

Delayed Superficial Femoral Artery Pseudoaneurysm Following Penetrating Trauma in a Young Patient with Sonographic Findings

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ABSTRACT

The most common causes of penetrating arterial injuries are stab and gunshot-related injuries. Any penetrating trauma to the vessel wall that causes damage to the arterial wall will result in a pseudoaneurysm. The time from initial injury to detection of the pseudoaneurysm has been reported to vary from hours to years, depending on the site of formation and clinical symptoms. Enlarging swelling, the presence of pulsatile mass, palpable thrill, edema, and paresthesia of the involved area can be present based on location. Ultrasonography (US) and color Doppler US have been the preferred initial imaging technique to evaluate the vascular structures, especially under emergency conditions. The detection of a turbulent flow that appears as a classic “yin-yang” sign is a characteristic feature of pseudoaneurysms on the color Doppler US. In addition, the identification of a “to and fro” spectral waveform in the neck is considered pathognomonic for a pseudoaneurysm. As per the literature, the color Doppler US demonstrated high sensitivity (94%) and specificity (97%) for the diagnosis of a pseudoaneurysm. Therefore, it is a noninvasive, inexpensive, easy, and very tolerable first choice method for the diagnosis of a pseudoaneurysm. Here, we report on a delayed posttraumatic distal superficial femoral artery pseudoaneurysm in a young patient with color Doppler US findings.

Key words: Pseudoaneurysm; superficial femoral artery; trauma, ultrasound

Introduction

Traumatic arterial injuries of the lower extremities can cause life-threatening bleeding. In addition, hematoma, distal ischemia due to thrombosis, laceration or disruption in the lumen, pseudoaneurysm formation, or an arteriovenous fistula can develop in an involved segment due to penetrating trauma.^[1] A pseudoaneurysm, or false aneurysm, is a collection of blood that results from a leak in a damaged artery. A pseudoaneurysm involves the intima and media layers of the arterial wall. It can originate from traumatic or iatrogenic injury or inadequate surgical anastomosis. Spontaneous

femoral artery pseudoaneurysm is rare, and only a few cases have been described in the literature.^[2,3] Here, we present a young male patient with delayed large pseudoaneurysm of the distal portion of the right superficial femoral artery (SFA) using B-mode and color Doppler ultrasonography (US).

Case Report

A 13-year-old boy was admitted to the emergency room with a palpable slow growing pulsatile mass in the distal right thigh after a penetrating injury 2 weeks ago. On physical

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examination, a locally pulsatile mass was detected in the medial aspect of the right distal thigh. In addition, the anterior-posterior tibial and popliteal pulses were weak, and the dorsalis pedis pulse was not palpable. Neurological exam was normal. A delayed pseudoaneurysm was suspected when clinical findings were considered. US (Mindray DC-7, Shenzhen, China) and color Doppler US were performed on the patient using 3.5 MHz curvilinear and 10 MHz linear probe. A 65 mm × 45 mm × 45 mm anechoic cystic lesion with the turbulent flow was noticed in B-mode US in the distal aspect of the right thigh [Figure 1]. Furthermore, B-mode US showed the communication between the lesion and SFA with a narrow neck [Figure 2]. The color Doppler US was performed to determine whether this lesion was loculated fluid or a vascular lesion. The color Doppler US showed mixed arterial and venous flow patterns (a “yin-yang” flow pattern) in this cystic mass [Figure 3]. In addition, color Doppler spectral waveform showed bidirectional “to and fro” flow within the neck [Figure 4]. Therefore, the findings of color Doppler US strongly suggested that the vascular lesion was compatible with a pseudoaneurysm of the SFA. Arteriovenous fistula formation was not detected by B-mode and color

Doppler US. A low monophasic flow pattern was detected in the anterior-posterior tibial and popliteal artery. The artery dorsalis pedis could not be clearly visualized by color Doppler US. A surgical excision of the pseudoaneurysm was done under general anesthesia, and vascular continuity was provided using a greater saphenous vein interposition graft. Postoperatively, the patient had palpable peripheral pulses in the right leg. The patient was discharged 2 days later without any complication.

Discussion

Pseudoaneurysms of the thigh are rare compared to pseudoaneurysms of the groin and usually result from arterial bleeding into the wall of an injured vessel.^[4] The uninjured side of the arterial wall prevents the vessel from contracting, leading to unbridled blood extravasation, which organizes and develops as a fibrous capsule.^[4] The time from initial injury to detection of the pseudoaneurysm has been reported to vary from hours to years, depending on the site of formation and

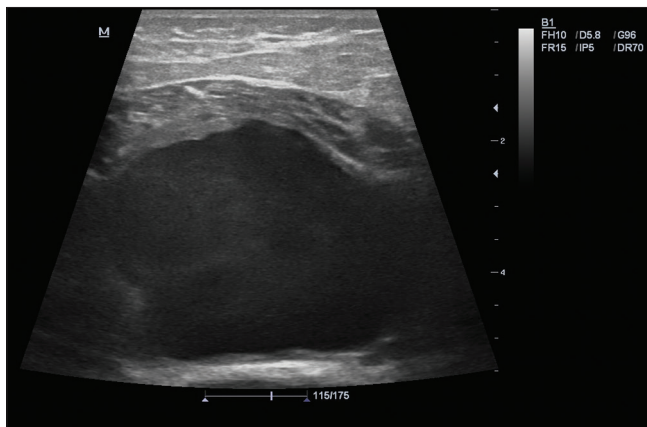


Figure 1: A 13-year-old male with right superficial femoral artery pseudoaneurysm. B-mode ultrasound image shows a large anechoic cystic lesion

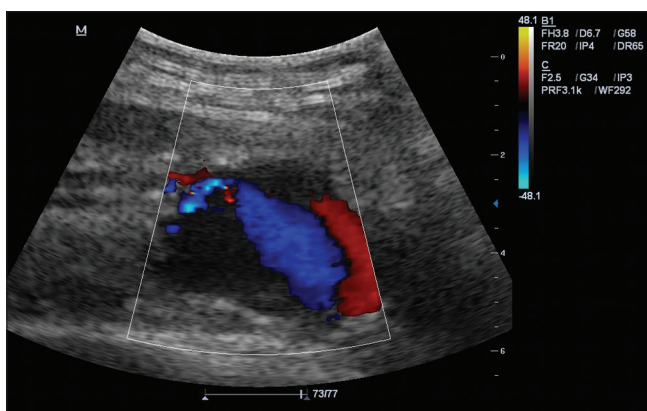


Figure 3: Color Doppler US image of the pseudoaneurysm demonstrating characteristic yin-yang (red-blue) flow in the sac

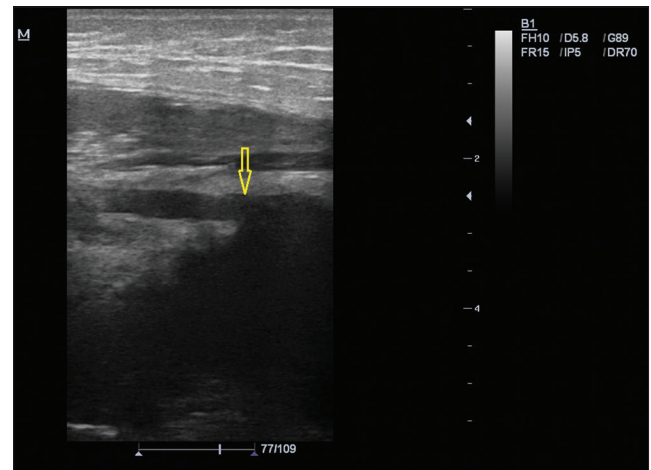


Figure 2: B-mode ultrasound image depicting the neck (yellow arrow) of the pseudoaneurysm, which is associated with superficial femoral artery

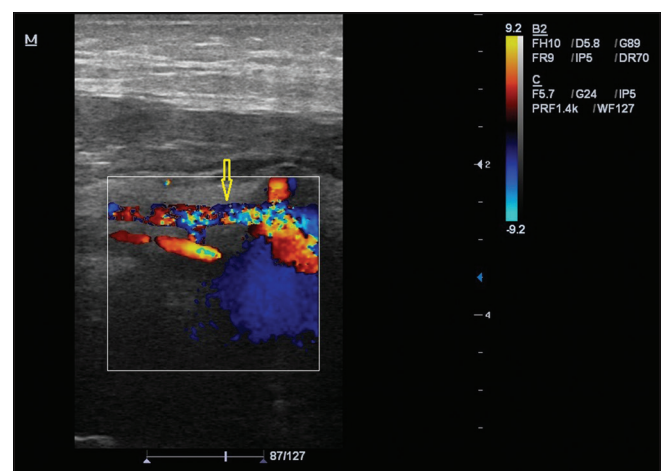


Figure 4: Color Doppler US image of the superficial femoral artery pseudoaneurysm demonstrating the “to and fro” flow between the native artery and the pseudoaneurysm via the neck

clinical symptoms.^[4,5] Pain is the most frequent complaint. Enlarging swelling, presence of pulsatile mass, palpable thrill, edema, and paresthesia of the involved area can be present based on location.^[6] Audible systolic bruits are frequently heard but are not always present. Pseudoaneurysm may not cause vascular insufficiency, and distal pulses may be normal.^[7]

Formerly, angiography was used to evaluate the determination of various vascular lesions, but it is invasive and expensive.^[8] Further, it has high radiation exposure, which is a disadvantage, especially when treating young patients. However, US and color Doppler US is a low-cost, noninvasive, easily accessible, and painless imaging modality of the vascular structures. Recently, it has been the preferred initial imaging technique to evaluate the vascular structures. Gray-scale examination combined with color Doppler US and spectral analysis are useful for the diagnosis of pseudoaneurysm.^[8]

A pseudoaneurysm can be seen on a B-mode US as an anechoic well-defined cystic lesion near the vascular structures. The dimensions of the lesion and width of the pseudoaneurysmal neck can be measured by B-mode US.^[9] Furthermore, the number of compartments (lobes) in the sac and the connection of the sac to the artery can be visualized by B-mode US.^[9] Simple (one lobe) and complex (two or more lobes separated by a patent tract with a diameter smaller than the minimal dimension of the smallest lobe) pseudoaneurysms can be seen by B-mode US. In addition, concentric layers of the hematoma can be visualized within the pseudoaneurysm. In fact, B-mode US is not enough at the diagnosis of the pseudoaneurysm. All these findings can be seen in simple or complex cysts and hematomas.^[9] However, color Doppler duplex US is a valuable diagnostic imaging modality of the pseudoaneurysm, and it can be used to improve detection of arterial lesions. It can delineate the cavity, the degree of clotting, the communication with the artery, and the blood flow pattern. In addition, the lumen has bidirectional swirling, or a yin-yang, color flow, and turbulent or pulsatile flow, on a spectral display. However, “yin yang sign” should not be used alone to the diagnosis of the pseudoaneurysms. Because, this pattern of flow can also be seen in the saccular aneurysm. The hallmark of diagnosis is the demonstration of a neck communicating between the sac and the affected artery, with a “to and fro” waveform by pulsed Doppler US. The “to” represents high-frequency systolic blood flow into the pseudoaneurysm, and the “fro” represents intermediate frequency blood flow out of the pseudoaneurysm.^[9] When considered with pulse Doppler findings and the patient’s history, pseudoaneurysm can be distinguished easily from the saccular aneurysms. Coughlin and Paushter^[10] reported 94% sensitivity and 97% specificity of the color Doppler US in detecting the femoral artery pseudoaneurysm when compared with surgical findings. Therefore, color Doppler US should be the preferred first method for diagnosis of pseudoaneurysm due to its high sensitivity and specificity.

However, US is operator dependent, and the evaluation of vessels in trauma patients, especially those with fractures or hematomas, may be difficult. In such cases, other imaging tests, such as multislice computed tomography (MSCT) or magnetic resonance (MR) imaging, may be used to diagnosis the lesion. Vascular structures can be evaluated easily with MSCT. However, as with angiography, high radiation exposure is a disadvantage of this process, especially when treating young patients. Magnetic resonance angiography (MRA) has emerged as an alternative to MSCT in recent years. Gadolinium-enhanced MRA allows 3D visualization of the pseudoaneurysm and surrounding structures.^[9] These imaging modalities may be used in cases where duplex ultrasound findings are equivocal, or the anatomy is not well-defined.

Soft tissue masses, such as abscesses, cysts, or neoplasms, can be considered for the differential diagnosis in patients without a history of trauma.^[11] Periarterial hematoma and arteriovenous fistula should be considered in the differential diagnosis of patients with a history of trauma. However, pseudoaneurysm can be easily distinguished from other lesions with characteristic imaging findings from color Doppler US.

Treatment approaches of pseudoaneurysm often depend on the size and localization of the lesion. Small asymptomatic lesions, or those involving noncritical vessels, may be followed for 4–6 weeks to detect possible spontaneous recovery.^[12] However, symptomatic lesions over 3 cm in diameter, or those associated with vital vascular structures, must be treated surgically.^[12] Current treatment options for pseudoaneurysms include ultrasound-guided compression, ultrasound-guided thrombin injection, coil embolization, endovascular stent graft insertion, and open surgery.^[3] The preferred method for young patients is the surgical evacuation of the hematoma and arterial suture, patch angioplasty, or interposition graft repair of the artery.^[3] In our case, we preferred to use greater saphenous vein interposition graft after the evacuation of the hematoma to maintain the vascular continuity. The distal arterial insufficiency, infection, and distal embolization can be seen in untreated patients. In addition, untreated lesions gradually increase in size and fatal rupture may occur.^[7]

Here, we presented a delayed SFA pseudoaneurysm with color Doppler US findings. Some traumatic vascular lesions can be detected late due to the variable clinical presentation, as in our case. Enlarging pulsatile swelling in the extremities should be suspicious for the vascular lesions especially pseudoaneurysm after blunt or penetrating trauma. Color Doppler US should be performed under emergency conditions without delay, and the appropriate treatment should be planned as quickly as possible to protect the vascular continuity of the extremity.

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Conflicts of interest

There are no conflicts of interest.

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