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Case Report

Percutaneous Treatment of Deep Femoral Artery Pseudoaneurysm Due to Penetrating Trauma

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Pseudoaneurysm of the deep femoral artery (FAP) due to penetrating trauma is less common and can be a challenging condition for surgeons. The conventional treatment strategy for FAP due to penetrating trauma is open surgical repair. With emerging technologies, less invasive techniques are being used in these patients. We report a 37-year-old male patient with delayed presentation of FAP secondary to a stab wound and treated successfully with ultrasound-guided thrombin injection.

Keywords: deep femoral artery, pseudoaneurysm, ultrasound-guided thrombin injection

Introduction

A pseudoaneurysm forms when an arterial puncture site fails to seal, allowing blood to leak and form a pulsatile hematoma covered by fibromuscular tissues. Iatrogenic pseudoaneurysm of the deep femoral artery (FAP) can be seen owing to a high number of endovascular interventions.[1)] However, FAP due to penetrating trauma is less common and can be a challenging condition for surgeons. FAP is most likely present with pulsatile and painful mass with ecchymosis. Symptomatic and large FAP should be treated; otherwise, FAP can progress in size and rupture. The conventional treatment strategy for FAP due to penetrating trauma is open surgical repair (OSR). With emerging technologies, less invasive techniques are being used in appropriate patients for treatment of FAP, such as ultrasound-guided compression (USC), ultrasound-guided thrombin injection (UGTI), covered stents, and coil embolization.[2)] UGTI for FAP can be used as a first-line treatment for selected patients.[3)] We report a case of delayed presentation of FAP treated with UGTI secondary to penetrating trauma.

Case Report

A 37-year-old male patient was admitted to the emergency department with a stab wound injury to the lateral side of his left thigh 2 months ago. He had no signs of vascular injury and was discharged with wound dressing and antibiotic prophylaxis. In the beginning, the patient was asymptomatic, but as time progressed, he experienced severe swelling and pain in the lateral side of his left thigh. He presented to the orthopedic clinic. Physical examination shows no neurological or vascular pathologies. A 2 cm knife entry and 8×8 cm non-pulsatile and non-ecchymosis mass were noted. Lower extremity arterial color Doppler ultrasound (CDU) showed a 6×4 cm pseudoaneurysm sac and 0.8 cm neck originating from the deep femoral artery (DFA) with an active yin–yang sign (**Figs. 1a** and **1b**). The patient was referred to our clinic with a diagnosis of FAP. Contrast-enhanced computerized tomography (CT) of the lower extremity was performed. CT revealed that the upper left thigh extravasation and surrounding hematoma emanated from a second perforating branch of DFA (**Figs. 2** and **3**). The patient was scheduled for UGTI. The affected groin was cleaned with povidone-iodine and covered with a sterile drape. Under local anesthesia, a 20-gauge, echogenic needle was punctured percutaneously to the pseudoaneurysm sac, away from the neck. Slow injection (0.1 mL/s) of 2.5 mL of thrombin was performed under continuous sonographic guidance. After the first injection, CDU confirmed partial thrombosis of the pseudoaneurysm, and an additional injection of 0.5 mL without needle repositioning was needed

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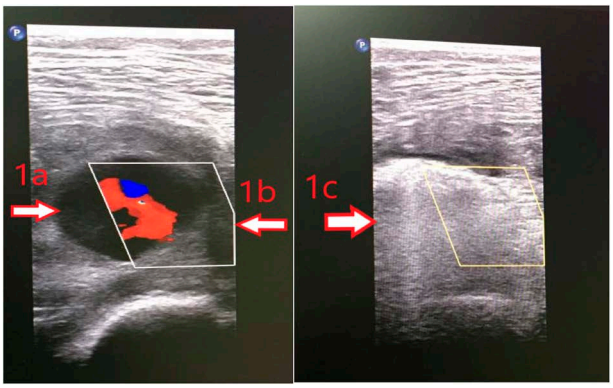

Fig. 1 Color Doppler ultrasound images. **a**) A pseudoaneurysm sac with an active yin–yang sign, **b**) the second perforator branch of the deep femoral artery, and **c**) a thrombosed pseudoaneurysm sac.

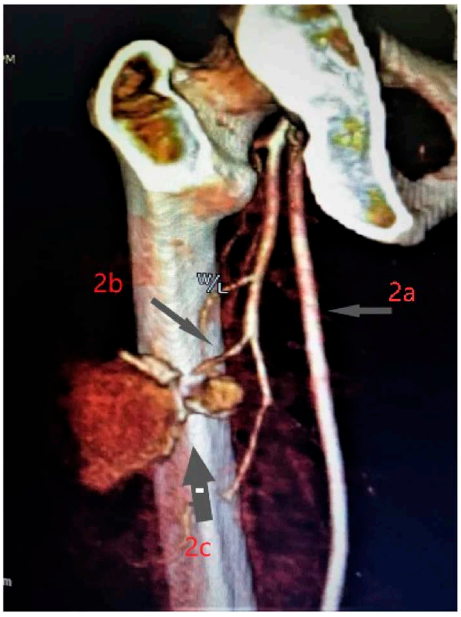

Fig. 2 Contrast-enhanced computerized tomography of the left thigh demonstrated an area of active extravasation. **a**) Superficial femoral artery, **b**) perforator branch of the deep femoral artery, and **c**) pseudoaneurysm sac.

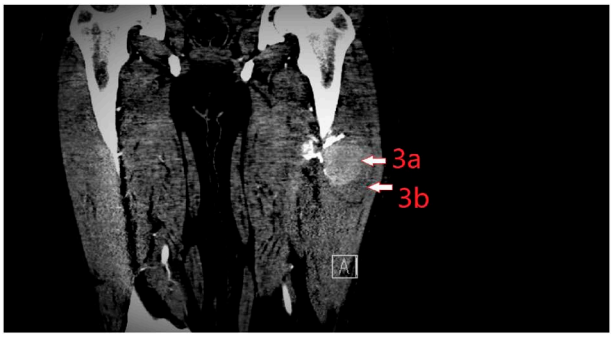

Fig. 3 Contrast-enhanced computerized tomography of the lower extremities. **a**) A pseudoaneurysm sac with active extravasation and **b**) surrounding hematoma.

to achieve complete thrombosis of the cavity. Once the pseudoaneurysm was thrombosed, the needle was withdrawn (**Fig. 1c**). The patient tolerated the procedure well. Post-intervention CDU revealed a normal triphasic flow from the distal DFA. The patient's pain ceased immediately after the procedure. The patient rested in bed for 6 h with restriction, and a repeat ultrasound examination was performed 6 h later, which showed complete thrombosis and no recurrent flow inside the pseudoaneurysm. The patient was discharged from the hospital 7 h after the procedure without any symptoms. One week later, the patient was asymptomatic. One month later, the mass in the left thigh regressed to 3×2.5 cm and was hardly noticed with physical examination.

Discussion

The DFA lies in close proximity to the shaft of the femur, and injuries to this vessel are uncommon and account for 2% of peripheral arterial wounds.[4,5] Diagnosis can be made easily in symptomatic patients. However, because of the localization of the DFA, patients can be asymptomatic. The complications of pseudoaneurysm can be devastating. Therefore, patients admitted to the emergency department with extremity injury should be evaluated with US for vascular injuries.

The treatment strategies for FAP secondary to penetrating trauma can vary because of limited experiences, but we can perform a similar strategy as in iatrogenic pseudoaneurysm. Unlike iatrogenic FAP, penetrating FAP may originate from the wider neck. Therefore, OSR is most likely chosen as an initial procedure.

Asymptomatic and small FAPs (2–3 cm) in a patient who is not under treatment of anticoagulation are prone to thrombosis spontaneously and can be observed up to 4 weeks. The rest of them should be treated.[6]

The treatment options for FAP include OSR, USC, UGTI, and endovascular repair with stent grafts or coil embolization.

OSR has advantages such as directly visualizing an injured vessel and draining the hematoma. OSR has been recommended to complicate FAP with ruptured pseudoaneurysm, limb ischemia, skin necrosis, infection, and neuropathy.[7] However, OSR has high mortality and morbidity rates (3%–20%).[8] Therefore, less invasive techniques are more commonly used with high success and low complication rates even in complicated FAP and hemodynamically unstable patients.[9]

As an initial treatment, ultrasound-guided compression can be performed in patients with small FAP who are not using anticoagulants. However, the recurrence rates are up to 20%, which is higher in patients who are using anticoagulants. During compression, pain causes discomfort, ne-

cessitating analgesic administration. Compression can last for 30–60 min, and patients are in bed with compression bandage for 8 h. In our patient, deep-seated location and the size of FAP made it difficult for effective compression.

UGTI is a less invasive technique that uses human or bovine thrombin. It was first described by Cope et al. in 1986.[10] Unlike USC, the success rates are high even in patients treated with anticoagulants (92%–100%).[11,12] The complication rate of UGTI is 1.3%–1.4%, and thromboembolic complication is 0.5%–0.8%.[13] The risk of thromboembolic events increases in FAP with short and wide neck. In our case, FAP had a wide neck, which was 0.8 cm. To prevent thromboembolic complications, slow injection of thrombin is recommended while compression of the neck is possible.[14] Also, there is still controversy on the standard dose of thrombin required to achieve successful thrombosis. Compared with USC therapy, UGTI requires less time and is well tolerated by patients.

Using a balloon in order to protect the native vessel during thrombin injection is recommended in wider FAP necks.[15] However, Owen et al. concluded that protective interventions are not necessary as the only complication that occurred was secondary to protective intervention.[16]

Conclusion

UGTI is a safe, effective, and less invasive treatment option for FAP secondary to penetrating trauma and could be considered an alternative to surgery.

Disclosure Statement

All authors have no conflict of interest.

Author Contributions

Study conception: OS, DS
Writing: OS
Critical review and revision: all authors
Final approval of the article: all authors
Accountability for all aspects of the work: all authors

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