Radiographic Evaluation of Arthritis

The main presentation of the different types of arthritis is 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.

Inflammatory Arthritis

Inflammatory joint conditions are characterized by:

Bone erosion

Erosion appears as focal discontinuity of the thin subchondral bone plate. Bone erosion is usually marginal.

- Uniform joint space narrowing follows the erosion of the margins.
- Osteopenia usually precedes the bony erosions that are typical of inflammation.
- Soft-tissue swelling is seen together with inflammatory forms or arthritis which is rare in degenerative joint diseases such as osteoarthritis.

The pattern of involved joints in inflammatory arthritis can differentiate between rheumatoid arthritis, septic arthritis or seronegative spondyloarthopathies.
Monoarticular joint inflammation is a hallmark of septic arthritis. Multiple proximal joint inflammation without bone proliferation is suggestive of rheumatoid arthritis. **Multiple distal joint inflammation with bone proliferation suggests 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 two main routes for the microorganisms to get 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 might be widened.

- Bone erosions: Bone erosions might be absent in the acute stage of septic arthritis
- Soft-tissue swelling

**Fungal and tuberculous arthritis usually have a more gradual onset** and are more common to present with joint widening rather than narrowing. Chronic tuberculous arthritis presents with juxtaarticular osteopenia, peripheral bone erosions and gradual narrowing of the joint space. This triad is known as the Phemister triad and is specific for tuberculous arthritis.

**Rheumatoid Arthritis**

Rheumatoid arthritis is a *systemic condition that is characterized by the involvement of*
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 an autoimmune pathogenesis.

Rheumatoid arthritis radiographic features include:
- Multiple joint inflammation that is 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. The involvement is usually bilateral and symmetric.

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

Calcaneal erosions and the 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 happens 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 the widening of the atlantodens interval are common findings suggestive of cervical spinal involvement in rheumatoid arthritis.

Degenerative Joint Disease

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

The joint involvement is also multiple but is 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 what happens in cases of peripheral neuropathy.
Psoriatic Arthritis

Psoriasis is an autoimmune condition that results from the interplay between unknown 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. Joint disease occurs in about 15% of the 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. The distal involvement of the phalanges with sclerosis, enthesitis, periostitis and soft tissue swelling in the feet is specific for psoriatic arthritis. 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 syndrome. This is a sterile inflammatory arthritis that follows an enteric or urogenital infection. Patients with reactive arthritis typically have urethritis, 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.

The 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 rather than
psoriatic arthritis.

Ankylosing Spondylitis

Ankylosing spondylitis is even more strongly associated with the HLA-B27 allele. Up to 96% of the 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 between 20 and 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 to other seronegative spondyloarthropathies. Spinal osteitis, syndesmophyte formation, facet joint disease, and facet joint fusion eventually leads to the bamboo spine sign.

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

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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