Imaging Choices in Occult Hip Fracture

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J Emerg Med. 2009;32(3):144-152

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Introduction

- High dependence on the integrity of this structure for people to function in their daily lives
- A delay of just 2 days in surgical treatment for an acute hip fracture doubles mortality
- Unrecognized non-displaced fracture may displace, requiring surgery of much higher risk

Introduction

- Suspicion of hip fracture despite negative X-ray studies → additional imaging to detect or exclude pathology.
- Computed tomography (CT), bone scanning, and magnetic resonance imaging (MRI).

Plain Radiography

- Occult fracture as the proximal femur
  - High percentage of trabecular bone
  - Difficult to detect than in cortical bone

occult intertrochanteric fracture 2 days after missed occult fracture

Plain Radiography

- Overall, 4.4% (95% confidence interval 3.0-6.5%) of patients with negative X-ray studies had an occult fracture, or 3.1% of all ED patients having hip X-ray studies

Sensitivity of Radiographs

- Standard radiographic hip imaging
- Sensitivity of these projections for hip fracture between 90% and 98%
- Dominguez et al. noted a sensitivity of 90.1% of plain radiographs for hip fracture in the ED

Sensitivity of Radiographs

- Several factors could lead to the lower sensitivity in the ED (90.1%) relative to other settings (average = 95.5%)
  - Emergently obtained → improper technique
  - Re-imaged after coming to the specialists
- More views may have increased overall sensitivity of radiography
  - frog-leg view, internal rotation view, inlet and outlet, Judet, and traction views

Occult Hip Fracture Studies

- **Three major characteristics are evident across the studies**
  - **Clinical presentations**
  - **Low-energy trauma**
  - **Elderly, women, or otherwise at risk for osteoporosis**

Clinical Presentation

- New inability to bear weight, pain on axial loading, was found to be 73% sensitive for occult fracture
- Pain on range of motion
  - straight leg raise and internal and external rotation
  - 50% and 70%, sensitive
- History of pre-fracture mobility and independent living; 76% of occult fractures

Low-energy Trauma

- A fall from a standing height
- It does seem that a fall to the side with impact on the greater trochanter, the mechanism in 76% of the falls associated with fracture

Osteoporosis Risk

- Advanced age, and female gender
- Smoking, inactivity, rheumatoid arthritis, post-gastrectomy syndrome, a low percentage of body fat, poor calcium intake, excessive alcohol intake, and endocrine disorders such as diabetes, hyperthyroidism, hyperparathyroidism, and hypercortisolemia
- Alcoholism as a factor in osteoporosis was seen in a 45-year-old-patient

Supplemental Imaging

- **Computed Tomography**
- **Bone Scanning**
- **Magnetic Resonance Imaging**

Computed Tomography

- Addition of the third dimension with CT can often define a fracture when it is not seen on X-ray study
- Resolution of osteoporotic trabecular bone is limited and fracture can lie hidden within

CT read as normal later found to have occult intertrochanteric fracture

(the same patient from Figure 1, Figure 2, the same day as Figure 1)

Computed Tomography

- Evidence supporting the use of CT in hip fracture is scant
- The full extent of the damage was not appreciated
- Some highlight the correlation of lipohemarthrosis with fracture as an indirect way to detect fracture.

Computed Tomography

- There is scarce evidence to support the use of CT for occult hip fracture evaluation.

Bone Scanning

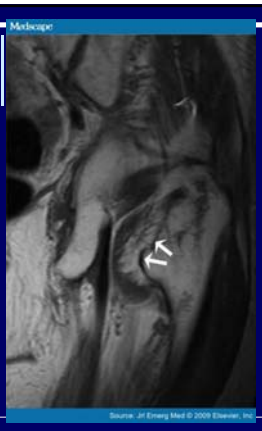
- Alternative to MRI if patients are admitted
- Sensitivity of 93.3% for scintigraphy
- Several unfavorable aspects to scintigraphy
  - Specificity is lower than other modalities
  - Poor spatial resolution of scintigraphy may not reveal the entire extent of a fracture (elderly)

Bone Scanning

- Scintigraphy relies on mechanisms that tend to degenerate with advancing age
  - perfusion, decrease by half from middle to old age
  - renal function, as good film quality depends on clearance of tissue radionuclide
  - overall bone radionuclide uptake is increased in the elderly owing to higher bone turnover, obscuring fractures
- The largest disadvantage→ at least 72 h after injury

Magnetic Resonance Imaging

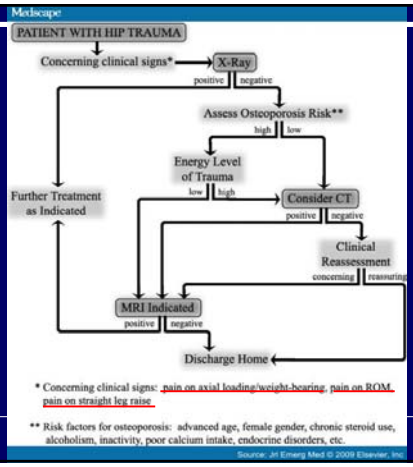
- Immediately after injury, bony trabecular disruption is evident on T1 imaging as low-density dark bands
- Sensitivity of MRI for fracture was 100% for both junior and senior radiologists. Specificity was 100% for senior radiologists but 93% for the junior radiologists



T1 MRI of occult hip fracture

Magnetic Resonance Imaging

- Additional techniques
  - T2 and short tau inversion recovery sequences, highlight edema or hemorrhage in bright white
- Soft tissue injury that could mimic fracture → muscle edema, osseous contusion, and bursitis
- A "limited" MRI (detailing only the hip region) results in room time of 15 min or less
- T1 images alone also decrease study time but will miss soft tissue injuries



Finding the Occult Hip Fracture

- Available evidence favors MRI as the diagnostic modality of choice for occult hip fracture.
- History →pre-trauma mobility and independent living
- Physical examination→ pain on range of motion, palpation, or weight bearing

Summary

- Hip fracture has significant morbidity and mortality, which worsens as time from injury progresses.
- Plain radiographs → 90% sensitive for hip fracture.
- 3-4% of ED patients having hip X-ray studies who harbor an occult hip fracture
- CT may not be accurate enough →reasonable to use in high-energy trauma

Summary

- Bone scanning → low specificity and delayed results
- MRI seems to be the modality of choice for the next step in evaluation of select patients

Thanks for your attention !!