



Case report

Late-onset pseudoaneurysms of lower limb arteries following late complications of orthopaedic constructs - Two cases and review of literature

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ABSTRACT

Introduction & importance: Damage to the adventitial layer of an artery leads to pseudoaneurysm formation. Pseudoaneurysms caused by complications of orthopaedic constructs are rare.

Case presentation & clinical discussion: Case report 01. A 27-year-old male presented with acute bleeding from an external fixator pin site. He had defaulted follow-up due to covid pandemic and presented with malunited distal tibia fracture and loosened Schanz pins. CT angiogram revealed a pseudoaneurysm of the peroneal artery over the loosened pin site. The patient underwent exploration and ligation of the peroneal artery.

Case report 02. 86-year-old female presented with a gradually enlarging lump on her left anteromedial thigh for three months duration. She underwent open reduction and internal fixation of ipsilateral femur fracture 17 months back. She was found to have a pseudoaneurysm of the superficial femoral artery caused by exposed screws following bony erosion. Exploration and repair of "neck" the pseudoaneurysm was performed and the recovery was uneventful.

Conclusion: Pseudoaneurysms are rare but carry devastating complications following various orthopaedic procedures. The common cause for the formation of pseudoaneurysms is trauma during surgery. But loosened Schanz screws and screws are also can be the cause. Early identification of a pseudoaneurysm and proper intervention will reduce morbidities.

1. Introduction

Pseudoaneurysms or false aneurysms are caused by physical or biological damage to the adventitial layer of the artery leading to gradual, persistent extravasation of blood into the surrounding soft tissues that connect within the arterial lumen [1]. Mechanical causes for pseudoaneurysms are trauma (fracture, dislocation and penetrating injuries) [2–4], vascular arterial interventions (anastomotic disruption and arterial cannulation procedures), and orthopaedic interventions (Drills, pins of external fixators, screws and arthroscopic portals) [4–6]. The biological cause for the pseudoaneurysm formation is infection [7]. Underlying collagen vascular disease is also described as a cause for the spontaneous onset of pseudoaneurysm of a peripheral artery [8].

We report two cases of peroneal artery pseudoaneurysm and superficial femoral artery pseudoaneurysm as late complications of

orthopaedic implants. Loosened external fixator pin and exposed screws following the bony erosion caused the initial traumatic event in described cases respectively. Clinical presentation, the treatments provided of these patients were different due to the nature of the arteries involved.

These cases have been reported according to the SCARE guideline 2020 [9].

2. Case 01

A 27-year-old male, presented with bleeding from the pin site of the external fixator to the Accident & Trauma unit, National Hospital-Colombo, Sri Lanka. He was treated with an external fixator for a compound fracture of the left tibia and fibula six months back. There were no immediate postoperative complications were documented. He

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lost the follow-up and admitted following bleeding from the pin site. Blood was bright red and it is spurting in nature. The external fixator was partly out of the leg and the pins were loose. Bleeding was from the upper pin site. Lower pin sites were infected. There was a wound over the malunited fracture site. He was haemodynamically stable on admission. Dorsalis pedis and posterior tibial pulses were present. He was taken immediately to the theatre to remove the external fixator (Figs. 1-3).

There was spurting bleeding from the proximal pin site which was settled with a pressure dressing. The vascular team has suggested doing an angiogram. The angiogram revealed a pseudoaneurysm arising from the peroneal artery at the proximal pin site (Fig. 4).

Exploration of the pseudoaneurysm was performed by two experienced postgraduate trainees in vascular surgery which revealed a pseudoaneurysm of the proximal peroneal artery directly below the proximal pin site with intact posterior tibial and anterior tibial pulses. The aneurysmal sac was opened which revealed a 1 cm defect on the proximal part of the peroneal artery. The proximal and distal end of the aneurysm was ligated. Distal vascularity was confirmed after surgery (Fig. 5).

3. Case 02

An 86-year-old female presented to us with a history of right thigh pain and swelling which was noted for about one year with progressive enlargement during the last three months. Signs and symptoms of inflammation were negative. The swelling was tense, non-pulsatile, non-tender, distal pulses were present and no distal neurological involvement was seen. She sustained a right femoral shaft fracture seventeen months before the indexed presentation following a fall; no other injuries were noted and distal pulses were normal at that time. She underwent Dynamic Compression Plate (DCP) fixation of the femur two days following the initial trauma. Surgery was performed in a lateral decubitus position using a standard lateral approach. The procedure was uncomplicated with no excessive blood loss. Post-operative pulses were normal and the patient was discharged with non-weight bearing



Fig. 1. Shows an immediate postoperative radiograph of the left tibia with an external fixator six months back.

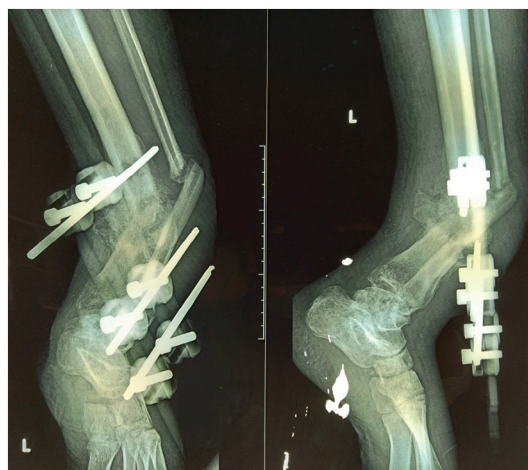


Fig. 2. Shows a radiograph of the left tibia on admission shows a malunited tibia fracture with a proximal pin that has loosened, migrated deeper than its previous position.



Fig. 3. Shows the clinical picture of shows wound over the deformed left leg, infected pin site, and the removed external fixator. The bleeding pin site was dressed with pressure.

ambulation. At outpatient follow up after 2 weeks skin staples were removed and no thigh swelling or wound complications were noted. Subsequent clinic follow-up was defaulted by the patient (Figs. 6-7).

On radiographs (Fig. 8), fracture union and medial femoral cortical erosion were observed. A duplex ultrasound scan showed a characteristic yin-yang sign (Korean flag) on colour flow with a to-and-fro pattern and a large thrombus (Fig. 9) was seen (Fig 10).

CT angiogram was done and showed a pseudoaneurysm of the superficial femoral artery with distal runoff (Fig. 11).

Her Haemoglobin level was 6.2 g/L on presentation and other causes for anaemia were excluded after evaluation. The cause for the anaemia is massive chronic bleeding and clot formation at the pseudoaneurysm site. Multiple blood transfusions were done and the patient was prepared for pseudoaneurysm repair. During the exploration, a pseudoaneurysm arising on the right side superficial femoral artery. Which is 8 × 10 cm in size. The Thrombus was large and the “neck” of the pseudoaneurysm was 5 mm. The neck was at the exposed screws due to bony erosion caused by the pressure effect of the aneurysm. Exposed screws were removed and the aneurysm was repaired primarily (Fig. 12). The post-operative distal limb circulation was confirmed.

The patient recovered without any complications. The viability of the distal circulation was persistent during the clinic follow-up.

4. Discussion

Pseudoaneurysms are formed usually following trauma. The false

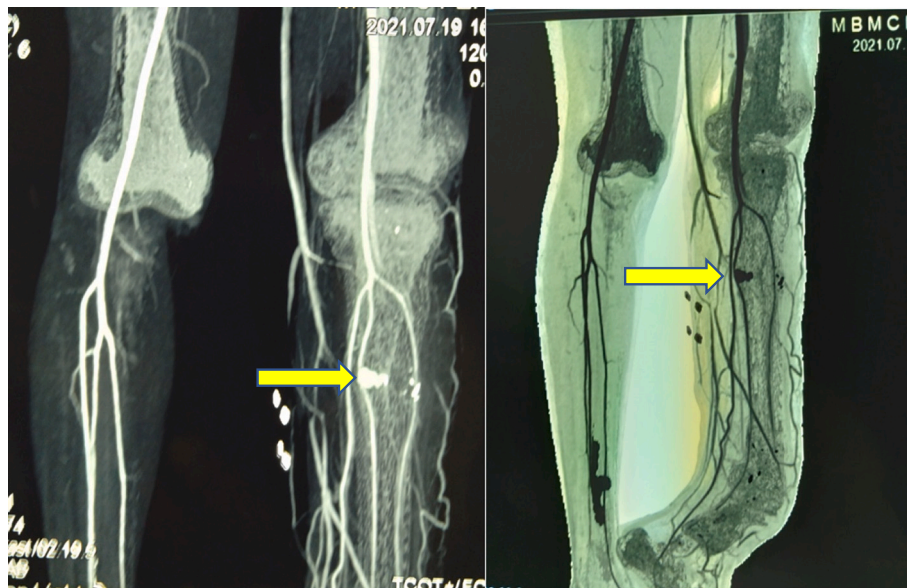


Fig. 4. Shows a CT angiogram of bilateral legs shows a pseudoaneurysm of the upper part of the peroneal artery (marked by arrows).

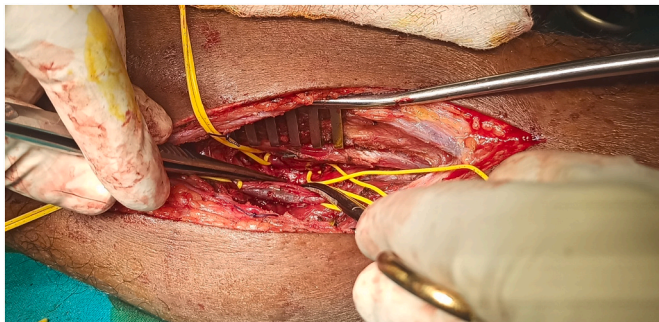


Fig. 5. Shows an intraoperative view of the pseudoaneurysm. The atraumatic forceps pointing the “neck” of the pseudoaneurysm.



Fig. 6. Shows a clinical picture of the right thigh with a tensed lump on the medial aspect of the thigh.



Fig. 7. Shows immediate post-operative radiograph right femur, showing osteosynthesis of femur fracture with dynamic compression plate and screws.

aneurysm differs from a true aneurysm as it does not contain all layers of the arterial wall [9]. Histologically it has been proven that the pseudoaneurysms does not contain internal elastic lamina but are covered only by the adventitial layer. Pseudoaneurysms following vascular injuries do not contain all three layers of arteries. The haematoma is connected to the arterial wall by the “neck” [2]. Blood flow will enter into the haematoma during each systole and leaves during diastole renders the pseudoaneurysms to pulsate [1].

Blunt or penetrating traumatic events can give rise to pseudoaneurysms. Blunt trauma to limbs is the common mechanism of injury to vessels that give rise to pseudoaneurysms. Not only the direct traumatic event but also reduction manoeuvres also can give rise to pseudoaneurysms [4]. Pseudoaneurysms of vascular injuries do not contain all three layers of arteries. Iatrogenic penetrating trauma including vascular interventions, radiological procedures, and orthopaedic interventions (Fracture fixation & arthroplasty) can cause pseudoaneurysms on various arteries [10–16]. Pseudoaneurysms arising from smaller arteries comprise around 26% out of total occurrence [1].

Pseudoaneurysms are commoner in males than females (sex ratio is 3.6). Males who are between ages 14 to 62 are the most affected population in the literature. The median days are between the trauma and the diagnosis of this entity in 30 days which ranges from 0.04 to 19,440

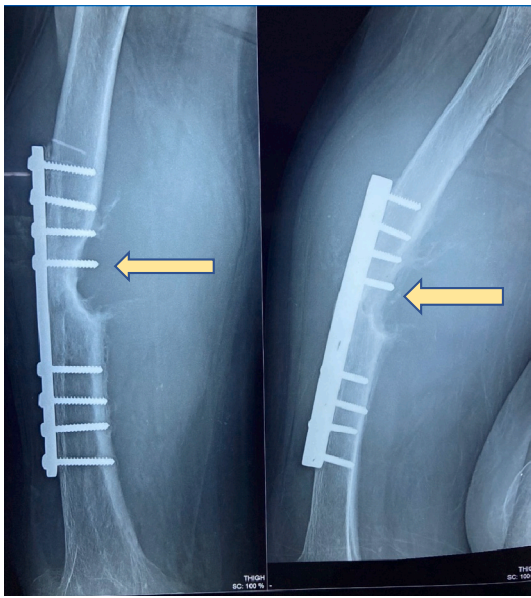


Fig. 8. Shows fracture union at the lateral side and erosive changes in the medial side due to the chronic pressure effect of the pseudoaneurysm. The erosion leads to exposure of screws on the medial side (yellow arrows). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

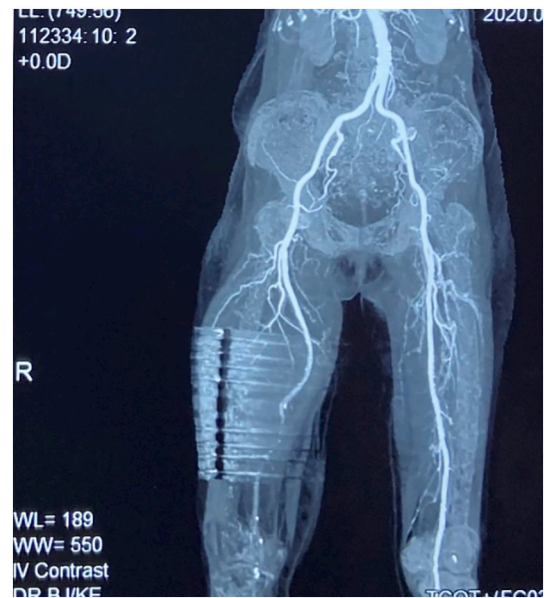


Fig. 11. Shows computed tomographic angiogram shows pseudoaneurysm on right superficial femoral artery.

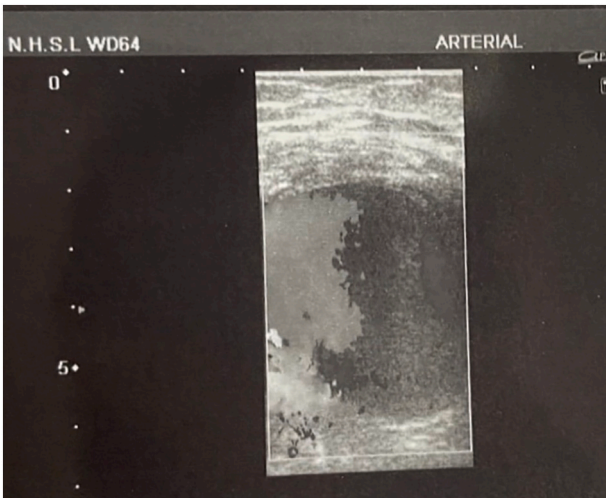


Fig. 9. Shows a duplex ultrasound of the left thigh revealed the “Yin-Yang sign” (Korean flag sign). (For interpretation of the references to colour in this figure, the reader is referred to the web version of this article.)

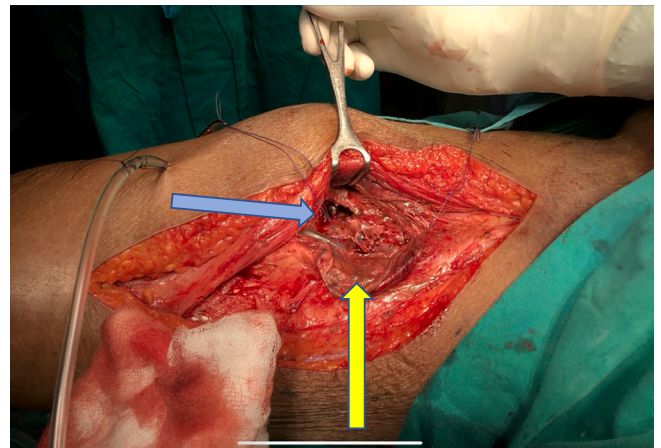


Fig. 12. Shows an intra-operative view of the pseudoaneurysm shows an opened-up aneurysmal sac (yellow arrow) and the medially exposed screw (blue arrow). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

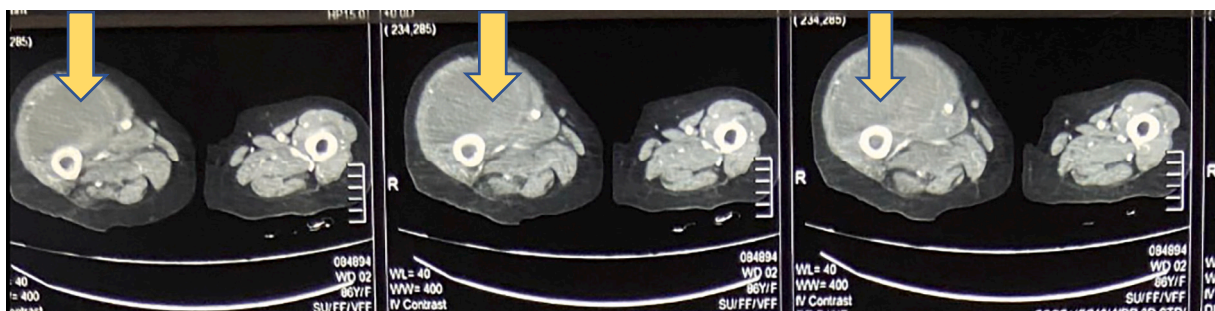


Fig. 10. Non-contrast computed tomography of the bilateral thigh shows a cystic lesion on the anteromedial thigh (yellow arrow). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

days [1]. Older age (more than 60), female sex, diabetes, hypertension and atherosclerosis have been described in the literature as risk factors [14].

The presentation may vary according to the site, size of the lesion and surrounding structures. The most common presenting complaint is painful swelling followed by pulsating mass and painful pulsatile swelling [1]. Rarely, some pseudoaneurysms may present with acute bleeding as described in case 1. The examination may reveal systolic bruit, ecchymosis, thrill, compartment syndrome, bleeding following rupture, nerve palsy, arterio-venous fistula, anaemia, evidence of venous thrombosis, acute limb ischaemia due to a shooting thrombus and skin necrosis due to pressure [4]. Among these complications, compartment syndrome and acute limb ischaemia should be identified promptly to avoid morbidity. Delayed diagnosis of pseudoaneurysm may lead to permanent disabilities.

A pseudoaneurysm can be diagnosed by Doppler ultrasound, computed tomography angiography and magnetic resonance imaging [1,4,14]. Doppler study will reveal the size, site, anatomy of the “neck” of the pseudoaneurysm and feeding vessels. Doppler ultrasound scan has many advantages such as being easy to perform, inexpensive, non-invasive and portable. But it is operator dependent and will not provide three-dimensional images [1]. Angiography is an invasive modality. Which is not only an investigation but also provide the possibility to perform endovascular treatment procedures. Computed tomographic angiography (CTA) will provide more detail than the simple angiogram but it carries a higher radiation dose, needs contrast media and does not allow intervention. Magnetic resonance imaging also has been described in the literature which is non-invasive, accurate and provides detailed images of flow and anatomy. But it takes time, expensive and it is not possible to perform in the presence of metallic implants or external fixators [1].

The differential diagnosis for pseudoaneurysms is an abscess, true aneurysms, vascular malformations, arterial infections, and arterio-venous fistula.

Surgical repair of the defect (neck of the pseudoaneurysm), endovascular intervention procedures [11], ligation of feeding or non-critical arteries, ultrasound-guided compression and ultrasound-guided thrombin injection have been described in the literature [4,14,17]. The procedure is selected according to the severity, availability of conduit and the risk of distal limb ischaemia.

Pseudoaneurysms arising from major vessels such as axillary-brachial and femoropopliteal are repaired surgically or with endovascular stent placement [6,18]. Arterial repair consists of primary repair, primary anastomosis following resection of a damaged segment of the artery and venous patch graft to the defect. Arterial reconstruction methods are autogenous venous bypass grafting or synthetic grafts. Small non-vital feeding arterial branches can be ligated surgically. Described complications following surgical intervention are wound complications, infections, thrombosis and graft occlusion [1].

Endo vascular coiling or embolization and surgical ligation are deserved for pseudoaneurysms arising from minor arteries, tibial arteries and isolated radial or ulnar arteries [1]. This procedure can readily be performed following diagnostic angiography, in which direct cannulation to the artery and embolization can be carried out.

Intraluminal stent placement is another successful endovascular procedure in which a covered stent is placed at the site of pseudoaneurysm to bypass the damaged arterial segment [6,18]. It carries lower morbidity and mortality, shorter hospital stays lesser recovery time, which preserve the saphenous vein and no donor site morbidity [1]. But, this modality of treatment is expensive, needs expertise and sophisticated equipment like fluoroscopy. In addition, stents cannot be placed near the joints due to their mobility [1].

Following the procedure, patients are evaluated clinically as well as radiologically by a doppler study or angiography to confirm the arterial flow and the resolution of the pseudoaneurysm. A few complications have been reported in the literature such as local infection, sepsis,

neuropathic pain due to nerve damage, loss of limb, bow out of the repair site and true aneurysmal recurrence [1,4].

5. Conclusion

This case report highlights the possibility of late-onset of pseudoaneurysms due to complications of orthopaedic constructs such as loosened external fixator pins and exposed screws. Diagnosing pseudoaneurysms can be challenging due to their non-specific symptoms. Awareness, clinical suspicion, utilization of imaging and appropriate intervention will prevent life-threatening complications.

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Ethical approval

Not applicable.

Consent

Informed written consent has been obtained from two patients for the case report and the accompanying images. Written consent is available for review on the request by the editor of this journal.

Authors' contribution

All authors of this case report are involved in patient management, collection of data, and writing of this article. The Clinical lead supervised the management and was involved in the correction and editing of the article.

Research registration

Not applicable.

Guarantor

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Declaration of competing interest

All authors have declared any conflicting financial or personal interests which could have inappropriately influenced their work.

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