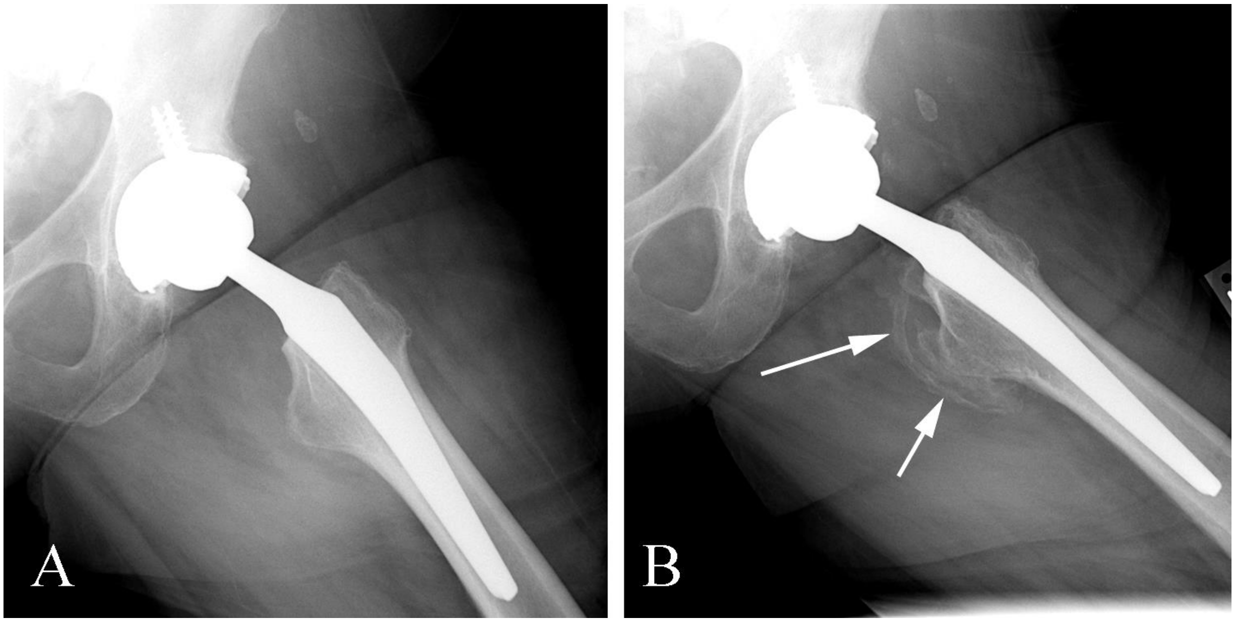

Figure 42. Dystrophic ossification in a 72 year old woman following hip prosthesis placement. A. Frog-lateral plain film of the hip following hip prosthesis placement demonstrates a normal post-operative appearance of the components and native bone and soft tissues. B. Frog-lateral plain film of the 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.

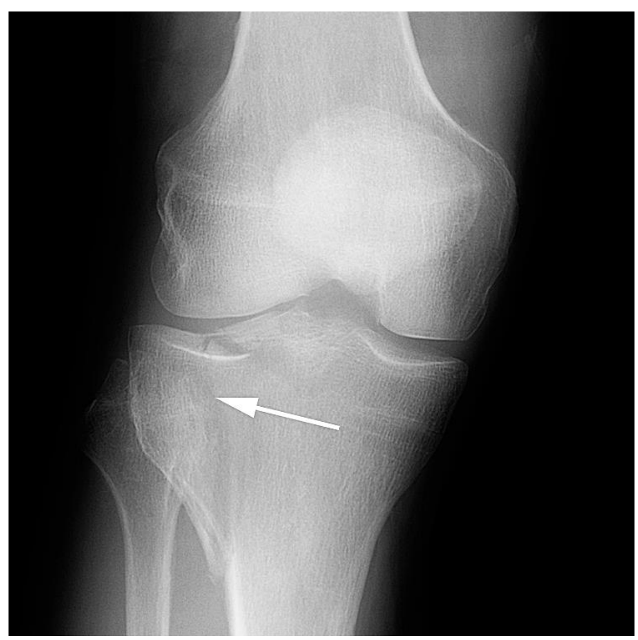

Figure 43. Tibial fracture in a 66 year old man with pain following trauma. AP plain film exam shows a parasagittal fracture through the lateral tibial plateau (arrow).

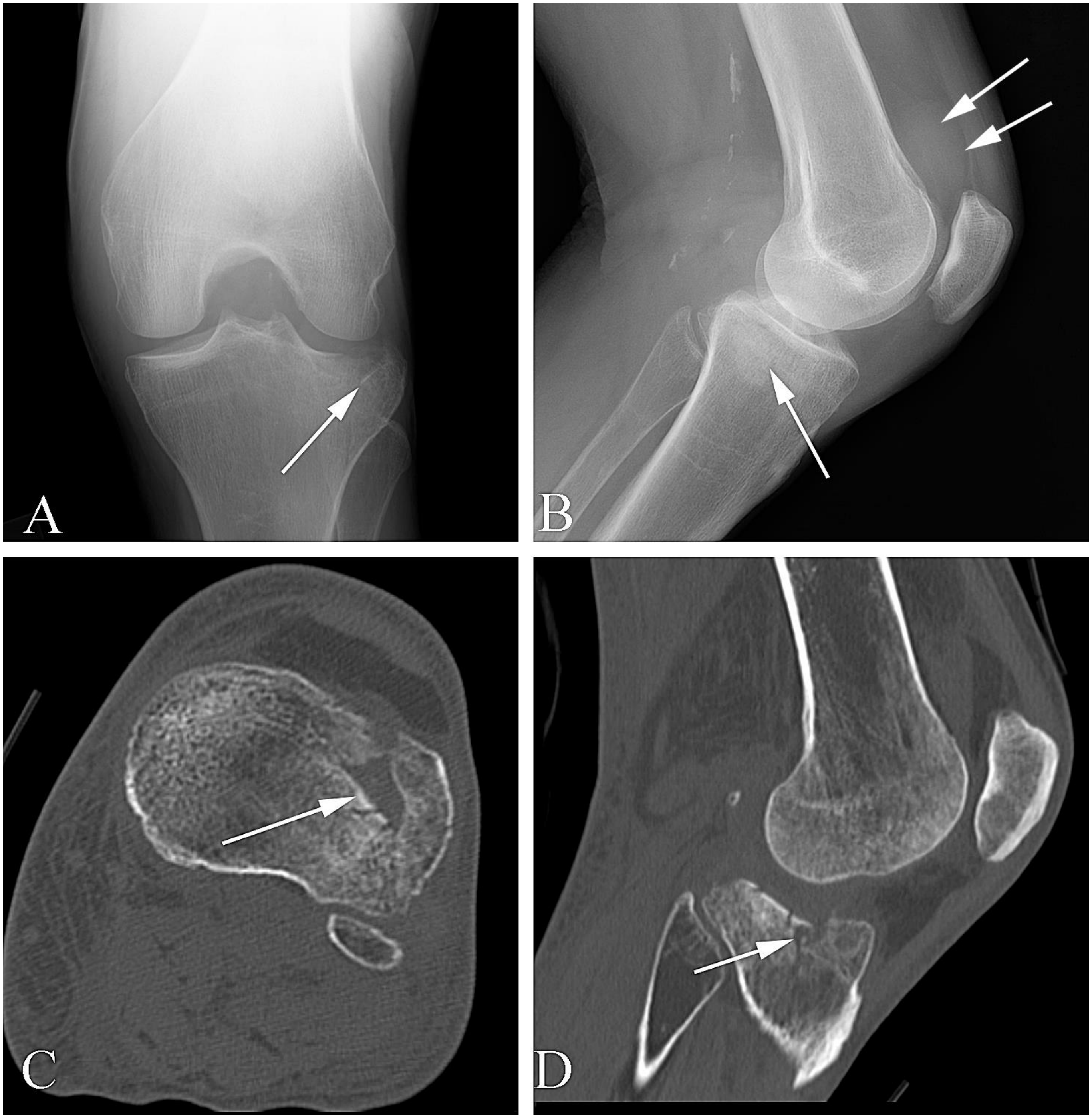

Figure 44. Tibial fracture in a 67 year old woman with knee pain following trauma. A. AP "notch" plain film of the knee shows a fracture along the lateral aspect of the tibial plateau (arrow). B. Lateral plain film of the knee shows an ill-defined density projecting at the level of the proximal tibia (arrow). Note the associated joint effusion superior to the patella (double arrow). C. Axial CT study shows a "hole" in the tibial plateau with rotation of the cortex out of its usual position (arrow). D. Sagittal reformatted CT study shows the tibial plateau fracture and documents the extent of depression and separation of fragments along the articular surface, as well as the number of fragments and their orientation (arrow).

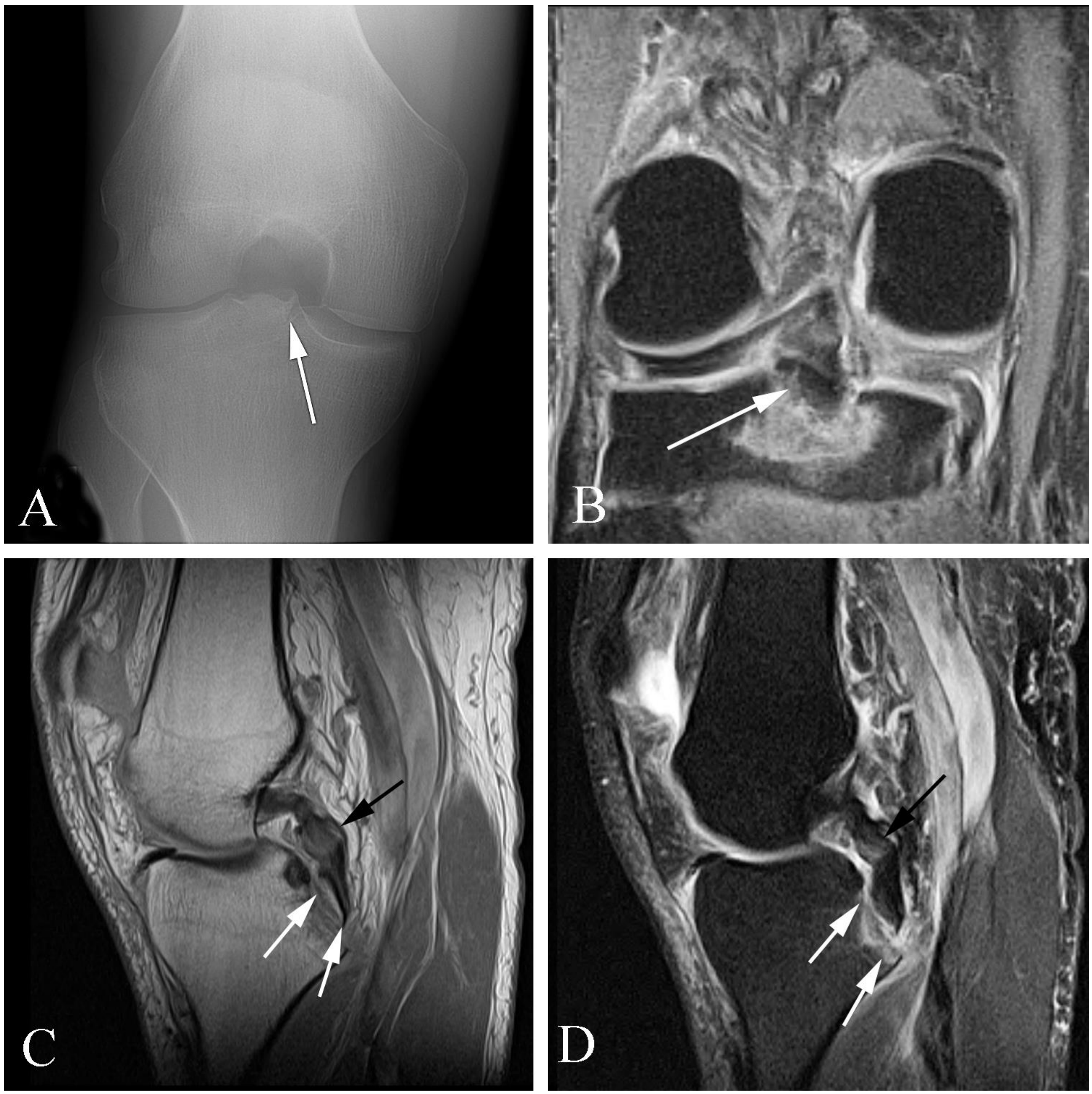

Figure 45. Fracture with associated soft tissue injury (posterior cruciate ligament avulsion) in a 49 year old man with pain following trauma. A. AP "notch" view of the knee shows a relatively subtle lucency in the mid portion of the tibial plateau. B. Coronal fat-suppressed proton density MR image shows a bone fragment of the tibial plateau (arrow) surrounded by a wide band of abnormal signal intensity. C. Sagittal proton density MR image shows separation of the posterior cruciate ligament from its insertion along the proximal, posterior tibia (white arrows). Note the abnormal thickening of the mid-portion of the posterior cruciate ligament compatible with tear (black arrow) D. Sagittal fat-suppressed T2 weighted image demonstrates abnormal signal intensity along the insertion of the posterior cruciate ligament (arrows).

Figure 46. Patellar fracture from transient lateral patellar dislocation in a 22 year old woman with pain following trauma. A. Plain film axial (also known as a “sunrise”) view demonstrates a fragment of bone along the medial patellar facet (arrow). B. Axial fat-suppressed proton density MR image shows the fracture (single arrow) along with abnormal increased signal intensity through the fracture fragment. In addition, there is extensive abnormal signal along the anterior, lateral aspect of the lateral femoral condyle (double arrows) from the associated contusion secondary to the transiently dislocated patella. C. Coronal fat-suppressed T2 weighted image also demonstrates the contusion along the anterior lateral femoral condyle (arrow). Note that this contusion is in a different location than that seen with an acute ACL tear. D. Sagittal fat-suppressed T2 weighted image demonstrates a fluid level in a knee joint effusion (arrow), indicating hemorrhage from the recent fracture.

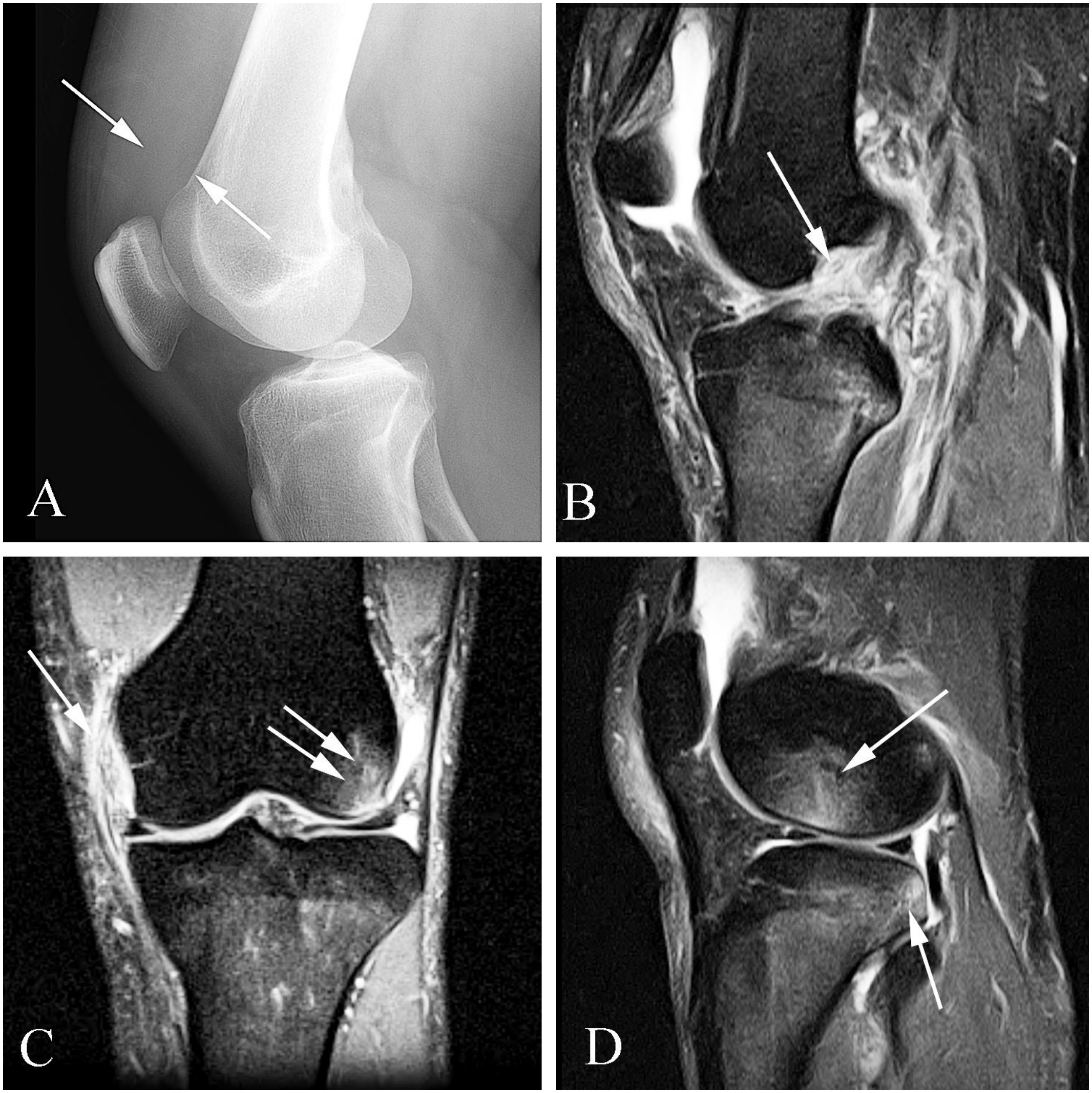

Figure 47. Knee effusion with associated ACL and MCL tears in a 33 year old man with knee pain. A. Lateral plain film shows fullness in the suprapatellar bursa (arrows), nearly always indicating a knee joint effusion. B. Sagittal fat-suppressed T2 weighted image demonstrates discontinuity of the anterior cruciate ligament (ACL) (arrow) secondary to an ACL tear. C. Coronal fat-suppressed proton density image demonstrates a tear of the proximal medial collateral ligament (MCL) (single arrow) along with abnormal increased signal in the lateral femoral condyle (double arrow) from bone marrow contusion. D. Sagittal fat-suppressed proton density image demonstrates so-called “kissing contusions” (arrows) of the lateral femoral condyle and posterior tibial plateau created by the pivot-shift injury which caused the patient’s ACL and MCL tears.

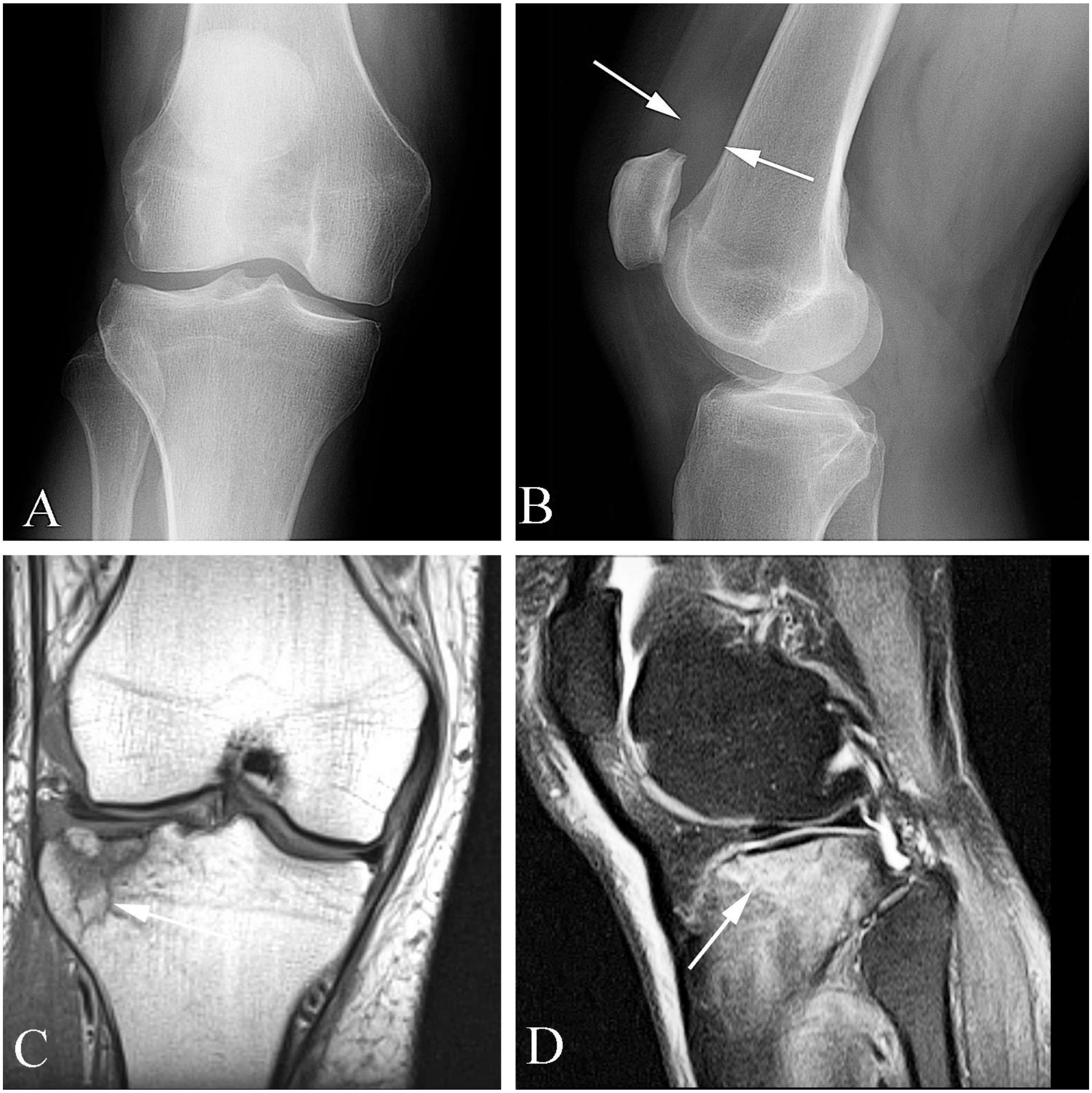

Figure 48. Radiographically occult fracture in a 62 year old man with pain following trauma. A. AP plain film of the knee shows no abnormality. B. Lateral plain film of the knee demonstrates fullness of the suprapatellar bursa (arrows), usually indicating a knee joint effusion. In the setting of acute trauma, this could indicate either a radiographically occult fracture, internal derangement (for example, a torn anterior cruciate ligament), or both. C. Coronal proton density MR image shows a combination of fracture (arrow) and contusion through the lateral tibial plateau. D. Sagittal fat-suppressed T2 weighted image demonstrates extensive increased signal intensity through the lateral tibial plateau (arrow) compatible with contusion.

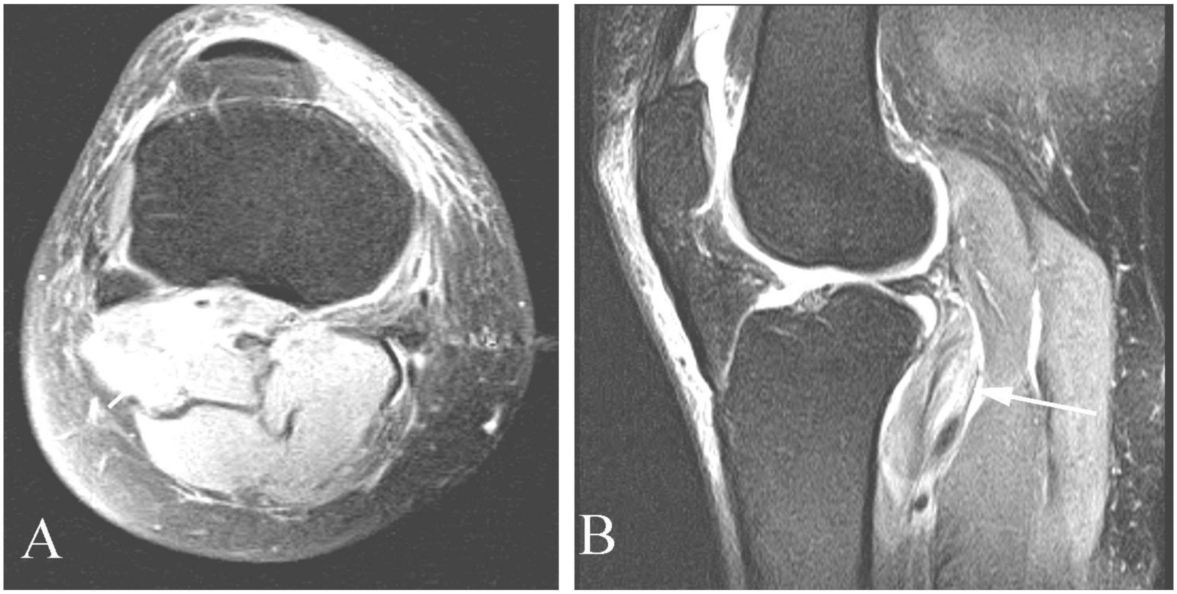

Figure 49. Popliteal muscle tear in a 48 year old man with pain following trauma. A. Axial fat-suppressed T2 weighted image shows abnormal signal and swelling of the popliteus muscle (arrow), compatible with a strain (partial thickness musculotendinous tear). B. Sagittal fat-suppressed T2 weighted MR imaging also demonstrates abnormal signal and swelling of the popliteus muscle (arrow).

Figure 50. Meniscal tear and tibial contusion in a 68 year old woman with knee pain following trauma. Coronal fat-suppressed T2 weighted image shows both a tear of the dorsal root of the medial meniscus (single arrow) and a contusion of the lateral tibial plateau (double arrow).

Chronic knee pain should also be first imaged with x-rays, which may demonstrate causative osteoarthritis (Figure 5,Chapter 13, page 186) or chondrocalcinosis characteristic of CPPD crystal deposition disease (Figure 3, Chapter 13, page 185). Note that CPPD causes not only chondrocalcinosis, but often preferential degenerative changes of the patellofemoral articulation[11]. When further imaging of the knee joint is required because the plain film does not demonstrate a reasonable explanation, MR may be performed. MR of the knee in chronic pain may demonstrate meniscal tears (Figure 51), loose bodies (Figure 52) or such infrequently seen entities as spontaneous osteonecrosis of the knee (SPONK) (Figure 53) and symptomatic bipartite patella (Figure 54). Beware of obtaining an MR without a plain film, because it is often difficult or impossible to see chondrocalcinosis on MR and a knee MR may be incorrectly interpreted as showing osteoarthritis and meniscal degenerative change rather than CPPD crystal deposition disease (Figure 55).

The considerations that apply to hip prostheses and hardware apply to the knee as well: follow-up films will typically be obtained by the operating orthopedic surgeon, with sequential plain film evaluation serving as the primary method of detecting hardware loosening or fracture, with a combined bone/WBC nuclear medicine study required to evaluate for possible infection.

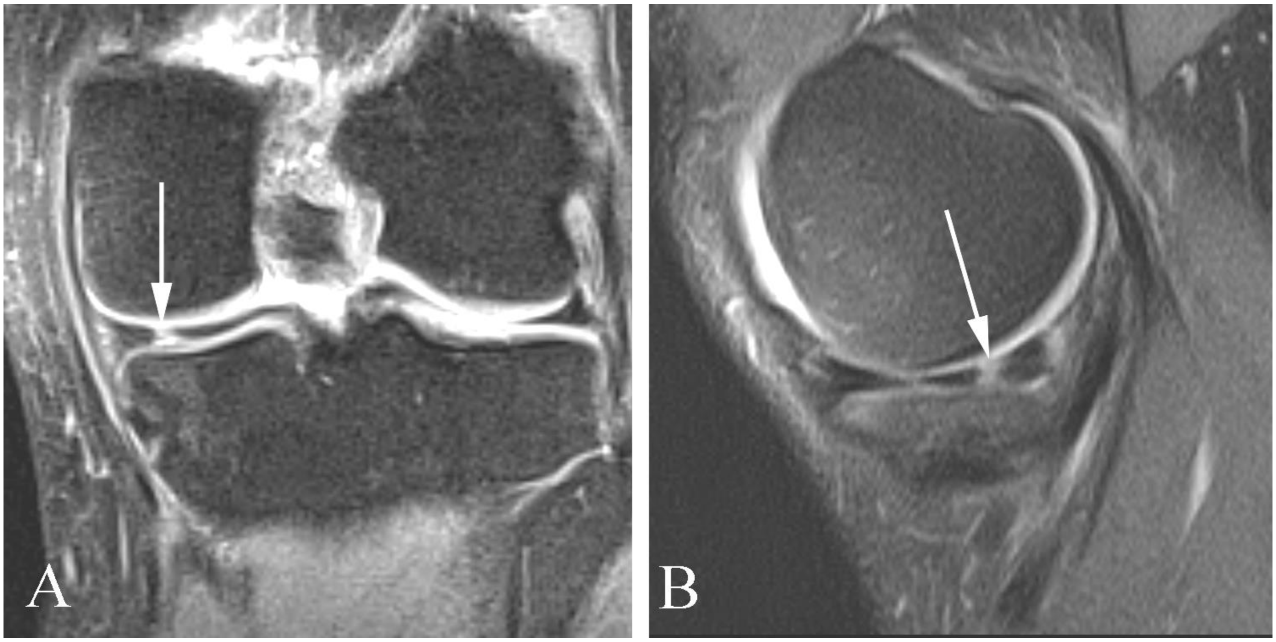

Figure 51. Meniscal tear in a 63 year old man with chronic knee pain. A. Coronal fat-suppressed proton density MR image shows a focal abnormality along the posterior horn of the medial meniscus (arrow). B. Sagittal fat-suppressed T2 weighted image (arrow) shows increased signal intensity extending through the meniscus from the femoral side to the tibial side (arrow), compatible with a full thickness meniscal tear.

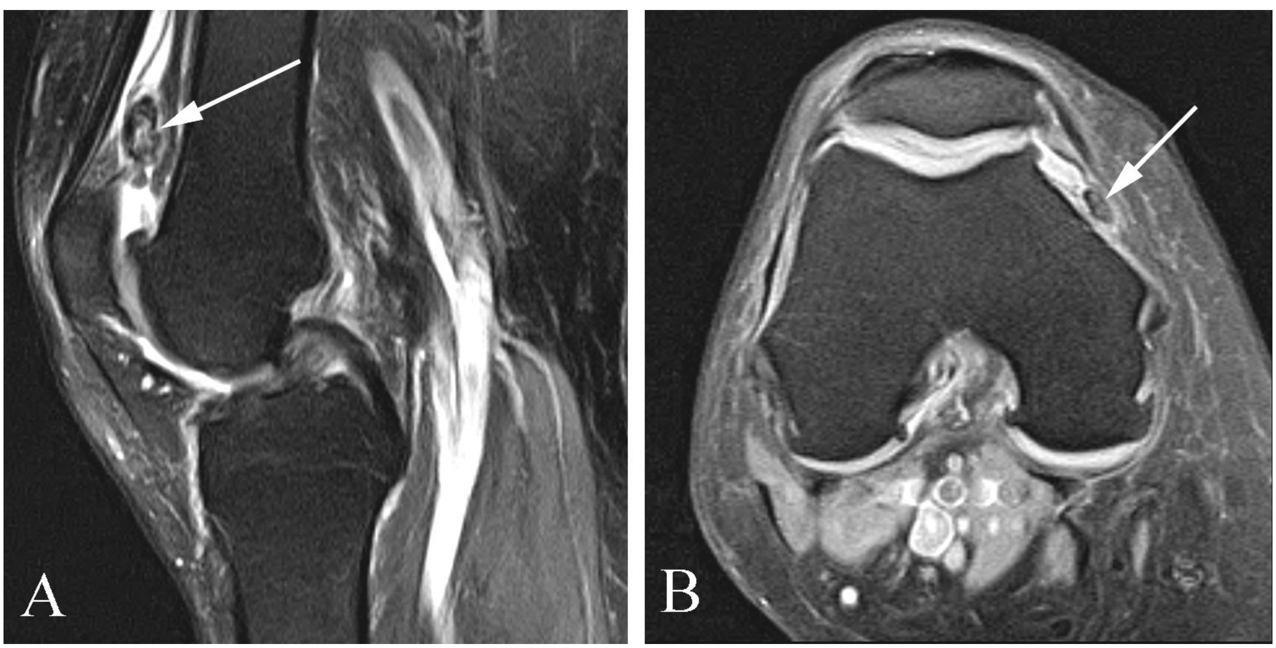

Figure 52. Loose body in the knee joint in a 56 year old woman with knee pain. A. Sagittal fat-suppressed T2 weighted image demonstrates an abnormality in the suprapatellar bursa (arrow). The lesion demonstrates mixed signal intensity compatible with an osseous fragment (with both cortical bone and bone marrow), and is surrounded by high signal intensity fluid. B. Axial fat-suppressed proton density image demonstrates another lesion along the lateral aspect of the joint (arrow). Note osteophytic spurring along the patellofemoral joint margins.

Figure 53. Spontaneous osteonecrosis of the knee (SPONK) in a 66 year old woman with chronic knee pain. A. Coronal proton density MR image shows focal signal abnormality along the medial femoral condyle (arrows). B. Coronal fat-suppressed T2 weighted image demonstrates extensive abnormal signal through the medial femoral condyle. Note the serpentine “double line” along the articular surface (arrow), characteristic of osteonecrosis. C. Sagittal proton density image shows the anterior to posterior extent of the osteonecrosis (arrow). D. Sagittal fat-suppressed T2 weighted image also demonstrates the “double line” of osteonecrosis paralleling the articular margin of the condyle (arrow).

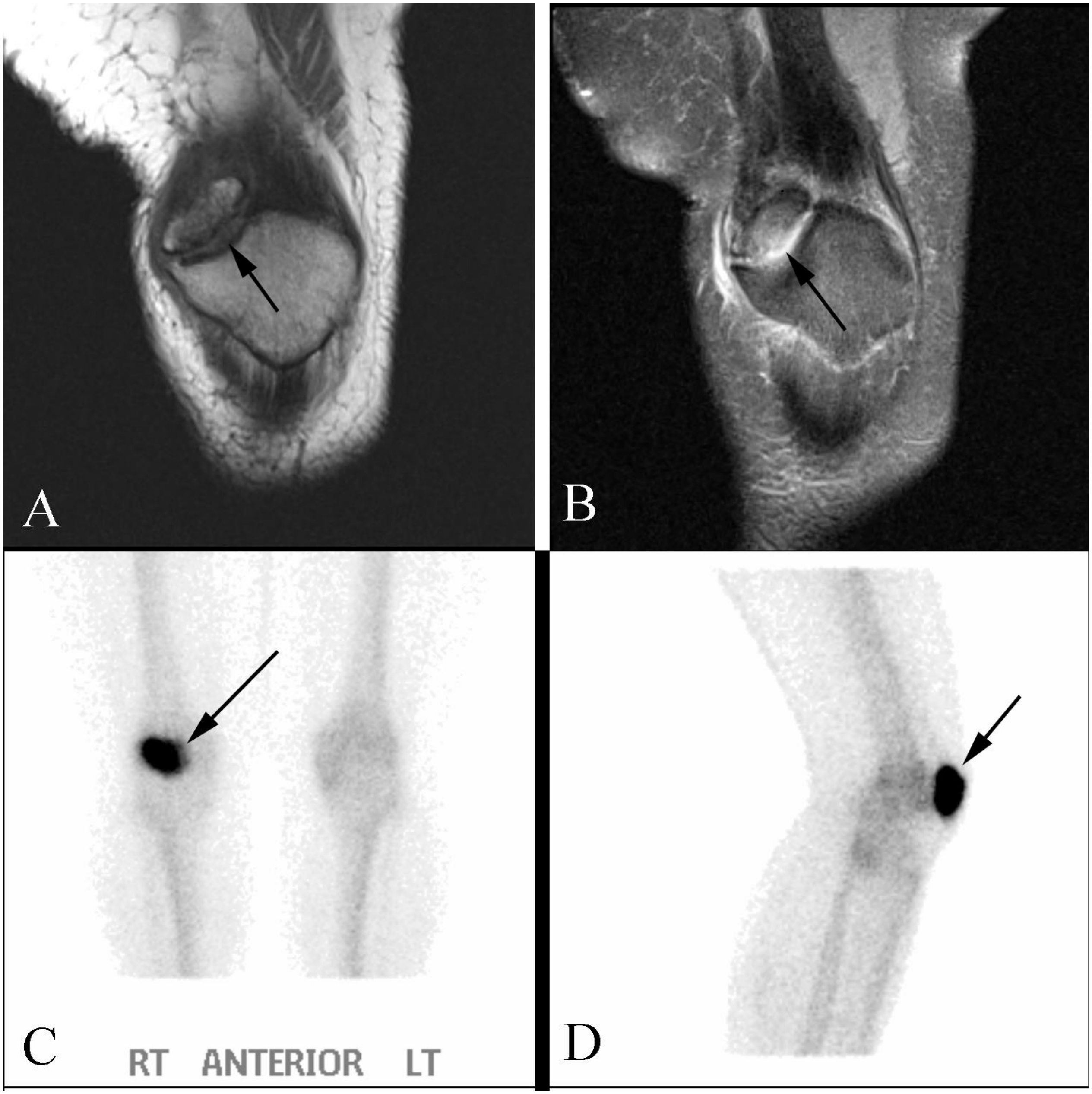

Figure 54. Symptomatic bipartite patella in a 41 year old woman with chronic knee pain. A. Coronal T1 weighted MR image demonstrates a cleavage plane between the body of the patella and a superolateral ossification center (arrow). Such an appearance is a relatively frequently seen (and usually asymptomatic) normal variation. B. Coronal fat-suppressed proton density image demonstrates increased signal intensity (arrow) along the interface between the patella and accessory ossification center. In asymptomatic patients, this interface will demonstrate *decreased*, not *increased* (as in this case), signal intensity. C. Frontal view nuclear medicine bone scan shows intense increased radiotracer uptake of the patella (arrow). D. Lateral view nuclear medicine bone scan confirms that the intense activity is in the patella (arrow) and not in the underlying femur.

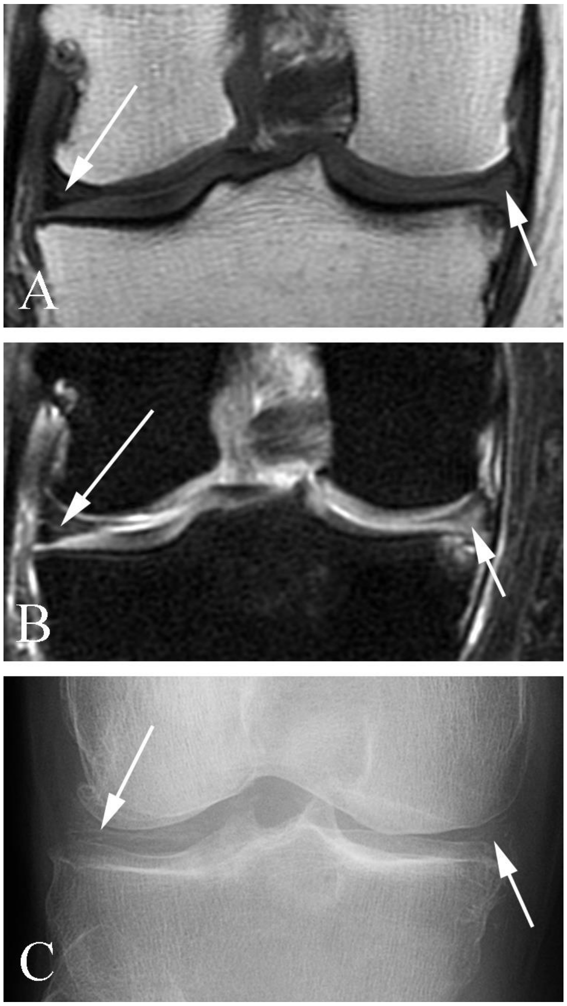

Figure 55. Chondrocalcinosis in a 71 year old woman with chronic knee pain, not seen on MR. A. Coronal proton density image shows mildly increased signal intensity in the menisci (arrows). B. Coronal fat-suppressed T2 weighted image also demonstrates increased signal intensity in the menisci (arrows). C. AP plain film examination shows extensive chondrocalcinosis (arrows).

Ankle

As in the other extremity joints, x-rays represent the first step in imaging the ankle. X-rays will demonstrate fractures (Figure 56) and fracture-dislocations (Figure 57) and will show ankle joint effusions which may be associated with fractures. For patients with negative plain films who have signs or symptoms of a radiographically occult fracture, MR is helpful. MRI of the traumatized ankle joint can demonstrate both fractures and ankle sprains. While imaging documentation of ankle sprains is not typically necessary, differentiation of a "regular" ankle sprain (involving the anterior talofibular, calcaneofibular, and posterior talofibular ligaments) (Figure 58) from a "high" ankle sprain (involving the distal tib-fib ligament) (Figure 59) may be important from a prognostic standpoint, given the necessity for athletes with a high ankle sprain to rehabilitate for longer prior to returning to play than athletes with a routine regular ankle sprain. MR can also detect radiographically occult fractures (Figure 60), and acute tendon ruptures.

For patients with chronic ankle pain, plain films may demonstrate osteoarthritis (Figure 61) or the rare condition of hypertrophic pulmonary osteoarthropathy (Figure 62). Plain films may also demonstrate either direct or indirect evidence of tarsal coalition in patients with painful flatfoot (Figure 63). CT is usually used for further evaluation of suspected tarsal coalition, given the superb bony detail of the complex articulations between the distal tibia and fibula, hindfoot, and midfoot, although MR may also demonstrate coalition (Figure 63). MR is more helpful in such soft tissue abnormalities as hindfoot sprain (Figure 64), tenosynovitis (Figure 65), tendon tears (Figure 66), bursitis (Figure 67) loose bodies within the ankle joint (Figure 68) and peroneus brevis tendon split (Figure 69).

Figure 56. Anterior process fracture in a 25 year old woman with ankle pain following trauma. Lateral plain film of the ankle shows a fracture line (arrow) along the base of the anterior process of the calcaneus.