Hybrid treatment strategies for persistent sciatic artery aneurysm: A clinical case report

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SUMMARY

The persistent sciatic artery is a rare congenital anomaly often complicated by aneurysmal degeneration and chronic limb-threatening ischemia, leading to potential limb loss. A 73-year-old man presented with left fifth toe discolouration and rest pain. Imaging revealed a 15mm thrombosed persistent sciatic artery aneurysm and a hypoplastic superficial femoral artery. A hybrid approach combining endovascular embolisation and surgical bypass was performed, resulting in complete aneurysm thrombosis and restored perfusion. Hybrid strategies, balancing durability and reduced invasiveness, are increasingly favoured for managing persistent sciatic artery aneurysms. This case underscores the importance of early diagnosis, tailored treatment, and multidisciplinary care for optimal outcomes.

INTRODUCTION

The persistent sciatic artery (PSA) is a rare congenital vascular anomaly, with an estimated prevalence of 0.025% to 0.04% in the general population. First described by Green in 1832, PSA arises from the incomplete regression of the embryonic sciatic artery, which typically diminishes during foetal development.[1] Despite its rarity, PSA carries significant clinical implications, including aneurysmal degeneration and chronic limb-threatening ischemia (CLTI). Open surgical repair, while effective, requires extensive exposure and prolonged recovery, whereas endovascular approaches face challenges in achieving stable aneurysm exclusion and managing complex anatomy. This report presents a case of PSA aneurysm with CLTI, highlighting the value of early detection and a combined open-endovascular hybrid strategy to optimise anatomical repair, minimise complications, and address both structural and ischemic sequelae.

CASE PRESENTATION

A 73-year-old man presented with a four-month history of progressive discoloration and rest pain of the left fifth toe. Clinical examination revealed gangrene of the toe, consistent with CLTI (Figure 1a). Pulses were palpable in the left lower limb, except for the absent dorsalis pedis pulse, with a toe pressure of 20mmHg. The patient was a former smoker with no significant comorbidities.

Computed tomography angiography (CTA) revealed a 15mm partially thrombosed PSA aneurysm (Figure 1b). Imaging also showed a hypoplastic superficial femoral artery (SFA) that tapered off before reaching the popliteal artery (Figure 1c). Diagnostic angiography confirmed the PSA as the dominant blood supply to the left lower limb, with inadequate perfusion from the SFA.

A hybrid treatment approach of aneurysm embolisation and bypass to restore distal circulation was pursued. The procedure began with retrograde access to the below-knee popliteal artery using a 5Fr sheath. A 0.035” Glidewire (Terumo Cooperation) and a 5Fr straight catheter (IMAGER™ II, Boston Scientific) were advanced to the proximal PSA. The sheath was then exchanged for a 6Fr straight sheath (Fortress Introducer Sheath, Biotronik), and endovascular embolisation was performed using two 16mm Amplatzer Vascular Plugs (AVP II; St. Jude Medical, St. Paul, MN) deployed proximal and distal to the aneurysm (Figure 2b & 2c).

Following embolisation, a left common femoral artery (CFA) to below-knee popliteal artery bypass was performed using an ipsilateral reversed saphenous vein graft (RSVG). Completion angiography confirmed successful aneurysm exclusion and graft patency with distal perfusion to lower limb. The gangrenous fifth toe was disarticulated.

Postoperatively, the patient recovered well, with palpable posterior tibial pulse and wound healing (Figure 3a). The patient was discharged on dual antiplatelet therapy (tablet Cardiprin 100 mg daily and tablet Clopidogrel 75 mg daily). Follow-up duplex ultrasound and six-month CT angiography demonstrated complete aneurysm thrombosis, a patent RSVG, and restored limb perfusion (Figure 3c).

DISCUSSION

The persistent sciatic artery is a rare embryological remnant of the primitive sciatic artery, which typically regresses during foetal development. In cases where the SFA fails to develop adequately, the PSA persists, often coexisting with a hypoplastic SFA. Anatomically, the PSA originates from the internal iliac artery, traverses the greater sciatic foramen, and courses posteriorly in the thigh to connect with the popliteal artery.[1,2]

PSA is prone to aneurysmal degeneration, occurring in 15% to 44% of cases. This is attributed to its vulnerable anatomical location, which subjects it to repeated trauma and compression near the greater and lesser trochanters.

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Table I: Ahn-Mihn Classification of Persistent Sciatic Artery

Class	Superficial Femoral Artery	Persistent Sciatic Artery	Aneurysm	Pillet-Gauffre Classification
Class I	Complete	Complete	-	Type I, Va
Class Ia[a]			+	
Class II	Complete	Incomplete	-	Type III, IV
Class II[a]			+	
Class III	Incomplete	Complete	-	Type IIa, IIb, Vb
Class III[a]			+	
Class IV	Incomplete	Incomplete	-	None
Class IV[a]			+	

[a] “a” indicates accompanying persistent sciatic artery aneurysm.

Additionally, congenital deficiencies in the arterial wall’s elastic tissue may contribute to structural weakness, accelerating aneurysm formation and atherosclerotic changes.[3] The pathophysiology of CLTI in PSA aneurysms typically stems from thromboembolic events originating from mural thrombus within the aneurysm or mechanical compression of collateral vessels by the aneurysmal sac.[4]

The most widely used classification system for PSA is the Pillet-Gauffre system, which categorizes PSA based on the developmental status of the PSA and SFA.[5] In 2016, Ahn et al. enhanced this system by incorporating aneurysm presence as an additional criterion, providing a more comprehensive framework for diagnosis and treatment planning (Table I).[4]

CTA is prioritised over duplex ultrasound for diagnosing PSA aneurysms, offering high-resolution 3D visualisation of deep anatomic structures to assess morphology, thrombus burden, and complications like rupture. While duplex avoids radiation, its limited depth resolution hinders accurate evaluation, making CTA critical for urgent intervention and surgical planning in complex cases.

The management of PSA aneurysms involves three primary treatment modalities: open surgery, endovascular therapy, and hybrid approaches. Each modality has its indications, advantages, and limitations, and the choice of treatment depends on the patient’s clinical presentation, anatomical considerations, and overall risk profile.

Open surgical repair remains a cornerstone in managing complex PSA aneurysms, particularly those with extensive thrombosis or anatomical distortion. The procedure typically involves resection of the aneurysmal segment followed by bypass using autologous veins or synthetic grafts. While open surgery offers durable revascularisation, it carries risks such as wound infections, sciatic nerve injury, and graft failure, particularly in patients with poor distal runoff.6 Despite these challenges, open repair remains indispensable in anatomically complex scenarios where endovascular techniques are contraindicated or technically unfeasible.

Endovascular therapy has emerged as a minimally invasive alternative for managing PSA aneurysms, particularly in high-risk patients unsuitable for open surgery. This approach primarily involves two techniques: embolisation using coils or vascular plugs to exclude the aneurysm and stent-graft placement to reconstruct the arterial lumen. Embolisation is particularly effective for saccular aneurysms with narrow necks, while stent grafts are favoured for fusiform aneurysms with adequate proximal and distal landing zones. The advantages of endovascular treatment include reduced perioperative risks, shorter hospital stays, and faster recovery times. However, limitations such as incomplete exclusion in thrombus-laden or tortuous aneurysms can lead to endoleaks or stent migration.[3,4,7-9] Additionally, in incomplete PSA variants with insufficient collateral circulation, standalone endovascular therapy may fail to address ischemia, often requiring adjunctive bypass procedures.

Hybrid procedures, which combine open surgical bypass with endovascular aneurysm exclusion, have gained traction as a balanced strategy for addressing both limb ischemia and aneurysm-related risks. This approach typically involves performing a femoral-popliteal bypass to restore perfusion, followed by endovascular embolisation to exclude the aneurysm. By leveraging the durability of surgical bypass while reducing the invasiveness of open aneurysm resection, hybrid techniques offer a compelling solution for complex cases. Recent case studies highlight the efficacy of hybrid approaches, with reports of 100% technical success and low recurrence rates. For instance, a 2023 report described a 75-year-old patient with a thrombus-containing PSA aneurysm who underwent left femoral-popliteal bypass using a synthetic graft and subsequent endovascular plug embolisation, achieving complete aneurysm exclusion and resolution of ischemic symptoms at one-month follow-up.[7] Similarly, a 69-year-old male with CLTI underwent below-knee femoropopliteal bypass and Amplatzer plug occlusion, resulting in restored perfusion and technical success.[9]

The hybrid approach balances costs and outcomes: open repair avoids endovascular device expenses but risks costly complications like infections, while hybrid strategies reduce recovery time and reoperations, offsetting initial costs. Hybrid methods require advanced imaging, hybrid suites, and multidisciplinary teams, feasible only in tertiary centres, yet minimise morbidity such as nerve injury from open dissection. Though logistics demand team coordination, hybrid therapy optimises outcomes in settings with sufficient resources, whereas open repair remains pragmatic in resource-limited areas despite higher complication risks.

Our patient presented with a thrombosed Class IIIa PSA aneurysm according to the Ahn-Minh classification, complicated by CLTI. The hybrid approach, which combined endovascular embolisation with surgical bypass, was chosen to ensure both aneurysm exclusion and limb

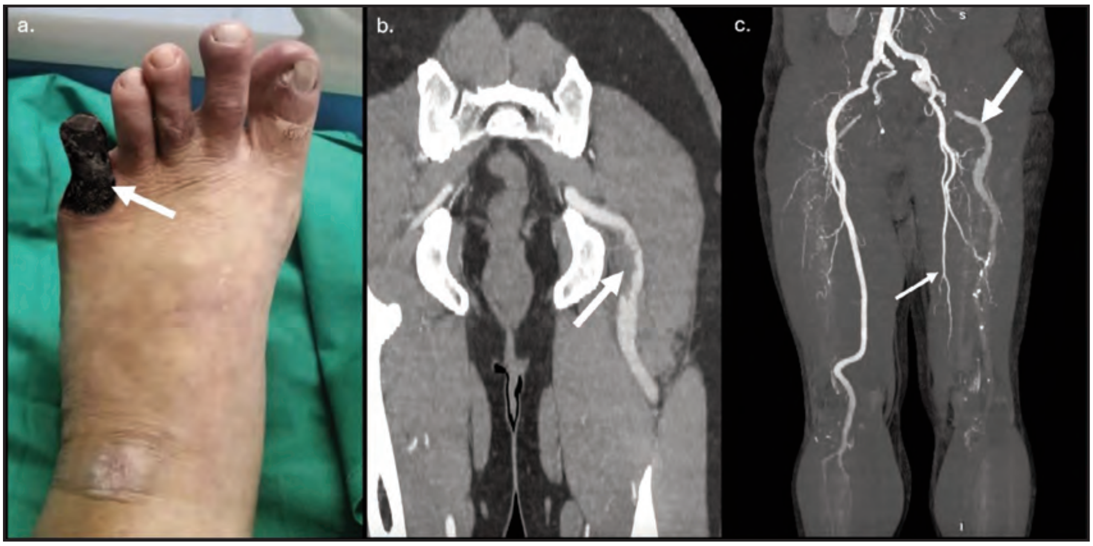

Fig. 1: (a) A 73-year-old man with a four-month history of progressive dry gangrene in the left fifth toe (white arrow). (b) Computed tomography angiography (CTA) revealed a 15-mm partially thrombosed PSA aneurysm (white arrow). (c) Reconstructed CTA showed a concurrent PSA aneurysm (large white arrow) with a hypoplastic superficial femoral artery (small white arrow)

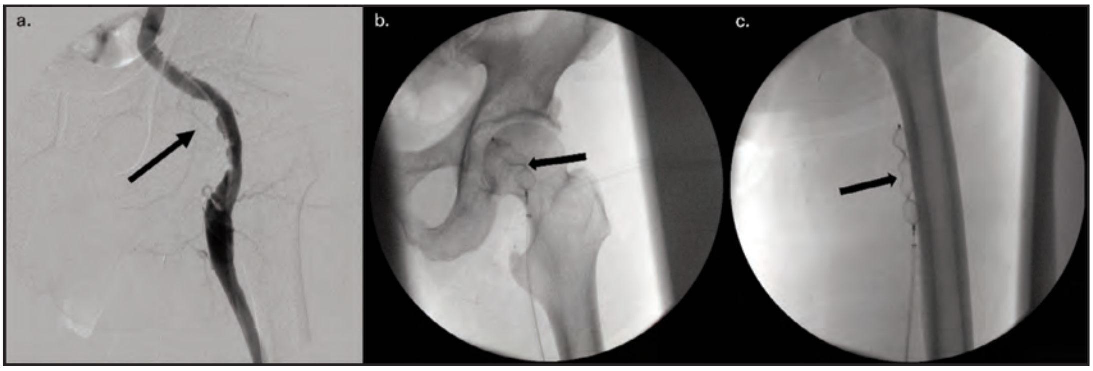

Fig. 2: (a) Intraoperative angiogram revealed thrombosed PSA aneurysm (black arrow). (b) and (c) Successful deployment of two 16mm Amplatzer Vascular Plugs (black arrows) proximal and distal to the aneurysm

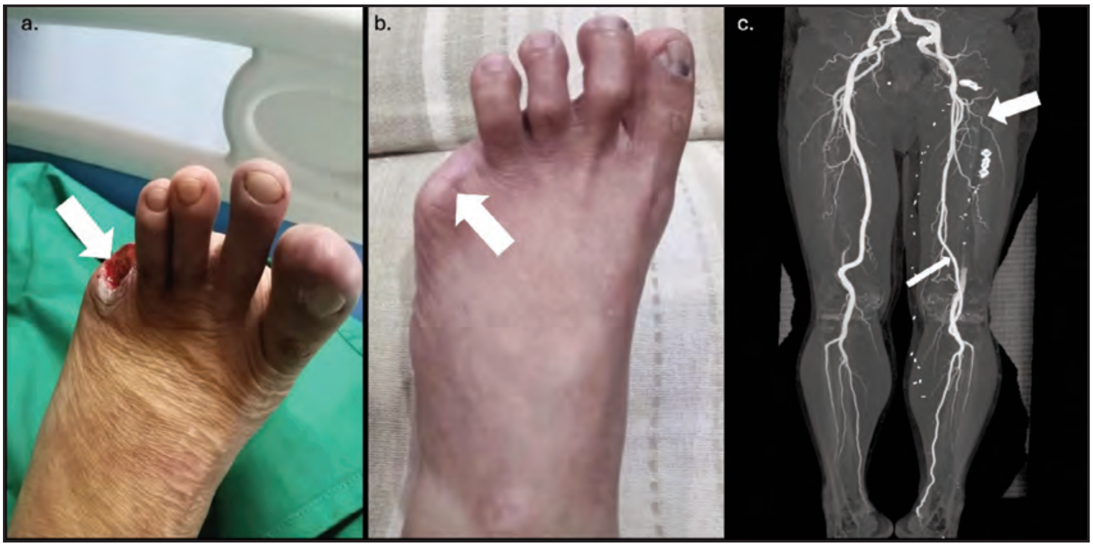

Fig. 3: (a) and (b) Photograph showing good wound healing (white arrows) following left fifth toe disarticulation. (c) Six-month CTA demonstrated complete PSA aneurysm thrombosis (large white arrow), a patent RSVG (small white arrow), and restored limb perfusion

revascularisation. This strategy aligns with recent trends favouring hybrid techniques for their balance of durability and reduced invasiveness. Retrograde access to the below-knee popliteal artery was chosen due to the failure of antegrade access through the ipsilateral common femoral artery, caused by the tortuous nature of the aneurysmal persistent sciatic artery, which hindered access to the aneurysmal sac, and to accommodate higher-profile access for the procedure. Therapeutic embolisation of PSA aneurysms has been reported in multiple cases, with most utilising intravascular coils. However, Amplatzer plugs, self-expanding nitinol mesh devices, had been chosen as it offer several advantages, including precise delivery, the ability to occlude large-diameter vessels, and reduced scatter on follow-up imaging.[10] Compared to coils, which can be challenging to place accurately and may require multiple units, Amplatzer plugs achieve equivalent efficacy with shorter procedure times.

Hybrid repair of PSA aneurysms combines risks from open and endovascular techniques, requiring surveillance addressing both complications while balancing cost and radiation exposure. Clinical follow-up at 1, 6, 12 months, and annually includes monitoring for claudication, rest pain, or acute ischemia, paired with ankle-brachial index (ABI) and toe pressure measurements to track perfusion. Imaging combines CTA (1 month, 6 months, annually) to verify aneurysm exclusion and bypass patency, and duplex ultrasound (3, 6, 12 months, annually) to assess graft velocity and detect recurrence. Early identification of bypass stenosis permits prompt percutaneous intervention, preserving graft function and improving outcomes.

CONCLUSION

Hybrid approaches, combining open bypass with endovascular exclusion, are increasingly favoured for managing PSA aneurysms complicated by CLTI. These strategies balance durability and reduced invasiveness, offering tailored solutions for complex cases. While open surgery remains essential for anatomical challenges, endovascular techniques benefit high-risk patients. Standardised protocols, guided by anatomic classification and individualised assessment, will further optimise outcomes for this rare yet high-stakes condition.

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DECLARATION

The authors have no conflict of interest to disclose.

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