



A rare paediatric case of post-traumatic pseudo aneurysm of posterior tibial artery

Ramesh M Tambat¹, Ashok V Kulkarni¹, Shabnam Sachdeva¹, Arshiya Sultana Khanum¹, Siddesh Guttidurga Basavaraj¹,
Yogendra Shrestha^{2*}

¹Department of Surgery, Saphthagiri Institute of Medical Sciences, Bangalore, Karnataka, India

²Research Scholar, Department of Pharmacy Practice, Sri Adichunchanagiri College of Pharmacy, Adichunchanagiri University, Nagara, Karnataka, India

Abstract

Background: The PTA pseudoaneurysm (PSA) is a rare condition with only a few cases reported in the paediatric age group.

Case history: A 9-year-old boy presented to surgery OPD with complaints of painless swelling near the right ankle joint post penetrating trauma over the right ankle joint 4 months ago.

Intra operatively: Excision and ligation of a fibrous aneurysmal sac arising from PTA that measured approximately 3×3 cm was done.

Discussion: Aneurysms are more common in the proximal arteries such as femoral and popliteal arteries compared to distal arteries. It is a rare pathology of the infra-popliteal area, where pseudo aneurysms are prevalent and trauma is the most common cause. Controversy exists as to whether the treatment of PSA is non-surgical or surgical. Treatment depends on location and presence of associated arterial competency.

Conclusion: Surgical ligation is the safest approach for this type of condition, with a minimal risk of complications and a high chance of success. Primary care providers should be aware of the possibility of PSA at the ankle after penetrating/blunt trauma; therefore, a thorough and complete assessment, including a neurovascular examination, is critical, and the injured vessels should be repaired as soon as possible.

Keywords: pseudo aneurysm, posterior tibial artery, penetrating trauma, excision

Introduction

Pseudoaneurysms (PSA) are permanent arterial dilatation with a diameter increase of at least 50% over the typical anticipated diameter [1]. They emerge when an arterial defect fails to seal, allowing blood to flow outside the artery and into the soft tissue around it. If left untreated, they can grow larger and cause bleeding, distal embolization, and arterial thrombosis [2]. In comparison to the distal vessels, aneurysms are more common in the proximal arteries, such as the femoral and popliteal arteries [3]. It is rare in the infra-popliteal arteries, where pseudo aneurysms are more common and trauma is the most common origin [4]. The specific cause of pseudo aneurysms is unclear; a fibromuscular fibrodysplasia similar to ulnar aneurysm could be one possibility, but traumatic, inflammatory, atherosclerotic, and other pathological processes are also involved [5]. Non-traumatic infra-popliteal aneurysms are rarely seen compared to traumatic aneurysms [6]. There have only been a few cases of PSA of the posterior tibial artery (PTA) in children. A case of traumatic PSA of the distal posterior tibial artery in a 9-year-old child was reported in this paper.

Case History

A 9-year-old male with good academic achievement presented to the surgery OPD with complaints of swelling over his right foot, near the right ankle joint, that had been worrying him for three months.

Patient received first aid at a local clinic 4 months ago after suffering a penetrating trauma to his right foot near the ankle joint while playing with a sharp object made of glass. They extracted a piece of glass from the wound site and treated him with oral medications for 1 week, including oral antibiotics and NSAIDs. For a month, the patient was asymptomatic and comfortable. He detected a swelling over the same site a month after the occurrence, which was 1×1 cm when he first noticed it while wearing his footwear and gradually developed to the current size of 3×3 cm (Fig.1).

The swelling was not accompanied by pain, and there was no h/o discharge from the region, nor was there a fever, nor were there any secondary alterations or other lumps elsewhere in the body, nor was there any restriction of function around the ankle joint. According to the National Immunization Schedule, his immunizations were up to date. A thorough assessment of the local area was carried out.

On close inspection, it appeared to be a single, spherical swelling above the right ankle joint, lateral to the medial malleolus, measuring approximately 3×3cm with a smooth surface and well-defined edges. The skin on top of the swelling appears to be normal.

Over the superior edge of the swelling, there was a scar. Rotation of movements around the right ankle joint was normal.

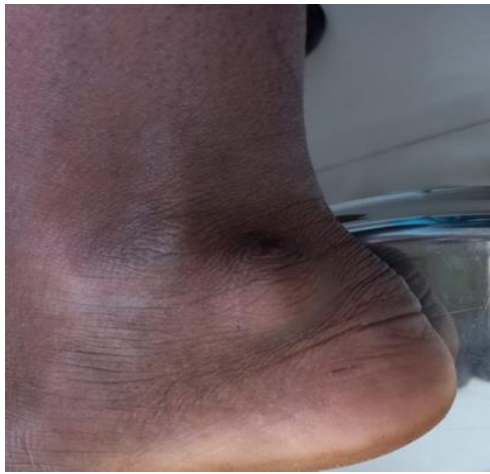


Fig 1: a solitary swelling present over right ankle joint

Inspectory observations are verified on palpation, with the margins of swelling well defined with cystic consistency, measuring 3 cm vertically and 3 cm horizontally. Swelling is compressible and fluctuant, with fluid thrill present and translucency absent. Expansile pulse is present, and the skin around the swelling was pinchable and shrinks in size when the PTA was proximally occluded. A bruit can be heard on auscultation. A smooth wall cystic lesion of 14x10 mm was discovered along the PTA at the ankle, posterior to the medial malleolus, on a CT scan. In the arterial phase, there was a contrast opacification of the sac, which was suggestive of a pseudoaneurysm. Neck-70 mm, Proximal and distal arterial ends measure 1.8 & 1.6 mm respectively (Fig 2&3).

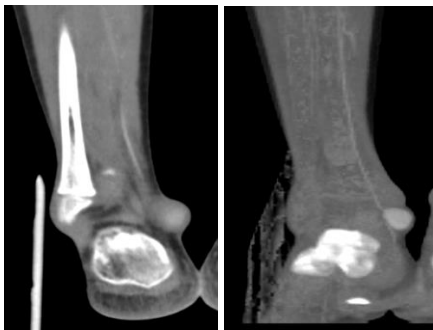


Fig 2: CT image showing aneurysm arising from posterior tibial artery.

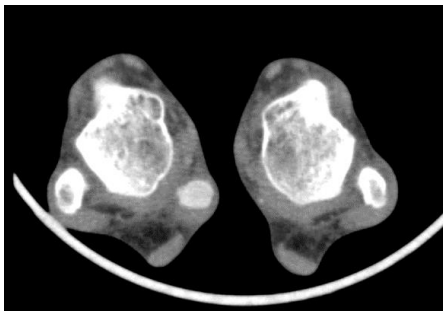


Fig 3: A smooth wall cystic lesion of 14x10 mm is noted along the PTA at the ankle posterior to medial malleolus. Contrast opacification of the sac seen in arterial phase- s/o pseudoaneurysm. Neck-70 mm, Proximal & distal arterial ends measure 1.8 & 1.6 mm respectively.

Intra operatively: Excision and ligation of a fibrous aneurysmal sac arising from PTA that measured approximately 3 x 3cm was done.

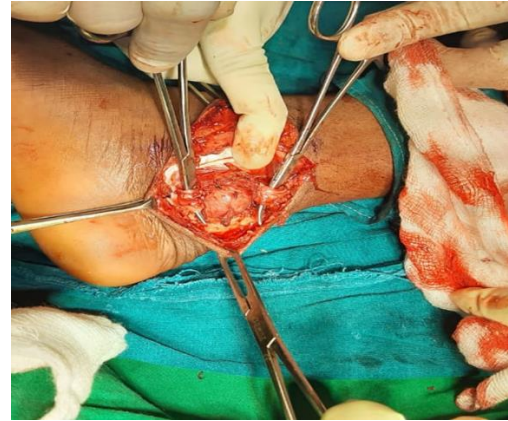


Fig 4: Fibrous aneurysmal sac arising from distal PTA

Discussion

PSA are rare consequences of foot and ankle injuries and surgery. Because of the increased incidence of ankle injury and anterior ankle surgery, anterior tibial artery PSA have been the most frequently reported till now. The majority are reports, usually involving an injury or a post-traumatic surgery [7]. Most are diagnosed typically in the acute period following injury or post-surgery, usually within the first few weeks [8]. However, the development of the lesion may occur anywhere from weeks to 5 years [9].

True aneurysms and pseudo aneurysms are the two basic types of foot aneurysms. True foot aneurysms are more prevalent in the elderly, and the underlying disease is atherosclerosis [8]. In comparison to true aneurysms of the infrapatellar blood arteries, PSA are more common [10]. Higgs SL et al., reported the first arterio-venous aneurysm involving the posterior tibial arteries after a foot stabilisation operation [11]. Morris and Morse were the first to report a foot pseudoaneurysm affecting solely the posterior tibial artery [12].

PSA's specific aetiology is unknown, but it has been linked to trauma, collagen vascular pathology, fibromuscular dysplasia, inflammation, infection, and atherosclerosis [10]. Marfan disease, Ehlers-Danlos syndrome, Behcet's disease, Type IV fibromuscular dysplasia, and osteogenesis imperfecta are all predisposing factors for PSA production because collagen disorders compromise the artery wall integrity. Furthermore, patients with co-morbidities such as diabetes, malnutrition, and immunological suppression are more prone to developing PSA [13].

A pseudoaneurysm is a collection of blood that forms when blood leaks into the limited perivascular space as a result of penetrating trauma (e.g., laceration), blunt trauma (e.g., ankle sprain), surgery, or endovascular operations. The blood collection is encased by connective tissue, but it has the ability to expand and compress the surrounding structures (nerves, veins, etc.) and even rupture [14, 15]. The aetiology in this case was penetrating trauma. Some PSAs can thrombose spontaneously, requiring treatment [15].

The central component of the hematoma undergoes

recanalization in cases of pseudo aneurysm formation, effectively "liquefying" the hematoma's centre. The outcome of this organisation, fibrosis, and eventual recanalization is a hollow or sac that is in direct continuity with the injured vessel's lumen. Continued inflow from the injured arterial can cause the aneurysm to expand and pulsate, usually resulting in localised swelling and greater pain until the hematoma has become encapsulated and become a mature false aneurysm. This is why the patients with PSA typically complain of a pulsing, painful, and warm mass near the site of the trauma [15]. A thrill may be palpable, and a bruit may be heard. The patient may also experience paraesthesia or numbness because of compression of nearby nerve [15]. Yao and McCarthy observed asymptomatic aneurysm for seven years without any enlargement of aneurysm or development of any symptoms [16].

Hematoma, abscess, arteriovenous fistula, or ganglion cyst are among the PSA's differential diagnoses. The skin surrounding the lesion may be warm and swollen, puncture wounds with consequent PSA development are frequently misdiagnosed with abscess formation. Incision and drainage of such lesions have resulted in catastrophic haemorrhage in some cases [15].

Clinically, PSA of the PTA may mimic a soft-tissue mass, and radiographs may provide a mixed image of benign and aggressive activity. The expansion of a pseudoaneurysm might result in bone erosion and secondary fracture [17].

Doppler ultrasound imaging techniques can detect the size and shape of the mass and assess if it has blood flow from a nearby artery, whereas arteriography, CT angiography, conventional MRI angiography, and time-resolved contrast enhanced 3D MRI angiography are superior at delineating the anatomy [18]. Angiography has been superseded by DSU combined with CTA and above mention all investigations over the last 13 years, and CTA is now considered the most sensitive and specific diagnostic tool for vascular traumas of the lower limbs [19]. Because of the effects of radiation, CTA is not always recommended, and the risk of contrast-induced nephropathy in children should be considered before undergoing CTA [20].

Several potential intervention techniques for foot aneurysms should be addressed during the preoperative evaluation, including percutaneous embolization, intact ligation, and surgical excision with reconstruction. The choice of intervention techniques is based on a number of parameters, including the foot's vascular structure, the presence or lack of collateral arteries, and the existence or absence of an associated AVF [8].

There are numerous debates on whether to treat PSA with a surgical or non-surgical technique. A standard therapy has yet to be determined due to the small number of recorded incidents. Treatment is determined on the PSA's location and the vessel's competence. Despite the fact that there are a variety of methods for managing PSA, the distal structure of the ankle makes it more complicated [20]. Small asymptomatic cases can be observed for spontaneous resolution whereas symptomatic cases should be treated and should not be neglected to avoid consequences. Due to the highly increased risk of embolization, thrombosis, and rupture, which can result in ischemia and amputation, aneurysms should be treated irrespective of symptomatology [21]. Contrast to this Borozan, on the other hand, who reported an asymptomatic aneurysm, supported for a conservative approach to asymptomatic aneurysms [22]. There is a lot of debate about

whether open or endovascular repair is better.²³ Coil embolization, ultrasound-guided compression, and percutaneous thrombin injection are all aspects of endovascular treatment [23]. In pseudoaneurysms less than 2 cm in diameter, spontaneous thrombosis can be induced, whereas pseudoaneurysms larger than 5 cm require surgical ligation and coil embolization [24, 25]. If endovascular techniques are ineffective, open vascular surgery may be the only remaining alternative.²⁴ A large pseudoaneurysm can be surgically removed, and bypass surgery can be used to restore distal blood flow [25]. Feeding vessel ligation or primary repair with or without interposition grafts are two further surgical options.^{24,25} In this case, open approach was the preferred method of choice with excision and ligation of sac. Our patient was benefited from the conventional open surgery treatment, which allowed extensive exploration to repair PTA carefully. However, traditional surgical treatment is associated with complications such as arterio-venous fistula formation, bleeding and hematoma formation [26]. Even though PSA are not life-threatening, surgery is necessary to decrease the risk of haemorrhage from spontaneous rupture or reinjury and to correct the cosmetic deformity. Neurological harm to the foot can be avoided by minimising dissection around the ankle. Short-term complications post-surgery includes pain and impaired motor function. There was no reported long-term complication after repair of an ankle pseudo aneurysm [21].

Currently, least invasive treatment modalities include compression and percutaneous thrombin injection which can be effectively performed with guide of an ultrasound. Compression method is not widely used for ankle PSA because it is considered inappropriate for a long-standing injury (ie, greater than 1 month) [20, 27]. Stent grafts are now being used in the treatment of PSA, particularly post-traumatic PSA, following recent developments in endovascular technology and therapy [6]. Surgical ligation and aneurysectomy is the chosen treatment method since it is the simplest and safest procedure in the majority of patients with long-term success.

Conclusion

Surgical ligation is the safest approach for this type of condition, with a minimal risk of complications and a high chance of success, when performed in patients with clinically patent collateral circulation.

This type of presentation requires immediate trauma care. Because of the rare presentation and location in the distal extremity, this sort of injury should have been better handled at the beginning to avoid the formation of a PSA. Primary care providers should be aware of the possibility of PSA at the ankle after penetrating/blunt trauma; therefore, a thorough and complete assessment, including a neurovascular examination, is critical, and the injured vessels should be repaired as soon as possible.

References

1. Cronenwett JL, Johnston KW, Rutherford RB. Rutherford's vascular surgery 7th edition, Philadelphia/USA: Saunders/Elsevier, 2010.
2. Marks RM, Stroud CC, Walsh D. Pseudoaneurysm of the lateral malleolar artery after an ankle sprain: case report and review of the literature. Foot & ankle

- international,1999:20(11):741-3.
3. Bejko J, Sgorlon G, Zanon C, Avruscio G, Zanon A. True Aneurysm on Posterior Tibial Artery as Late Complication of SARS-CoV-2. *Annals of Vascular Surgery*, 2021.
 4. Chrencik MT, Caraballo B, Yokemick J, Pappas PJ, Lal BK, Nagarsheth K. Infrapopliteal Arterial Pseudoaneurysm Development Secondary to Blunt Trauma: Case Series and Literature Review. *Vascular and endovascular surgery*,2020:54(4):367-74.
 5. Tshomba Y, Papa M, Marone EM, Kahlberg A, Rizzo N, Chiesa R. A true posterior tibial artery aneurysm: a case report. *Vascular and endovascular surgery*,2006:40(3):243-9.
 6. Mönig SP, Walter M, Sorgatz S, Erasmi H. True infrapopliteal artery aneurysms: report of two cases and literature review. *Journal of vascular surgery*,1996:24(2):276-8.
 7. Yu JL, Ho E, Wines AP. Pseudoaneurysms around the foot and ankle: case report and literature review. *Foot and Ankle Surgery*,2013:19(3):194-8.
 8. Alhaizaey A, Hussain MA, Aljabri B, Al-Omran M. Aneurysms of the foot arteries. *Vascular*,2016:24(1):109-12.
 9. Yamaguchi S, Mii S, Yonemitsu Y, Orita H, Sakata H. A traumatic pseudoaneurysm of the dorsalis pedis artery: report of a case. *Surgery Today*,2002:32:756-7.
 10. Sagar J, Button M. Posterior tibial artery aneurysm: a case report with review of literature. *BMC surgery*,2014:14(1):1-4.
 11. Higgs SL. Arteriovenous Aneurysm of the Posterior Tibial Vessels following Operation for Stabilizing the Foot. *Proc R Soc Med*,1931:24:1378-9.
 12. MORRIS E, MORSE TS. Aneurysm of the posterior tibial artery after a foot stabilization procedure: a case report. *JBJS*,1966:48(2):337-8.
 13. Williams JC, Roberts JW, Yoo BJ. Dorsalis pedis artery pseudoaneurysm after Lisfranc surgery. *Journal of orthopaedic trauma*,2010:24(11):e98-101.
 14. Economou P, Paton R, Galasko CS. Traumatic pseudoaneurysm of the lateral plantar artery in a child. *Journal of pediatric surgery*,1993:28(4):626.
 15. Singh D, Ferero A. Traumatic pseudoaneurysm of the posterior tibial artery treated by endovascular coil embolization. *Foot & ankle specialist*,2013:6(1):54-8.
 16. Yao JS. Multiple arterial aneurysms: a seven-year follow-up. *Contemp Surg*,1987:31:73-8.
 17. Singh PK, Banode P, Shrivastva S, Dulani R. Pathological fracture of the fibula due to a late presenting posterior tibial artery pseudoaneurysm: a case report. *JBJS*,2011:93(10):e54.
 18. Murakami AM, Chang A, Foo LF. Traumatic lateral plantar artery pseudoaneurysm and the use of time-resolved MR angiography. *HSS Journal*,2010:6(2):214-8.
 19. Fox N, Rajani RR, Bokhari F, Chiu WC, Kerwin A, Seamon MJ, Skarupa D, Frykberg E. Evaluation and management of penetrating lower extremity arterial trauma: an Eastern Association for the Surgery of Trauma practice management guideline. *Journal of Trauma and Acute Care Surgery*,2012:73(5):S315-20.
 20. Aimanan K, Chea CH, Lim KY, Damodaran A. Ankle pseudoaneurysm: distal posterior tibial artery pseudoaneurysm in a child following blunt trauma. *BMJ Case Reports CP*, 2019, 12(5).
 21. Bejko J, Sgorlon G, Zanon C, Avruscio G, Zanon A. True Aneurysm on Posterior Tibial Artery as Late Complication of SARS-CoV-2. *Annals of Vascular Surgery*. 2021 Oct 10.
 22. Borozan PG, Walker III HS, Peterson GJ. True tibial artery aneurysms: case report and literature review. *Journal of vascular surgery*,1989:10(4):457-9.
 23. Murphy AD, Chan M, Fairbank SM. Tibial nerve palsy as the presenting feature of posterior tibial artery pseudoaneurysm. *ANZ journal of surgery*,2018:88(11):1206-8.
 24. Audenaert E, Vuylsteke M, Lissens P, Verhelst M, Verdonk R. Pseudoaneurysm complicating knee arthroscopy. *Acta orthopaedica belgica*,2003:69:4-2003.
 25. Hilborn M, Munk PL, Miniaci A, MacDonald SJ, Rankin RN, Fowler PJ. Pseudoaneurysm after therapeutic knee arthroscopy: imaging findings. *AJR. American journal of roentgenology*,1994:163(3):637-9.
 26. Patel A, Parikh R, Bertrand OF, Kwan TW. A novel patent hemostasis protocol-prevention of pseudoaneurysm after tibioepidial arterial access for evaluation and treatment of peripheral arterial disease. *Cardiovascular Revascularization Medicine*,2019:20(7):598-602.
 27. Fellmeth BD, Roberts AC, Bookstein JJ, Freischlag JA, Forsythe JR, Buckner NK, et al. Postangiographic femoral artery injuries: nonsurgical repair with US-guided compression. *Radiology*,1991:178(3):671-5.