Case Report

Vol. 8, No. 3; 2024; pp 86–89
DOI: https://doi.org/10.26676/jevtm.26872

Endovascular Management of a Post-traumatic Popliteal Fossa Arteriovenous Fistula

Jayesh Patel[1], Haryax Pathak[2], Ayushi Rathod[2] and Manushree Barot[3]

[1]Department of Vascular Surgery, Shree Krishna Hospital and Pramukh Swami Medical College, Bhaikaka University, Gokalnagar, Karamsad, Anand, Gujarat 388325, India
[2]Department of General Surgery, Shree Krishna Hospital and Pramukh Swami Medical College, Bhaikaka University, Gokalnagar, Karamsad, Anand, Gujarat 388325, India
[3]Narendra Modi Medical College and L G Hospital, Gujarat University, Opposite Adani CNG Station, Near Rambaug, Maninagar, Ahmedabad, Gujarat 380008, India

Background: Arteriovenous fistulas (AVFs) are abnormal communications between an artery and a vein. Post-traumatic AVFs, including those in the popliteal fossa, are rare but require prompt management to prevent complications.
Case Report: A 35-year-old male presented with a painful, pulsatile swelling over the left knee, 15 days post-arthroscopic anterior cruciate ligament and posterior cruciate ligament reconstruction. Clinical examination showed a 5 × 5 cm^2 tender swelling with a palpable thrill. Computed tomography angiography revealed a communication between the popliteal artery and vein. An endovascular intervention was performed using two Bentley covered balloon expandable stents. Post-procedure, the patient showed uneventful recovery, with follow-up Doppler scans indicating normal vascular flow and no residual abnormalities.
Conclusions: Post-traumatic AVFs, often resulting from penetrating injuries or iatrogenic causes, can present with painful, pulsatile swellings and may lead to severe complications if untreated. Advances in endovascular techniques, such as stenting, have improved outcomes such as reduced post-operative morbidity, eliminating complications associated with open surgery.

Keywords: *Arteriovenous Fistula; Endovascular Procedures; Stents; Popliteal Artery; Vascular Fistula*

Received: 16 August 2024; Accepted: 21 September 2024

INTRODUCTION

Arteriovenous fistulas (AVF) are defined as abnormal communications between an artery and a vein, which may be congenital or acquired (iatrogenic – as in haemodialysis; or traumatic). Congenital AVFs are the rarest of all, followed by post-traumatic AVFs. The popliteal fossa AVF is a rare vascular anomaly, usually found because of abnormal communication between the popliteal artery and vein. It leads to shunting of blood from the arterial system and can cause symptoms such as varicose veins, localised swelling, aneurysmal dilatation of the popliteal vessels and venous hypertension leading to heart failure. It requires a high index of clinical suspicion and prompt management to prevent further complications [1].

We present here a case of a 35-year-old male patient who presented with a post-traumatic popliteal fossa AVF, managed with endovascular stenting as damage control surgery, resulting in resolution of symptoms such as pain, swelling and movement restriction.

Corresponding author:
Haryax Pathak, Department of General Surgery, Shree Krishna Hospital and Pramukh Swami Medical College, Gokalnagar, Karamsad, Anand, Gujarat 388325, India.
Email: haryax0909@gmail.com

CASE REPORT

A 35-year-old obese male presented with a painful swelling over the back of his left knee. The patient had a history of left lower limb trauma for which he underwent arthroscopic reconstruction of the anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) over the left knee. Following surgery, the patient recovered uneventfully. However, one and a half months following

Figure 1 CTA showing left popliteal AVF (green arrow).

the surgery, the patient developed a swelling over the back of his left knee, gradually increasing in size, which was pulsatile in nature and associated with a moderate amount of pain. Upon examination, a 5 × 5 cm^2 tender, pulsatile swelling was present over the popliteal fossa, with a palpable thrill, and dilated superficial veins around the knee joint with pitting oedema over the left leg distal to the knee joint. The patient also had significant restriction of joint movement at the knee. Peripheral pulses were palpable, but the left lower limb distal to the knee joint appeared pale and was cold to the touch.

The patient underwent a computed tomography angiography (CTA) of the left lower limb, which was suggestive of a well-defined communication between the popliteal artery and the popliteal vein, likely to be a fistula, with width of 5.7 cm and antero-posterior dimension of 2.5 cm, associated with slowing of arterial flow below the left knee (Figure 1). A normal two-dimensional echocardiography ruled out the possibility of cardiac overload.

Based on clinical findings and the CTA report, the need for surgical intervention, either open exploration or endovascular intervention, was explained to the patient. In view of the patient's history of recent knee surgery and prolonged immobilisation, obesity, clinical features of a cold limb and the presence of an AVF, the patient was taken up for percutaneous angioplasty and stenting as a minimally invasive and damage control procedure. The left common femoral artery was punctured antegrade and progressed under duplex guidance. An active leak was noted in the left popliteal artery just behind the knee

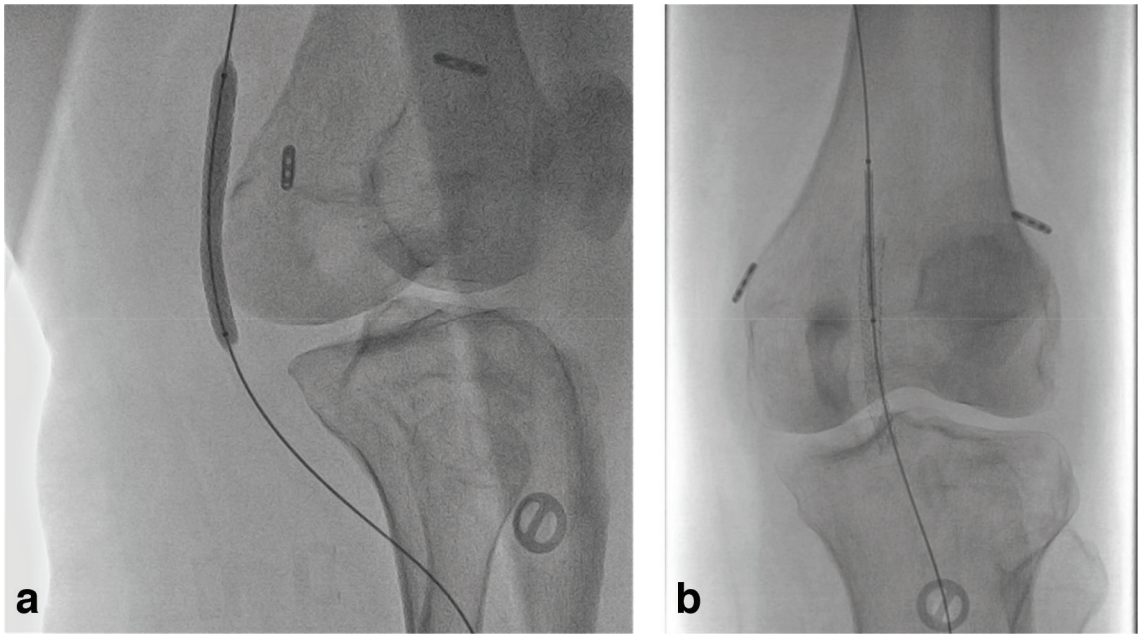

Figure 2 Dual overlapping covered balloon expandable stenting of the popliteal artery. (**a**) Lateral view. (**b**) Anterior view.

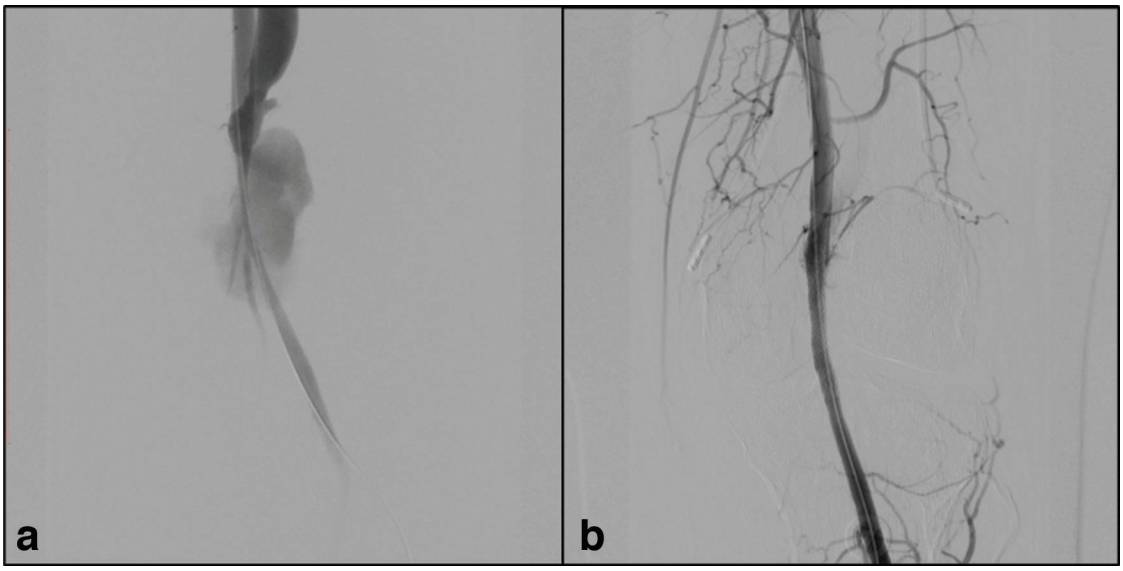

Figure 3 Intra-operative angiograms. (**a**) Pre-stent showing leakage and evidence of fistula at the level of the popliteal artery. (**b**) Post-stent showing good flow and no leakage.

joint, with evidence of AVF. A command wire was crossed using a Rubicon catheter under road-map guidance. Two Bentley covered balloon expandable stents, 6 × 38 mm^2 and 6 × 58 mm^2, were placed across the leak. Brisk flow was noted in the popliteal artery and the tibial vessels, with no evidence of leak or AVF (Figures 2 and 3).

Following the procedure, the patient made an uneventful recovery. Subsequent repeated Doppler scanning upon follow-up at 1 month and 3 months post-surgery revealed no residual abnormalities and good flow in the left lower limb, with no evidence of leakage or vascular insufficiency. The patient exhibited complete recovery, with no residual pain, swelling or restriction in mobility.

Ethical Approval and Informed Consent

Ethical approval to report these cases was given by the Institutional Ethics Committee, Bhaikaka University. Written informed consent was obtained from the patient.

DISCUSSION

Post-traumatic AVFs are a rare entity, the majority of which occur due to penetrating injuries such as gunshot wounds, which disrupt the regional vascular anatomy. They may also be iatrogenic, caused during the course of medical procedures. Such fistulas may become symptomatic within a few days or weeks following the causative event, while some may remain dormant and may be diagnosed even months or years later. Certain fistulas may even prove to be fatal and require rapid diagnosis and management. Patients have varying clinical presentations such as painful pulsatile swellings, the presence of a thrill or a bruit, evidence of distal limb ischemia, cardio-respiratory overload, heart failure, etc. Diagnosis can be confirmed on clinical examination and after radiological investigations such as Doppler ultrasound or a CTA [2,3].

In the previous century, traumatic AVFs were usually managed conservatively, while open surgery was reserved for complicated cases. With the advent of endovascular therapies, the management of traumatic AVFs has become much more rapid and effective. A variety of options are available such as the use of covered balloon expandable stents, coiling, glue, grafts, etc. Endovascular management is now the mainstay of treatment for traumatic AVFs, while open surgery is carried out in cases where endovascular management fails [4,5].

Among traumatic AVFs, popliteal AVFs are relatively less common, occurring due to direct penetrating trauma to the lower limbs, and may be associated with concomitant injuries such as fractures or ligament injuries, requiring surgical intervention. Patients present with a painful swelling in the popliteal region, days to weeks after the traumatic event. Delayed presentations may show signs of peripheral limb ischemia and cardiac overload or heart failure. CTA shows abnormal communication between the popliteal artery and vein, around the level of the knee joint, with surrounding hematoma or aneurysmal dilatation of the popliteal artery. It may also show shunting of blood leading to peripheral vascular insufficiency. Management is usually by endovascular treatment with the use of covered stents or coiling [6].

Ilijevski et al. report a series of seven cases with post-traumatic popliteal AVFs, two of which required amputation of the lower limbs, while the rest recovered uneventfully following surgical intervention in the form of vessel reconstruction [7]. Another case report of a popliteal fossa AVF describes hybrid management of the fistula, wherein open surgery was carried out following failure of endovascular stenting [8]. Popliteal AVFs are

also known to occur following knee surgery. Ceallaigh et al. conservatively managed a case of popliteal AVF following total knee replacement surgery, with no ensuing complications noted on follow-up [9]. Another report by Dinh et al. emphasizes endovascular management of a popliteal AVF following knee surgery, using a covered stent [10].

In our case, the patient had a history of a road traffic accident with trauma to the left lower limb, requiring surgery for reconstruction of the ACL and PCL. The subsequent popliteal AVF could have been a result of the direct trauma or the knee surgery. While there are recommendations to pursue open surgery for such cases, especially for AVFs over joints, certain patient factors must be considered when deciding the correct course of management. In our case, the patient was obese and had a recent history of knee surgery – which were both deterrents for open surgery in the prone position. Endovascular intervention was preferred as a minimally invasive damage control surgery and a potentially life-saving procedure. The patient was managed using two covered balloon expandable stents, overlapping with each other, with no evidence of failure or complications, such as pain, joint movement restriction or recurrence, noted on extended follow-up.

CONCLUSIONS

Post-traumatic AVFs are a rare occurrence and require a high index of clinical suspicion, especially in the presence of a thrill/bruit on examination. Popliteal AVFs may be due to direct trauma or following knee surgery, and can effectively be managed using endovascular techniques if diagnosed early, thereby preventing complications such as amputation.

Ethics Statement

(1) All the authors mentioned in the manuscript have agreed to authorship, read and approved the manuscript, and given consent for submission and subsequent publication of the manuscript.
(2) The authors declare that they have read and abided by the JEVTM statement of ethical standards including rules of informed consent and ethical committee approval as stated in the article.

Conflicts of Interest

The authors have nothing to disclose.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

REFERENCES

[1] Jayroe H, Foley K. Arteriovenous fistula. In: StatPearls [Internet]. Treasure Island, FL: StatPearls Publishing; 2024. Accessed 17 July 17. http://www.ncbi.nlm.nih.gov/books/NBK559213/.
[2] Morgan MA. Radiopaedia. Accessed 17 July 2024. Arteriovenous fistula | Radiology Reference Article | Radiopaedia.org. https://radiopaedia.org/articles/arteriovenous-fistula?lang=us.
[3] Nagpal K, Ahmed K, Cuschieri RJ. Diagnosis and management of acute traumatic arteriovenous fistula. Int J Angiol. 2011 28;17:214–6.
[4] Yousuf KM, Bhagwani AR, Bilal N. Management of chronic traumatic arteriovenous fistula of the lower extremities. Eur J Trauma Emerg Surg. 2013;39(4):393–6.
[5] Clark RA, Gallant TE, Alexander ES. Angiographic management of traumatic arteriovenous fistulas: clinical results. Radiology. 1983;147(1):9–13.
[6] Pritchard DA, Maloney JD, Barnhorst DA, Spittell JA Jr. Traumatic popliteal arteriovenous fistula: diagnostic methods and surgical management. Arch Surg. 1977;112(7):849–52.
[7] Ilijevski N, Radak D, Radevic B, et al. Popliteal traumatic arteriovenous fistulas. J Trauma Acute Care Surg. 2002;52(4):739.
[8] Góes Junior AM de O, Jeha SAH, Franco RSM. Hybrid treatment of arteriovenous fistula between popliteal vessels. J Vasc Bras. 2014;13:325–9.
[9] Ceallaigh PÓ, Hogan N, McLaughlin R, Bouchier-Hayes D. Popliteal arteriovenous fistula post total knee replacement. EJVES Extra. 2004;7(2):33–5.
[10] Dinh K, Ying A, Al-Asady R, Vicaretti M. Endovascular treatment of a large iatrogenic popliteal arteriovenous fistula. Interv Cardiol Rev. 2021;16:e15.