Imaging for Rheumatic Diseases

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Outline

- Introduction to imaging modalities
- Focus on plain radiography
  - OA
  - RA
  - PsA
  - AS
  - Gout
  - Pseudogout
  - osteoporosis

X-rays

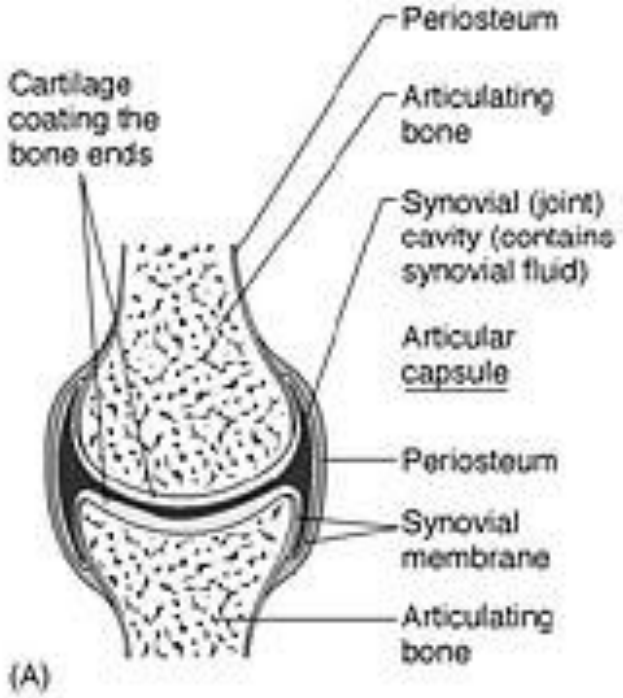
- Taking a 2-dimensional image of a 3-dimensional structure
- Superimposition of structures can thus obscure pathology
- Quality is also affected by patient positioning, exposure techniques
- Multiple views of the same area are useful
- Good for: fractures, bone lesions, osteophytes, joint space narrowing, erosions, cysts

Approach to an Image

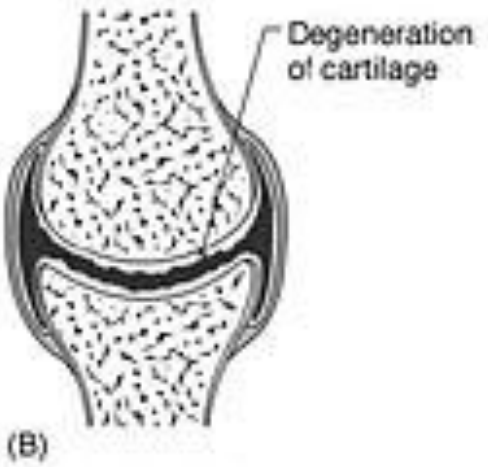
- Soft tissues: effusions, calcification, masses
- Mineralization: diffuse demineralization, periarticular demineralization
- Joint and subchondral bone: narrowing, subchondral sclerosis, intraarticular bodies, ankylosis
- Erosions: central (articular surface), marginal (bare area), periarticular, mutilans
- Proliferation: osteophytes, periostitis
- Deformity: varus/valgus, flexion/extension, subluxation, dislocation, collaps

Osteoarthritis

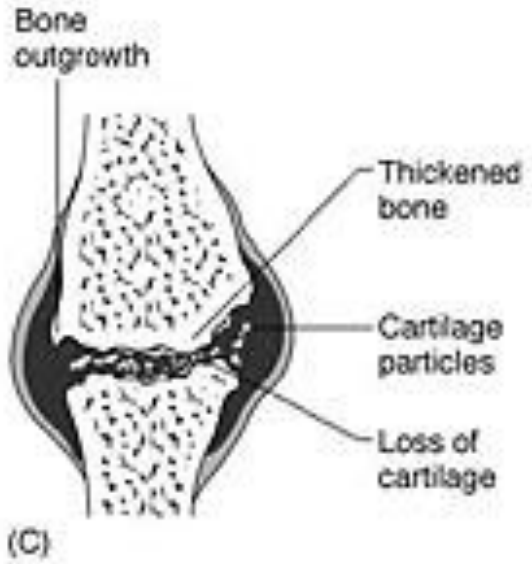
- Joint space narrowing
- Osteophytes
- subchondral sclerosis
- cysts



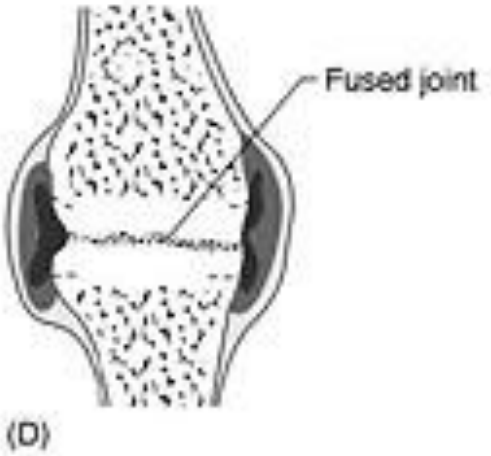
Normal joint



Early stage of osteoarthritis



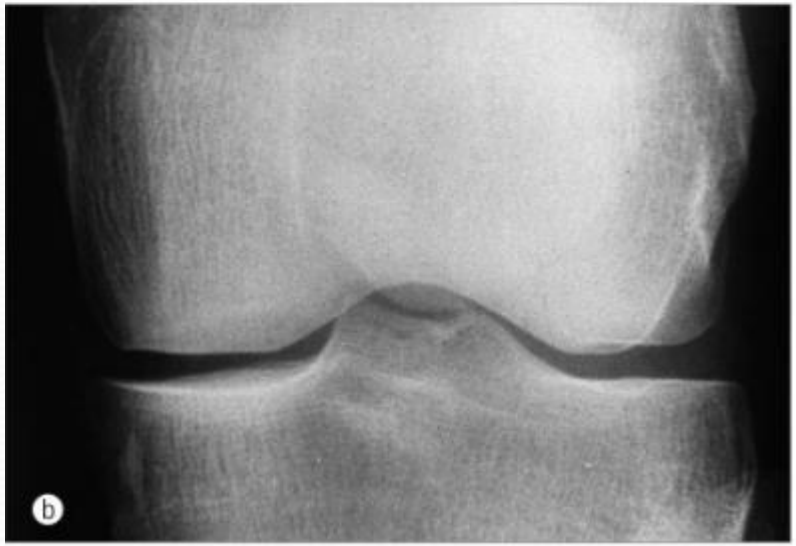
Late stage of disease



THE PATHOLOGY OF OSTEOARTHRITIS DETERMINES THE CHARACTERISTIC RADIOGRAPHIC FEATURES

Pathology		Radiology
Altered articular cartilage biochemistry	**Early disease stage** Cartilage biomechanically weaker	Narrowing of joint space due to cartilage compression
Cartilage fissuring and rupture	**Later disease stage** Focal loss and removal of cartilage	Loss of joint space
Increased activity at the articular margins	**Early disease** Bone alters early in the disease due to the blood supply	Osteophytosis
Increased activity of subchrondral bone		Increased subchondral cortical plate thickness Increased trabecular sclerosis
Altered bone biochemistry	**Later disease stage** Biomechanically weaker bone	Remodeling of joint surfaces, cyst formation, and late joint mal-alignment

a



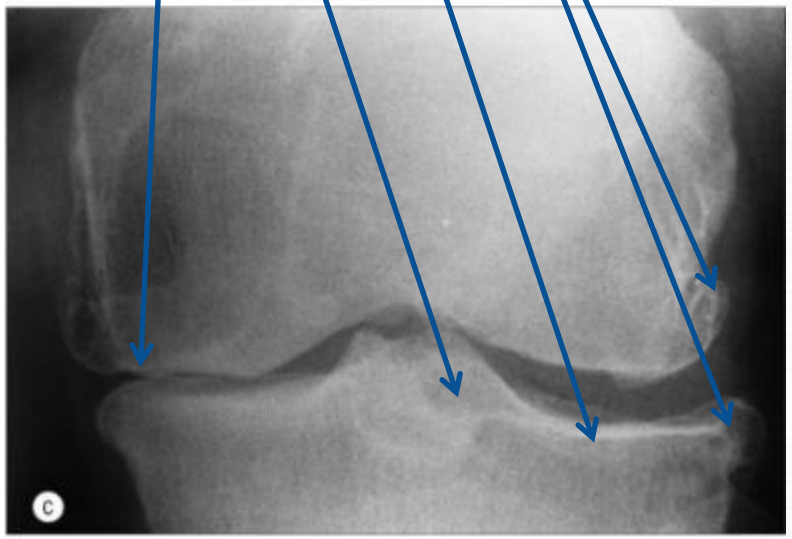


Figure 1

Figure 2

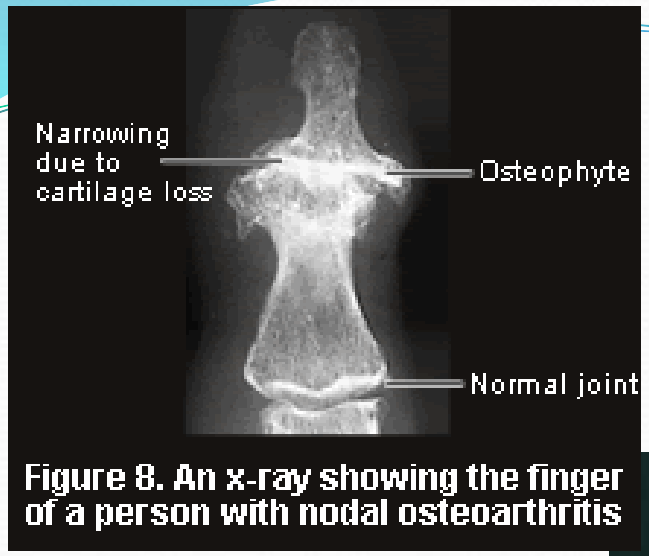


Figure 8. An x-ray showing the finger of a person with nodal osteoarthritis


A

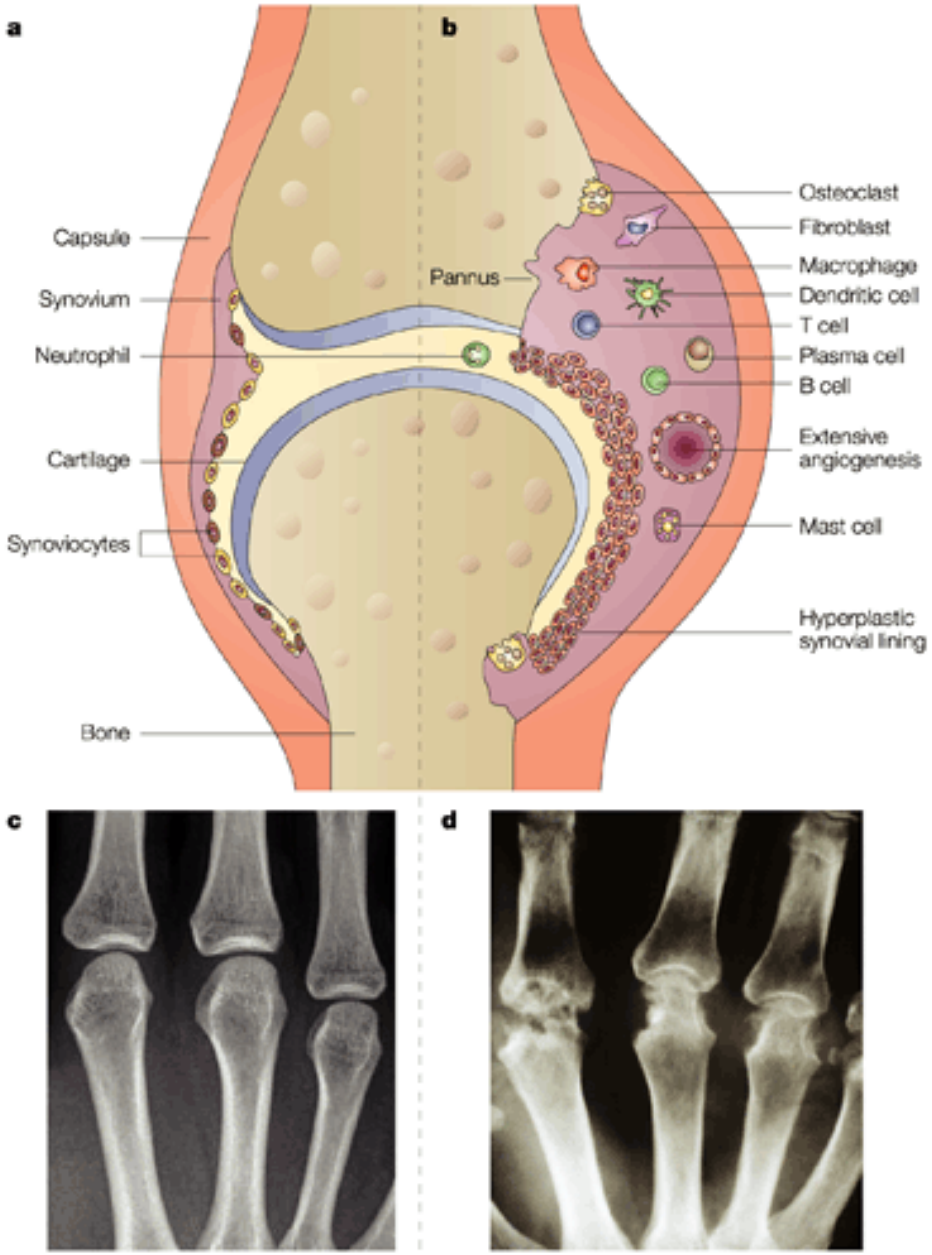
Rheumatoid Arthritis

- Periarticular osteoporosis is an early finding , but can also see generalized osteoporosis


A

Rheumatoid Arthritis

- Characteristic lesions are erosions in the marginal (bare) area
  - Pannus erodes the bone at the margin of the joint capsule where the redundant synovium exits, next to the articular cartilage
- Osseous proliferation is not commonly seen with RA, but can be seen with secondary OA in joints with RA
- Subchondral cysts may be large
- Earliest changes are usually in the hands and feet
  - Ulnar styloid soft tissue swelling, extensor carpi ulnaris tenosynovitis



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Marginal erosion
Erosions
Soft tissue swelling
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Rheumatoid Arthritis

- Deformities
  - Subluxations at the MCPs and MTPs
  - Ulnar deviation of the digits
  - Swan-neck and Boutonniere deformities

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Severe ulnar deviation

Severe erosions of MCPs

Complete destruction of the wrist

Resorption of the carpals and the heads of the metacarpals

Radial deviation of the wrist

Boutonniere deformity of the thumb

Flexion with dislocation of the first MCP joint

Hyperextension of the IP joint

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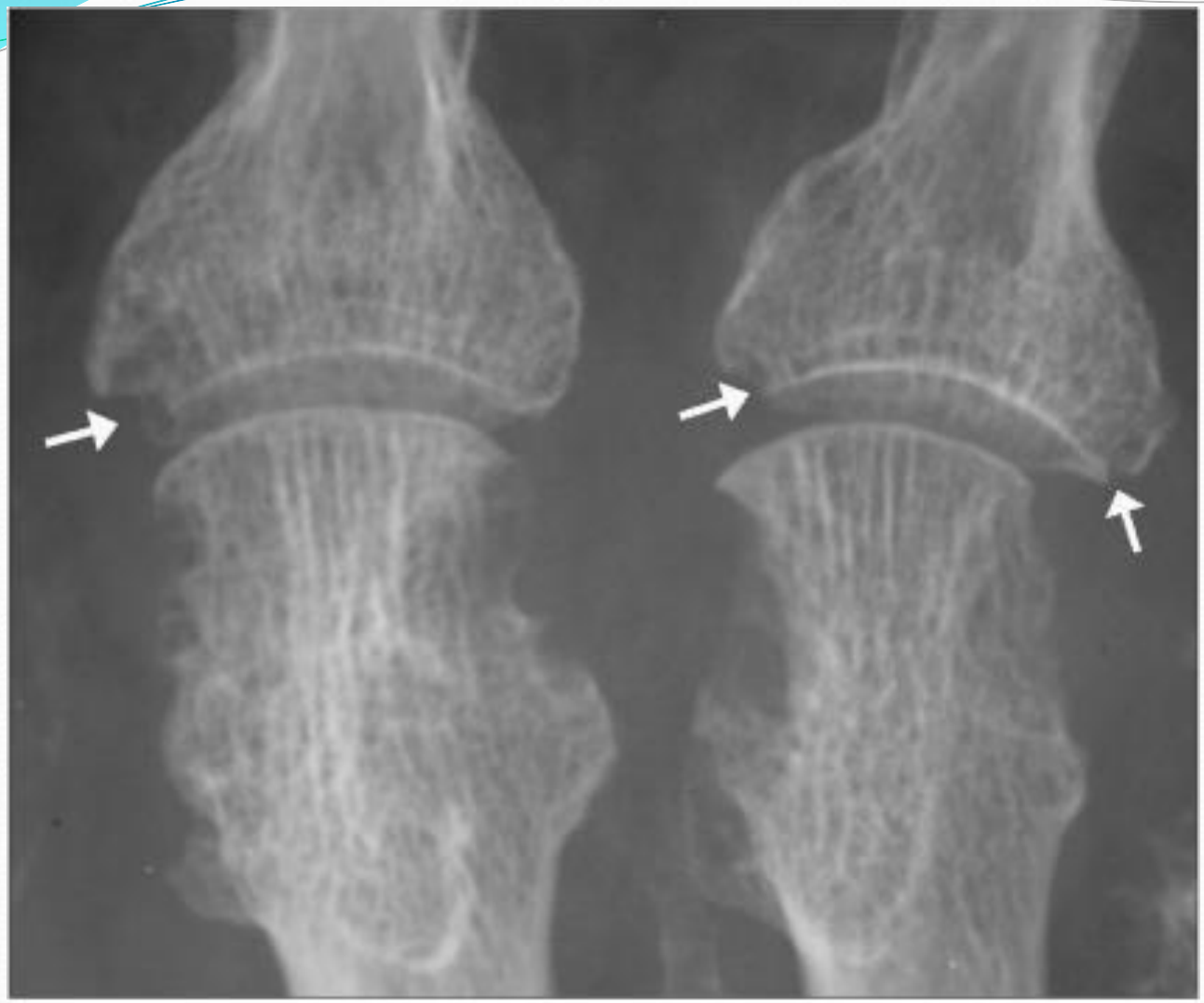
Rheumatoid wrist: articular destruction, carpal fusion and carpal collapse.

Severe destruction of the distal radius and ulna.



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Rheumatoid foot

Multiple osseous erosions and defects at the medial and lateral margins of the metatarsal heads

Marginal erosions at the bases of the proximal phalanges (arrows)

Rheumatoid foot

Medial and lateral erosions of the 5th metatarsal head

Subluxation of the 5th MTP joint

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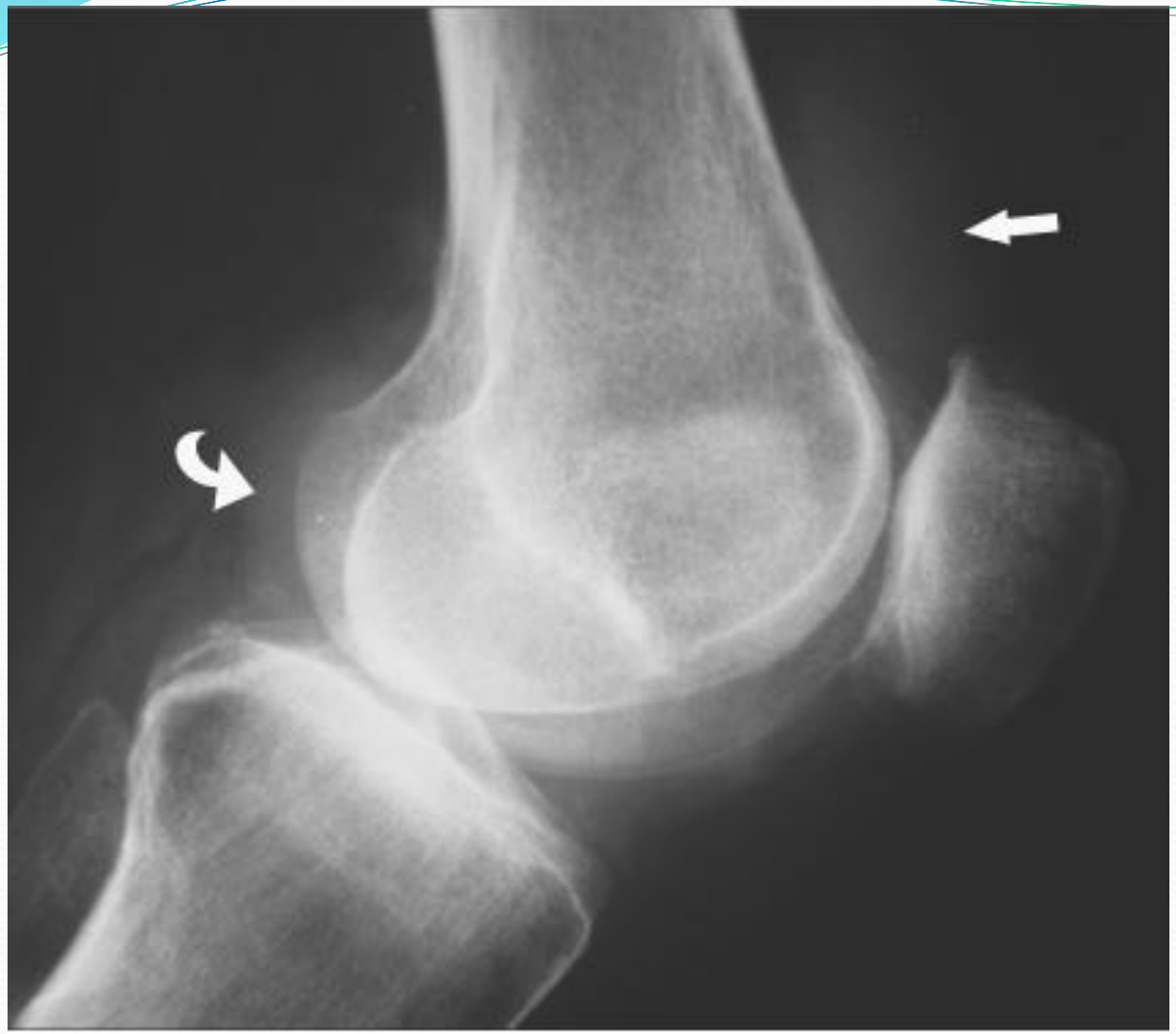
Rheumatoid foot

Subchondral cyst at the base of the distal phalanx

Characteristic erosion along the medial margin of the proximal phalanx of the great toe



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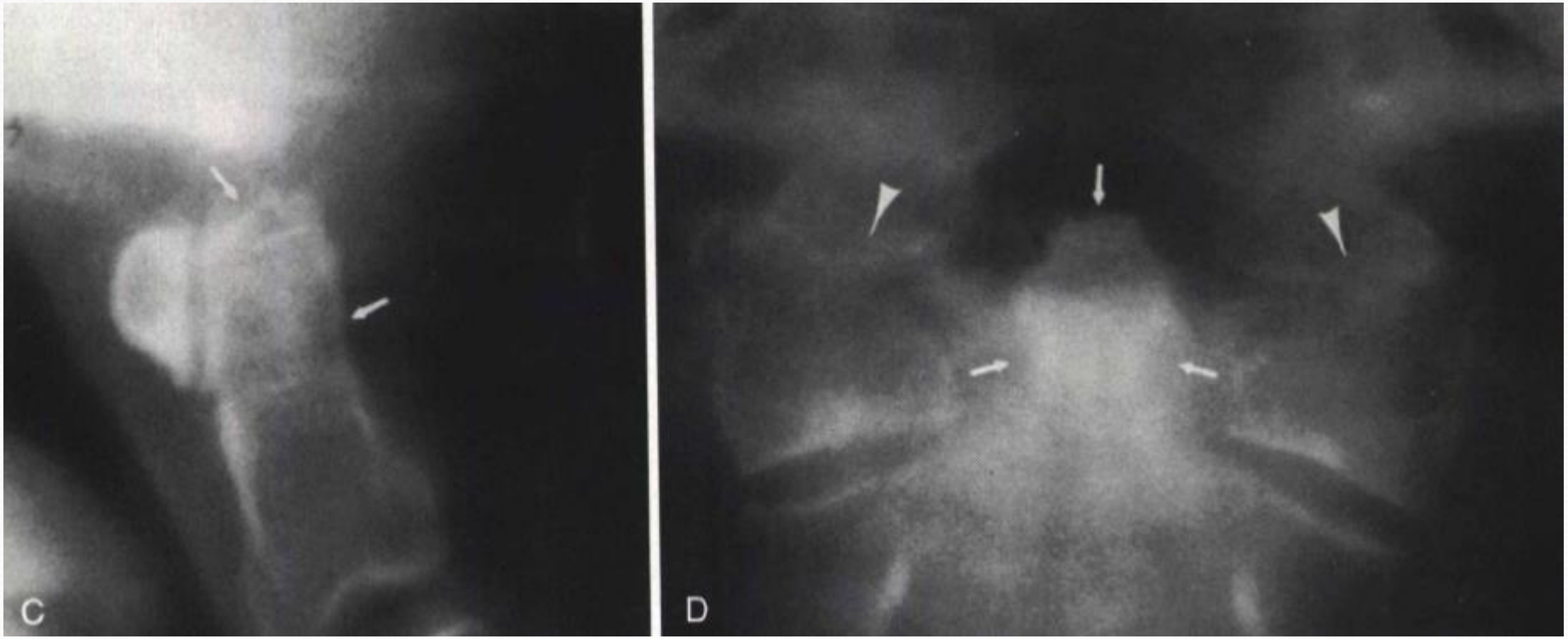
Soft tissue findings in rheumatoid knee

Synovial effusion in the suprapatellar pouch and posterior recesses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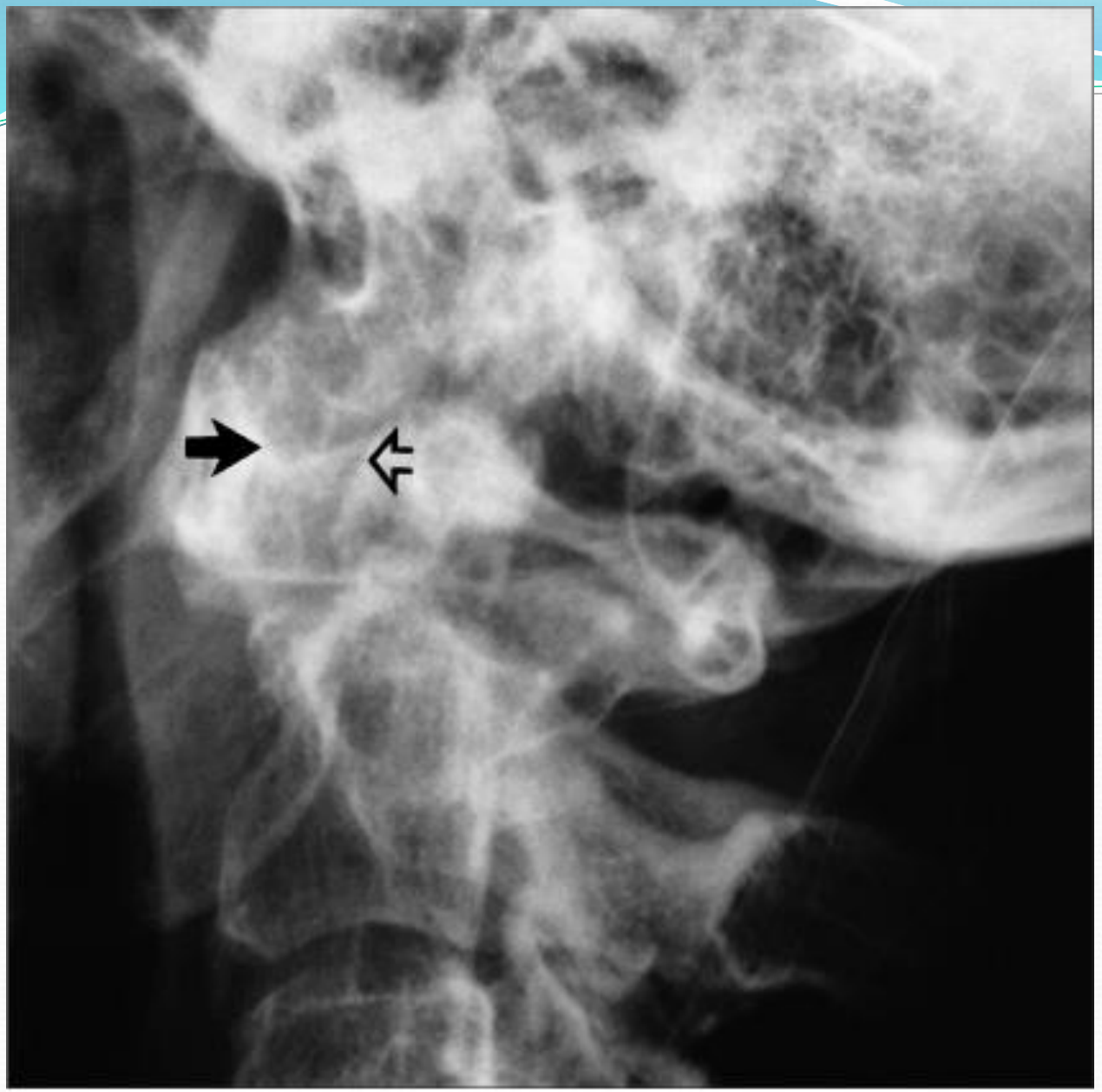

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Atlantoaxial subluxation in RA

Always a concern in patient with longstanding RA and neck pain or cervical neurological symptoms

Order a view of the atlantoaxial articulation through an open mouth to fully assess. This shows lateral atlantoaxial subluxation of the odontoid process with respect to the lateral masses of the atlas.

Psoriatic Arthritis

- Characterized by erosions and bony proliferations
  - RA does not typically have new bone formation
- Asymmetric distribution
- Can involve the axial skeleton, as in ankylosing spondylitis (AS)
- Soft tissue findings: fusiform soft tissue swelling around the joints; can progress so the whole digit is swollen (sausage digit or dactylitis)
- Periostitis

Psoriatic Arthritis

- Deformities
  - Pencil and cup – end of bone looks like it has been through a pencil sharpener, reciprocating bone becomes cupped
  - Telescoping of one bone into another
  - Complete destruction of bone (arthritis mutilans)

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Psoriatic hands

Erosive changes at the DIPs and PIPs

Sparing of MCPs and wrists

Arthritis mutilans

Pencil and cup deformity

Pencilling

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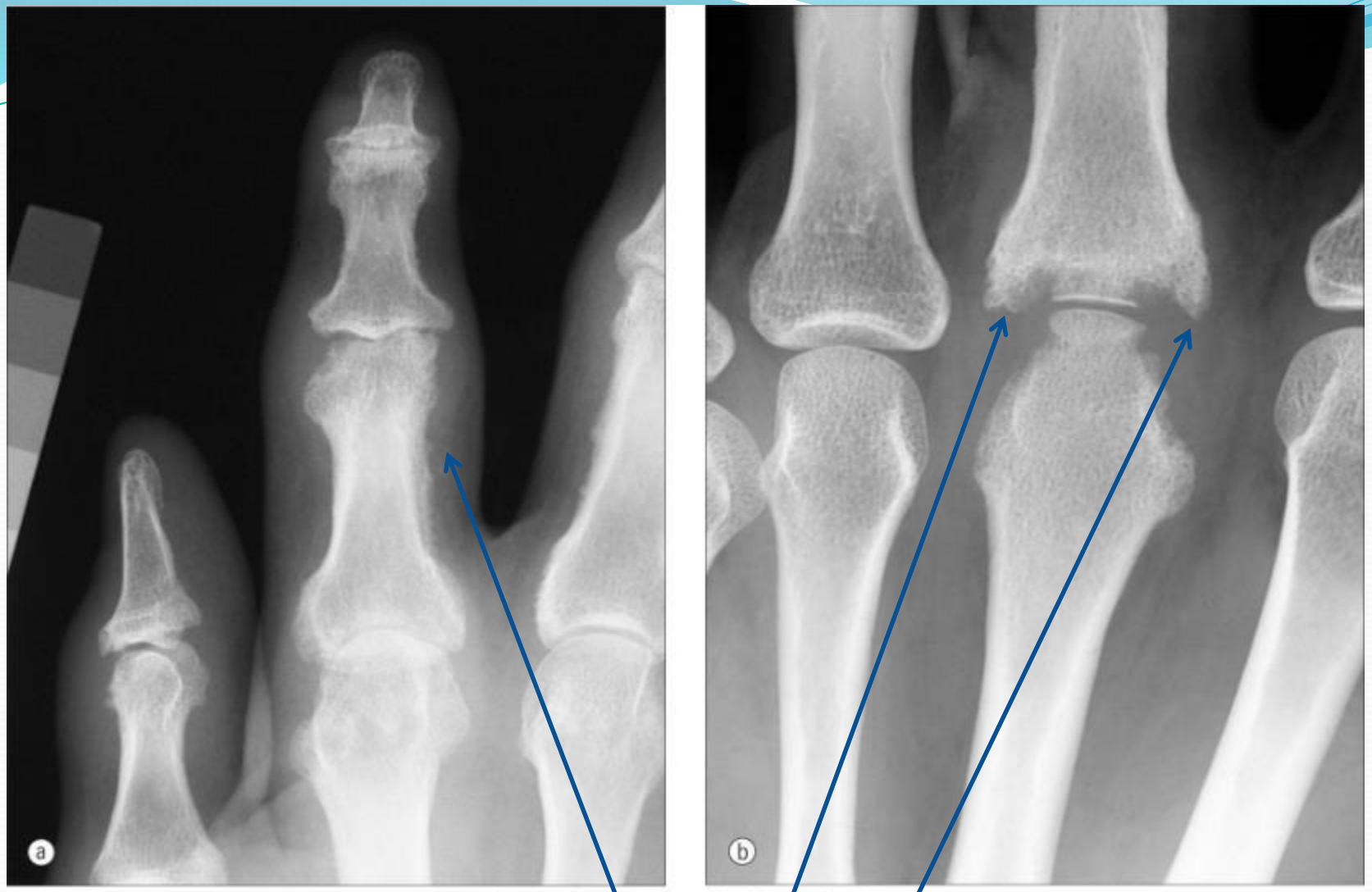
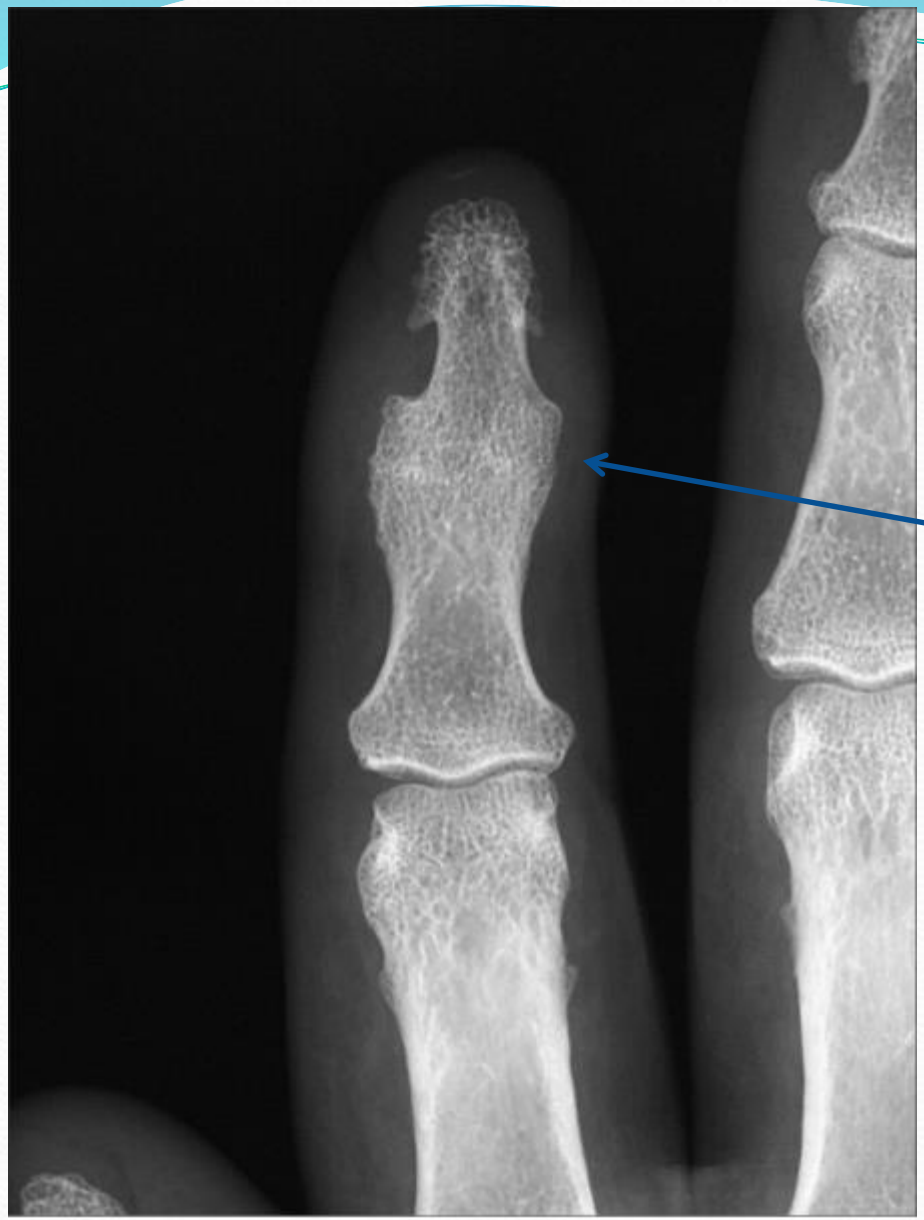
Psoriatic arthritis

Asymmetric involvement

Soft tissue swelling and periosteal reaction in 2nd and 3rd fingers



Periosteal reactions



Bony ankylosis of DIP joint

Psoriatic Arthritis

- Spine
  - Asymmetric sacroiliitis
  - Chunky, asymmetrical syndesmophytes (bony bridges between vertebrae)

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Chunky, non-marginal syndesmophytes typical of psoriatic arthritis

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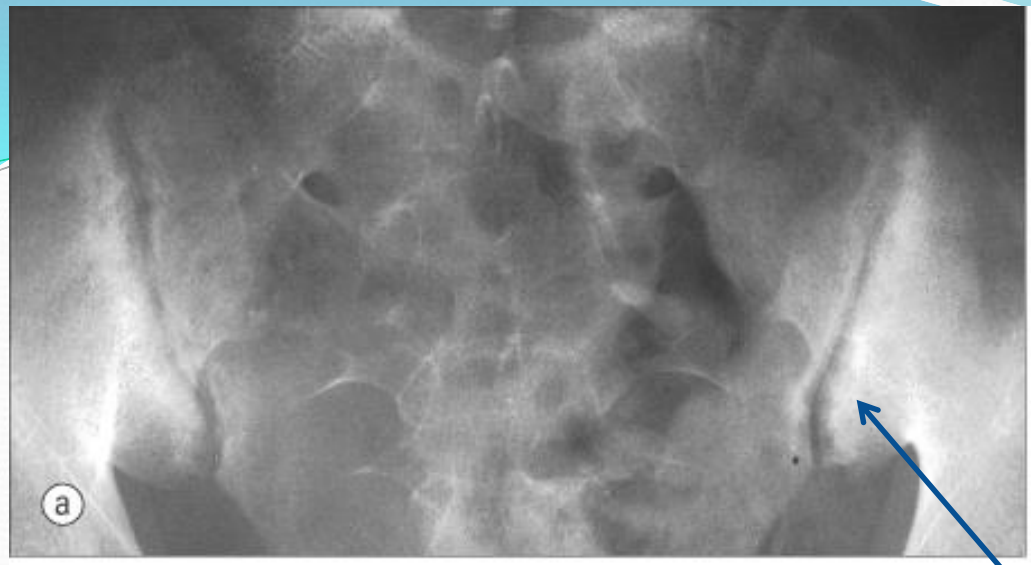
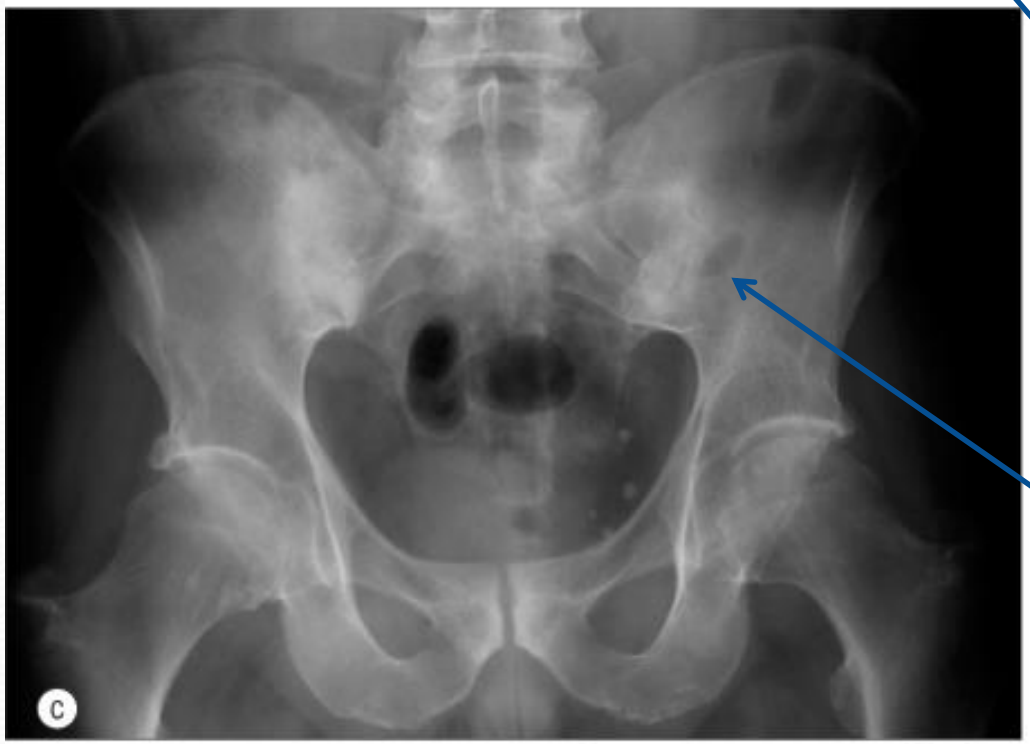
Asymmetric sacroiliitis with left sided erosions and sclerosis

Ankylosing Spondylitis

- Changes begin at SI joints and lumbosacral junction, then typically move up the spine
- SI joints:
  - Small erosions cause “pseudowidening” of the SI joints
  - Erosions occur first at iliac side, which has thinner cartilage
  - Remember that the synovial part of the SI joint is the anterior, inferior portion
  - Reactive sclerosis with eventual fusion





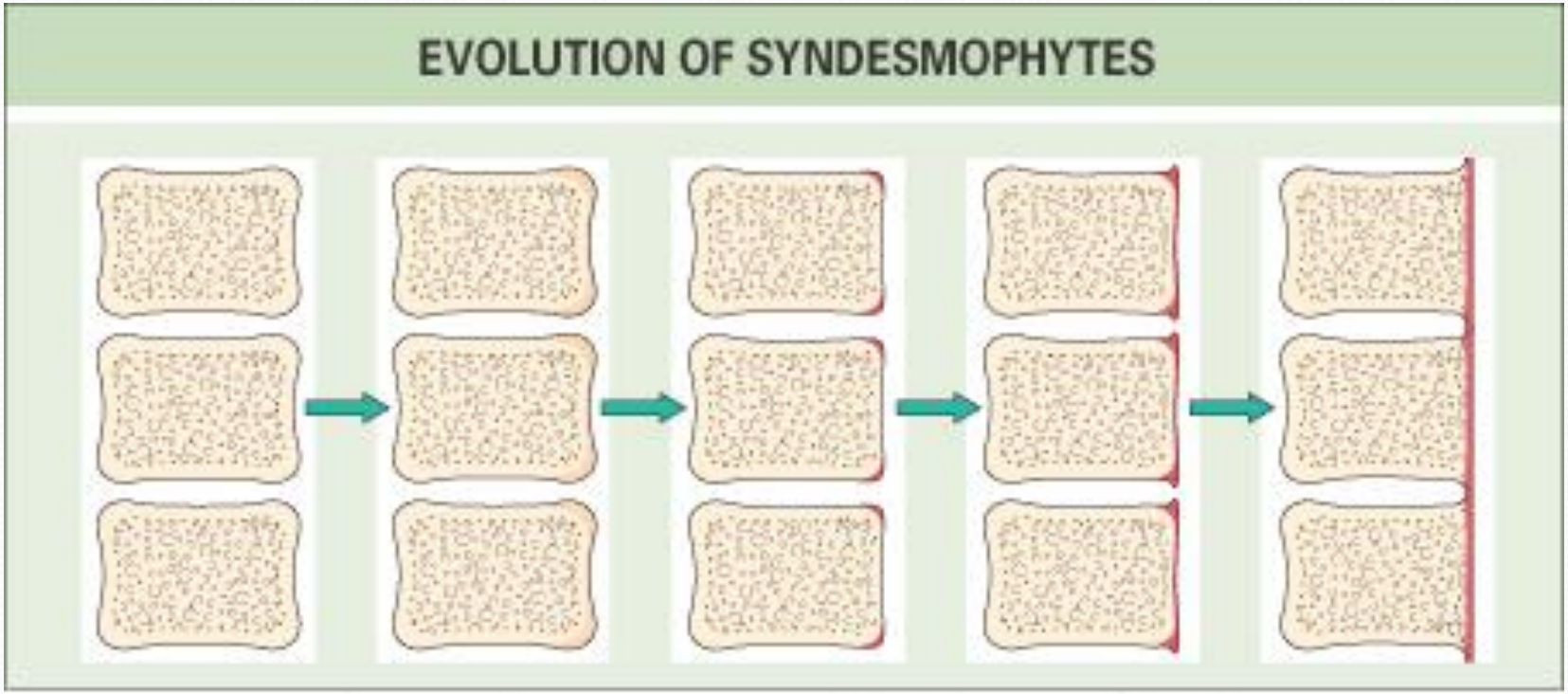
Erosions and sclerosis on iliac side

Bilateral sacroiliitis with erosions, bony sclerosis and joint width abnormalities

Bilateral sacroiliitis, definite erosions, severe juxta-articular bony sclerosis and blurring of the joint

Ankylosing Spondylitis

- Spine
  - Early changes include squaring of the anterior vertebral body
  - Enthesitis (whiskering) and sclerosis (shiny corners) where Sharpey's fibres mineralize
  - Progressive mineralization of Sharpey's fibres to form osseous bridging syndesmophytes
  - Ossification of the interspinous ligaments
- Most commonly involved peripheral joint is the hip


EVOLUTION OF SYNDESMOPHYTES
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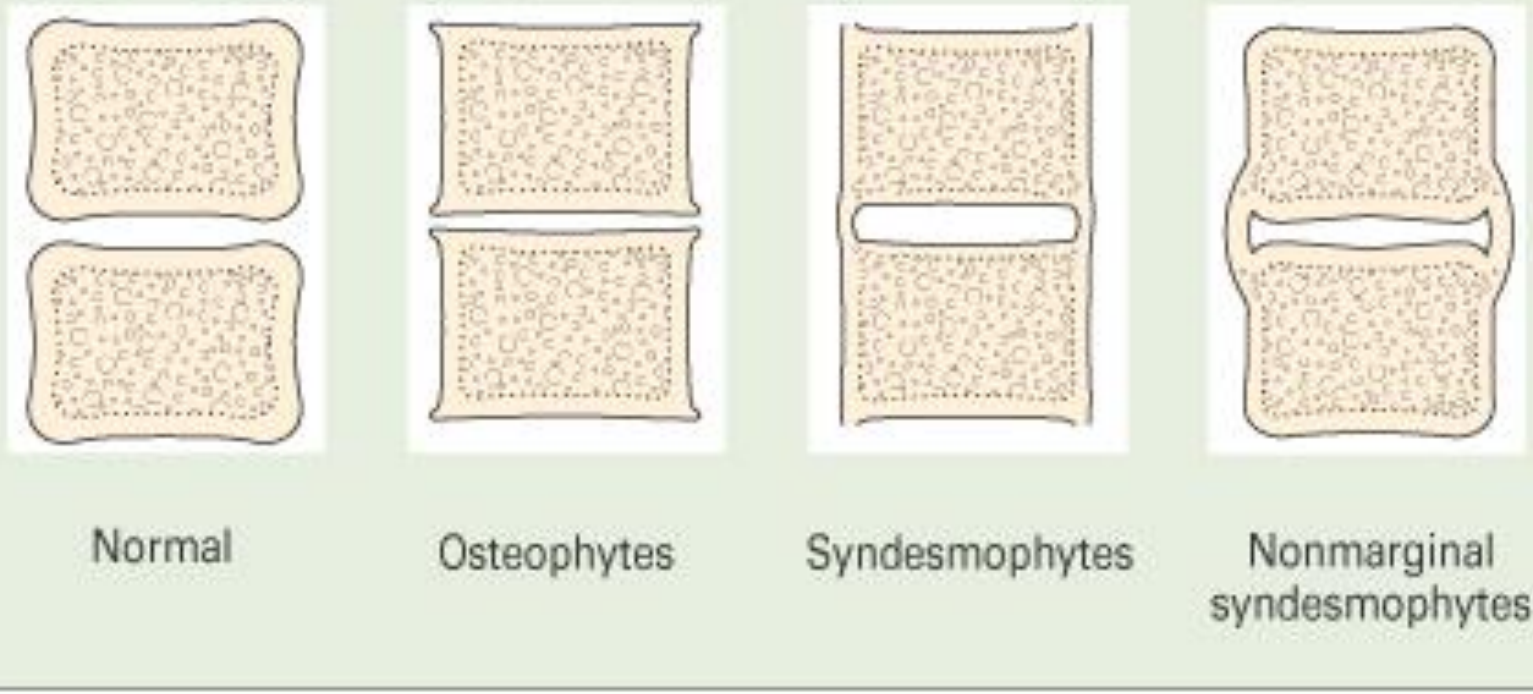
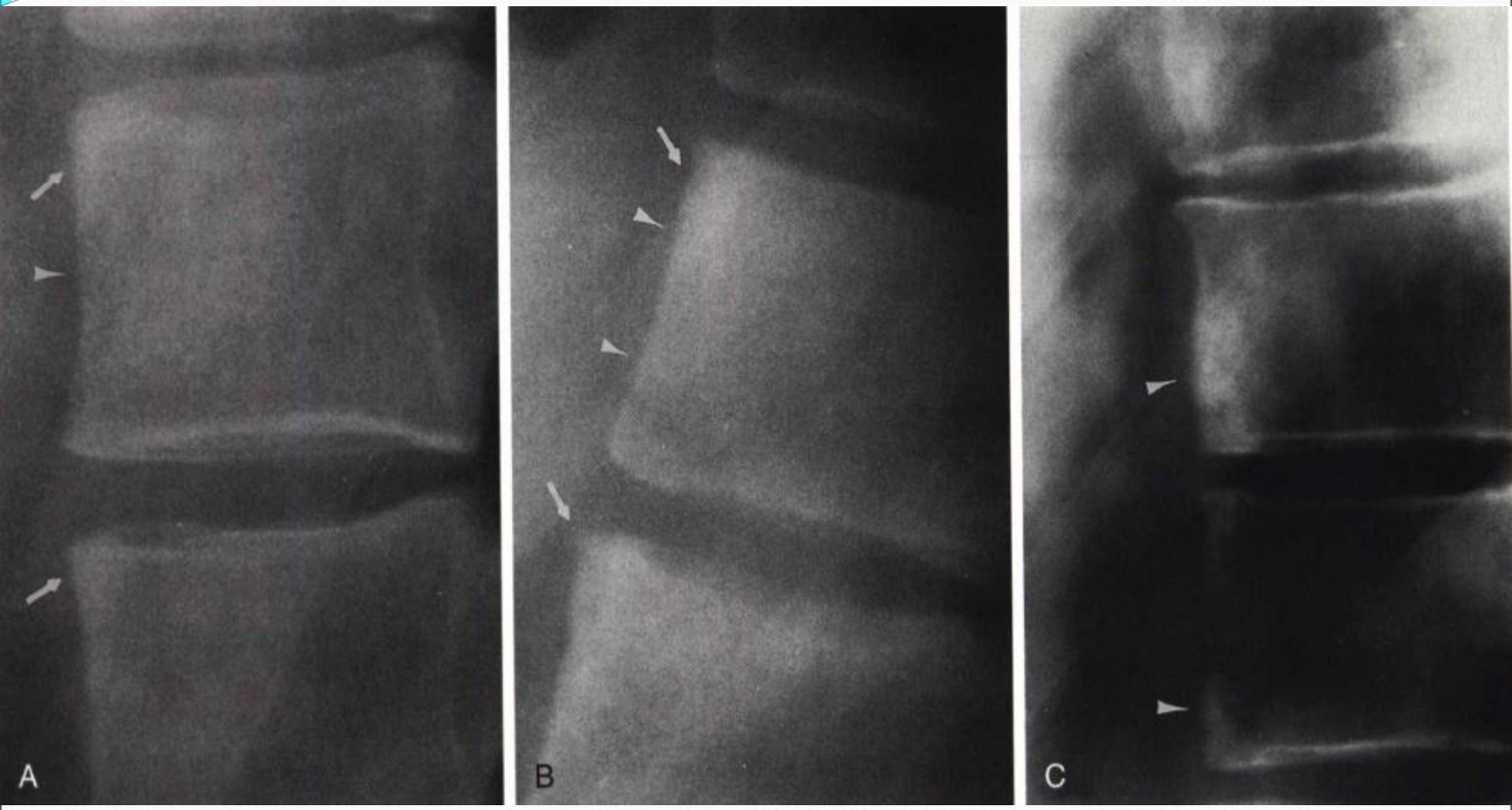
BONY CHANGES IN VERTEBRAL COLUMN

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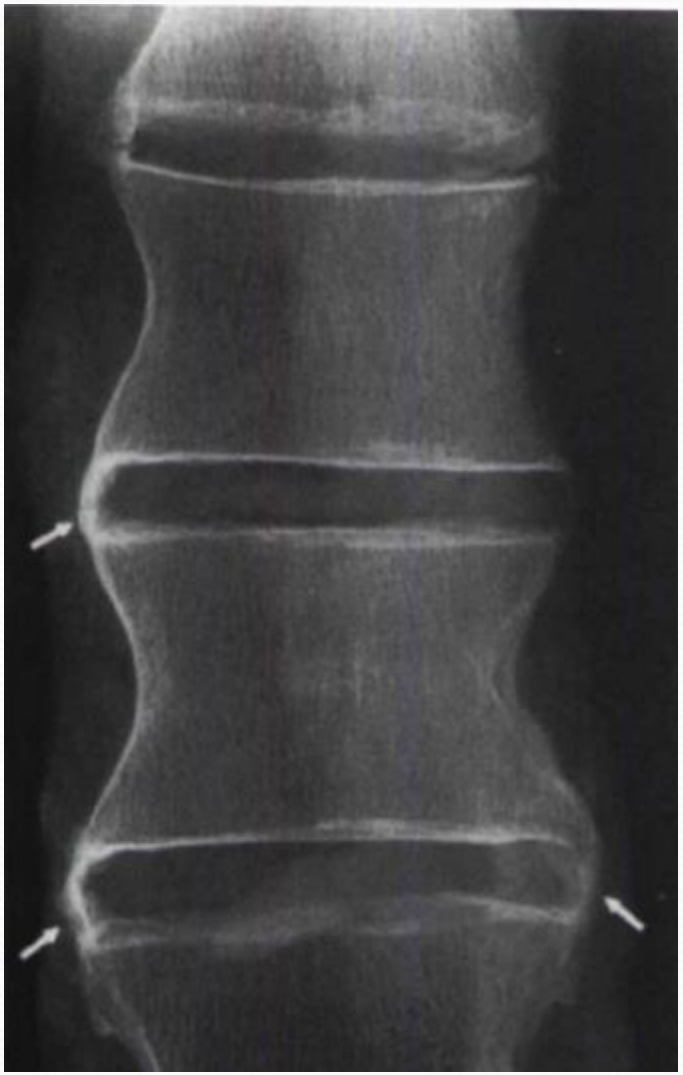
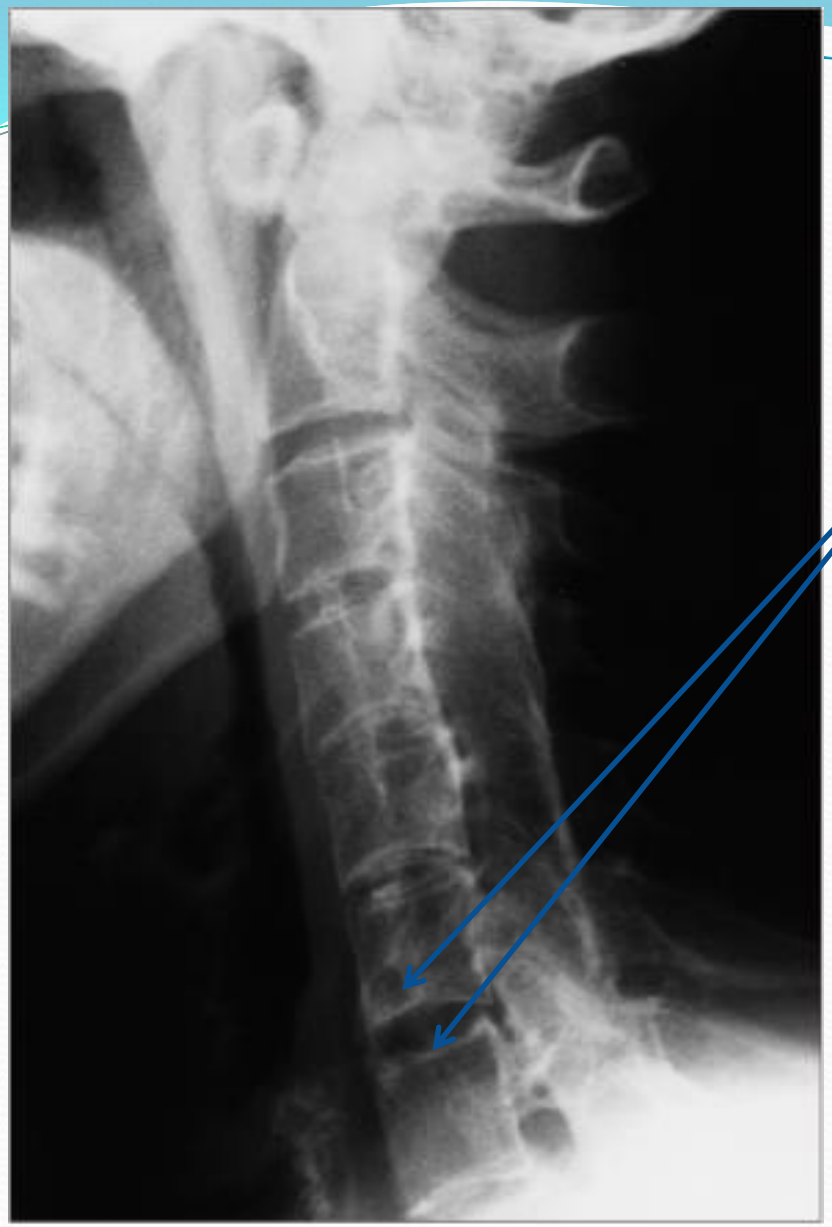


Advanced AS

Fused sacroiliac joints

Ankylosis of the lower lumbar spine (bamboo spine)



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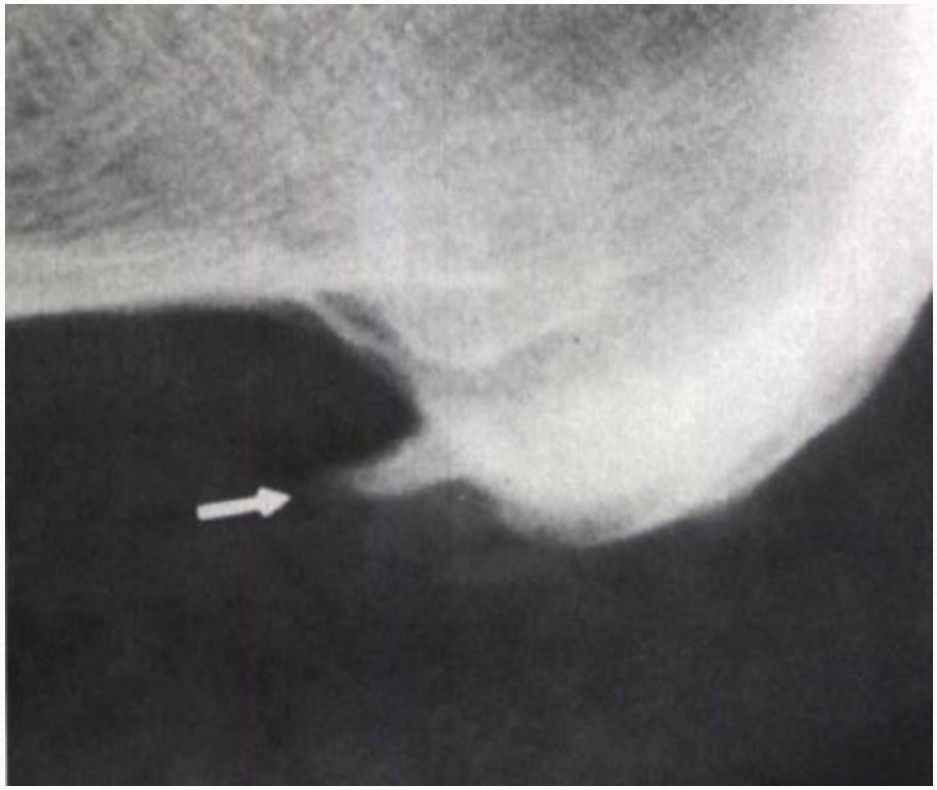
Cervical spine in AS

Shiny corners

Squaring of the vertebral bodies

Syndesmophytes



Gout

- Erosions and masses, especially in the peripheral joints
- Masses may be dense, due to crystals or associated calcification
- Erosions are juxtaarticular from adjacent soft tissue tophi or intraosseous crystal deposition
  - Appear rounded with a well circumscribed sclerotic margin
- Deformity occurs early
- Olecranon and prepatellar bursitis may calcify

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Gouty changes in the big toe

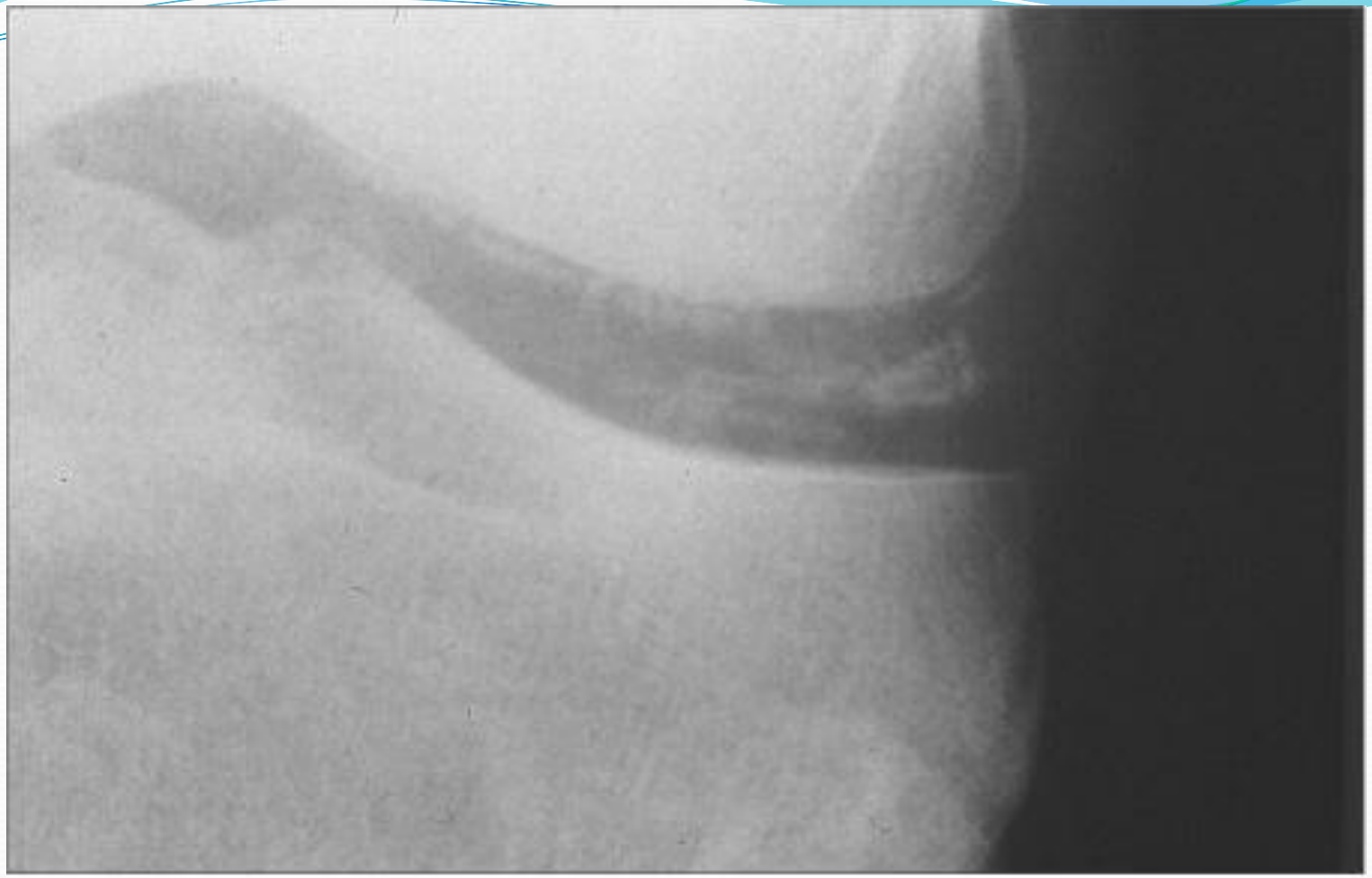
Erosions due to tophi

Olecranon bursitis with erosions due to gout

Large, destructive tophus of first MTP

Pseudogout (CPPD)

- Usually manifests as OA in an unusual distribution
- Prominant osteophytes
- Soft-tissue calcification in the joint capsule, synovium, bursa, tendons, ligaments, periarticular soft tissues
- Chondrocalcinosis (cartilage calcification)
  - Linear and regular deposits in articular cartilage, coarse deposits in fibrocartilage



Chondrocalcinosis

Calcifications at the MCPs

Chondrocalcinosis of the triangular ligament

Multiple cysts

Osteoporosis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A