

Radiographic Evaluation of Arthritis

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The main presentation of the different types of arthritis is a pain. Pain characteristics, timing, and aggravating or relieving factors can help in the differentiation between degenerative and inflammatory joint disease; however, in this discussion, we will focus on the radiographic differences between the two and the outstanding features of specific types of arthritis.



Arthritis refers to joint pain commonly associated with stiffness. It is not a diagnosis in itself but refers to a group of joint diseases. There are dozens of types of arthritis. The main 2 categories are inflammatory and non-inflammatory. Inflammatory arthritis is characterized by joint inflammation leading to erosion of the anatomical structures, usually caused by an autoimmune condition. Rheumatoid arthritis is a prime example of this type. Non-inflammatory arthritis comprises all causes of joint pain that are not associated with autoimmune conditions, including infectious, metabolic, and degenerative types of arthritis. A prime example of this type is osteoarthritis.

Inflammatory Arthritis

Bone erosion is characteristic of inflammatory joint conditions. Erosion appears as a focal discontinuity of the thin subchondral bone plate and is usually marginal.

- Uniform joint space narrows following erosion of the margins.
- Osteopenia usually precedes the bony erosions that are typical of inflammation.

- **Soft-tissue swelling is seen in inflammatory forms of arthritis, which is rare in** degenerative joint diseases such as osteoarthritis.

The pattern of involved joints in inflammatory arthritis varies between rheumatoid arthritis, septic arthritis, and seronegative spondyloarthropathies.

- Monoarticular joint inflammation is a hallmark of septic arthritis.
- Multiple proximal joint inflammation without bone proliferation is suggestive of rheumatoid arthritis.
- **Multiple distal joint inflammations with bone proliferation suggest seronegative spondyloarthropathy.**

Septic Arthritis

A staphylococcal or streptococcal infection most commonly causes septic arthritis. The direct spread from a skin cut into the joint space or hematogenous spread are the 2 main routes by which microorganisms gain access to the joint space.

Radiographic features that indicate the likelihood of septic arthritis include:

- Periarticular osteopenia
- Uniform joint space narrowing

When the joint effusion is quite large, the joint space may be widened.

- Bone erosions may be absent in the acute stage of septic arthritis.
- Soft-tissue swelling also occurs.

Fungal and tuberculous arthritis usually have a more gradual onset and more commonly present with joint widening rather than narrowing. Chronic tuberculous arthritis presents with juxta-articular osteopenia, peripheral bone erosions, and gradual narrowing of the joint space. This trio of effects is known as the Pheemister triad and is specific to tuberculous arthritis.

Rheumatoid Arthritis

Rheumatoid arthritis is a **systemic condition that is characterized by the involvement of**



Image: Signs of metatarsophalangeal instability. Anteroposterior X-ray of a 40-year-old woman with rheumatoid arthritis shows signs of metatarsophalangeal instability, osteophytes of both medial cuneometatarsal joints (white arrows). Hypermobility of the first metatarsal bone in patients with rheumatoid arthritis is treated using the Lapidus procedure. By: Popelka S, et al. License: [CC BY 2.0](https://creativecommons.org/licenses/by/2.0/)

multiple joints at the same time.

The condition is more common in middle-aged women. Antibodies to cyclic citrullinated peptide are usually positive in rheumatoid arthritis. The positivity of these antibodies, along with the presence of the rheumatoid factor, is suggestive of autoimmune pathogenesis.

Rheumatoid arthritis radiographic features include:

- Multiple joint inflammation characterized by osteopenia
- Uniform joint space narrowing
- Bone erosions and soft-tissue swelling
- Juxta-articular osteoporosis
- Pannus of the bony areas

The **involved joints are usually proximal**. The most commonly involved joints in the hands are the metacarpophalangeal, proximal interphalangeal, midcarpal, and radiocarpal joints. Involvement is usually bilateral and symmetric (see image).

A similar distribution is observed in the feet. When evaluating X-rays of the feet in a patient suspected to have rheumatoid arthritis, the head of the 5th metatarsal bone should be closely evaluated. **Lateral bony erosions in the 5th metatarsal head are a very early and specific finding of rheumatoid arthritis.**

Calcaneal erosions and loss of the radiolucency of the triangle between the calcaneus and the Achilles tendon are also suggestive of rheumatoid arthritis and the formation of bursal fluid. This occurs because of bursa formation within the inflamed synovial sheets.

Involvement of the large joints is also possible. The knees, hips, and sacroiliac joints can present with radiographic features suggestive of inflammatory changes. Involvement of the C1-C2 vertebrae is also seen in rheumatoid arthritis. Erosion of the odontoid process and widening of the atlantodens interval are common findings suggestive of cervical spinal involvement in rheumatoid arthritis.

Degenerative Joint Disease

The degenerative joints can be damaged by osteoarthritis or by trauma, crystal deposition, neuropathy, or hemophilia hemarthrosis.

Joint involvement is also multiple but asymmetric. The main features of radiography are:

- The formation of osteophytes
- Osteosclerosis
- Absence of inflammatory features such as soft-tissue reaction and pannus formation

Osteopenia, bone erosions, and uniform joint space narrowing are not common features of osteoarthritis.

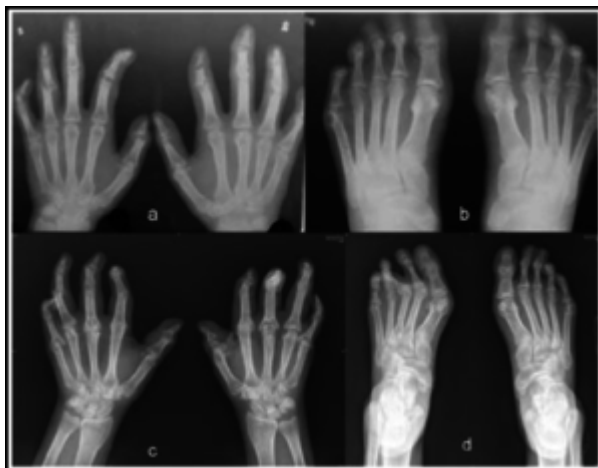
When a single joint is involved, the condition is very severe, or the patient is too young to develop osteoarthritis, the possibility of atypical osteoarthritis should be ruled out.

The most common causes of atypical osteoarthritis are trauma, crystal deposition, or the mechanical destruction of the bones by repeated minor trauma, as occurs in cases of peripheral neuropathy.

Seronegative Spondyloarthropathies

Psoriatic Arthritis

Psoriasis is an autoimmune condition that results from the interplay between unknown



[Image](#): A and B: Radiographs show arthritis in multiple small joints, with bone erosion, in both hands and feet. By: Ding WQ.
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environmental factors and genetic predisposition in the individual. HLA-B27 is positive in up to two-thirds of psoriatic patients, strongly suggesting an autoimmune pathology behind the condition. The joint disease occurs in about 15% of patients.

The main difference between psoriatic arthritis and rheumatoid arthritis is the pattern of joint involvement, where it is distal in the former. **Bone proliferation is only seen in seronegative spondyloarthropathies**, including psoriatic arthritis, but not in

rheumatoid arthritis.

A “pencil-and-cup” appearance of an involved joint is more common in seronegative spondyloarthropathies but is not specific to this condition. The distal involvement of the phalanges with sclerosis, enthesitis, periostitis, and soft-tissue swelling in the feet is specific for psoriatic arthritis (see image). This radiographic pattern is known as ivory phalanx.

Involvement of the spine, sacroiliac joints, knees, elbows, and ankles is also seen in psoriatic arthritis. Vertebral body squaring is not seen in psoriatic arthritis.

Reactive Arthritis

Reactive arthritis is also known as Reiter’s syndrome. This **sterile inflammatory arthritis follows an enteric or urogenital infection**. Patients with reactive arthritis typically have urethritis and conjunctivitis, and are positive for HLA-B27.

The radiographic picture of reactive arthritis is very similar to psoriatic arthritis. Bone erosions, bone proliferation, periostitis, and enthesitis are all seen in reactive arthritis. The **involvement of the lower limbs is more common than the upper limbs**.

Differentiation between reactive arthritis is largely dependent on the clinical history of the patient. Younger patients who present with arthritis-related symptoms after a urogenital or enteric infection are more likely to have reactive arthritis than psoriatic arthritis.

Ankylosing Spondylitis

Ankylosing spondylitis is even more strongly associated with the HLA-B27 allele. Up to 96% of patients with ankylosing spondylitis are HLA-B27 positive. In contrast to other inflammatory joint diseases, ankylosing spondylitis is more common in men. The **condition typically affects men aged 20-40 years**.

The main radiographic features of ankylosing spondylitis are axial joint involvement, spinal disease, and sacroiliac joint disease. Peripheral joint disease is less common in ankylosing spondylitis compared with other seronegative spondyloarthropathies. Spinal osteitis, syndesmophyte formation, facet joint disease, and facet joint fusion eventually lead to a bamboo spine sign.

In contrast to axial involvement of the spine in psoriasis, **involvement of the spine in ankylosing spondylitis eventually leads to vertebral body squaring**. Ossification of the interspinous ligaments is also seen in this condition.

The formation of subchondral cysts and osteophytes within the head of the humerus is also seen in some patients with ankylosing spondylitis.

References

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