

## Endovascular treatment of a post-traumatic posterior tibial artery pseudoaneurysm: A case report

Mohamed Osman , Sakr Abd-Elaty , Zamzm Lotfy , Mostafa Mohamed , El-areef Emad 

Department of Vascular Surgery, Kobry El-Qobba Hospital, Cairo, Egypt

### ABSTRACT

Post-traumatic pseudoaneurysms of the posterior tibial artery are uncommon and are very rarely seen due to firearm injuries. These pseudoaneurysms are seldomly located in the middle one-third of the posterior tibial artery. In recent years, in the management strategy of post-traumatic pseudoaneurysms, endovascular repair, as being an anatomical and less invasive modality, has increasingly gained more attention, compared to open repair. Herein, we present a 22-year-old male case of a delayed symptomatic post-firearm injury pseudoaneurysm of the posterior tibial artery treated with an endovascular stent graft in the light of literature data.

**Keywords:** Firearm injury; posterior tibial artery; pseudoaneurysm; stent graft.

Post-traumatic pseudoaneurysms (PAs) are not uncommon in the military facilities during periods of armed conflicts;<sup>[1]</sup> however, they are rarely seen in the civilian health care system. These PAs can occur due to penetrating or blunt injury, orthopedic injuries, sporting activities, or iatrogenic injuries.<sup>[2]</sup> The therapeutic strategy before the endovascular era included artery ligation or reconstruction with an autologous material, external compression, coil embolization, or echo-guided thrombin injection.<sup>[3]</sup> The introduction of endovascular approaches for peripheral arterial lesions with covered stents has allowed a less traumatic and anatomic reconstruction of such lesions.

Herein, we present a case of a delayed symptomatic post-firearm injury PA of the posterior tibial artery (PTA) treated with an endovascular stent graft in the light of literature data.

### CASE REPORT

A 22-year-old man presented to our outpatient clinic with a painful pulsating swelling at the lateral aspect of the left lower limb seven months after a

penetrating firearm bullet injury which was treated conservatively in a secondary care center (Figure 1). On physical examination, there was a scar of small inlet wound at the lateral aspect of the left leg and a larger exit one at the medial aspect (Figure 2). On palpation, a pulsatile mass was evident with no thrill. The dorsalis pedis artery (DPA) pulse was intact, but not the PTA. Neurological examination findings were normal. Duplex ultrasound examination confirmed the presence of a 7×7.5×8 cm PA of the PTA with an ankle-brachial pressure index (ABPI) of 1 over the DPA. After team discussion and patient counseling, we decided to adopt the endovascular intervention approach first, as open surgical repair of a PA of the middle one-third of the PTA (which is the deepest third of the PTA) in the presence of extensive fibrous tissues would be technically very demanding with a high risk of morbidity.

A written informed consent was obtained from the patient. Under local anesthesia, a 6 French (F) introducer sheath was inserted through an ipsilateral antegrade approach into the left common femoral artery. A contrast angiography showed patent arterial

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**Correspondence:** Mohamed Osman, MD. Department of Vascular Surgery, Kobry El-Qobba Hospital, Cairo, Egypt.  
e-mail: zahran65@hotmail.com

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**Figure 1.** A mass in the left lower limb (marked round) with a scar of the firearm inlet on admission.

tree with a 7×8 cm PA arising from the lateral aspect of the middle one-third of the PTA posterior to the tibial shaft with no evidence of an arteriovenous fistula (Figure 3). After many attempts in different projections, we managed to engage a 0.035 inch Terumo hydrophilic-coated guidewire (Terumo; Somerset, NJ, USA) into the PTA distal to the neck of the PA, and we first attempted to do transluminal temporary occlusion of the PA neck using a 3×80 mm balloon (Mustang Balloon Dilatation Catheter, Boston Scientific, MA, USA) for five min. After deflation of the balloon, although it induced a significant thrombosis of the sac, flow could still be detected (Figure 4). As the vascular team, do not usually keep small-sized stented grafts on shelf, we asked the cardiology team to provide us



**Figure 3.** Contrast angiography showing a middle one-third of posterior tibial artery pseudoaneurysm.

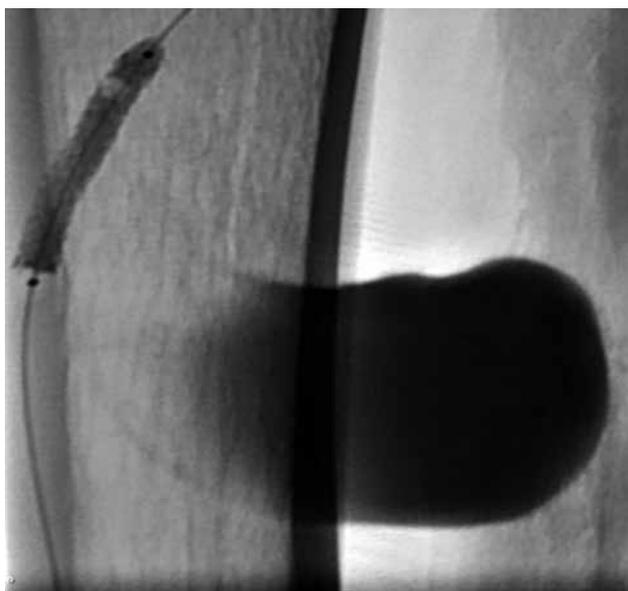


**Figure 2.** Medial aspect of the left lower limb showing a scar of the firearm exit on admission.

with a suitable-sized covered stented graft (a 4×24 mm balloon-expandable covered stent graft [BeGraft Bentley InnoMed. GmbH, Hechingen, Germany]) (Figure 5), which totally excluded the aneurysm with a well-preserved blood flow into the PTA (Figure 6) with sudden reduction of the size and absence of the



**Figure 4.** A patent pseudoaneurysm after transluminal temporary occlusion of neck by ballooning.



**Figure 5.** A 4×24-mm balloon-expandable covered stent graft (Bentley-Innomed) deployed at the neck of pseudoaneurysm.



**Figure 6.** Angiographic view after stent placement. The pseudoaneurysm was completely excluded.

pulsations over the swelling, as evidenced by physical examination of the lower limb.

The patient was discharged on the next day, although pulse was unable to be felt over the PTA; however, the ABPI over the palpable DPA was still 1. Dual antiplatelet therapy was prescribed to the patient and he was scheduled for follow-up visits at 1, 3, 6, and 12 months.

## DISCUSSION

Post-traumatic pseudoaneurysms of the crural arteries are very rare. In the literature, causes of PAs are mainly orthopedic interventions and traumatic arterial lesions due to penetrating or blunt injuries, followed by vascular interventions.<sup>[4]</sup>

The treatment of PAs of the crural arteries depends on the size and localization of the PA and to the presence of symptoms or complications due to the PA. Symptoms include swelling, an expanding mass, bruising, pain, or neurological signs due to nerve compression.

Alternatively, they can be initially asymptomatic and become symptomatic at a time remote to the injury.<sup>[5]</sup> Complications of PAs include thrombosis, distal embolism, rupture, and compartment syndrome. Currently, due to the small number of published cases, there is no consensus regarding the plane of management of these PAs; either open or endovascular repair. Nonetheless, any repair should aim at their complete exclusion and/or excision from the main

vessel. Open surgical repair (i.e., ligation and/or excision and bypass grafting) in a deep and hostile anatomical field may subject the patient to extensive dissection, prolonged duration of operation, and higher incidences of morbidity (i.e., motor and sensory nerve damage, prolonged recovery, deep vein thrombosis, bleeding, or wound-related complications). Other techniques including Duplex ultrasound-guided compression, thrombin injection, and coil embolization have been also described. The recent development and application of endovascular technology and therapy have allowed us to use stent grafts in the management of arterial injuries and post-traumatic PAs. Parodi et al.<sup>[6]</sup> and Marin et al.<sup>[7]</sup> described the value of endovascular treatment of complex peripheral lesions with satisfactory results for arterial injuries of the arms and the neck. De Roo et al.<sup>[8]</sup> described the treatment of an iatrogenic isolated aneurysm of the tibial arteries with a covered stent with satisfactory mid-term results. Currently, there are only few published case reports describing the use of a covered stent to treat PAs of the PTA (Table 1). The first report was published by Joglar et al.<sup>[9]</sup> in 2010 which described a case of a 39-year-old male victim of blunt trauma who presented three weeks after injury with a PA arising from the middle one-third of the right PTA which was excluded through the placement of a covered balloon expandable stent graft. Marks et al.<sup>[10]</sup> in 2011 reported another case of a post-traumatic PA of the PTA in a 19-year-old man after a gunshot to the left lower limb

**Table 1. Reported cases of stent graft used to treat posterior tibial artery pseudoaneurysms**

Reference	Year	Etiology	Stent grafts used
Joglar et al. <sup>[9]</sup>	2010	Blunt trauma	A 3×19 mm balloon-expandable covered stent graft (JOSTENT, Abbott Vascular, Santa Clara, CA, USA)
Marks et al. <sup>[10]</sup>	2011	Gunshot	A 5×16×120 mm balloon-expandable iCast covered stent (Atrium Medical Corporation, Hudson, NH, USA)
De Troia et al. <sup>[11]</sup>	2013	Penetrating work injury	A 3×19 mm ePTFE covered coronary stent graft (InSitu Direct Stent Technologies Inc., St. Paul, MN, USA)
Gangadharan et al. <sup>[4]</sup>	2015	Iatrogenic injury	A 3.5×40 mm Prograft balloon mounted covered stent (Vascular Concepts Limited, Essex, UK)
<i>Current case</i>	2015	Firearm	A 4×24 mm balloon-expandable covered stent graft (Bentley- InnoMed, GmbH, Hechingen, Germany)

ePTFE: Polytetrafluoroethylene.

treated with an endovascular stent. De Troia et al.<sup>[11]</sup> in 2014 presented a case of a post-traumatic PA of the PTA in a 34-year-old man treated with endovascular stent grafting. Another case was reported in 2015 by Gangadharan et al.,<sup>[4]</sup> and in this case report, a 64-year-old man presented five days after surgical transfemoral embolectomy with a PA of the middle one-third of PTA. It was successfully managed by endovascular stenting without compromising the distal blood flow. In our case, there was a peculiar issue, and the patient was a soldier during the military conscription and, by law, any open vascular surgery procedure would make him unfit and, hence, he would be dismissed from the military service in any situation which would minimize his chance to have a civilian job later on. That is why we were very keen to use the minimally invasive endovascular approach, even if the cost was the patency of the PTA (as the other two tibial arteries in this young man were patent, a situation would not compromise the foot vascularity) in contrast to open surgery which does not only carry a high rate of morbidity, but also questionable long-term patency rates, irrespective of the method for repair or the use of a patch graft or a bypass graft.

In conclusion, post-traumatic PA exclusion can be achieved by stent grafting, preserving the tibial artery patency, bearing in mind that most patients with these types of injuries are young with relatively healthy endothelia and a lower long-term risk of occlusion. On the other hand, open surgery is reserved for cases of PA, where endovascular treatment has failed.

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