Traumatic Proximal Femur Fractures

Molly E. Collins, Harvard Medical School
Gillian Lieberman, MD
Overview of Presentation

• Discuss the importance of fractures affecting the hip joint
• Review anatomy and types of fractures
• Introduce a classic patient presentation
• Discuss the radiologic evaluation
• Address complications and treatment principles
Falls and Fractures

- More than one-third of those over age 65 fall each year.
- 90% of fractures involving the hip joint occur in those over age 50.
- 90% of falls in the elderly are the result of a simple fall.
- We may think of the scope of this topic as…

Tinetti, NEJM 2003
Scope of Topic

Risk Factors
- Prevention
- Mediating Factors
  - Bone strength
  - Force vector of fall
  - Medical issues
  - Baseline function

Predisposing Medical Conditions

Falls

Complications
- Fractures affecting hip joint
- Other MSK trauma
- Subdural hematoma
- Dehydration
- Immobility, disability

Tinetti, NEJM 2003
Background

• Epidemiology:
  – 250,000 fractures affecting the hip joint in the U.S. each year.
  – Affects one-third of American women who survive past 80 years old.
  – Risk factors include: maternal history of fracture, excessive consumption of alcohol and caffeine, physical inactivity, low body weight, tall stature, previous fracture, use of certain psychotropic medications, residence in an institution, visual impairment, and dementia.

• The bones of the hip joint are among the most common sites of fracture in those with osteoporosis.

• Downward spiral: Mortality rate is 14-36% in the first year following a fracture involving the hip joint.

Anatomy of Proximal Femur

Anterior View

- Greater trochanter
- Head
- Fovea of head
- Neck
- Lesser trochanter
- Proximal line of capsular reflection
- Intertrochanteric line
- Body (shaft)

Netter, http://www2.ma.psu.edu/~pt/384fem1a.gif
Types of Proximal Femur Fractures

- Fractures may be classified anatomically as intracapsular or extracapsular.
- ~45% of proximal femur fractures occur at the femoral neck (intracapsular), and ~45% are intertrochanteric (extracapsular).
- Subtrochanteric fractures (also extracapsular) account for 5-10%.
Describing Fractures

- Although there are many different classification systems for proximal femur fractures, it is usually most helpful to identify the fracture anatomically and describe it accurately.
- With proximal femur fractures, it is especially important to note whether there is displacement, as this reflects stability of the fracture and the likelihood of complications.
Our Patient: History and Physical

- 84 year-old female presenting with pain status-post mechanical fall onto left hip.
- HPI: No head trauma, loss of consciousness. No preceding vertigo, lightheadedness.
- PMH: Osteoporosis, atrial fibrillation, hypertension.
- Exam: Left lower extremity shortening and external rotation, peripheral pulses intact.
Our Patient: Left Femoral Fracture on Pelvis Radiograph

**Film Findings**

- Comminuted intertrochanteric fracture
- Asymmetric lesser trochanters
- Degenerative changes: sclerosis and joint space narrowing along pubic symphysis, SI joints, and lower lumbar spine
Our Patient: Fracture on Proximal Femur Radiograph

Film Findings

- Comminuted intertrochanteric fracture lines appearing as lucencies, with communicating fracture planes
- Extension of fracture into the femoral shaft
Our Patient: Fracture on Cross-Table Lateral Radiograph

Film Findings
- Film is underexposed and this is, therefore, a limited evaluation of the femoral head and neck for displacement.
- Cortex discontinuity, comminuted fracture.
Our Patient: Fracture Description

• In summary, our patient’s fracture is described as a comminuted left intertrochanteric fracture extending into the proximal femoral shaft with mild varus angulation of the femoral shaft.

• The most common complications of intertrochanteric fractures are malunion and shortening.

• Avascular necrosis and nonunion are rare here given the rich blood supply to the intertrochanteric region from cancellous bone.
Radiologic Evaluation of Suspected Proximal Femur Fractures

• First obtain **plain radiographs** in anteroposterior and lateral views.
  – Obtain AP view with 15-20 degrees of internal rotation at the hip joint to lengthen the femoral neck for the best view.

• Beware of occult fractures, which can be difficult to see, especially when nondisplaced and in osteopenic bone.
  – In one study of 70 patients with negative plain films, 37% had proximal femur fractures discovered with **MRI**.
  – Delayed diagnosis can lead to complications. In one study of 38 patients with delayed diagnosis, 7 of 9 who had displaced fractures developed avascular necrosis or nonunion.

Radiologic Evaluation, Continued

• If plain film is nondiagnostic and there is continued clinical suspicion of a proximal femur fracture, this must be pursued.

• Next obtain:

  – **MRI**
    • **Test of choice** given high sensitivity and specificity, approaching 100% within the first 24 hours following a fracture.
    • Detects marrow edema and hemorrhage.
    • May distinguish other injuries that mimic fractures clinically, such as muscle injury.

  – **Bone scan**
    • 80% detection rate in the first 24 hours, may take up to 72 hours to show radiotracer uptake.

  – **CT**
    • Less sensitive than MRI, so consider if there is contraindication to MRI.
    • Will show fracture lines better than plain film, and can identify cortical abnormalities.

Occult Fractures

• A demonstration of these concepts…
Companion Patient 2: Normal Proximal Femur on Radiograph

- Plain film obtained for suspected femoral fracture.

**Film Findings**
- Film read as normal by radiologist.
- Patient positioned well, with good visualization of femoral neck.
Companion Patient 2: Proximal Femur Fracture on MRI

Film Findings
• Low signal fracture line
• Fluid in soft tissue, likely blood
• Significant bone marrow edema

MRI
• Fractures are seen as low signal in all sequences.
• American College of Radiology appropriateness criteria guidelines recommend coronal T1-weighted sequence to evaluate suspected occult fracture.
• MRI can facilitate appropriate early intervention or discharge and can also aid in surgical planning by showing the axis of fracture and the extent of injury.
Complications of Femoral Neck Fractures

- Common complications of femoral neck fractures include avascular necrosis and nonunion.
- Incidence varies by fracture location, degree of fracture displacement, and is decreased with appropriate treatment.
Companion Patient 3: Right Femoral Neck Fracture on Pelvis Radiograph

Film Findings
- Minimally displaced femoral neck fracture

88 year-old woman s/p mechanical fall.
Companion Patient 3: Femoral Neck Fracture on Femur Radiograph

Film Findings

- Minimally displaced femoral neck fracture
Companion Patient 3: Fracture on Cross-Table Lateral Radiograph

Film Findings

- **Femoral neck fracture**
- **Femoral head with slight posterior rotation/displacement**
- **Ischial tuberosity**
- **Pubic symphysis**

- Even minor displacement may be associated with avascular necrosis (AVN) due to the anatomy of the vascular supply of the femoral neck.
The femoral head and neck are supplied by the medial and lateral femoral circumflex arteries, with a minor contribution from a branch of the obturator artery.

Vascular Anatomy, Continued

- Vessels may be kinked, torn, or compressed by a displaced fracture, leading to AVN.

Treatment Principles

• Stabilize the patient:
  – Correct fluid and electrolyte abnormalities if present.
  – Prevent weight-bearing on injured hip until work-up is complete.

• Early surgery followed by early mobilization:
  – If indicated, surgery should be performed within 24-48 hours, as longer intervals increase post-operative complications and mortality at one year.

• Return patient to prior level of function:
  – 50-65% regain prior level of ambulation.

• Address osteoporosis:
  – In a recent study only 13% of women >65 with a recent fracture received adequate treatment.

Morrison, Siu, UpToDate 2008; Zuckerman, NEJM 1996
Our Patient: Hospital Course

• Taken to the OR for open reduction internal fixation.
• Our patient was able to ambulate with a walker upon discharge.
Our Patient: Post-Op Fixation on Pelvis Radiograph

Film Findings

- Intramedullary nail in femoral shaft
- Gamma nail in femoral head
Our Patient: Post-Op Fixation on Femur Radiograph

**Film Findings**

- Intramedullary nail in femoral shaft
- Gamma nail in femoral head
- Screw fixing intramedullary nail

- Screws prevent migration of the intermedullary nail.
Summary

• Proximal femur fractures are common, and can be life-changing events with significant associated morbidity and mortality.
• Early radiological identification of fractures with radiograph and follow-up studies is critical.
• Detection rate of subtle or occult fractures has been improved with MRI.
• Accurate description of fractures allows appropriate and timely treatment to avoid long-term complications and improve outcomes.
References

Morrison RS, Siu AL. Medical consultation for patients with hip fracutre. UpToDate, 2008.
Neter, F. Femur anterior view. http://www2.ma.psu.edu/~pt/384fem1a.gif
I would like to sincerely thank:
Dr. Ferris Hall
Dr. Gillian Lieberman
Dr. Sanjay Shetty
Dr. Jim Wu