AMSER Case of the Month
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80 yo F with hip and leg pain s/p fall

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Patient Presentation

- HPI: 80 y.o. F presents via EMS after being found down with left leg pain and deformity following a fall from standing height. Of note, patient recently saw a physician for left anterolateral thigh pain exacerbated by ambulation, and was diagnosed with stress fracture after an MRI.

- PMH: Osteoporosis, HTN, HLD, hypothyroidism

- PSH: R femur fracture s/p ORIF, carpal tunnel release

- Medications: Alendronate 70 mg weekly, Omeprazole 20 mg BID, HCTZ 12.5 mg QOD, Levothyroxine 137 mcg daily

Physical Exam

- **Neuro** - AOx3 normal speech, no focal deficits
- **Cardiovascular**: Normal rate, regular rhythm and intact distal pulses
- **Pulmonary/Chest:** Effort normal. Lungs clear to auscultation bilaterally
- **Abdominal**: Soft, non-tender, non-distended
- **Musculoskeletal** - Shortened left leg with tenderness at left hip and knee. Pain with left hip ROM. Sensation intact.
- **Skin** - No wounds or evidence of skin breakdown

Initial Labs

- CBC
  - WBC - 17.3 k/mcL
  - Platelets - 349 k/mcL
  - Hgb - 11.9 g/dL
- Electrolytes
  - Creatinine - 0.47 mg/dL
  - Calcium - 9.2 mg/dL
  - Phosphorus - 3.0 mg/dL
- INR - 1.2
- Total CK - 818 U/L

What Imaging Should We Order?

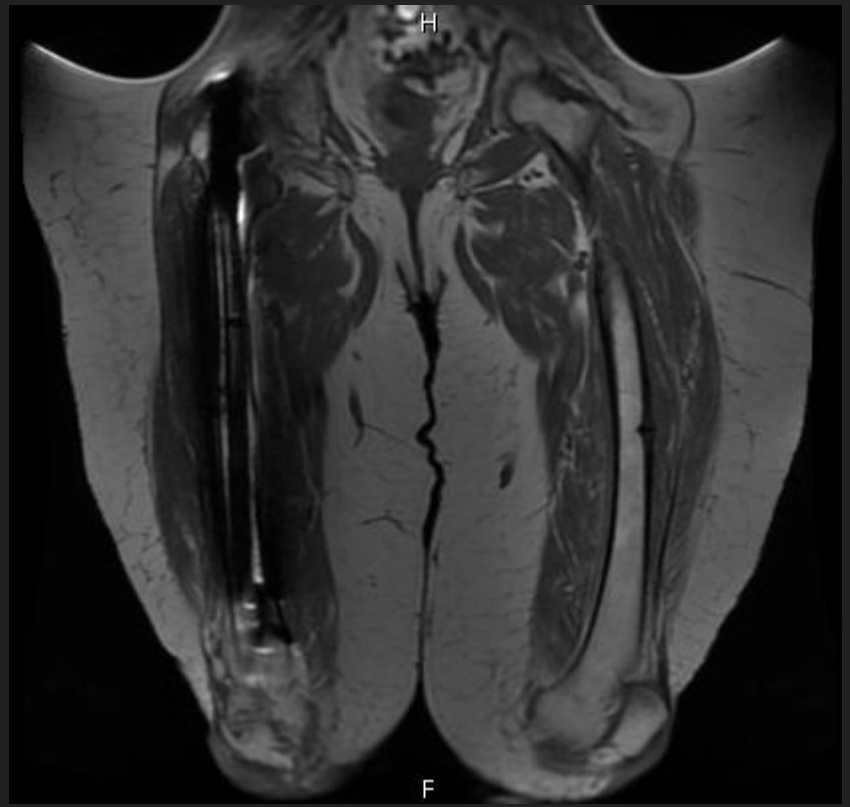
ACR Appropriateness Criteria for Acute Pain s/p Fall

Variant 1: **Acute hip pain. Fall or minor trauma. Suspect fracture. Initial imaging.**

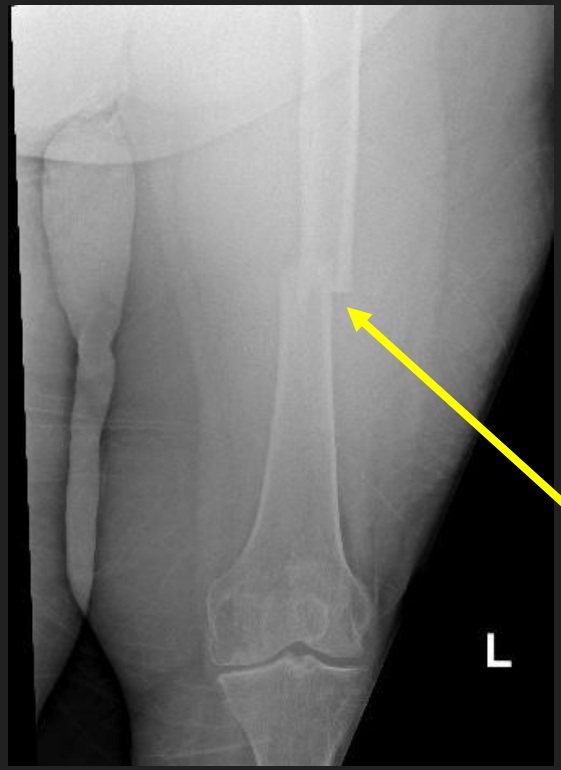
Procedure	Appropriateness Category	Relative Radiation Level
Radiography hip	Usually Appropriate	☢☢☢
Radiography pelvis	Usually Appropriate	☢☢
Radiography pelvis and hips	Usually Appropriate	☢☢☢
CT pelvis and hips with IV contrast	Usually Not Appropriate	☢☢☢
CT pelvis and hips without and with IV contrast	Usually Not Appropriate	☢☢☢☢
CT pelvis and hips without IV contrast	Usually Not Appropriate	☢☢☢
MRI pelvis and affected hip without and with IV contrast	Usually Not Appropriate	O
MRI pelvis and affected hip without IV contrast	Usually Not Appropriate	O
Tc-99m bone scan hips	Usually Not Appropriate	☢☢☢
US hip	Usually Not Appropriate	O

Left Hip and Femur Radiographs - Findings (Unlabeled)

Hip MRI Prior to Admission - Findings (Unlabeled)



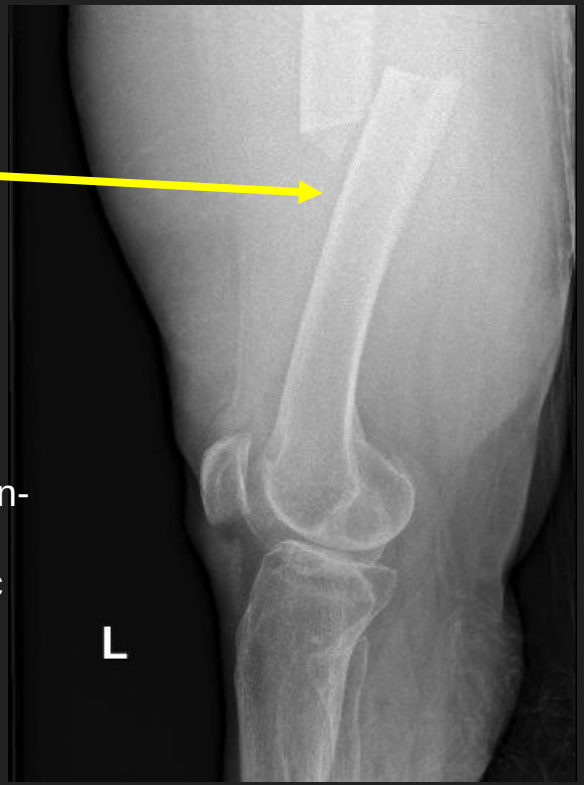
Radiograph Findings (Labeled)



Anterior-posterior radiograph of left femur

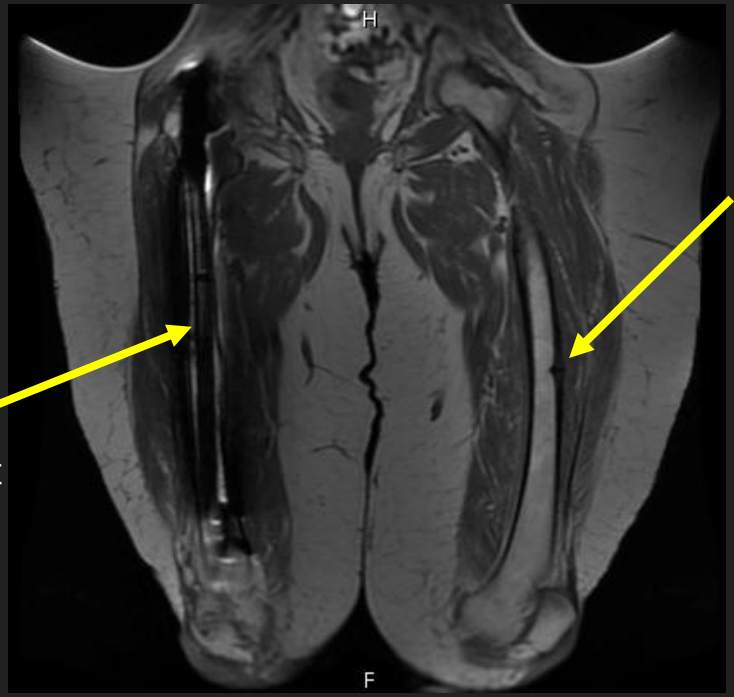
Posterior displacement and angulation of distal fragment apparent on lateral view

Complete, transverse, non-comminuted, laterally displaced subtrochanteric fracture



Lateral radiograph of left femur

Hip MRI Findings (Labeled)



Artifact from past internal fixation

Hypointensity located on lateral aspect of femoral diaphysis

Coronal T1-weighted FSE

Linear, hypointense signal of the subtrochanteric humeral shaft

Sagittal T1-weighted FSE

Final Dx:

Atypical femoral fracture secondary to bisphosphonate use

The patient underwent a left retrograde intramedullary fixation procedure.

Radiographs s/p ORIF with Left Intramedullary Nail

Atypical Femoral Fracture (AFF)

- Definition: Fracture predominantly seen in the proximal third of the shaft, just distal to the lesser trochanter, but can occur throughout the diaphysis down to the supracondylar region.
  - In comparison to 75% of femoral fractures which occur as result of high-impact trauma and are spiral in >50%, must be result of minimal to no trauma

- Epidemiology: Seen in women continuously treated with bisphosphonates with a 1 in 1000 prevalence compared to 0.02 in 1000 for untreated women

- Pathogenesis: Type of insufficiency fracture, occurring with normal stress on abnormal bone. Long-term suppression of bone remodeling by bisphosphonates is believed to cause deterioration of bone microarchitecture and reduction in the bone repair processes

ASBMR Task Force Definition of AFF

Table 3. ASBMR Task Force 2013 Revised Case Definition of AFFs

To satisfy the case definition of AFF, the fracture must be located along the femoral diaphysis from just distal to the lesser trochanter to just proximal to the supracondylar flare.
In addition, at least four of five Major Features must be present. None of the Minor Features is required but have sometimes been associated with these fractures.
Major features[a]
The fracture is associated with minimal or no trauma, as in a fall from a standing height or less
The fracture line originates at the lateral cortex and is substantially transverse in its orientation, although it may become oblique as it progresses medially across the femur
Complete fractures extend through both cortices and may be associated with a medial spike; incomplete fractures involve only the lateral cortex
The fracture is noncomminuted **or minimally comminuted**
Localized periosteal or endosteal thickening of the lateral cortex is present at the fracture site ("beaking" or "flaring")
Minor features
Generalized increase in cortical thickness of the **femoral diaphyses**
Unilateral or bilateral prodromal symptoms such as dull or aching pain in the groin or thigh
Bilateral **incomplete or complete femoral diaphysis fractures**
Delayed **fracture** healing

Changes are in bold.

ASBMR = American Society for Bone and Mineral Research; AFF = atypical femur fracture.

[a]**Excludes** fractures of the femoral neck, intertrochanteric fractures with spiral subtrochanteric extension, periprosthetic fractures, and pathological fractures associated with primary or metastatic bone tumors and miscellaneous bone diseases (eg, Paget's disease, fibrous dysplasia).

Atypical Femoral Fracture

- Radiographic/CT Features:
  - 1) Fractures are transverse (or <30° oblique) w/ focal hypertrophy of the lateral cortex and lack of comminution
  - 2) Periosteal and endosteal callus formation
  - 3) Fracture has medial unicortical beak, w/ no features suggestive of underlying lytic process
- MRI Features:
  - Low signal intensity fracture line on all sequences traversing an area of bone marrow edema
    - diffusely decreased signal intensity on T1W sequences
    - Increased signal intensity on T2W and STIR sequences
  - May see cortical thickening
- Clinical Presentation:
  - As with any fracture, pain and inflammation
  - The distinguishing clinical features includes their bilaterality and prodromal symptoms of deep thigh or groin pain

Atypical Femoral Fracture - Management

- Bisphosphonates should be discontinued.
  - Dietary calcium and vitamin D status should be assessed and adequate supplementation recommended.

- Incomplete fractures with cortical lucency accompanied by pain may undergo prophylactic fixation to prevent complete fracture

- Incomplete fractures without pain, or those with periosteal thickening but no cortical lucency may undergo conservative management with limited weight-bearing and avoidance of vigorous activity.
  - Activity restrictions should be continued until there is either no bone edema on MRI or no increased activity detected on bone scan.

References

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