Exploring the Intriguing Consequences of Trauma – Pseudoaneurysm of the Tibial Arteries

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Abstract: Aneurysms are commonly managed by vascular surgeons, primarily affecting proximal arteries in the lower limb. In contrast, pseudoaneurysms often occur in the infrapopliteal region (Nair and Suhania, 2021), with anterior tibial artery involvement being particularly rare. It is even more uncommon for both the anterior and posterior tibial arteries to be affected simultaneously. Here, we present a case of a 21-year-old man who sustained vascular trauma to his right calf and presented one month later with difficulty in ambulation. A diagnosis of pseudoaneurysm involving both the anterior and posterior tibial arteries was made, and he successfully underwent reversed saphenous vein graft interposition for both arteries.

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Introduction

Aneurysms are frequently managed by vascular surgeons, typically occurring in the proximal arteries of the lower limb, such as the femoral and popliteal arteries, compared to the smaller distal vessels. Pseudoaneurysms are more common in the infrapopliteal region and occur when all three layers of the arterial wall are injured, leading to blood extravasation contained within a fibrous capsule.

Pseudoaneurysm of the anterior or posterior tibial artery is rare and usually results from trauma or iatrogenic injury. Many reports discuss pseudoaneurysms of either the anterior or posterior tibial artery. However, to the best of our knowledge, there are no reported cases of pseudoaneurysm involving both arteries in the same limb simultaneously. Here, we describe our experience in successfully managing such a case following a stab injury.

Case report

A 21-year-old gentleman was assaulted by a group of tugs and sustained a stab wound over his right calf. Post trauma, he sought treatment at a nearby health facility and underwent toilet and suturing and before being discharged. Since discharge, he experienced progressive swelling in the right calf, which became increasingly painful and eventually limited his ability to walk.

On physical examination, patient appeared clinically pale and tachycardic. Examination of the lower limb noted that there was swelling from the foot extending till the knee. He was unable to extend his knee due to pain. There were no skin changes, the surrounding skin felt warm, and the wound over the calf was well healed with no discharge seen. Distal pulses (posterior tibia artery [PTA] and dorsalis pedis artery [DPA]) were not palpable in view of the gross swelling. However Doppler ultrasound revealed biphasic wavelength over the right PTA and DPA.

A computer tomography angiography (CTA) demonstrated contrast extravasation from mid part of right anterior tibial artery into anterior compartment of the right leg, with pooling of extravasated contrast measuring approximately 3.1×2.2×2.9 cm (anterior posterior×width×craniocaudal). There is also a saccular dilatation arising from mid part of the right posterior tibial artery (PTA), which is filled with contrast on arterial phase, likely representing a pseudoaneurysm (Figure 1). Presence of intramuscular collections were observed within anterior, superficial posterior and deep posterior compartments of the right leg, which have layering of various densities within.

The patient subsequently underwent mid PTA and ATA (anterior tibial artery) reversed saphenous vein graft (RSVG) interposition. Intraoperatively there was mid PTA pseudoaneurysm of 6 cm in size with a 2 cm arterial defect, requiring evacuation of 500 cc of blood clots. The pseudoaneurysm sac was resected and RSVG was anastomosed via end-to-side anastomosis (ETSA) fashion to the proximal and distal PTA. As for the ATA, there was a mid-ATA pseudoaneurysm of 4 cm, also containing 500 cc of blood clots with visible puncture site of 1 cm. Pseudoaneurysm was resected and RSVG anastomosed via end to side fashion to the

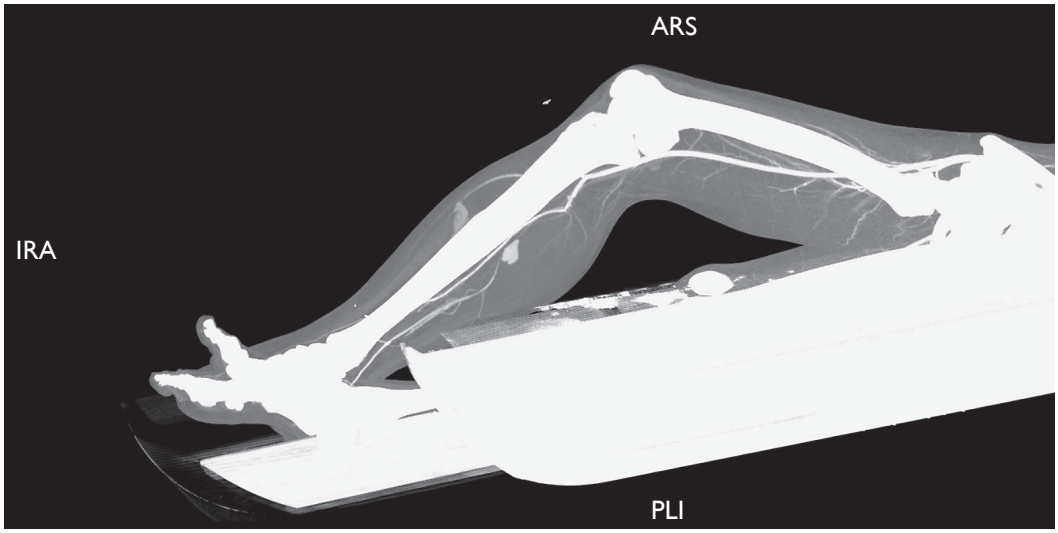

Figure 1: Computed tomography angiogram of lower limb in maximum intensity projection showing a saccular dilatation from mid part of right posterior tibial artery and contrast extravasate from mid part of right anterior tibial artery with pooling of contrast suggestive of active bleeding.

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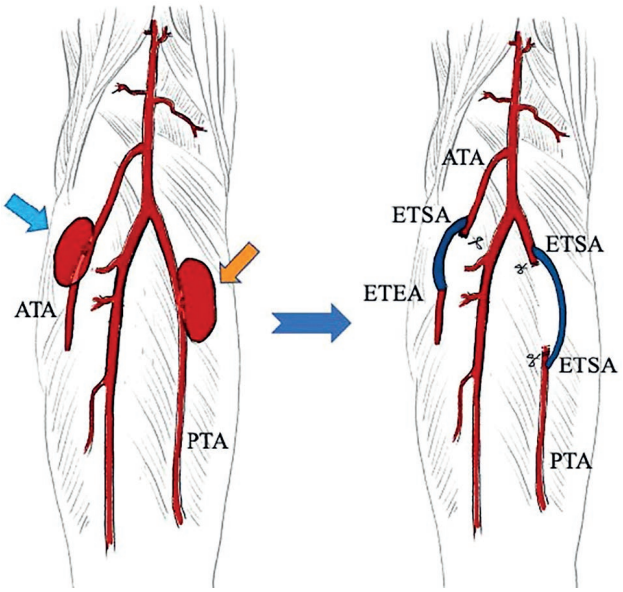

Figure 2: A schematic diagram of the lower limb showing the pseudoaneurysm of the right posterior tibial artery (PTA) and anterior tibial artery (ATA) and the anastomosis of the PTA and ATA using saphenous vein graft from the same leg. The left arrow shown PTA pseudoaneurysm; the right arrow shown ATA pseudoaneurysm; ETSA – end-to-side anastomosis; ETEA – end-to-end anastomosis.

Figure 3: Right lower limb is generally more edematous and in flex position compared to the left. Arrow shown posterior tibial artery pseudoaneurysm.

proximal ATA with end-to-end anastomosis (ETEA) fashion over the distal ATA (Figures 2–6). Doppler signal of DPA and PTA were biphasic preoperatively and remained so postoperatively.

Post operatively patient recovered well and was discharged home one week after surgery. On interval follow-up, patient demonstrated good functional recovery, with unremarkable vascular examination of lower limb.

Discussion

Pseudoaneurysm is a localized arterial injury, with or without the involvement of the adventitia. It is characterized by damage to all three layers of the arterial wall, leading to blood extravasation. This extravasation is contained by the surrounding connective tissues, which form a cavity that remains connected to the arterial lumen via a neck, allowing continuous leakage into the pseudoaneurysm. The most common site of pseudoaneurysm in the lower limb is the anterior tibial artery (Suri et al., 2011; Tonogai et al., 2017; Eilersen and Strøm, 2021) while pseudoaneurysms of the posterior tibial artery are rare, with only a few cases reported in the literature (Sagar and Button, 2014; Gangadharan et al., 2015; Liu et al., 2020; Beijers et al., 2024).

The causes of pseudoaneurysms are typically traumatic, iatrogenic, or inflammatory. Trauma-related pseudoaneurysms have increased due to road traffic accidents and violent assaults. Both Suri et al. (2011) and Tonogai et al. (2017) describe pseudoaneurysms related to trauma and iatrogenic factors, particularly during lower limb surgeries. Sharp hardware used in surgical procedures can cause traction injuries to arterial structures, resulting in pseudoaneurysm formation. In our case, the patient sustained a stab wound to the right medial calf. However, despite the superficial nature of the injury and absence of deep penetration, the patient developed both PTA and ATA pseudoaneurysms. We speculate the ATA pseudoaneurysm may have developed spontaneously, as almost the same case as described in Al-Zoubi et al. (2017).

The clinical presentation of pseudoaneurysms depends on their size. Symptoms can range from being asymptomatic, with spontaneous regression, to the opposite end of the spectrum, where the pseudoaneurysm progressively enlarges, causing swelling, throbbing pain, paresthesia, neuralgia, or even ischemia.

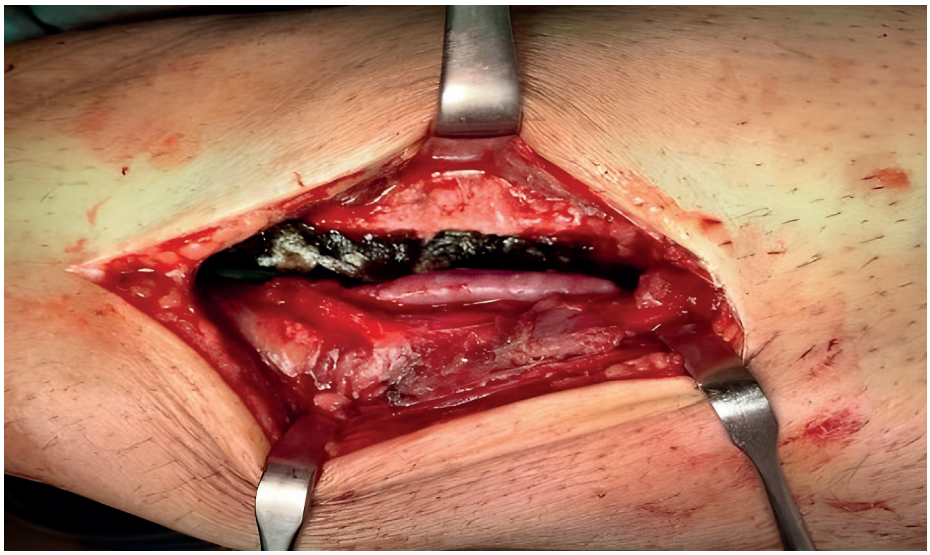

Figure 4: Anterior tibial artery pseudoaneurysm post reversed saphenous vein graft anastomosis.

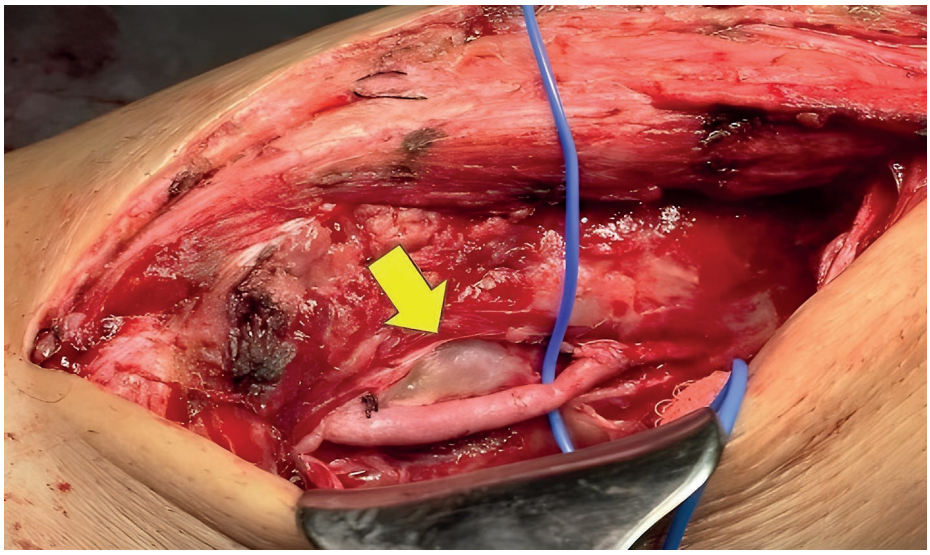

Figure 5: Posterior tibial artery pseudoaneurysm with proximal and distal artery control. Arrow showing site of pseudoaneurysm.

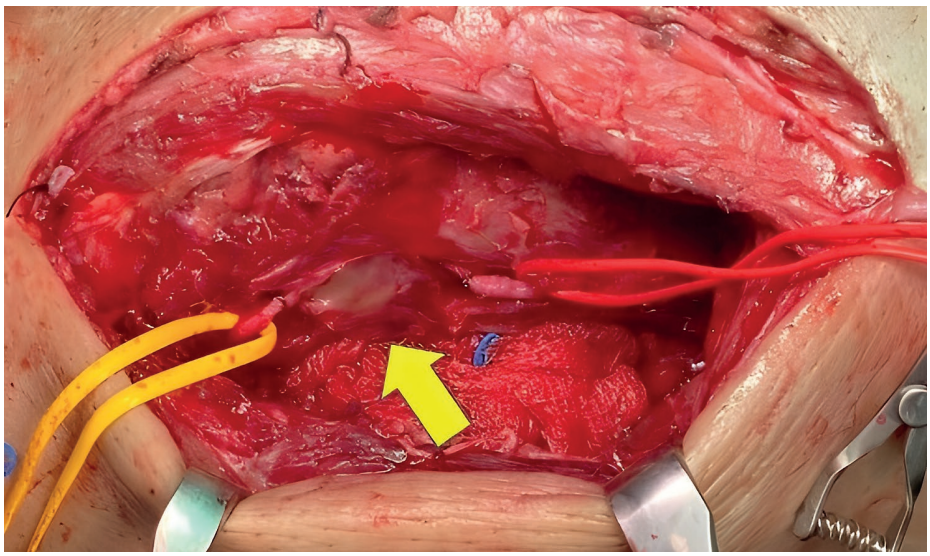

Figure 6: Posterior tibial artery pseudoaneurysm post reversed saphenous vein graft anastomosis. Arrow showing site of pseudoaneurysm.

The primary diagnostic tools are CTA and, ideally, magnetic resonance imaging (MRI) of the lower limb. Prompt intervention is essential upon diagnosis to prevent further enlargement of the pseudoaneurysm and avoid potentially life-threatening complications.

There is no universally accepted treatment strategy for pseudoaneurysms, and management depends on factors such as size, location, symptoms, and clinical findings. While endovascular treatments have become increasingly popular for pseudoaneurysm management, traditional open repair remains a crucial option, particularly for ruptured, infected, large, or complex pseudoaneurysms (Sagar and Button, 2014; Gangadharan et al., 2015). In our case, open surgery was chosen due to the presence of dual PTA and ATA pseudoaneurysms. Additionally, the patient had significant calf swelling that required tissue decompression, and the open approach allowed for extensive exploration and meticulous repair of both the ATA and PTA. Given that the patient was young and relatively stable at the time of presentation, we decided to proceed with saphenous vein grafting for both arteries.

To the best of our knowledge, the simultaneous occurrence of anterior and posterior tibial artery pseudoaneurysms is extremely rare, with limited literature addressing the management of this pathology. Most reports focus on isolated anterior or posterior tibial artery pseudoaneurysms, and while their management is generally similar, there are no established guidelines specific to such cases.

In young patients like our patient with peripheral arterial pathologies, efforts are directed toward preserving as much of the arterial structure as possible. This approach has a significant impact on the patient's long-term outcomes and quality of life. Moreover, preserving arterial integrity is beneficial in the event of future peripheral arterial disease, which may require further interventions.

Conclusion

The presence of aneurysm of both ATA and PTA is a rare presentation. The management dilemma of endovascular approach versus open intervention has not been clearly delineated. The open surgery method has benefited the patient in terms of proper exploration and meticulous repair of both pseudoaneurysm of the ATA and PTA and tissue decompression.

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