Percutaneous coil embolization of feeder vessels as a management option of symptomatic, previously excluded popliteal aneurysms

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In most cases, excluded popliteal aneurysm remains silent as the lumen is obliterated with a thrombus. However, continued perfusion through geniculate collateral vessels, leading to pressurization of the ligated aneurysm, can become symptomatic. A 95-year-old healthy-looking male who presented with a pressurized symptomatic popliteal artery aneurysm, 2.5 years, following ligation and exclusion bypass grafting. Two feeding collaterals were shown on computed tomography angiogram, and percutaneous endovascular coiling of these vessels was successfully carried out. This report underscores the value of this minimally invasive approach, particularly in fragile patients, with a review of the pertinent literature.

Keywords:
aneurysm, coil, embolization, popliteal

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Introduction

Popliteal artery aneurysms (PAAs) represent the most common peripheral arterial aneurysms. About 50% of PAAs are bilateral, and usually affect elderly men [1]. PAA, left untreated, can lead to significant complications, most frequently thrombosis and distal embolization. Elective surgical intervention is generally indicated for PAAs more than 2 cm in low-risk patients.

The most commonly performed operation, described by Edwards in 1969, is proximal and distal aneurysm ligation through a medial approach followed by autologous vein grafting [2]. The medial approach is particularly advantageous when treating large aneurysms in the absence of vein or nerve entrapment [3]. We report on a large symptomatic previously excluded popliteal aneurysm with active filling from two collaterals treated percutaneously by endovascular coil embolization.

Case report

A 95-year-old male presented with increasing left leg pain and swelling behind his left knee. He had previously undergone exclusion, and reversed saphenous vein bypass surgery for a symptomatic 3.7 cm left PAA 2.5 years ago. Physical examination showed a large tense mass in the left popliteal fossa. Both feet were pink and warm, with normal ankle–brachial indices. Arterial duplex revealed patent left femoropopliteal bypass graft, and a partially thrombosed 7.6 cm popliteal aneurysm with persistent flow (70 cm/s). Further contrast-enhanced computed tomographic evaluation performed in the arterial phase revealed two sizable vessels, originating from the superficial and deep femoral arteries, feeding the excluded popliteal aneurysm (Fig. 1a–c).

Following discussion at the vascular multidisciplinary meeting, we elected to treat this by endovascular methods initially. Under local anesthesia, and using contralateral femoral arterial access, selective catheterization of the left superficial femoral artery (SFA) was accomplished. On-table angiography revealed filling of a large extremely tortuous branch arising directly from the anterior aspect of the distal SFA (Fig. 2a) eventually flowing into the proximal end of the excluded popliteal artery. This branch was selectively cannulated, and coils embolized using a 'Progreat' microcathether (2.7F, Terumo, Somerset, New Jersey, USA) and 4 and 7 mm diameter coils (Cook Medical, Bloomington, Indiana, USA) (Fig. 2b). The torqueable 5F Kumpe catheter (AngioDynamics, Queensberry, New York, USA) was then withdrawn to the common femoral artery, and the profunda femoris artery was successfully cannulated. On-table angiography was performed, and the second feeding collateral was demonstrated (Fig. 2c) and a similar procedure performed (Fig. 2d).

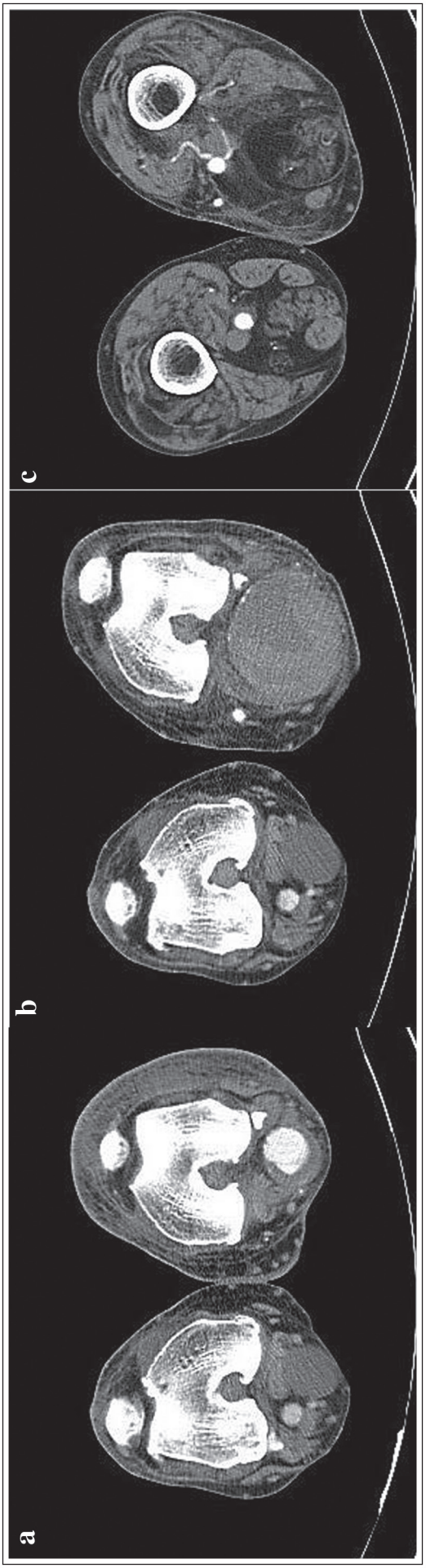


Figure 1

(a) CTA showed left popliteal artery aneurysm (PAA) 3–5×4 mm before exclusion operation. (b) CTA diagnosed the growth of left PAA to a larger size of 8×9 mm with partial thrombosis. (c) CTA confirmed two large collaterals feeding the left PAA. CTA, computed tomography angiogram.

Completion angiography revealed immediate technical success with very delayed filling of the excluded popliteal artery from two tiny branches arising from the distal SFA (Fig. 2e). Because of the extremely low flow, ensuing thrombosis seemed very likely. Outflow angiography also showed a good distal runoff through the left peroneal artery with evidence of distal anterior and posterior tibial occlusions, probably embolic in origin (Fig. 2f). Symptomatic relief was noted on the immediate postoperative period. There were no immediate postoperative complications. Arterial duplex, on the following morning, confirmed complete aneurysm thrombosis (Fig. 3a–d), and the patient was discharged 24 h later. The patient is still asymptomatic, 6 months later on review in the vascular clinic.

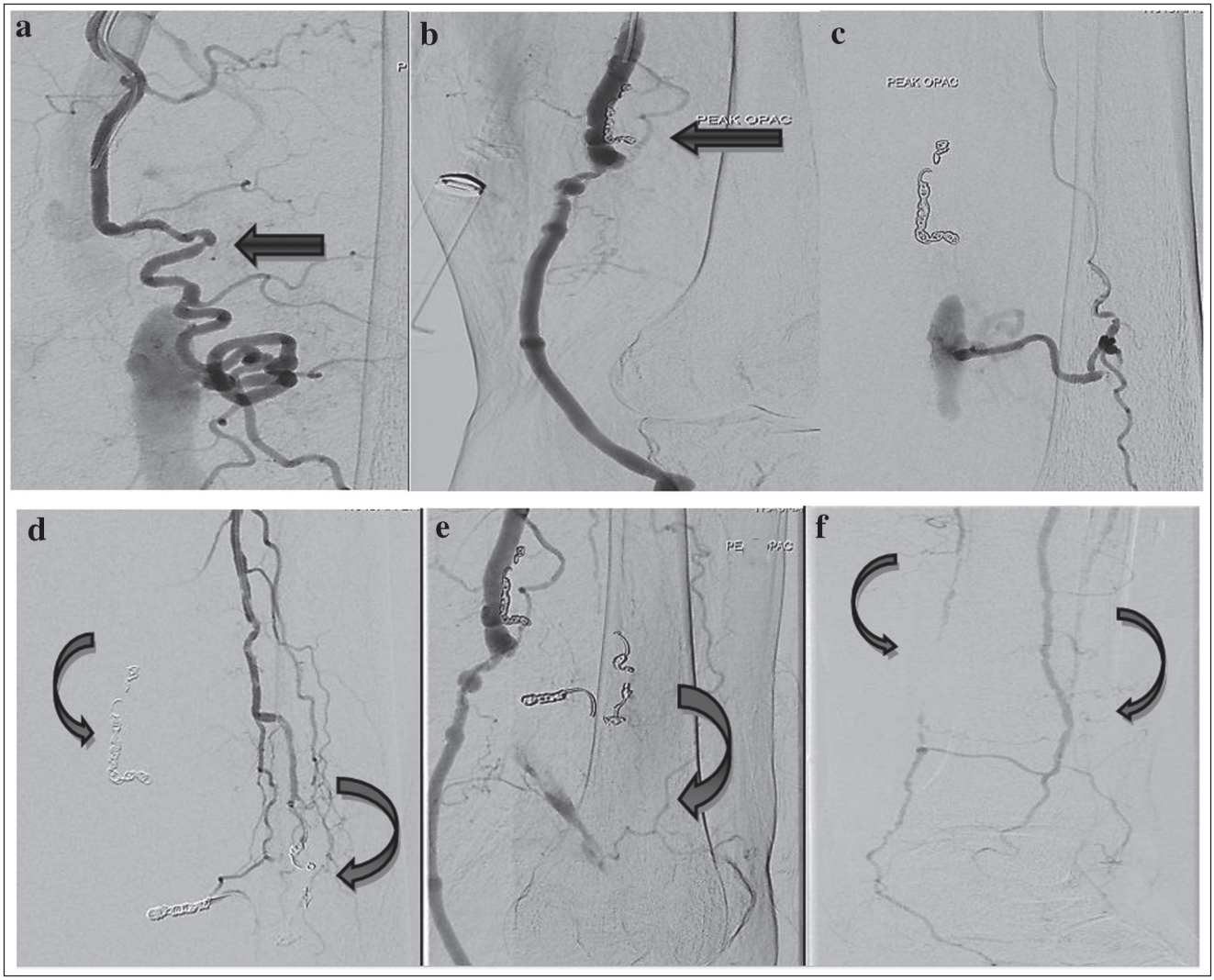
Discussion

Popliteal aneurysm growth despite successful ligation through the medial approach has been previously described. The mechanism of aneurysm growth following ligation may be analogous to a type 2 endoleak following endovascular abdominal aortic aneurysm repair [4]. In up to one-third of the patients, this continued expansion may present with pain, and tenderness resulting from compression [5]. In extreme cases, rupture of the excluded PAAs has been reported [2].

Averting these consequences, the posterior approach has been advocated. Using a curved incision in the popliteal fossa, the aneurysm sac can be opened, side branches interrupted, followed by venous or synthetic interposition grafting. Although, retrograde filling of the aneurysm sac can no longer happen, difficult exposure, and more dissection-related complications may be encountered [6]. Endovascular PAA repair has been described with excellent immediate success, but the long-term patency of the stent grafts across the knee joint is still, largely, undetermined [7].

In addition to graft patency surveillance, duplex ultrasound scanning has been recommended for the follow-up of excluded PAA, for up to or even beyond 10 years postoperatively [8]. Duplex ultrasound scanning may be used to measure the greatest transverse diameter, while the intrasac flow, along with the potential feeding vessels, may be visualized using Color Flow [9]. In addition, multislice computed tomography angiography has been shown to be a useful tool to evaluate residual perfusion in the popliteal aneurysm sac, and may be instrumental in the localization of feeding vessels. Interestingly, a recent case series showed that 24% of the patients after surgical exclusion of PAAs have had residual perfusion within the aneurysmal sac during follow-up,

Figure 2



(a) Angiography of the left superficial femoral artery (SFA) showed a large branch arising directly from the distal SFA following extreme tortuosity and eventually reached the top end of the left popliteal artery (PA). (b) Selective coil embolization of the collateral of left SFA using a 'Progreat' microcathether. Both (c, d) angiograms are showing previously placed coil and another source of left profunda femoris artery (PFA) giving a significant supply to the upper left popliteal artery. (e) Angiography from the left CFA after coil embolization of the feeding collaterals showed two tiny branches giving very minimal flow to the upper left PA. (f) Angiogram revealed previous distal embolization of the distal third of anterior and posterior tibial arteries with good patent left peroneal artery till the ankle.

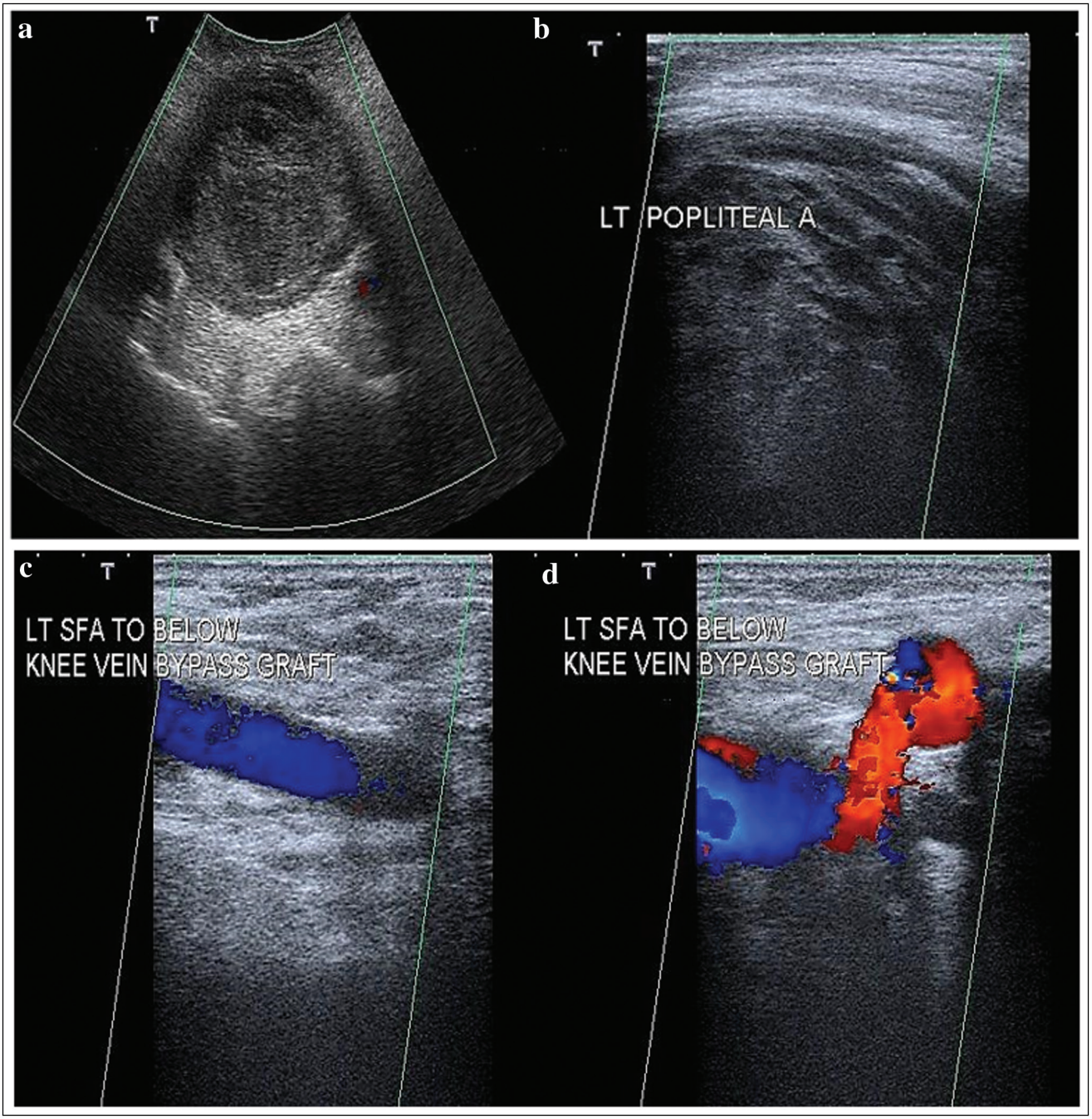
with a significant increase in the aneurysmal size with multislice computed tomography [10].

Patients with substantial sac growth, especially if symptomatic, may require secondary interventions including surgery or endovascular embolization of injectable materials such as thrombin [11], ethylene-vinyl-alcohol copolymer (Onyx, MicroTherapeutics Inc., Irvine, California, USA) [12], biologic glue, Lipiodol (Guerbet, Roissy, France), and Microcoils (Cook, Charenton, France) [13]. Despite being a technically demanding procedure, with superselective catheterization of these extremely tortuous small vessels, the outcome was rewarding, with both immediate technical and clinical successes. This case is unique in that we were able to coil the feeding collaterals from two different sources of SFA and profunda femoris artery, avoiding the potential risks of general anesthesia and operative reintervention. Quick recovery and shorter hospital stay were attainable due to the minimally invasive nature of the procedure.

In addition, if this problem is to be prevented, as Szilagyi *et al*. [14] have warned, care should be taken to avoid leaving any potential collateral arterial branches between the aneurysm and the point of ligation, that is type I exclusion [5].

In conclusion, this case report highlights the merits of minimally invasive endovascular interventions in dealing with the ever-increasing aging population. It should be considered as the principal treatment strategy if, at all, possible. On the other hand, a successful endovascular technique needs significant endovascular expertise, with high-quality road mapping and

Figure 3



(a–d) Follow-up duplex: (a) duplex scan confirmed thrombosed left PAA with no detectable flow. (b) Duplex image showed thrombosed left popliteal artery behind the knee with no flow. Both (c and d) duplex ultrasound images showed patent bypass graft with no significant lesions. PAA, popliteal artery aneurysms.

digital subtraction angiography essential for proper management and satisfying results. Moreover, PAA ligation through the medial approach should be done accompanied with opening the sac and securing all the feeding arteries to ensure cure of the aneurysm.

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Informed consent: 'a detailed consent, for the publication of this case report and any additional related information was taken from the patient involved in the study.'

Author contributions

Conception and design: A.K.S.A., A.E.B., D.C., and G.Ò. Acquisition of data: A.K.S.A., A.E.B., and G.Ò. Analysis and interpretation of data: A.E.B. and A.K.S.A. Drafting the case report: A.K.S.A. and A.E.B. Critical revision: A.K.S.A., A.E.B., D.C., and G.Ò. Final approval: G.Ò.

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Conflicts of interest

There are no conflicts of interest.

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