A Review of the Radiographic Manifestations of Gout

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Hyperuricemia and gout are found in high percentages of the Pacific Island population. As local clinicians and radiologists are more likely to have patients with either the diagnosis or suspicion of gout, a pictorial review of the common radiographic manifestations is presented especially for their information.

Introduction

Gout is a disorder caused by hyperuricemia: Primary is caused by an inborn error of uric acid metabolism, and secondary by an abnormally high rate of uric acid production, incomplete excretion or a combination of both.

Uric acid stones have been recovered from Egyptian mummies dating from about 5000 BC and continue to cause problems in modern medicine today.[1] Hyperuricemia is especially important to physicians in Hawaii because ethnicity plays a role in gout with higher rates reported in the Pacific Islands. Men account for an 8% incidence of gout and women a 1.5% incidence.[2,3] Blacks and certain families have higher rates of gout; some physicians suggest a genetic predisposition may contribute to the pathogenesis of this disease.[4,5]

Case Presentation

Throughout history various etiologies have been postulated regarding gout including anxiety, the passions of one's mind, and a settling of a person's bad humors to the feet.[6]

Primary gout affects men more commonly than women with a ratio of approximately 12 to 1; however, reported rates can vary. The Framingham study reported an incidence in men to be 3.2 per 1,000 and 0.5 per 1,000 in women.[7]

Risk factors associated with hyperuricemia and secondary gout are obesity and alcohol use, which have been linked to higher uric acid clearance. Renal insufficiency, whether secondary to chronic medical disease, hypertension or perhaps lead intoxication can lead to increased uric levels.[4]

Any process that causes an increase in cell turnover in the body, whether malignant or benign such as the hemolytic anemias, can result in a hyperuricemic state and lead to gout.[8]

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The presentation of primary gout usually occurs between 40 and 50 years of age secondary to monosodium urate crystals deposited in articular, periarticular and subcutaneous tissues.

Monoarticular disease classically occurs in the first metatarsal phalangeal joint, although any joint can be affected.

Patients commonly awaken with exruciating pain and swelling. The pain was described by the heroic figure Milton in *Lives of the Poets* by Samuel Johnson as being so intense that "...was he free from the pain of gout, his blindness would be tolerable."[9] Not only is there pain and swelling, but the overlying skin is often discolored to reddish or purple and can progress to ulceration. There is a tendency for gouty attacks to become frequent, to involve more joints, and to last longer.

Early in the course of the disease radiographic evaluation of the affected joints may be completely normal or can demonstrate soft tissue swelling without bone or joint space abnormalities.

Soft tissue and synovial tophi are commonly noted a few years after the first attack. Calcification of the tophi is not common and is seen only after tophi have been present for a long time.[6]

Early on, these tophi cause bone erosion without joint space destruction or surrounding osteoporosis (Figure 1). In Figure 1, a large osteophyte (See arrow in Figure 1) is seen forming along the proximal portion of the erosive change, which is characteristic of gout.

In a retrospective review of 78 randomly selected cases of gout, Martel reports an elevated bone margin that appears to hang over the tophaceous nodule in 40% of cases.[10] This same study shows a predilection for this finding to manifest most commonly in the foot and hand.

The patient in Figure 1 was relatively asymptomatic; significant radiographic abnormalities can be present in patients without any joint pain.[11]

The patient in Figure 2 did not demonstrate the classic metatarsal phalangeal abnormalities in the first digit but instead presented with multiple punched-out erosions at the bases of the second to fifth metatarsals and significant tarsal involvement. There was no associated osteoporosis and the lytic erosions somewhat parallel the long axis of the bone. This parallel appearance has been associated with gouty arthropathy. The joint space is commonly preserved until late in the disease and in this patient, although significant bone erosions have occurred on both sides of multiple joints, the joint spaces are maintained.

Figure 1 Radiograph of the left foot in a middle-aged Samoan man with soft tissue calcified tophus causing erosion at the proximal aspect of the first metatarsal phalangeal joint. Arrow points to an osteophyte beginning to surround the tophus.

Figure 2 Multiple punched-out lesions at the bases of the metatarsals(arrow) without joint space narrowing or surround ing osteoporosis. The tarsal bones are involved (arrow-heads).

Figure 3 Long-standing history of gout in a patient with severe destructive changes in the hand. Carpal and meta-carpal eccentric erosive, destructive changes are present with preservation of surrounding bone mineralization (arrows).

Figure 4 Total joint destruction from an uncalcified soft tissue tophus. It is evident from this radiograph of the right hand that the mass originated adjacent to the third metacarpal and invaded inwardly. The lack of any periosteal reaction suggests a nonaggressive nature.

Figure 3 illustrates the severe carpal and metacarpal destruction that was present in another patient with long-standing gout. Although gout exhibits bare area erosive changes in a proximal distribution, this entity should not be confused with rheumatoid arthritis.

Rheumatoid arthritis commonly presents as a bilateral symmetric process with juxta-articular osteoporosis and is more common in women. Gout however is usually asymmetric and may not be bilateral.

An increase of reported cases of gout has been seen in post-menopausal women. Some reports indicate women comprise 40% of patients in their 70s who present with gout.[12] Multiple factors are thought to contribute to this increase. Women show a rise in serum uric acid levels after menopause, the joints have degenerative changes present which may predispose them to damage from uric acid deposition and many are on diuretic therapy for medical reasons which could further elevate uric acid levels.

Gouty tophi, although located peripherally, can result in total destruction of the adjacent bone or joint space if allowed to progress without treatment (Figure 4).

One man who was recently diagnosed with gout presented with an asymmetric polyarthritis in the lower limbs. A native of the Pacific Islands, he had reported arthralgias waxing and waning for months, always involving multiple joints in the lower extremities.

Gout has been reported to present itself as an acute polyarthritis in as many as 39% of all gout patients evaluated in one study.[13] Sixty percent of these patients had asymmetrical involvement with most affecting the lower extremities.

This patient's radiographs of the feet (Figures 5 and 6) demonstrated not only well-circumscribed erosions at the bases of the third, fourth, and fifth metatarsals (See the black arrows) but also asymmetric, irregular, bony spicules at the sites of muscle and tendon insertions which has been described in gout (See the white arrow).[14] On the lateral projection (Figure 7), these bony spicules or osteophytes are prominent along the anterior and posterior tibiotalar joint space (See arrows). Smaller osteophytes were noticed at the calcaneocuboid joint.

Articular disease in the elbows is present in approximately 30% of patients with gout.[15] Gout should be considered to be a possibility in patients with bilateral or unilateral olecranon bursitis. Figure 8 demonstrates erosive changes both medially and laterally in the distal humerus without surrounding osteoporosis or narrowing of the joint space.

Sacroiliac joint involvement has been reported to occur in 7% to 17% of patients with gout.[16] This same report claimed an increased incidence in sacroiliac involvement in younger patients. Monosodium uric acid deposits cause the typical gouty destruction noted elsewhere that begins along the iliac side of the joint. The hyaline cartilage is thinnest along the iliac side of the joint accounting for the earliest and more severe destructive changes. Sacroiliac involvement can be bilaterally symmetric as in Figure 9, bilaterally asymmetric or unilateral. In this patient the absence of the sharp cortical margin is apparent along the iliac side of the joint when compared to the sacral side (See arrows). This represents sacroiliitis, which in this case was caused by gout.

Erosions in the knees frequently are found along the medial and/or lateral femoral condyles; also the tibia is commonly involved. The joint space may be unaffected; however, since most gout patients are in an older age group, joint space narrowing commonly is present and most likely is due to a combination of degenerative disease and gout.

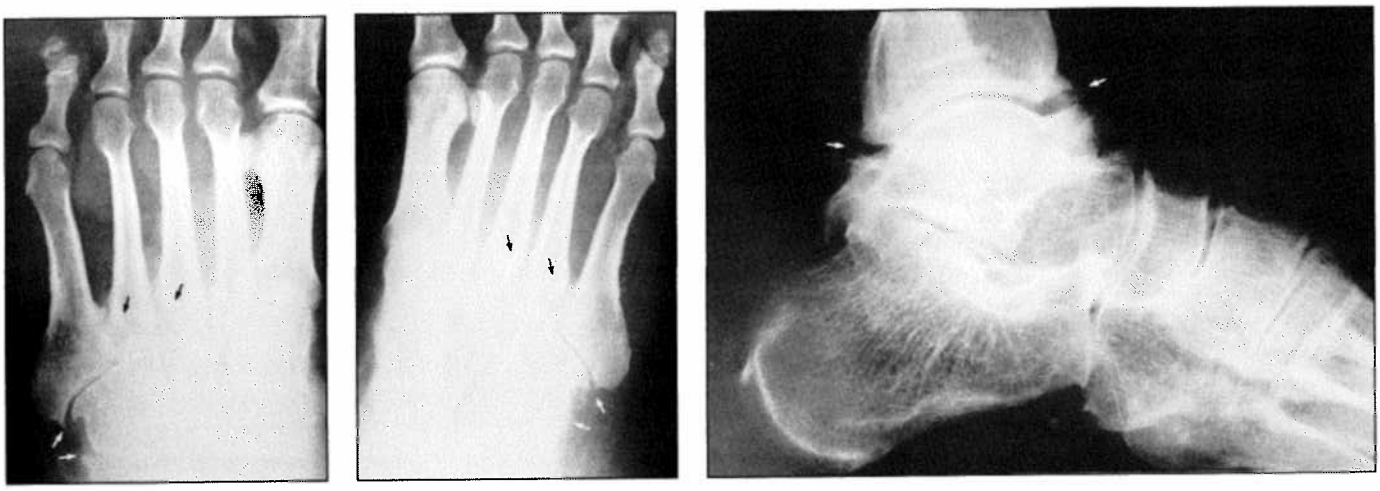

Figure 5, 6 and 7 Radiographic exam of the ankle and foot in a 28-year old man with gout. The black arrows demonstrate the erosive changes at the metatarsal bases characteristic of gout. The white arrows point to the osteophytes.

Figure 8 AP radiograph of the elbow with medial and lateral erosions in the distal humerus (arrows).

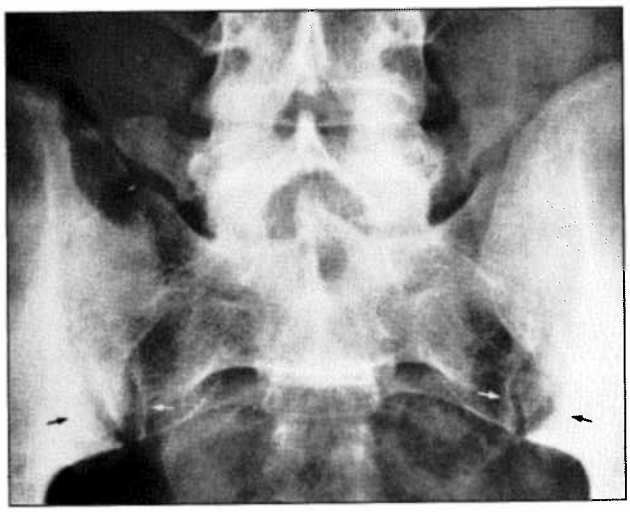

Figure 9 Radiograph of the sacroiliac joints demonstrating irregularity of the iliac side of the joint (black arrow) secondary to erosive changes in this patient with gout. This process is symmetrical. The cortical margin remains sharp without destruction on the sacral portion of the joint (white arrows).

Figure 10 A large erosion is present in the lateral femoral condyle (arrowhead) with smaller erosions present medially (arrows). Note the mild joint space narrowing secondary to degenerative changes.

Cystic changes caused by intraosseous uric acid deposits can appear on the patella; furthermore, chondrocalcinosis and tendon ruptures have been associated with gout.[17]

Gouty erosions are prominent along the lateral aspect of the distal femur (Figure 10) and to a lesser degree medially involving both the femur and tibia. Moderate joint space loss is also present.

Magnetic resonance imaging (MRI) was performed with a 1.5 Tesla General Electric unit in both coronal (Figures 11 and 12) and sagittal planes (Figures 13 and 14). T1 weighted (TR500, TE18) and MPGR (TR517, TE17) weighted sequences were performed (See Figures 11 and 13; Figures 12 and 14, respectively).

Figures 11 and 12 show multiple bare area erosions in the tibia medially and in both femoral condyles (See arrows). An abnormal area of high signal intensity is present below the lateral tibial spine on the MPGR image (Figure 12-arrowhead) consistent with a subchondral cyst. Joint space narrowing is present medially.

The sagittal images in Figures 13 and 14 demonstrate a large subchondral cyst and marginal erosions in the posterior tibial plateaus (Arrows numbered 1). A large joint effusion is also present extending into the suprapatellar bursa (Arrow numbered 2). Although MRI is not advocated or practical for all cases of gout, it can be helpful in evaluating the joint and surrounding soft tissue structures when the patient's symptoms are not explained completely by the physical exam, laboratory results or radiographic exams.

As presented in this article, monosodium uric acid deposition from gout can cause a variety of radiographic abnormalities

throughout the skeletal system. Knowledge of these appearances and of patients with various predispositions for hyperuricemia, such as those of Pacific Island descent, is critical in making a prompt and correct diagnosis.

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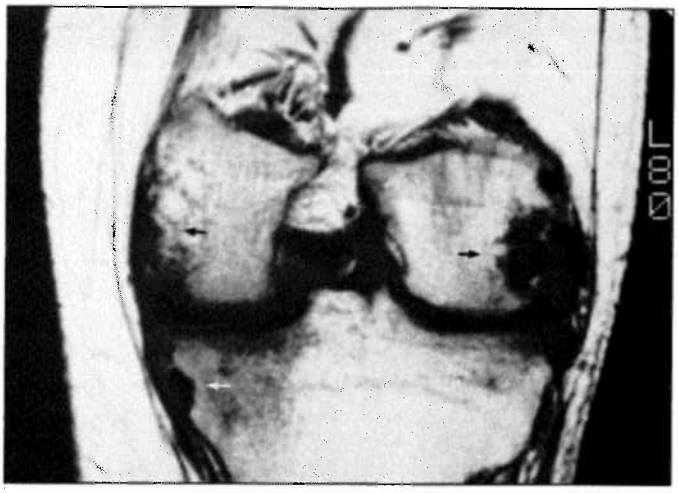
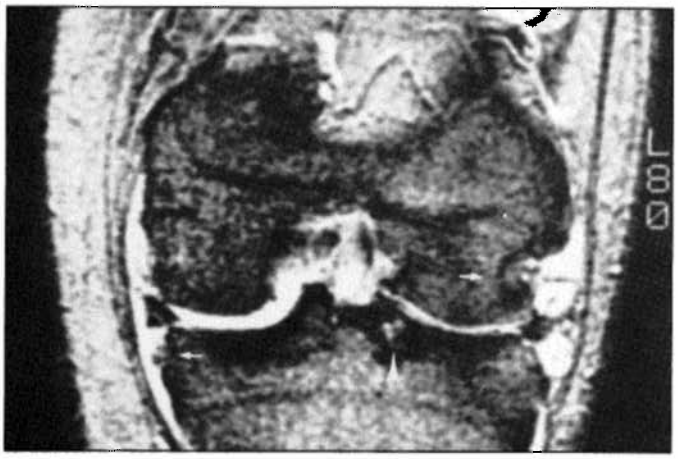
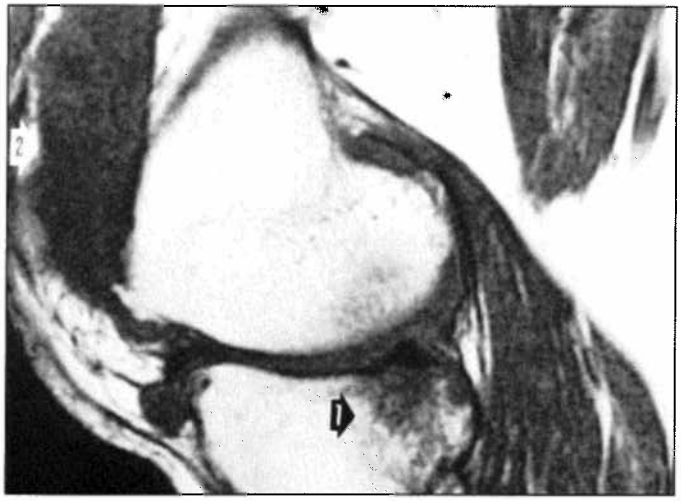


Figure 11 and 12 Coronal T1 and MPGR weighted MR images of the same patient in Figure 10 demonstrate the bare area erosive changes seen in the radiograph (arrows). A large subchondral cyst is identified as areas of abnormal increased signal in the tibial plateaus (arrowhead) on the MPGR image. A moderate joint effusion is present as noted by the high signal within the joint on the MPGR images.





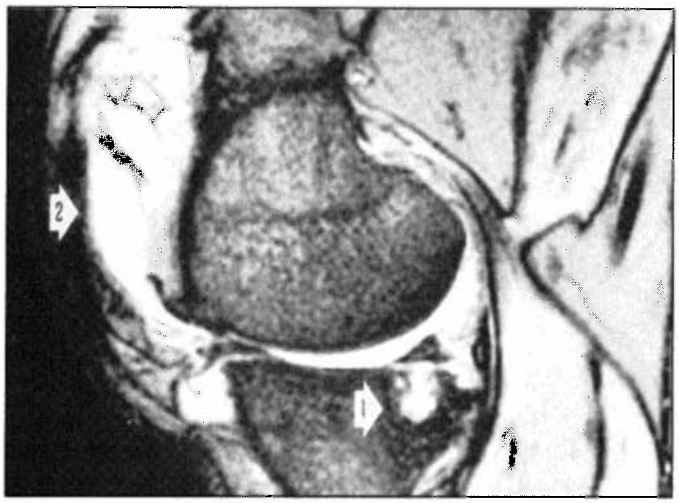


Figure 13 and 14 The sagittal images sharply define the subchondral erosive changes now filled with fluid on both T1 and MPGR weighted images (arrows numbered 1). Arrows numbered 2 demonstrate the patient's joint effusion.