Figure 30. Gouty tophus in a 59 year old woman with acute thumb pain but no injury. AP plain film of the thumb shows calcified tophus in the soft tissues adjacent to the thumb interphalangeal joint (arrows).

Hip

X-ray examination is the study of choice for evaluation of the acutely traumatized hip[8]. Plain films will typically demonstrate fractures (Figure 31) and dislocations. In cases where the plain films are negative but persistent severe pain causes a high level of suspicion for fracture, either CT or MR may be performed. CT may be a better alternative when there is substantial trauma as in an MVA (Figure 32), whereas MR is actually more sensitive to subtle fractures[9] (Figure 33), and will detect soft tissue injuries not seen on plain films (Figure 34).

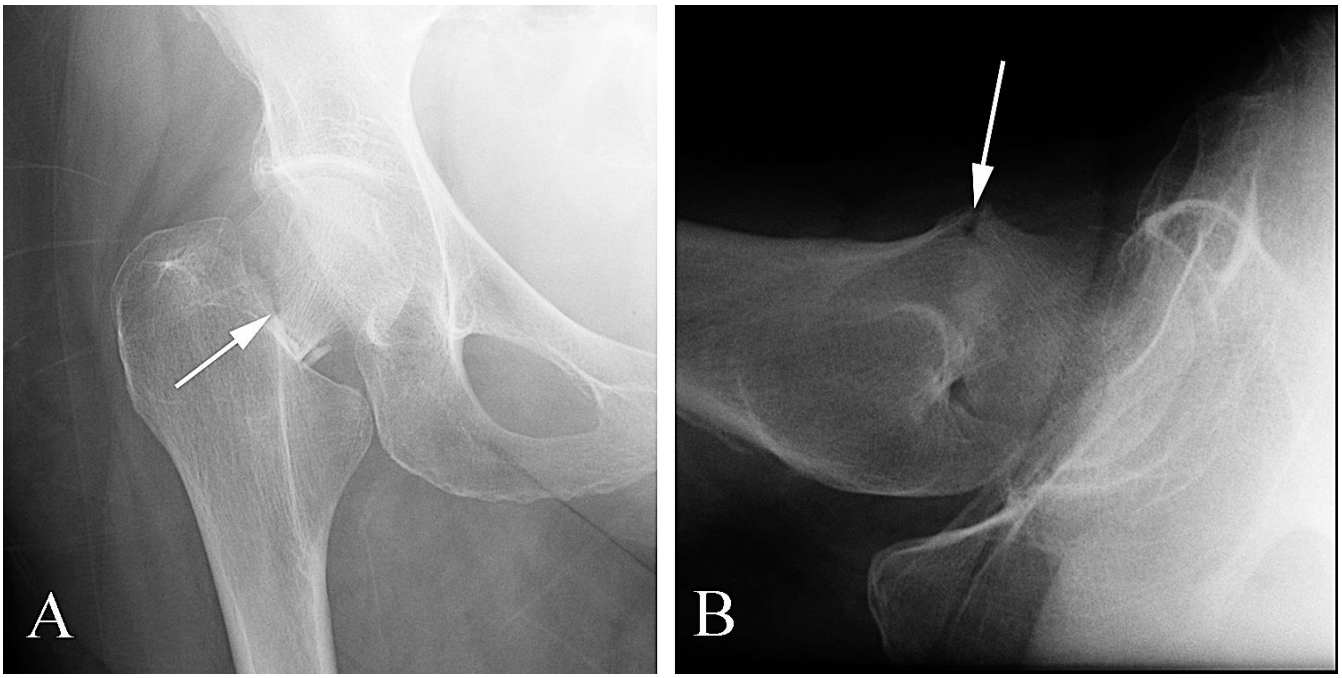

Figure 31. Proximal femur fracture in a 75 year old with pain following trauma. A. AP plain film of the hip shows a fracture through the base of the femoral neck (arrow) with associated shortening of the femur. B. Axial view of the hip shows anterior angulation of the fracture apex (arrow).

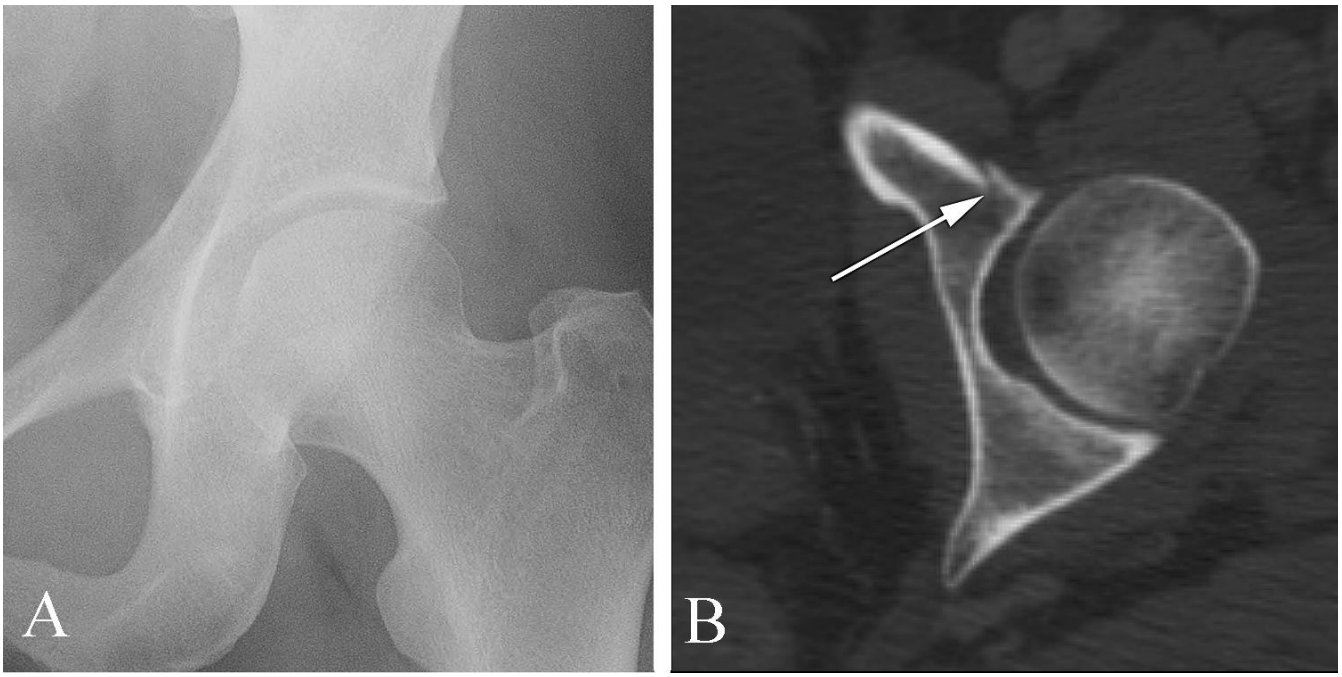

Figure 32. Acetabular fracture not visible on plain film but seen on CT in a 38 year old with pain following trauma. A. AP plain film examination of the hip shows no abnormality. The patient had persistent severe pain and therefore a CT was performed. B. Axial CT of the hip shows a fracture through the anterior column of the acetabulum (arrow).

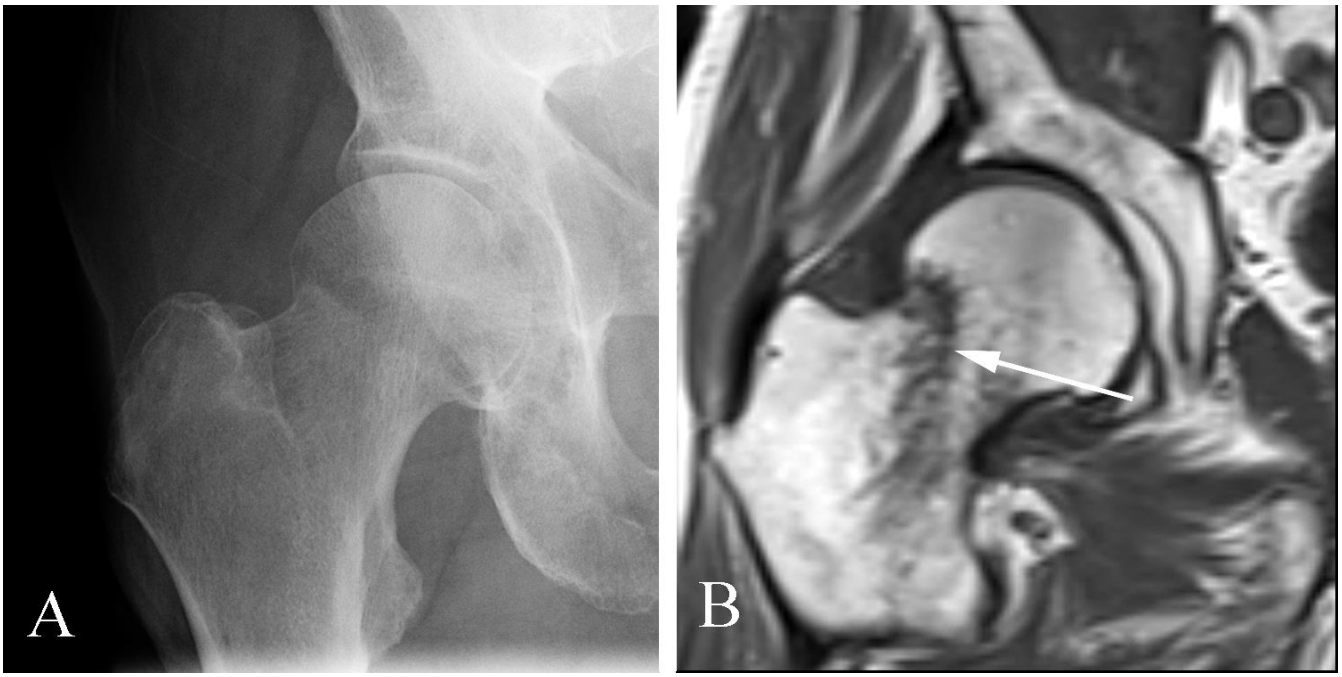

Figure 33. Hip fracture seen on MR in a 94 year old man with persistent pain following trauma. A. AP plain film of the hip shows no fracture. B. Coronal T1 weighted MR study shows a fracture line through the femoral neck (arrow).

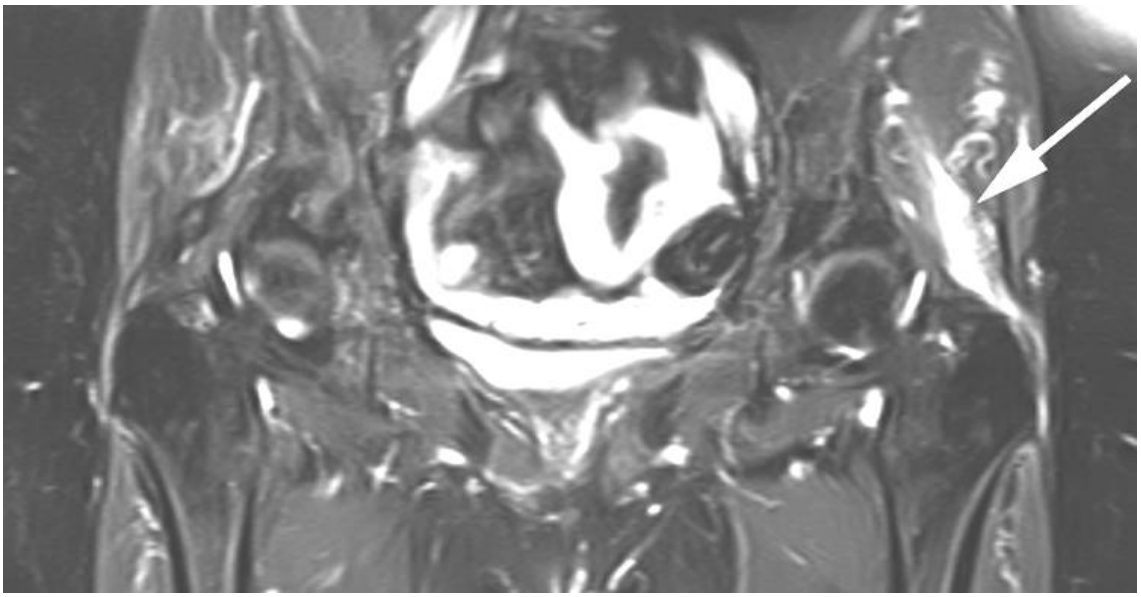

Figure 34. Gluteus medius muscle tear in a 75 year old woman with chronic hip pain. Coronal STIR image demonstrates abnormal increased signal in the left gluteus medius muscle (arrow) compatible with a muscle tear.

The first step in evaluation of chronic hip pain is also x-ray examination, which may demonstrate such causative abnormalities as osteoarthritis (Figure 35), CPPD, or gout (Figure 36). Plain films may demonstrate some processes which require further evaluation with MR, such as rapidly destructive osteoarthritis (Figure 37) or avascular necrosis (Figure 38). If plain films are unremarkable in patients with chronic hip pain, MR may demonstrate osteoarthritis (Figure 39) or avascular necrosis which is either subtle or not appreciated on plain film examination. In patients with symptoms of an acetabular labral tear (clicking or locking of the hip joint) MR arthrography is helpful to evaluate the internal structures of the joint including the labrum.

Patients with prostheses and following fracture fixation should also first undergo x-ray examination to evaluate possible dislocation (Figure 40), hardware complication (Figure 41), and dystrophic calcification (Figure 42). Such films are typically ordered at 1 year, 3 years, and 5 years (and then at 5 year intervals) by the operating orthopedic surgeon[10]. Painful prostheses which show no plain film abnormalities but for which there is suspicion of an infection can be aspirated; if imaging is required, the best course is performance of a nuclear medicine bone scan examination, followed by indium-labeled WBC evaluation: the combination of the two studies can help distinguish normal post-operative prosthesis changes from loosening and loosening from infection[10].

X-ray guidance is typically used for hip intra-articular injections of either lidocaine (for diagnosis) or steroids (for treatment) or combinations of the two, as injection without radiographic guidance is insufficiently accurate.

Figure 35. Osteoarthritis of the left hip in a 35 year old with chronic hip pain. AP plain film exam shows joint narrowing and subchondral sclerosis.

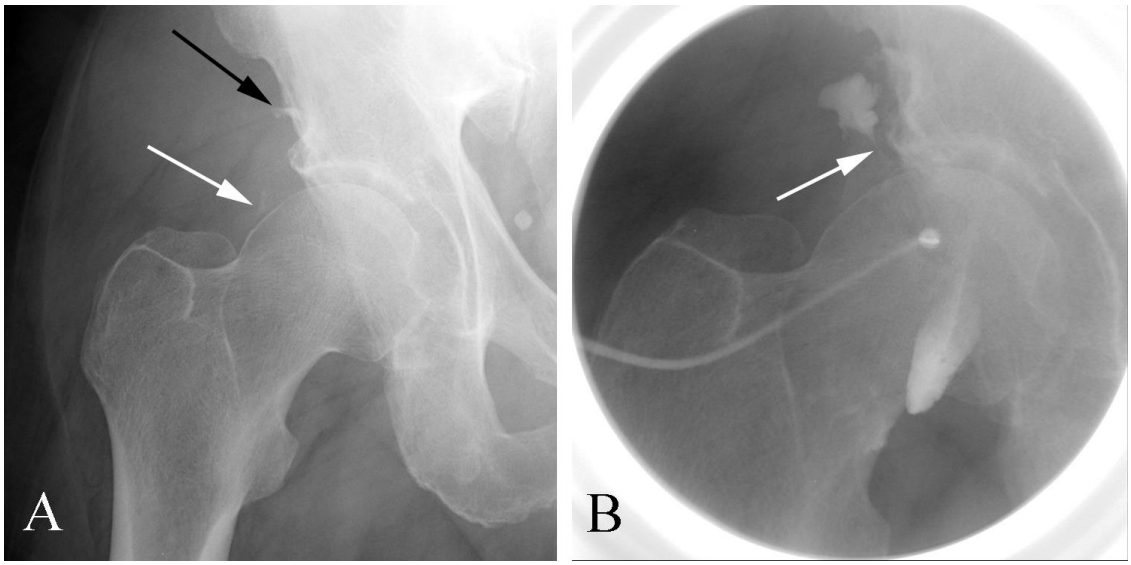

Figure 36. Gout of the right hip in a 70 year old man with chronic hip pain. A. Plain film examination shows calcification along the margin of the femoral head (white arrow). There is erosion with an overhanging edge along the lateral acetabulum (black arrow). B. Hip arthrogram shows contrast along the synovial extension adjacent to the acetabulum through a narrow connection along the femoral head (arrow).

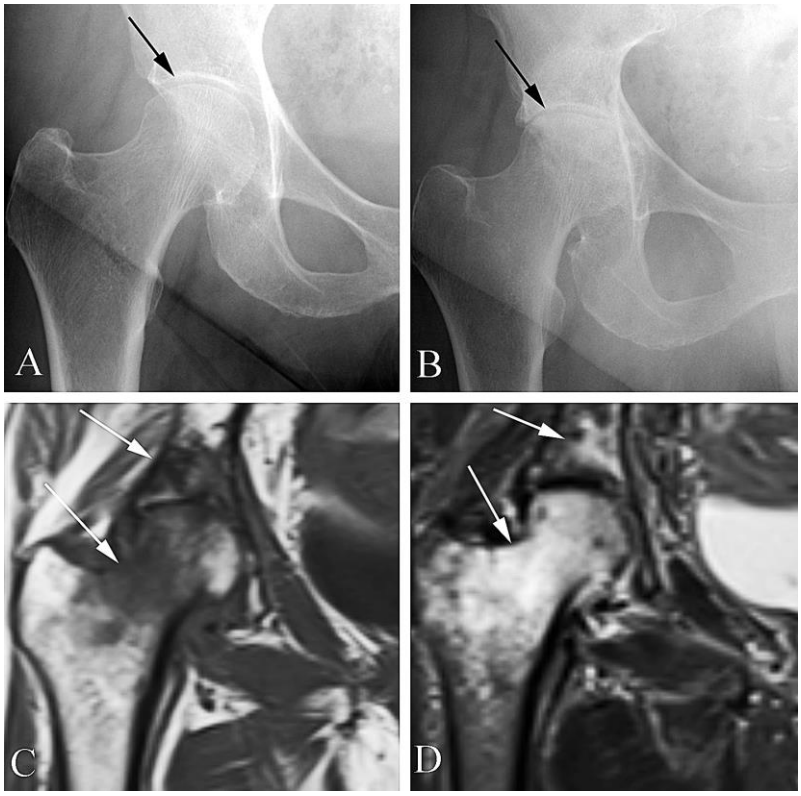

Figure 37. Rapidly destructive osteoarthritis of the right hip in an 80 year old woman with progressive hip pain. A. AP plain film at the onset of hip pain shows mild joint narrowing (arrow). B. AP plain film obtained six months later (with steadily increasing pain) shows marked progression of joint space narrowing (arrow). C. Coronal T1 weighted image shows extensive abnormal decreased signal intensity through the femoral neck and acetabulum (arrows). D. Coronal T2 weighted image shows abnormal increased signal intensity through the femoral head, neck, and acetabulum (arrows).

Figure 38. Avascular necrosis of the hips in a 38 year old man with chronic hip pain. A. AP view of the pelvis shows abnormal increased density (arrows) in both femoral heads. B. Coronal T1 weighted MR image demonstrates extensive decreased signal intensity (arrows) in the subchondral aspects of both femoral heads. Note mixed signal intensity at the interface between the normal signal intensity in the femoral necks and the decreased signal intensity in the heads. C. Coronal STIR image demonstrates mixed signal intensity in the femoral heads (arrows).

Figure 39. Early degenerative change seen on an MR study in a 50 year old woman with chronic hip pain. A. AP plain film of the hip shows no significant joint space narrowing, subchondral sclerosis, osteophytic spurring, or subchondral cyst formation. B. Coronal T1 weighted image demonstrates abnormal decreased signal intensity in the acetabulum (arrow). C. Coronal fat-suppressed proton density image demonstrates abnormal increased signal intensity in the acetabulum. D. Sagittal STIR image confirms abnormal signal intensity in the acetabulum.

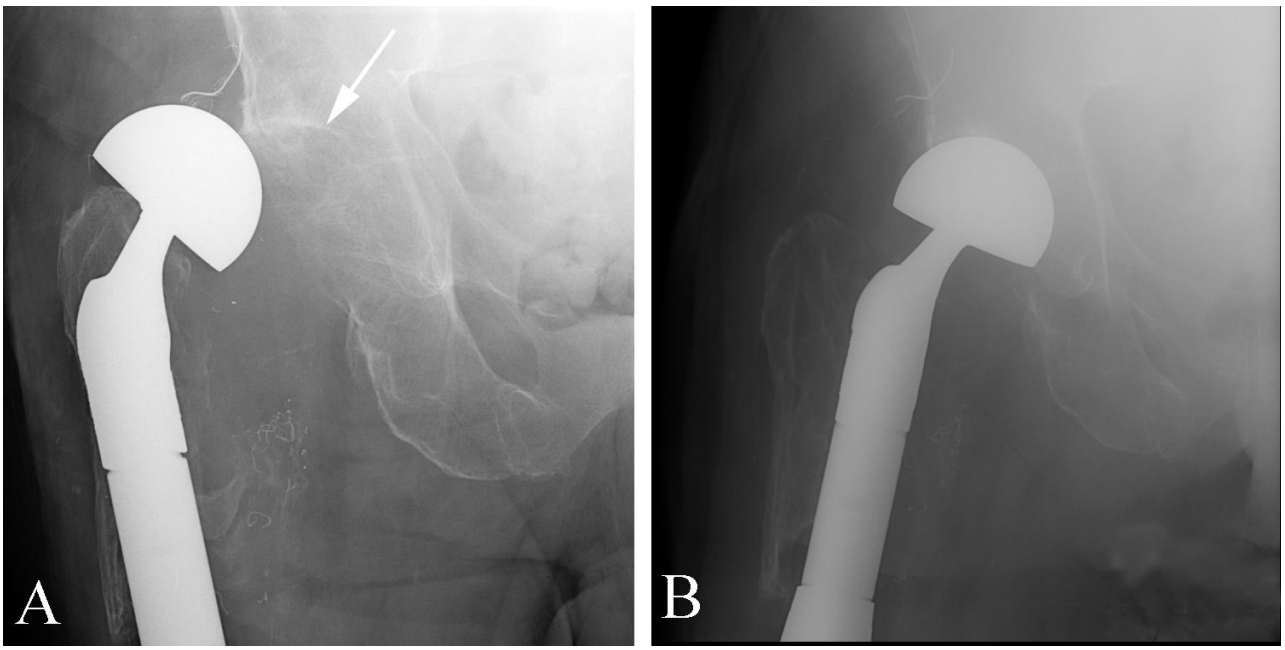

Figure 40. Dislocated hip prosthesis in an 87 year old with pain and hip deformity. A. AP plain film of the hip shows the femoral prosthesis displaced superolateral to the acetabulum (arrow). B. AP plain film of the hip following reduction demonstrates correct positioning of the prosthesis.

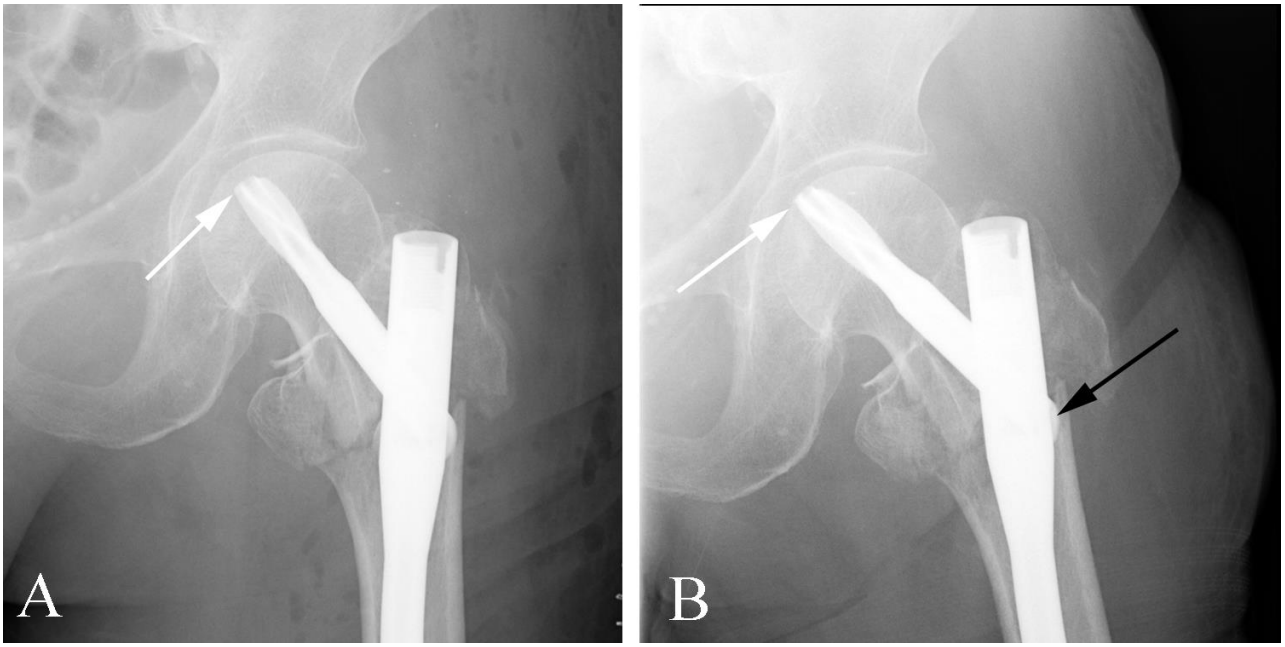

Figure 41. Complication of fixation device in an 82 year old woman s/p ORIF. A. AP plain film of the hip demonstrates the fixation device with an intramedullary rod and interlocking blade-plate with the tip of the blade-plate device projecting inside the femoral head (arrow). B. AP plain film shows migration of the helical blade plate through the femoral head cortex. Such migration is generally prevented in these devices because the device can "back out" of the medullary rod. In this case, the position of the device prevented "backing out" because the sliding, interlocking helical blade plate was covered by the margin of the femoral shaft (black arrow).

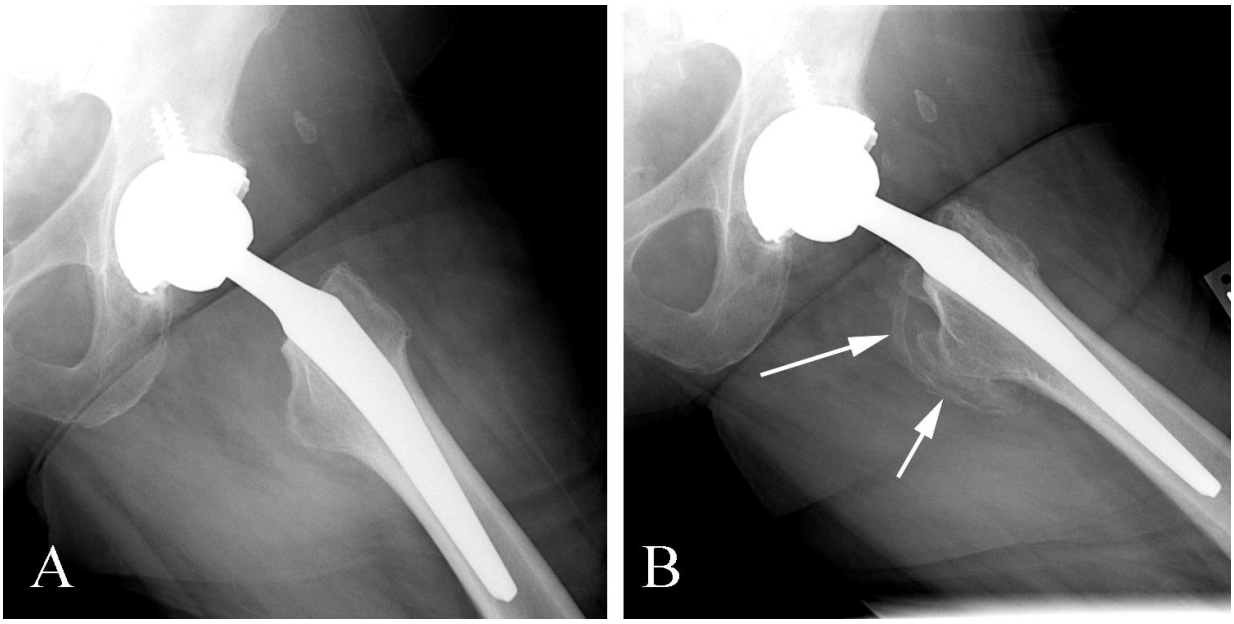

Figure 42. Dystrophic ossification in a 72 year old woman following hip prosthesis placement. A. Frog-lateral plain film of the hip following hip prosthesis placement demonstrates a normal post-operative appearance of the components and native bone and soft tissues. B. Frog-lateral plain film of the hip three months later demonstrates heterotopic bone formation along the hip joint margin (arrows).

Knee

As in other joints, x-ray examination is the first step in imaging the traumatized knee. Knee films may show and fully characterize the fracture, so that no further examination is necessary (Figure 43). Plain films may demonstrate a severe fracture that needs further evaluation with CT for surgical planning (Figure 44). Plain films may show a fracture that has a known associated significant ligamentous or other soft tissue injury, with an MR required for further evaluation (Figures 45 and 46). On the other hand, the plain films may show a nonspecific effusion, which suggests possible internal derangement and likely requires further work-up with MRI as well (Figure 47). If the plain films are negative and the patient has significant pain and/or instability, MR should be performed. MR has the ability to accurately characterize a wide range of injuries which may show no significant plain film findings, including: anterior cruciate ligament contusion and rupture (Figure 47); posterior cruciate ligament rupture (Figure 45); collateral ligament rupture (Figure 47); posterolateral corner injury; transient dislocation of the patella (Figure 46); radiographically occult fractures (Figure 48,); bone contusions; muscle tears (Figure 49); cartilage injuries; and meniscal tears (Figure 50). A negative MR effectively excludes significant osseous, cartilaginous, ligamentous, and tendinous injury.

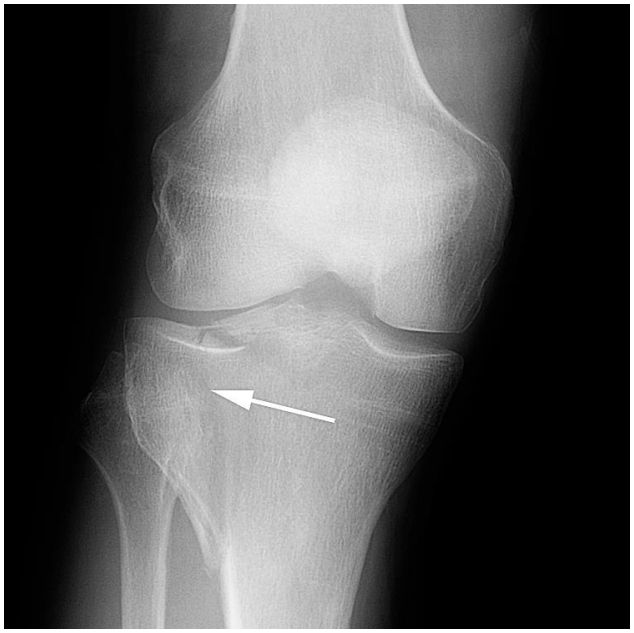

Figure 43. Tibial fracture in a 66 year old man with pain following trauma. AP plain film exam shows a parasagittal fracture through the lateral tibial plateau (arrow).