Point-of-care Ultrasound Helps Differentiate the Causes of Unilateral Lower Limb Swelling with Rapid Progression: A Case Report with Literature Review

CME Credits

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Abstract

Unilateral lower limb swelling is a common complaint among emergency department (ED) patients. However, an isolated intramuscular hematoma is an uncommon cause of lower limb swelling. We present a case of left thigh swelling after a traffic accident in which an intramuscular hematoma was diagnosed using point-of-care ultrasound. A literature review was also conducted.

Keywords: Intramuscular hematoma, trauma, ultrasound

Introduction

Lower limb swelling may occur on unilateral or bilateral sides. This is a common complaint in emergency department (ED) patients.[1] Although the causes of lower limb swelling can be differentiated based on medical history and physical examination, a definite diagnosis requires imaging studies; ultrasound is one of the useful tools.

Case Report

An 83-year-old male with a medical history of coronary artery disease and regular use of aspirin visited our ED due to left thigh swelling and pain following a traffic accident. He was a bicyclist who collided with a motorcycle and was sent to our ED by ambulance immediately after the injury. His blood pressure was 142/77 mmHg, heart rate was 91 beats/min, and oxygen saturation was 94% in room air. Physical examination revealed motion limitation over his left thigh, with severe swelling. There was no wound, bruise, or local heat over the patient's left thigh. His distal pulsation was symmetric, and he had no distal numbness. The laboratory data were as follows: white blood count, 7,950/μL; hemoglobulin, 12.3 g/dL; aspartate aminotransferase, 32 IU/L; creatinine, 1.31 mg/dL, and creatine phosphokinase, 624 U/L. Plain film of the left thigh showed no displaced fractures.

Point-of-care ultrasonography (Canon, SSA-780A, Tokyo, Japan) with a 12 MHz linear probe was performed 2 h after the injury, which revealed a 5 cm × 3 cm heterogeneous mass in the left vastus intermedius muscle without pulsatile Doppler signals [Figure 1]. The left femoral and popliteal veins were compressible. An intramuscular hematoma without active bleeding was suspected and confirmed by contrast computed tomography [Figure 2]. Contrast extravasation was not observed. Due to the stable condition and no evidence of active bleeding, the patient was treated with an elastic bandage and ice packing and was discharged. The hematoma gradually resolved during the outpatient follow-up.

Discussion

Lower limb swelling is a common complaint in the ED. Differential diagnosis of lower limb swelling can be

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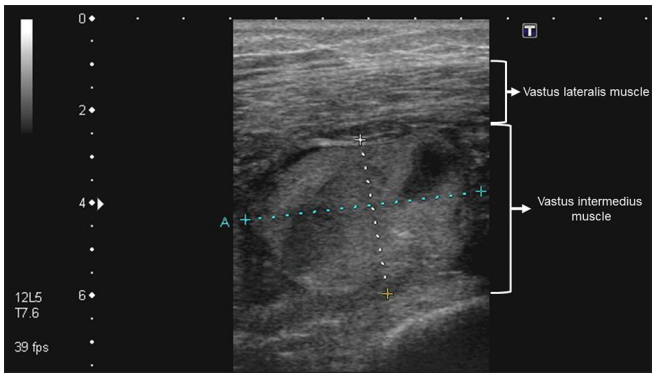

Figure 1: Ultrasonography revealed a 5 cm × 3 cm heterogeneous mass in the left vastus intermedius muscle without pulsatile Doppler signals. Mild edematous changes in the peripheral muscles were also observed. There was no significant edematous change or fluid accumulation in the skin or subcutaneous level

Figure 2: Contrasted computed tomography revealed a hematoma in the right vastus intermedius muscle (white arrow). There was no contrast extravasation

approached based on whether the swelling is unilateral or bilateral and by the speed of swelling progression.[1]

Bilateral swelling or edema of the lower limbs can be caused by systemic diseases, such as heart failure, renal failure, liver cirrhosis, nephrotic syndrome, pulmonary hypertension, or vasodilating medications, and pelvic tumors. In contrast, the causes of unilateral lower limb swelling can be categorized as fast-progressive (hours to days) or slow-progressive (weeks to months) diseases. Slow-progressive lower limb swelling can result from benign tumors or malignancies. Rapid-progressive lower limb swelling, as in this case, can originate from three major types of diseases: deep vein thrombosis, infectious disease (cellulitis, necrotizing fasciitis, abscess), or soft tissue injury such as rhabdomyolysis, acute compartment syndrome, and muscle injury. Ultrasound is a useful diagnostic tool for differentiating between these diseases.[1]

First, deep vein thrombosis can be easily diagnosed by noncompressible femoral and popliteal veins on ultrasonography or by evaluating blood flow and possible thrombosis using power Doppler ultrasound.[2]

Second, infectious diseases such as cellulitis appear as diffuse thickening of involved subcutaneous and soft tissues with reticulated disorganized anechoic stranding as a result of distended lymphatic channels and fluid accumulation on ultrasound. Doppler sonography may show a variable degree of increased flow due to inflammation. If an air-like hyperechoic signal is found at the subcutaneous level, necrotizing fasciitis should be considered.[1]

Abscesses have a variable sonographic appearance, ranging from simple anechoic fluid collection to a complex heterogeneous lesion with internal debris and septations. Doppler ultrasound may demonstrate peripheral surrounding hyperemia; however, ultrasound-guided aspiration may be required both for diagnosis and for obtaining pus for culture, aiding the choice of antibiotics.[1]

Third, soft tissue injury, such as rhabdomyolysis, is diagnosed based on history, clinical symptoms, and laboratory data. Ultrasound may show mixed hyperechogenicity (hypercontractile muscle fibers) and hypoechogenicity (edema and inflammation) of the muscle, as well as disorganized muscle fibers with surrounding areas of fluid. Fluid accumulation at the subcutaneous level may sometimes be seen on ultrasound of rhabdomyolysis; it can be easily differentiated from cellulitis by history and physical examination.[3]

Compartment syndrome is mainly diagnosed by clinical symptoms and intracompartmental monitoring can be a diagnostic adjunct. In compartment syndrome, ultrasound may find an increased blood flow velocity in the arteries proximal to the area of the affected leg.[4]

Muscle injury can be classified as extrinsic (contusion or laceration) or intrinsic (contraction and contemporary elongation of the muscles leading to muscle fiber destruction) injuries, which causes an intermuscular, intramuscular, or mixed type of hematoma depending on the muscular structures involved.[5,6]

The intermuscular hematoma tends to be superficial, and the integrity of the muscles remain intact. Blood may extravasate through the fascia, causing bruises of the skin. In contrast, intramuscular hematoma is characterized by destructive muscle, and the blood is not likely to extend to the skin in the acute phase.[5,6] The sonographic appearance of hematomas due to muscle injury depends on age and location. The acute phase of hematoma may be heterogeneous, as both hypoechoic and hyperechoic relative to the adjacent muscle due to the clotting process, whereas chronic hematomas are typically homogeneously hypoechoic but may have a complex or anechoic appearance.[6,7] In this case, the ultrasound image of the injured thigh appeared as an acute phase of intramuscular hematoma.

Differentiation of hematoma from abscesses and rhabdomyolysis is needed. Although an abscess rarely occurs within 24 h of injury, the sonographic appearance of a hematoma is similar to an abscess. Ultrasound-guided aspiration may be necessary to differentiate between these two entities. As for rhabdomyolysis, findings in the ultrasound usually involve the whole muscle in a diffuse manner, whereas the sonographic findings of intrinsic muscle injuries are limited to a focal area of the injured muscle.[1]

In most cases, an intramuscular hematoma can be treated conservatively. Aspiration of hematoma may be needed to relieve pain, but it is controversial to reduce complications, such as myositis ossificans.[8] The intramuscular hematoma was recommended to be best aspirated in 3–5 days or even 1 week after injury.[9,10] We discussed the aspiration of hematoma with our patient, but he refused the procedure. Doppler ultrasound may help detect the pulsatile signals in or near the hematoma, which demonstrates active bleeding. In such cases, surgical intervention or transarterial embolization may be performed.[1,6,7]

In conclusion, lower limb swelling is a common complaint and ultrasound is a powerful tool for differential diagnoses for the lower limb swelling and it may guide treatment.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that his name and initial will not be published and due efforts will be made to conceal the identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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