Ultrasound Evaluation of Arthritis

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Fundamentals of Musculoskeletal Ultrasound are copyrighted by Elsevier Inc.

Arthritis: approach
- Degenerative:
  - Osteophytes
  - Minimal if any synovial proliferation
- Inflammatory:
  - Synovial proliferation and erosions
  - Enthesitis
- Radiographs: appearance, distribution
- Laboratory values

Arthritis: bone
- Ultrasound not very good for erosions:
  - Better than radiographs
  - 40% sensitivity\(^1\), 29% false positives\(^2\):
    wrist/hand compared with CT
  - Very non-specific, time consuming
- Adjacent synovitis adds specificity
- Correlate with radiographs, labs, distribution

Arthritis: synovitis
- Synovial locations:
  - Joint recess, bursa, tendon sheath
- Hypoechoic compared to adjacent subcutaneous fat
  - May be isoechoic or hyperechoic
- Hyperemia: variable
  - Represents activity of inflammation
  - Decreased: treatment (even NSAIDS)

\(^1\)Dohn UF M, Arthritis Res Ther 2006; 8:1
\(^2\)Finzel S. et al. Arth Rheumatism 2011; 63:1231

Cortical Irregularity

Psoriatic Arthritis
Osteoarthritis
Rheumatoid Arthritis
Normal

Backhaus M, Arthritis and Rheum 1999; 42:1232
**Synovitis: dorsal wrist**

Sagittal Plane: Radiocarpal and Mid-carpal Joints

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**Synovitis: color flow**

RA Ankle
No flow

RA ankle
Positive flow

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**Fluid versus Synovitis**

- Anechoic and compressible = simple fluid
- If not anechoic:
  - Compressible, no hyperemia = complex fluid
  - Non-compressible, hyperemia = synovitis

AJR 2000; 174: 1353

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**Outline: arthritis**

- *Rheumatoid arthritis*
- Seronegative spondyloarthritis
- Gout
- Osteoarthritis

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**Inflammatory Arthritis: role**

- Identify synovitis and erosions
  - Prior to initiating treatment
- Determine activity: hyperemia
- Aspirate or inject
- Follow-up after therapy
  - Decreased hyperemia
  - Decreased synovial thickness
Synovitis: MCP joint

Rheumatoid Arthritis

Pitfall Alert!
Pseudoerosion

- Metacarpal head: dorsal
- Up to 37% of metacarpal heads: 2nd most common
- Bare area: no hyaline cartilage
- Unlike erosion:
  - Smooth
  - Maximum depth: 2 mm
  - No adjacent synovitis

Boutry N. et al. Radiology 2004; 232:716
Rheumatoid Nodules
- Up to 20 - 30% of patients with rheumatoid arthritis
- Autoimmune response
- Sites of mechanical repetitive trauma
- Females, often asymptomatic
- Hypoechoic mass
  - Several mm to 4 cm


Outline: arthritis
- Rheumatoid arthritis
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Seronegative Spondyloarthritis
- Synovial joints:
  - Erosions, uniform joint space narrowing
  - Periostitis
- Cartilaginous joints: erosions
- Entheses:
  - Tendon and ligament attachment
  - Fluffy enthesophytes, erosions, hyperemia

Seronegative Spondyloarthritis
- Key to diagnosis: distribution
- Psoriatic: hands, feet, spine, SI joints
- Reactive arthritis: feet, SI joints
- Ankylosing spondylitis: axial skeleton, glenohumeral joints
Psoriatic Arthritis

Note: bone proliferation, erosions, synovitis, and hyperemia

3rd MCP: dorsal

Radiocarpal: dorsal

Note: joint space narrowing and extensive bone proliferation

Psoriatic Arthritis

Note: erosions, enthesitis, thick ligament, adjacent edema, and hyperemia


Psoriatic Arthritis: collateral ligament finger

Ankylosing Spondylitis

Outline: arthritis

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Tenosynovitis: ankylosing spondylitis
Gout: *intra-articular*

- Monosodium urate crystal deposition in joint
- Joint effusion\(^1\):
  - Microtophi
  - Cartilage icing: double contour sign (ultrasound)
- Synovitis
- Erosions
- Knee: common site\(^2\)

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\(^{1}\) Thiele RG, Rheumatol Int 2010; 30:495

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**Tibiotalar Joint Effusion: gout**

- Hyperechoic foci: surface of hyaline cartilage
- Does not demonstrate anisotropy
- Unlike normal cartilage interface
- Disappears with serum urate < 6 ml/dl

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**Gout: Double Contour Sign**

- Normal
- Gout
- CPPD

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From: Thiele RG, Rheumatology 2007; 46:1116
Gout: Double Contour Sign

- Ultrasound: specific
  - Hyperechoic heterogeneous with hypoechoic rim
  - “wet clump of sugar” appearance
  - Variable shadowing; even without calcification
- MRI: non-specific
  - T1w: low to intermediate
  - T2w: heterogeneous mixed signal
  - Heterogeneous enhancement

1Fernandes et al. Skeletal Radiol 2011; 40:309

Tophi

Gout: tophus

1st Metatarsophalangeal Joint

Gout: tophus and intra-articular microtophi

1st Metatarsophalangeal Joint

Gout: tibialis posterior tendon

Gout: knee

- 29% with asymptomatic hyperuricemia have tophi about the knee1
- Patellar tendon (especially distal):
  - May present clinically as a mass
- Popliteus tendon2
  - May appear as tendinosis or tear (MRI)
- Bursa and trochlear cartilage

1Puig et al. Nucleosides Nucleotides and Nucleic Acids; 2008; 27:592
Outline: arthritis

- Rheumatoid arthritis
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Osteoarthritis

- Refers to degenerative joint disease of a synovial articulation
- Secondary mild inflammation
- Imaging findings: result of cartilage damage
**Osteoarthritis:**

- Typical osteoarthritis:
  - Repetitive wear and tear on cartilage
  - After ages 40 – 50
  - Characteristic joints

**Osteoarthritis:**

- Hands:
  - Interphalangeal
  - 1st CMC joint
- Shoulder:
  - Acromioclavicular joint
- Later: knees and hips
- Feet: 1st MTP joint

**Osteoarthritis: ultrasound**

- Osteophytes
- Joint effusion
- Minimal synovial proliferation
- Variable hyperemia
- Possible intra-articular bodies

Keen HI et al. Radiol Clin N Am 2009; 47:581

**First CMC joint: osteoarthritis**

- First CMC joint: Thumb
  - Sagittal Plane: dorsal
  - Note: osteophytes (arrow) and intra-articular body (open arrow)

- Knee Osteoarthritis
  - Coronal Plane: medial
  - Note: joint space narrowing, osteophytes, meniscal extrusion
Take Home Points

- **Synovitis**
  - Diffuse involvement of a synovial space
  - Assess activity: hyperemia

- **Erosions**
  - Ultrasound: not sensitive or specific
  - Look for synovitis to add specificity
  - Compare with radiographs!

- **Enthesitis**
  - Ligament and tendon attachments
  - Bone proliferation: ligament, tendon
  - Possible erosions and hyperemia
  - Adjacent soft tissue inflammation

- **Bone proliferation**
  - Cortical irregularity
  - Not confined to synovial surfaces

- **Gout**
  - Characteristic ultrasound features
    - Double contour sign
    - Tophi
    - Echogenic fluid / synovitis
  - Characteristic location and distribution

Inflammatory Arthritis: wrist / hand

- **Rheumatoid:** synovial
  - Wrist: radioulnar, radiocarpal, midcarpal
  - MCP/PIP: dorsal
  - Tendon sheaths: especially ECU
- **Psoriatic:** synovial + enthesis
  - Ligament and tendon attachments
  - Focus where symptomatic or abnormal x-rays
- **Osteoarthritis:** DIP, 1st CMC

Inflammatory Arthritis: ankle / foot

- **Rheumatoid:** synovial
  - Ankle joint: anterior recess
  - MTP/PIP: dorsal (esp. 5th metatarsal head)
- **Psoriatic:** synovial + enthesis
  - Ligament and tendon attachments
  - Focus where symptomatic or x-ray findings
- **Gout:** 1st metatarsal medial
- **Osteoarthritis:** 1st MTP joint

Ultrasound: arthritis diagnosis

- To add specificity of ultrasound findings:
  - Correlate with history
  - Correlate with lab values
  - Review radiographs!
  - Look at distribution
Syllabus on line and other educational material:
www.jacobsonmakus.com

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