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Ultrasound in Emergency Medicine

DIAGNOSIS OF AN OCCULT HIP FRACTURE BY POINT-OF-CARE ULTRASOUND

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☐ **Abstract—Background: Hip fractures are common injuries, particularly among elderly patients. Although plain radiographs are the initial imaging modality of choice, approximately 10% of hip fractures are not radiographically evident. Failure to diagnose a hip fracture in the emergency department may result in delayed diagnosis and potentially devastating consequences. Case Report: We report the case of an 81-year-old woman with right hip pain after a fall. Although plain radiographs of the right hip and femur were negative for fracture, point-of-care ultrasound of the right hip demonstrated a cortical disruption in the femur consistent with a fracture. Given the clinical and ultrasound findings, computed tomography of the bony pelvis and proximal femurs was performed, which confirmed an oblique complex fracture of the right femur through the greater and lesser trochanters. Why Should an Emergency Physician Be Aware of This?: Point-of-care ultrasound, in conjunction with clinical suspicion, may help identify patients who require more advanced imaging to identify occult hip fractures.** © **2015 Elsevier Inc.**

☐ **Keywords—emergency ultrasound; hip fractures/diagnosis; hip fractures/radiography; hip injuries/ultrasonography**

INTRODUCTION

Hip fractures are common injuries; in 2010 alone, there were an estimated 258,000 hospitalizations for hip fractures among persons 65 or older in the United States (1). Worldwide, the total annual number of hip fractures is projected to exceed 6 million by the year 2050 (2). Accurate and early diagnosis of hip fractures is of particular significance, because delays in diagnosis are associated with increased morbidity and mortality (3,4). One study found that an operative delay beyond 2 days doubled mortality at 1 year (5). Moreover, nondisplaced occult fractures may shift if they are unrecognized upon initial presentation at the emergency department (ED), because patients may be encouraged to weight bear, potentially necessitating a greater-risk surgery for a secondarily displaced fracture (6).

Although the plain radiograph is the initial imaging modality of choice to diagnose hip fractures, not all fractures are radiographically evident (7). Approximately 3–4% of patients presenting to the ED with hip fractures will have normal radiographs (5,6,8). For patients with a clinical presentation concerning for fracture and negative plain films, magnetic resonance imaging (MRI) is considered the most accurate imaging modality, with a sensitivity and specificity of 100% (9,10). Computed tomography (CT) is less accurate than MRI in identifying radiographically occult hip fractures, and CT also may underestimate the full extent of injury in those fractures identified (11–13). Still, there is increasing evidence that CT is able to identify the majority of occult hip fractures, and can be a valuable test when MRI is not readily available (12,13).

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CASE REPORT

An 81-year-old woman presented to the ED with right hip pain after a trip and fall onto her right side. She was unable to bear weight at the scene because of severe pain in her right hip. Her medical history included diabetes mellitus, hypertension, and a left intertrochanteric hip fracture treated with an intramedullary rod 16 months previously. On examination, she had a temperature of 97.6°F, pulse of 70 beats/min, blood pressure 131/102 mm Hg, respiratory rate 24 breaths per minute, and oxygen saturation 100% on room air. Her right leg was rotated externally, with tenderness to palpation over the greater trochanter; she had right hip pain with log roll and axial loading. Her skin was without ecchymosis and her compartments were soft. Bilateral lower-extremity strength at the knee and ankle was intact. She had normal sensation to light touch and symmetric posterior tibial and dorsalis pedis pulses. The remainder of her examination was without evidence of traumatic injury.

While waiting for plain radiographs of the right hip, femur, and pelvis to be performed, a point-of-care ultrasound of the right hip was performed by the treating emergency physicians with a 5-2 MHz curved array transducer (Sonosite M-Turbo, Bothell, WA). The patient was lying supine on the gurney and the transducer was placed on the right anterior hip inferior to the inguinal ligament (parallel to the femoral neck) with the directional indicator towards the patient's umbilicus. Distal to the femoral neck, there was an abrupt cortical break, concerning for a fracture (Figure 1). The patient had received 4 mg of intravenous morphine at arrival and tolerated the ultrasound well; the procedure did not require any manipulation of her hip joint and lasted approximately 5 min.

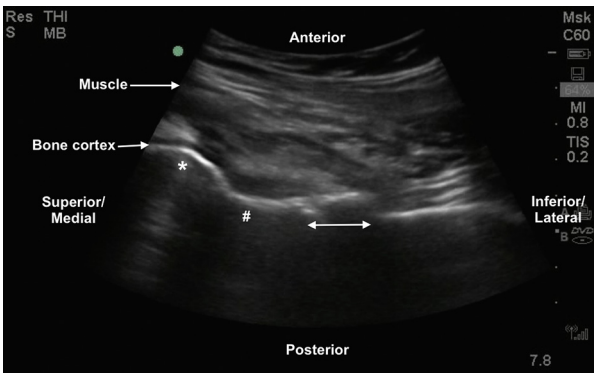

Figure 1. Point-of-care ultrasound of the right hip along the axis of the femoral neck. Superior/Medial has been labeled in the image to reflect that the directional indicator is oriented toward the umbilicus parallel to the axis of the femoral neck. The cortex of the femoral head (*) and neck (#) is normal, but there is an irregularity and abrupt break in the cortex of the femur (*double headed arrow*) concerning for a fracture.

Plain radiographs of the right hip and femur were performed and interpreted by the attending radiologist as "negative for acute fracture" (Figure 2). Given the results of the ultrasound and clinical concern for occult hip fracture, CT of the bony pelvis and proximal femurs was performed, which showed an oblique, complex fracture of the right femur through the greater and lesser trochanters (Figure 3).

The patient was admitted to the hospital for an open reduction and internal fixation of the right femur. The surgery was without complications, and the patient was discharged in stable condition to a physical rehabilitation facility on postoperative day 2.

DISCUSSION

Ultrasound typically is not considered in the diagnostic evaluation of occult hip fractures. To our knowledge, only one published study has examined ultrasound as the initial test in the evaluation of occult hip fractures, with a calculated sensitivity and specificity of 100% and 65%, respectively (14). In this study, two radiologists with extensive musculoskeletal ultrasound experience performed and interpreted bilateral hip ultrasounds in 30 patients with a clinical picture suspicious for occult hip fracture. All patients had an MRI of bilateral hips after the ultrasound, and 10 hip fractures were identified by MRI. Ultrasound showed trauma-related changes (defined as fracture lines, joint and bursal effusions, and peritrochanteric fluid) in all 10 patients with hip fractures and correctly identified 13 patients without hip fractures; however, seven patients with trauma-related changes on ultrasound did not have hip fractures on MRI. (Of note, three of the patients with a "false-positive" ultrasound had pubic rami fractures on MRI.)

Proper evaluation for fracture with ultrasound generally begins with scanning the injured extremity in the region of tenderness or deformity in both the short and long axis. A linear, high-frequency transducer typically is used to perform these examinations, but a curvilinear, low-frequency transducer may be used to evaluate deeper structures, such as the adult hip. Fractures appear as a break, step-off, or irregularity of the bone cortex. The contralateral, unaffected extremity can be scanned for comparison. In this case, we were able to see a distinct interruption in the bony cortex when scanning the femur along the axis of the femoral neck. Sonographically, occult hip fractures may not have an obvious cortical break but instead will be identified by soft-tissue abnormalities around the hip, such as joint effusions and peritrochanteric edema. Indeed, only 2 of the 10 true hip fractures sonographically identified by Safran et al. had fracture lines; most were detected by soft-tissue