Limb threatening thigh hematoma diagnosis accelerated by emergency physician bedside ultrasound

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Abstract
Introduction: Compartment syndrome is a serious condition that requires prompt diagnosis, specialty consultation, and definitive management to prevent significant morbidity. Traditionally, compartment syndrome is identified by physical exam findings including the presence of pain, pallor, paresthesia, pulselessness, and paralysis involving the affected limb. Identifying the presence of compartment syndrome prior to the onset of signs that portend a poor outcome (i.e. pallor, pulselessness, and paralysis) can be challenging since many other less serious traumatic conditions can lead to paresthesia and pain in a limb. Bedside ultrasound is increasingly being utilized by emergency providers to expedite identification of various emergent diagnoses and guide care for patients who present to emergency departments. Bedside ultrasound allows emergency providers to visualize pathologic processes occurring that may be difficult to identify through traditional physical exam findings. This case report highlights the use of bedside ultrasound to promptly identify the presence of a traumatic thigh hematoma, which led to expedited advanced imaging and specialty consultation for compartment syndrome prior to the onset of physical exam findings consistent with compartment syndrome.

Conclusion: The identification of compartment syndrome in the early stages is challenging given the overlap of signs and symptoms with other less emergent conditions. Early diagnosis of compartment syndrome is important to decrease morbidity, which can result from a delayed diagnosis of compartment syndrome. To our knowledge, this is the first case report to describe the use of bedside ultrasound to aid in the diagnosis of compartment syndrome and accelerate the care for a patient who presented with a traumatic thigh hematoma, which rapidly progressed to compartment syndrome and required emergent operative intervention.

Keywords
Ultrasound, point-of-care ultrasound, bedside ultrasound, hematoma, compartment syndrome

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Introduction
Compartment syndrome is a serious condition that requires prompt diagnosis, specialty consultation, and treatment to prevent significant morbidity including permanent disability and limb compromise. Traditionally, compartment syndrome is identified by assessing for physical exam findings including the presence of pain, pallor, paresthesia, pulselessness, and paralysis involving the affected limb. Identifying the presence of compartment syndrome prior to the onset of signs that portend a poor outcome (i.e. pallor, pulselessness, and paralysis) can be challenging since many other less serious conditions can lead to paresthesia and pain in a limb following trauma. Bedside ultrasound is increasingly being utilized by emergency providers to expedite identification of various emergent diagnoses and guide care for patients who are presented to emergency departments. Bedside ultrasound allows emergency providers to visualize pathologic processes occurring that may be difficult to identify and appreciate through traditional physical exam findings. We present an interesting case of a patient in whom bedside ultrasound was used to promptly identify the presence of a traumatic thigh hematoma, which rapidly progressed to compartment syndrome and required emergent operative intervention.

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traumatic thigh hematoma, which raised the provider’s concern for the presence of early compartment syndrome prior to the onset of physical exam findings consistent with compartment syndrome. The expedited identification of the hematoma was clinically relevant given it resulted in accelerated advanced imaging and specialty consultation for a patient who ultimately required emergent fasciotomy and arterial embolization to treat compartment syndrome of the leg.

Case

An 86-year-old gentleman presented to the emergency department for abrasions and right leg pain. Immediately prior to arrival, he had experienced a mechanical fall onto concrete. His medical history consisted of atrial fibrillation for which he took daily anticoagulation medication (rivaroxaban). On arrival, he reported posterior right thigh discomfort that was constant, described as “tightness,” worse with movement of the right leg, and associated with mild, vague paresthesias of the right foot. His vital signs were within normal limits including a pulse rate of 65 beats/min and a blood pressure of 129/96. The physical exam was notable for focal tenderness to palpation over the posterior right thigh with a compartment that felt mildly firm to palpation. There was no overlying rash or ecchymosis. There was decreased sensation to light touch in the right foot with fully intact motor function. Distal pulses in the right leg were intact. The bilateral feet appeared symmetric and well perfused and were both warm to touch.

Bedside ultrasound of the posterior right thigh was performed and revealed an area of hypoechogenicity without Doppler color flow concerning for a fluid collection (Figures 1 and 2). This finding raised the provider’s concern for a traumatic hematoma in the setting of anticoagulant use and an expedited computed tomography (CT) scan with intravenous (IV) contrast of the right leg was obtained, which revealed an 8-cm hematoma in the right posterior thigh with active extravasation (Figure 3). Immediate specialty consultation was obtained for further management. During the patient’s emergency department course (after acquisition of focused advanced imaging and initial specialty consultation), he developed hypotension requiring bolus intravenous fluids as well as progression of right foot paresthesias and interval development of motor weakness in the right foot concerning for sciatic nerve palsy. The patient was taken in an emergent manner to the operating room and underwent a fasciotomy of the right posterior thigh followed by interventional radiology embolization of a profunda femoral vessel. Following the above interventions, the patient’s symptoms gradually improved and at his 1-month follow-up appointment, he did not have any significant morbidity related to his compartment syndrome.

Figure 1. B-mode ultrasound of right posterior thigh. Asterisk identifies area of hypoechogenicity that represents hematoma.

Figure 2. Color Doppler ultrasound of posterior thigh hematoma. Yellow box shows absent flow within area of hypoechogenicity suggesting the presence of a fluid collection. The two punctate areas of color are likely due to either subtle movement of ultrasound probe or due to the active extravasation of blood noted on CT scan imaging.

Figure 3. Representative image of CT scan, white circle show 8-cm posterior thigh hematoma with area of active extravasation.
Discussion
The case presented highlights the novel use and potential utility of bedside ultrasound for emergency providers in the diagnosis of a traumatic extremity compartment syndrome related to a hematoma with associated anticoagulant use. Bedside ultrasound has previously shown utility in the identification and measurement of soft tissue hematomas. To our knowledge, there are no reports of bedside ultrasound being utilized to expedite the diagnosis of an extremity compartment syndrome in the setting of a traumatic soft tissue hematoma with associated anticoagulant use leading to neurovascular compromise. In this case, the use of bedside ultrasound helped expedite the diagnosis of leg compartment syndrome and avoid a delay in specialty consultation and treatment. If the emergency provider had not utilized bedside ultrasound, and instead performed serial physical exams to assess for findings consistent with extremity compartment syndrome, there would have been a delay in diagnosis with associated increased risk of permanent disability and limb compromise.

Bedside ultrasound is advantageous in its ability to allow providers to obtain focused imaging in a rapid, nonionizing manner at the point of care and visualize pathologic processes occurring that may be difficult to identify through traditional physical exam findings. Oftentimes, bedside ultrasound is already being used in patients who present with blunt trauma for completion of the focused assessment with sonography for trauma (FAST) exam to assess for intra-abdominal injury, and therefore, its use could easily be applied in the evaluation of other traumatic injuries.

Conclusion
In this particular case, the use of bedside ultrasound to identify the presence of a soft tissue hematoma in the setting of neurologic symptoms increased the provider’s suspicion of a possible early compartment syndrome and led the provider to obtain and expedite focused advanced imaging and subsequent specialty consultation prior to the onset of additional neurologic deficits, which eventually developed during the patient’s emergency department course. Bedside ultrasound should not be used in isolation for the diagnosis for traumatic extremity compartment syndrome. However, there are limitations of the physical exam findings that are associated with early compartment syndrome given that the symptoms associated with benign traumatic injuries (i.e. contusion or muscle strain) can be similar and difficult to differentiate from the symptoms associated with an early compartment syndrome. Therefore, we recommend that emergency providers consider the use of bedside ultrasound to augment their evaluation of extremity trauma with possible compartment syndrome due to a traumatic hematoma in the setting of anticoagulant use.

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