

Endovascular stent graft repair of complete persistent sciatic artery aneurysm with lower limb ischemia: A case report and review of the literature

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Abstract

Background: Persistent sciatic artery is a rare embryological vascular anomaly, with an incidence of 0.01%–0.05%. Up to 60% of persistent sciatic artery patients will develop aneurysms that can subsequently lead to distal embolization and a high risk of limb loss.

Method: Here we report a case with acute limb ischemia caused by thrombus in a right persistent sciatic artery aneurysm. The patient underwent endovascular treatment by deploying a 10 × 150 mm stent graft (Viabahn) in the persistent sciatic artery and two self-expanding bare stents (10 × 40 mm, 10 × 60 mm, SMART) in the stent graft to reinforce the radial resistive force. In addition, we conducted a literature review of articles published in PubMed from 2001 to 2018 regarding stent graft repair of complete persistent sciatic artery aneurysms. A total of 13 articles reported 13 patients with complete persistent sciatic artery aneurysms who underwent endovascular stent graft repair.

Result: A favorable result was obtained for this patient, and computed tomographic angiography at 6 months of follow-up revealed patent stent graft. Most articles reported favorable results.

Conclusion: Favorable results can be achieved with endovascular stent graft repair and anticoagulation therapy for complete persistent sciatic artery aneurysms.

Keywords

Persistent sciatic artery, aneurysm, limb ischemia, endovascular management, stent graft

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Introduction

Persistent sciatic artery (PSA) is an exceptionally rare embryological vascular anomaly with an incidence of 0.01%–0.05%.¹ PSAs exist in two forms: complete and incomplete. Complete PSA is the most common, occurring in 70%–80% of PSAs.² PSAs are prone to vessel wall degeneration and arterial sclerosis. Up to 60% of patients will develop aneurysms according to the available case data and literature.³ Complete PSA aneurysm often requires aneurysm exclusion and revascularization because it may cause acute and chronic ischemia of lower limb with a high incidence of limb loss. The femoropopliteal bypass and resection of the aneurysm are the most common surgical procedure.⁴

Endovascular exclusion was first reported by Gabelmann et al.⁵ via the contralateral femoral artery approach. Endovascular stent graft repair became an option for the treatment of PSA aneurysm. Nevertheless, there are limited case

reports confirming the effectiveness and long-term durability of stent grafts.⁶ We successfully performed endovascular repair for a patient with complete (type IIa) PSA aneurysm and acute limb ischemia (ALI) and reviewed the current literature regarding stent graft repair of complete PSA aneurysms.

Case report

A 62-year-old man with type 2 diabetes mellitus and hypertension was admitted to our emergency department for

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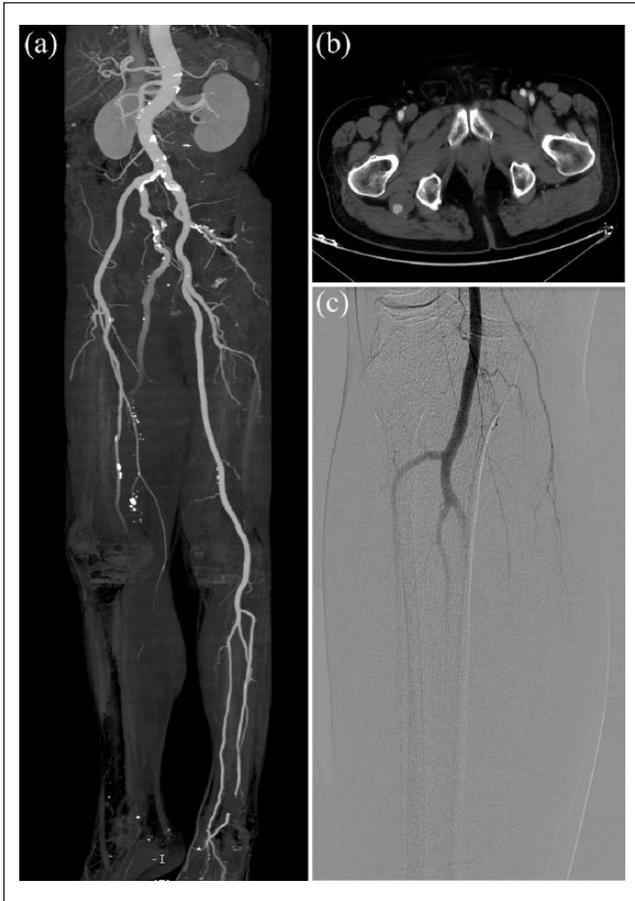


Figure 1. (a) Computed tomography angiography (CTA) revealing a complete persistent sciatic artery (PSA) branching off from the right common iliac artery and the hypoplastic superficial femoral artery terminated in the mid-thigh. (b) The complete PSA formed a partially thrombosed aneurysm (36 mm in diameter) in the right gluteal region. (c) Intraoperative angiogram revealed occlusion of distal arteries below the knee (BTK).

sudden-onset severe pain of the right calf and foot for 3 days. Physical examination demonstrated a cyanotic and cold right foot with normal knee activity, decreased activity of ankle joint, and foot tactile depression (Rutherford IIb). Normal femoral and popliteal pulses on the right were palpated. The posterior and anterior tibial arteries were not palpable, and the ankle-brachial index (ABI) could not be calculated. Laboratory examinations showed a creatinine phosphokinase of 24740 U/L. Computed tomographic angiography (CTA) revealed a complete PSA extending from the right internal iliac artery to the popliteal artery and forming a partially thrombosed fusiform aneurysm (36 mm in diameter) in the right gluteal region, causing embolization of distal arteries (Figure 1(a) and (b)). The superficial femoral artery (SFA) was hypoplastic and terminated in the mid-thigh (Figure 1(a)). Intraoperative angiogram revealed occlusion of distal arteries below the knee (BTK; Figure 1(c)).

The patient underwent emergent percutaneous transluminal angioplasty (PTA) and catheter-directed thrombolysis (CDT) of the anterior tibial artery and posterior tibial artery, respectively, using an infusion catheter (Merit Medical, Utah, USA) and urokinase. Urokinase (800,000 U) was used intraoperatively. Postoperative CTA, at 10 days, showed patent PSA, popliteal artery, and arteries BTK (Figure 2(a)). Aspirin and rivaroxaban were administered. Two months later, the patient was re-admitted to our department for intermittent claudication of the right lower limb. The claudication distance was about 100 m, and the ABI was 0.61. CTA revealed that the PSA was totally occluded from the pelvic level, and there was a large collateral from the common femoral artery to the popliteal artery (Figure 2(b) and (c)). The guide wire and catheter was unable to pass through the occluded PSA via the contralateral femoral approach (CFA; Figure 2(d)). We performed PTA of the PSA using a 4×150 mm balloon (BIOTRONIK AG, Bulach, Switzerland) over a V-18 control wire (Boston Scientific, Marlborough, MA, USA; Figure 3(a) and (b)) and CDT through a 4-F sheath by retrograde puncture of the anterior tibial artery (Figure 3(c) and (d)). The duration of thrombolysis was 48 h, and dosage of urokinase was 1,600,000 U. The PSA aneurysm was excluded by implantation of a 10×150 mm peripheral endograft (Viabahn; W.L. Gore & Associates, Flagstaff, AZ, USA) over a 0.035-in. stiff guide wire (Boston Scientific, Natick, MA, USA) via CFA and 12-F introducer (St. Jude Medical, MN, USA; Figure 4(a)). Two self-expanding bare stents (10×40 mm, 10×60 mm, SMART, Cordis, FL, USA) were deployed in the Viabahn stent graft, and one self-expanding bare stent (10×60 mm, Cordis, FL, USA) was deployed in the hypogastric artery proximal to the PSA aneurysm. Postdilation was performed using an 8×80 mm balloon (Invatec, BS, Italy; Figure 4(b) and (c)). Completion angiogram revealed the excluded aneurysm and the patent stent, popliteal artery and distal arteries of BTK (Figure 4(d)–(f)). The puncture site of the femoral artery was closed with ProGlide (Abbott Vascular, CA, USA). The ABI increased to 1.0 from 0.61.

Thereafter, the patient was given antiplatelet agent (aspirin) and anticoagulant (rivaroxaban) therapy. CTA at 6 months of follow-up after re-intervention revealed patent stent graft, popliteal artery, and arteries of BTK (Figure 5). At 1 year of follow-up, the patient had no symptoms of lower limb ischemia, and the dorsal artery of foot and posterior tibial artery could be palpated.

The study was approved by the ethics committee of the Affiliated Hospital of Qingdao University, and informed consent was obtained from the patient.

Discussion

PSA is a rare congenital vascular anomaly associated with various complications, including atherosclerotic changes and aneurysms that can result in thrombosis of the PSA or

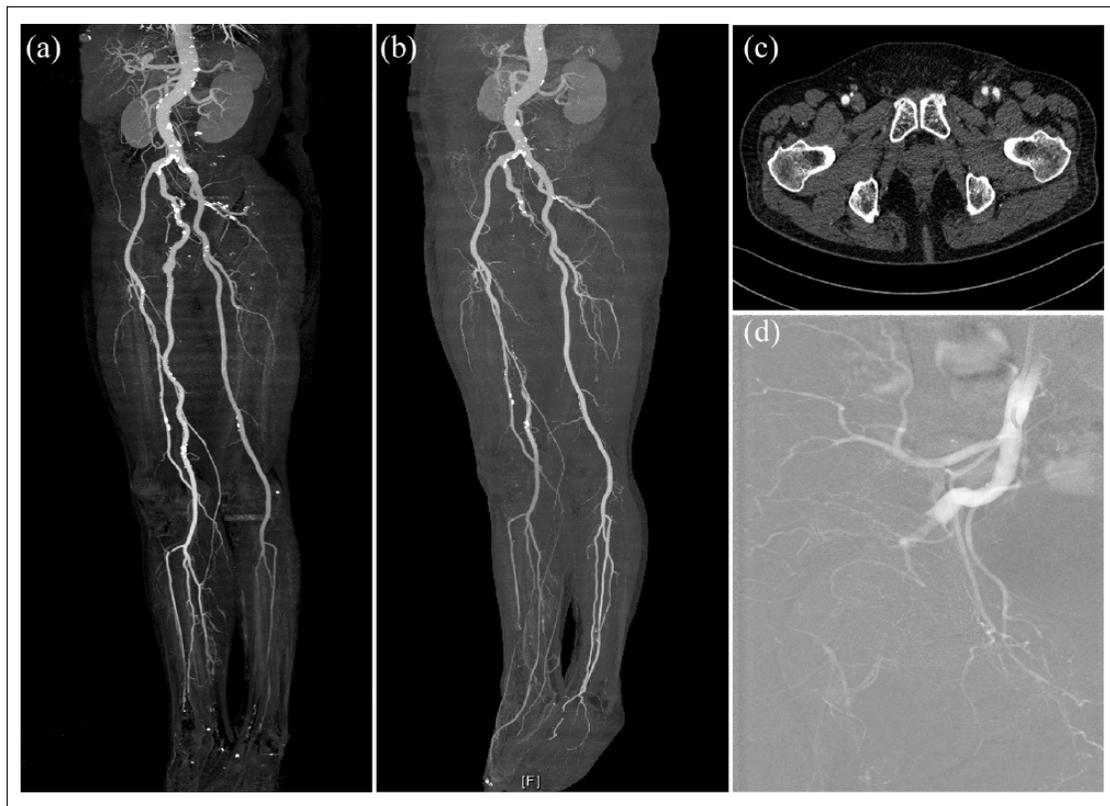


Figure 2. (a) Postoperative CTA at 10 days showing a patent PSA, popliteal artery, and arteries BTK. (b) CTA after 2 months revealed that there was a large collateral from the femoral artery to the popliteal artery and (c) the PSA was totally occluded from the pelvic level. (d) Angiogram showing the PSA totally occluded and the guide wire, and catheter was unable to pass through via a contralateral femoral approach.

embolization of distal artery. Aneurysm formation is the most frequent complication of PSA and occurs in up to 60% of cases. The treatment of PSA aneurysm is dependent on both the symptoms and classification type. The classification type of PSA was described by Pillet et al. and modified by Gauffre et al. based on the blood flow of lower limb. Pillet et al.⁷ described four types of PSA: type I represents a complete PSA and a normal femoral artery; type IIa represents a complete PSA with an incompletely developed femoral artery; type IIb represents a complete PSA with an absent SFA; in type III, an incompletely PSA, in which only the upper part persists in combination with normal femoral artery; and type IV represents an incomplete PSA, in which only the lower part persists in combination with normal femoral artery. Gauffre et al.⁸ reported a fifth type: the PSA originates from the median sacral artery. The fifth type includes two subtypes: type Va with a developed SFA and type Vb with an undeveloped SFA. Complete PSA extends to the popliteal artery directly with hypoplasia or deficit of the SFA. For incomplete PSA, the SFA was the dominant blood supplier of lower limb with hypoplastic PSA in the mid-thigh. About 80% of PSAs are of complete type that require revascularization because of high risk of distal embolization from PSA aneurysm. In the present case, the PSA aneurysm

was type IIa that was a complete PSA and an incomplete SFA with ALI caused by the PSA aneurysm.

The treatment of complete PSA aneurysms includes surgical resection, embolization or endovascular therapy. Surgical resection has risks of potential complications, including injury of sciatic nerve and need to be performed in a narrow and deep surgical field in the buttock. Although embolization is minimally invasive, femoropopliteal bypass is required.⁹ The advantage of endovascular stent graft repair is that the aneurysm can be excluded and that the vascular can be reconstructed simultaneously without risk of sciatic nerve injury. Nevertheless, the durability of endovascular stent graft repair has not been determined.

Therefore, we searched the literature in PubMed to determine the effectiveness and long-term results of stent grafts to treat PSA aneurysms. From 2001 to 2018, 13 articles reported on 13 patients with complete PSA aneurysm undergoing endovascular stent graft repair (Table 1).^{5,10–21} The ages ranged from 47 to 88 years. Complete PSA aneurysm was diagnosed in five men (44%) and eight women (56%). Complete PSA was on the left in six patients and on the right in seven patients. The mean diameter of the aneurysm was 4.8 (2.6–8.3) cm. Lower limb ischemia, as result of distal embolization, was the most common clinical presentation

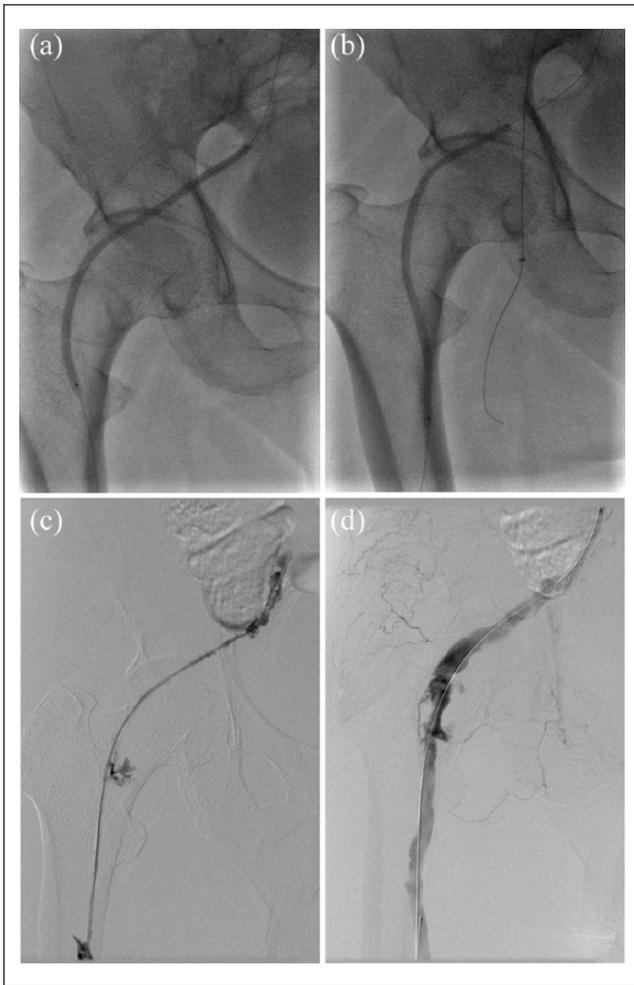


Figure 3. (a, b) The occluded PSA underwent percutaneous transluminal angiography with balloon over a V-18 control wire, (c) we performed catheter-directed thrombolysis using an infusion catheter, (d) and the PSA was patent after CDT.

(84.6%). Eight patients were treated via the CFA: four via the ipsilateral popliteal artery and one via the PSA. Stent grafts implanted to treat complete PSA aneurysm included six Viabahn stent grafts, three Hemobahn stent grafts, two Excluder stent grafts, one AneuRx stent graft, and one Fluency stent graft. There were no amputations, deaths, or other complications perioperatively. The follow-up time ranged from 1 to 48 months. Most reports reported favorable short-term and mid-term results. The longest patency reported was 4 years. Only Girsowicz et al.¹⁷ reported that the stent graft (Viabahn) fractured at 6 months of follow-up. Because the stent graft is implanted in the PSA exposing to chronic extrinsic compression over the hip joint, the radial resistive force of the stent graft may be insufficient. Fracture and occlusion of the stent graft may occur because of chronic compression and stretch. In the present case, we deployed a self-expanding bare stent in a Viabahn stent graft to reinforce the radial resistive force. The stent graft remained patent with no occlusion and fracture at 6 months of follow-up. To

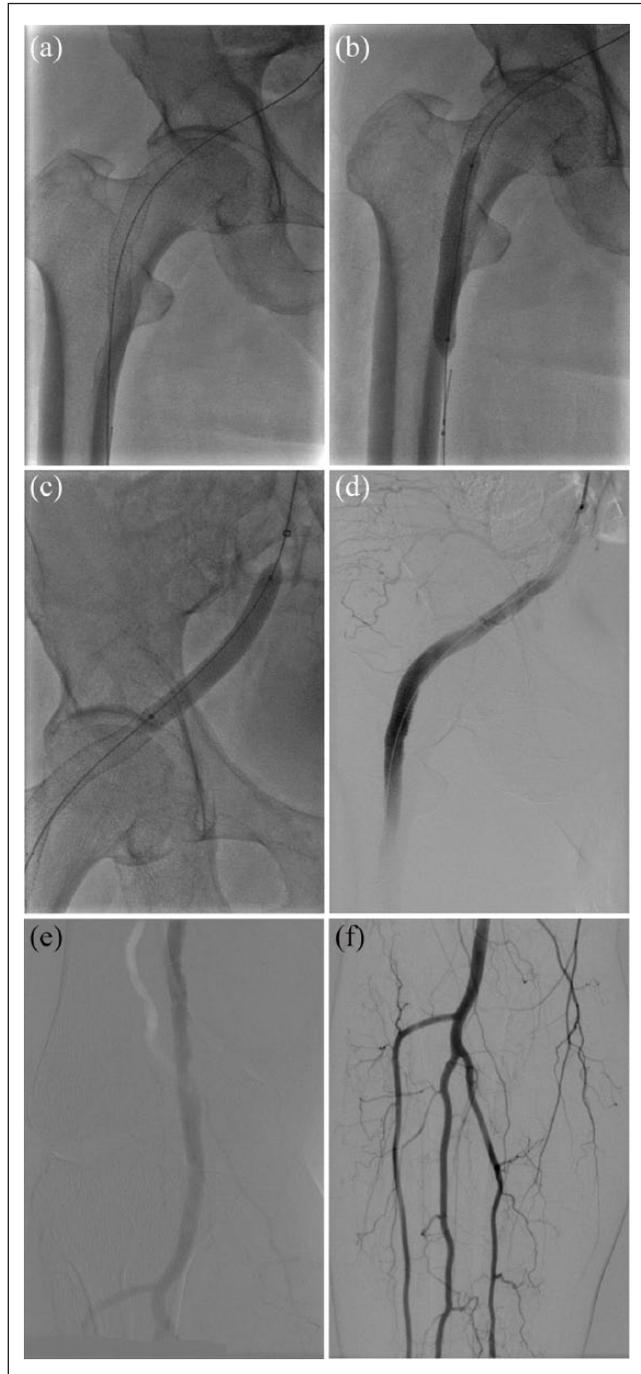


Figure 4. (a) The PSA aneurysm was excluded by deployment of a 10×150 mm Viabahn stent graft. (b, c) Postdilation was performed after stent graft and self-expanding bare stent implantation. (d–f) Final angiogram revealed exclusion of the aneurysm and patent stent, popliteal artery, and distal arteries of BTK.

our knowledge, this was the first report of deployment of a self-expanding bare stent in a stent graft to treat complete PSA aneurysm. The long-term durability of stent grafts requires further follow-up. Antiplatelet and anticoagulation therapy must be given to maintain long-term patency.



Figure 5. CTA at 6 months of follow-up revealing a patent stent graft, popliteal artery and arteries of BTK without fracture of the stent.

In addition, stent grafts could be deployed via femoral, popliteal, or transluteal approaches. Most patients underwent stent grafting via the CFA (61.5%).^{5,12–17} Several reports described exclusion of PSA aneurysm with stent graft through an open above-knee popliteal artery exposure because of large profiles and stiffness of stent grafts (AneuRx and Excluder).^{10,18,20} Wijeyaratne and Wijewardene¹¹ suggested ipsilateral popliteal artery puncture and retrograde approach to prevent anticipated difficulties in deploying stent graft (Viabahn) via a tortuous antegrade approach. In this report, we preferred to deploy a stent graft via CFA and a 12-F sheath. The puncture site was closed with ProGlide with no need for popliteal artery exposure. This approach was simple and effective.

For patients with femoral artery occlusion and claudication, open surgery presents risks of sciatic nerve injury and need to be performed in a narrow and deep surgical field in the buttock and thigh. Endovascular repair can exclude the aneurysm and reconstruct simultaneously without risk of sciatic nerve injury. We prefer to endovascular repair because it is minimally invasive with low morbidity rates. If endovascular repair fails or the patient develops critical ischemia due to occlusion of stent graft at follow-up, we can perform femoropopliteal bypass as an alternative procedure.

Conclusion

Recognition of the PSA aneurysm is essential because patients commonly present with symptom of limb ischemia that may lead to incorrect diagnosis of artery occlusive disease. Endovascular stent graft repair of complete PSA aneurysm via CFA is minimally invasive that can exclude the lesion and revascularization simultaneously with low morbidity rates.

Table 1. Review of published cases in PubMed regarding endovascular stent graft repair of complete PSA aneurysm.

Author	Year	F/M	Age (years)	CS	Side	Aneurysm size (cm)	Access	SG	AAT	F/U (mo)	Result
Gabelmann et al. ⁵	2001	F	63	SA	L	NM	CFA	10 × 60 mm Hemobahn	NM	22	Patent
Fearing et al. ¹⁰	2005	F	88	NM	L	6.5	RPA	12 × 11.5 mm AneuRx	NM	39	Patent
Wijeyaratne and Wijewardene ¹¹	2009	F	55	ALI	R	3.5	RPA	6 × 15 mm Viabahn	Clopidogrel	48	Patent
Verikokos et al. ¹²	2010	M	57	CLI	R	2.6	CFA	7 × 5 mm, 8 × 5 mm Viabahn	Clopidogrel	6	Patent
Mascarenhas and deSouzaMourao ¹³	2011	M	70	CLI	L	4.4 cm	CFA	8 × 150 mm Viabahn	NM	6	Patent
Debels and De Gendt ¹⁴	2011	F	47	CLI	R	NM	CFA	11 × 110 mm × 2 Hemobahn	NM	1	Patent
Shibutani et al. ¹⁵	2013	F	74	CLI	R	2.1 × 3.6	CFA	10 × 80 mm Fluency	Aspirin, cilostazol, and warfarin	6	Patent

(Continued)

Table 1. (Continued)

Author	Year	F/M	Age (years)	CS	Side	Aneurysm size (cm)	Access	SG	AAT	F/U (mo)	Result
Nuño-Escobar et al. ¹⁶	2013	M	53	ALI	L	7	CFA	10 × 50 mm × 2 Hemobahn	NM	6	Patent
Girsowicz et al. ¹⁷	2014	M	65	ALI	R	2.4	CFA	11 × 110 mm Viabahn	NM	6	Occlude
Sato et al. ¹⁸	2014	F	74	NM	R	5	RPA	16-14.5 mm × 14 cm, 16-18 mm × 13.5 cm Excluder	Clopidogrel	12	Patent
d'Adamo et al. ¹⁹	2017	M	77	ALI	R	NM	CFA	13 × 100 mm × 2 Viabahn	NM	12	Patent
Fukuda et al. ²⁰	2017	F	70	ALI	L	NM	RPA	16-12 mm × 12 cm Excluder	Clopidogrel and apixaban	12	Patent
Inui et al. ²¹	2018	F	72	ALI	L	8.3	SA	8 × 150 mm, 10 × 100 mm Viabahn	NM	6	Patent

PSA: persistent sciatic artery; F: female; M: male; CS: clinical aspect; ALI: acute limb ischemia; CLI: chronic limb ischemia; L: left; R: right; SG: stent graft; F/U: follow-up; SA: subacute; NM: not mentioned; CFA: contralateral femoral artery; RPA: retrograde popliteal artery; SA: sciatic artery; AAT: antiplatelet and anticoagulant therapy.

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Y.W. and H.W. were responsible for the conception and design of the study. Y.W. and X.H. were responsible for writing the article of the study. H.W. gave the critical revision of the article. The final approval of the article: Y.W., H.X., H.T., and H.W. Overall responsibility for this article was undertaken by Y.W.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

Ethical approval to report this case was obtained from the ethics committee of the Affiliated Hospital of Qingdao University.

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Informed consent

Written informed consent was obtained from the patient(s) for their anonymized information to be published in this article.

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