patient morbidity and in-patient stay. Covered stents help exclude the fistula from the arterial blood flow and thus results in thrombotic occlusion of the fistula.⁹⁻¹¹⁾ In addition, there is also the option of using glue to occlude the fistula by selective catheterization of the affected vessel.¹²⁾

Surgical management is reserved for arteriovenous fistulae that are symptomatic and fail treatment by non-invasive techniques. It is the gold standard and involves identification of the fistula, resecting it and repair of the artery. Although it has a high success rate of over 96%, there are potential complications of major bleeding from the arterialized vein, groin infection and scarring.^{13, 14)}

The complication of arteriovenous fistula resulting from percutaneous procedures can be minimized by various precautionary measures. The use of an ultrasound-guided, central venous line cannulation has been recognized as a safe technique to reduce complications. Similarly, there is emerging evidence to demonstrate that the use of ultrasound-guided femoral puncture reduces the incidence of complications such as arteriovenous fistula, false aneurysm formation and haematoma. Ultrasound helps determine the level of bifurcation of the common femoral artery and thus avoids the inadvertent puncture of the superficial femoral or profunda artery. The latter are well identified risk factors for arteriovenous fistula formation.¹⁾

The use of fluoroscopy to mark the head of the femur, which is also a reliable anatomical landmark for bifurcation of the common femoral artery, has been demonstrated

to be a safe technique to avoid puncture of the superficial femoral artery and profunda artery.⁵⁾

Commercially available vascular closure devices are increasingly being used in the clinical practice due to their convenience and ease of use. These devices are introduced intra-luminally and deploy a seal or ligature over the arterial puncture site. There is evidence to suggest that these devices, when used appropriately, help reduce the complications associated with percutaneous puncture.¹⁵⁾

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