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Ultrasound in Emergency Medicine

BEDSIDE ULTRASOUND DIAGNOSIS OF ACUTE EMBOLIC FEMORAL ARTERY OCCLUSION

Daniel M. Rolston, MD, MS,*† Turandot Saul, MD, RDMS,* Tommy Wong, MD,* and Resa E. Lewiss, MD*

*Emergency Ultrasound Division, Department of Emergency Medicine, St. Luke's/Roosevelt Hospital Center, New York, New York and †Ronald Reagan UCLA Medical Center, Los Angeles, California

Reprint Address: Resa E. Lewiss, MD, Division of Emergency Ultrasound, Department of Emergency Medicine, St. Luke's/Roosevelt Hospital Center, 1000 Tenth Avenue, New York, New York 10019

□ **Abstract—Background: Acute limb ischemia is both a limb-threatening and life-threatening disease process. Nontraumatic acute peripheral arterial occlusion is most commonly caused by a thrombosis or an embolism. Objectives: There is limited evidence on the use of bedside ultrasound for the detection of acute limb ischemia, but duplex ultrasonography is standard in the diagnosis and operative planning in chronic limb ischemia. Emergency physicians may use bedside ultrasound in the evaluation of patients with symptoms and signs suggestive of this disease entity. Case Report: A 64-year-old man with a past medical history of hypertension and an ischemic stroke presented to the Emergency Department with <2 h of severe upper left leg pain that radiated down to his foot. A bedside ultrasound of the left lower extremity was emergently performed. On B-mode ultrasound evaluation, echogenic material was visualized in the left common femoral artery, the artery was noncompressible, and there was an absence of Doppler flow signal. He was then directly taken to the operating room for an emergent limb-saving procedure. Conclusion: A focused examination of the aorta, iliac vessels, and femoral artery bifurcation with bedside ultrasonography may help to localize peripheral arterial occlusions and can assist the emergency physician in seeking timely surgical consultation and management.** © **2013 Elsevier Inc.**

□ **Keywords—bedside ultrasound; Doppler ultrasound; limb ischemia; arterial thrombus; arterial embolus**

INTRODUCTION

Acute ischemia can threaten both a limb and a life. Nontraumatic acute peripheral arterial occlusion is most commonly caused by thrombosis (85%) followed by embolism (15%) (1,2). Although thrombotic occlusions are more common, they are usually associated with advanced atherosclerosis, collateral blood supplies, and a less dramatic clinical presentation than acute embolic occlusions. Ischemic limbs due to thrombosis may even present silently, except in a thrombosis of a peripheral arterial vascular bypass conduit, which will present more similarly to an acute embolic event. In fact, bypass conduit thrombosis is now the most frequent cause of acute limb ischemia (2). The majority of emboli (>90%) arise from the heart in patients with atrial fibrillation, infarction, or valvular heart disease (2–4). Approximately two-thirds of noncerebral emboli obstruct the lower extremities, and approximately two-thirds of these involve the aorto-ilio-femoral arteries. The femoral artery is the most common anatomical location (5).

In the Emergency Department (ED), bedside ultrasound (BUS) is commonly used to distinguish the femoral vein from the femoral artery for central venous cannulation, and ultrasonography results in fewer arterial catheterizations than the landmark approach (6). Additionally, the aorta and iliac bifurcation are easily and

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accurately evaluated for aneurysms with bedside ultrasonography (7,8). Although the aorto-ilio-femoral arteries are easily visualized with BUS, and a large proportion of peripheral arterial emboli lodge in these vessels, emergency physicians infrequently use ultrasound to localize peripheral arterial occlusions.

CASE REPORT

A 64-year-old man with a past medical history of hypertension and an ischemic stroke presented to the ED with 90 min of severe upper left leg pain that radiated down to his foot. Thirty minutes prior to presentation, he had developed left foot weakness and difficulty ambulating while outside in the cold weather. He also reported increasing numbness and tingling of the foot, but not in the more proximal left lower extremity. Although his previous stroke had affected his left lower extremity, he had recovered full strength and had no residual deficits. Additionally, he had seen his primary care doctor for a routine medical check-up 5 days prior to his ED visit and was told he had "an irregular heartbeat." He was not prescribed any additional medications at that time.

On physical examination, the patient's vital signs were: temperature 37.3°C (99.2°F) orally, pulse 70 beats/min, blood pressure 243/135 mm Hg, respirations 18 breaths/min, and room air pulse oxygenation of 95%. The patient was visibly uncomfortable, diaphoretic, holding his left leg and changing the position of the leg frequently. The patient had a regular heart rate and rhythm and no audible murmurs on cardiac examination. His lungs were clear to auscultation bilaterally, and his abdominal examination was unremarkable. The lower extremities were cool bilaterally, with pallor noted on the plantar surface of the left foot. The patient's dorsalis pedis pulses were nonpalpable bilaterally. In addition, the posterior tibial pulse was nonpalpable on the left lower extremity, but 1 + on the right lower extremity. Sensation was present but decreased to light touch on the entire left foot. This deficit was not appreciated more proximally. The examining physician appreciated decreased strength in the left lower extremity: 0/5 dorsiflexion of the hallux, 0/5 dorsiflexion and plantar flexion of the foot, 3/5 knee flexion/extension, and 5/5 hip flexion. In the right lower extremity, no neuromuscular deficits were appreciated.

A handheld vascular Doppler evaluation was initially unavailable, so a BUS of the left lower extremity was emergently performed (Figures 1, 2). The examining physician placed the high-frequency linear transducer in the area of the left inguinal ligament to visualize the common femoral vessels and their bifurcations. On B-mode, the emergency physician saw hyperechoic material in the left common femoral artery, which extended to the superficial and deep femoral arteries. The affected arteries were noncompressible, even with significant applied pressure. Color flow Doppler mode of the same vessels revealed no flow in the left common femoral artery. There was flow in the common femoral and saphenous veins.

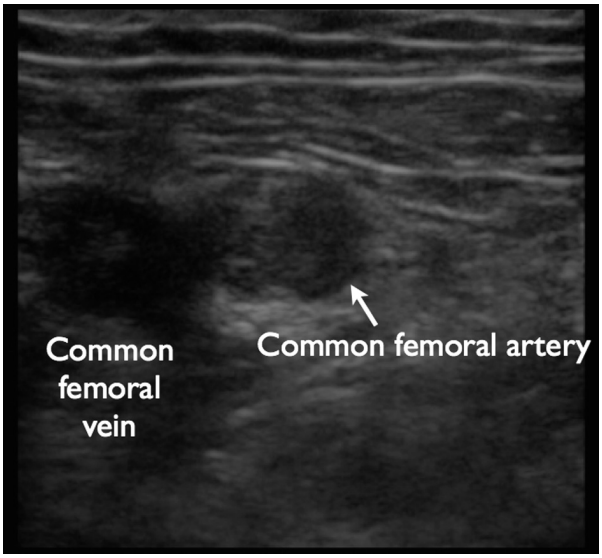

Figure 1. Transverse B-mode ultrasound image of the left common femoral artery and vein. Echogenic material can be seen in the left common femoral artery.

The patient was given a total of 12 mg of morphine intravenously for analgesia. The surgical consultation resident was emergently called and arrived to the ED as the BUS was being performed. A handheld vascular Doppler was brought by the surgeon and demonstrated absent flow in the left dorsalis pedis and posterior tibial arteries, and normal flow in the right dorsalis pedis and posterior tibial arteries. A point-of-care blood glucose was 139 mg/dL,

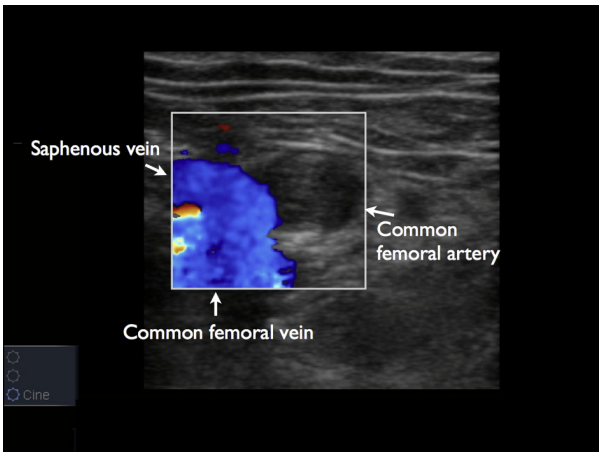

Figure 2. Transverse color flow Doppler ultrasound image of the left common femoral artery and saphenous common femoral vein junction. Flow can be seen in the common femoral and saphenous veins but arterial flow is absent.

and an electrocardiogram revealed normal sinus rhythm without ischemic changes. Significant laboratory results included a hemoglobin of 14.7 g/dL, creatinine of 1.8 mg/dL, international normalized ratio of 1.1, and a creatine kinase of 192 IU/L. After this rapid assessment by the surgical consultant and a review of the images, the patient was emergently taken to the operating room for a presumptive arterial embolectomy. No further imaging was obtained.

In the operating room, an arteriotomy was performed and the patient was found to have an embolus located at the common femoral artery bifurcation. The clot was removed successfully and the patient had complete return of blood flow and pulses to the left lower extremity. His inpatient stay was complicated by episodes of paroxysmal atrial fibrillation. Consequently, he was started on warfarin and discharged on this medication.

DISCUSSION

A patient with acute limb ischemia typically presents with paresthesia, pain, pallor, pulselessness, poikilothermia, and progression to paralysis (the 6 Ps). The emergency physician should focus the patient's history to the timing of symptom onset, previous history of symptoms related to vascular claudication or surgical bypass, or any risk factors for cardioembolic disease. There is very limited evidence on the use of BUS for the detection of acute limb ischemia. Duplex ultrasonography is standard in the diagnosis and operative planning in chronic limb ischemia. Duplex ultrasonography has been used effectively to replace pre-operative contrast angiography as the sole pre-operative imaging modality during several studies in the setting of chronic limb ischemia (9–11).

Contrast-enhanced computed tomography angiography (CTA) and magnetic resonance angiography (MRA) are useful noninvasive tools in the detection of arterial stenosis; however, they are time-consuming modalities in a time-dependent disease process and they require potentially nephrotoxic contrast media in a patient population that may have chronic renal insufficiency or the potential for concurrent renal emboli. One systematic review studied the utility of the three noninvasive imaging modalities (duplex, CTA, MRA) and a second meta-analysis evaluated CTA in patients with symptoms of peripheral vascular disease (12,13). For detecting a >50% stenosis, duplex ultrasonography had a significantly lower sensitivity, but similar specificity to CTA and MRA (12,13). In patients found to have arterial occlusion, duplex ultrasonography was still less sensitive, but as specific (median sensitivity 90%, specificity 99%) as CTA (median sensitivity 97%, specificity 99.6%) and MRA (median sensitivity 94%, specificity 99.2%) (12). Importantly, both the systematic review and the meta-analysis evaluated patients with symptoms of lower-limb peripheral arterial disease, but they did not differentiate patients with symptoms of acute arterial occlusions. BUS may be a feasible screening test to quickly identify the location of an arterial occlusion; however, if an occlusion is not identified, ultrasound is not sensitive enough to rule out the diagnosis and further imaging is needed.

Emergent surgical or intra-arterial intervention is prudent in cases of acute arterial occlusive disease, especially if the patient develops sensory loss or motor weakness. Embolic occlusions frequently require an embolectomy, whereas thrombotic occlusions are most commonly treated with arterial bypass or endarterectomy (2). The treatment modality will be determined by the patient's clinical presentation, comorbid medical problems, and etiology of the vasoocclusion.

CONCLUSION

Emergency physician-performed bedside ultrasonography focused on the aorta, iliac vessels, and femoral artery bifurcation may help to localize emboli or thromboses causing acute arterial occlusions. Moreover, it may assist the surgical consultation team in evaluating and providing definitive treatment in a timely manner. This case presentation demonstrates the feasibility of detecting an embolic femoral artery occlusion using BUS in a patient presenting with a limb-threatening condition.

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