Ultrasound Evaluation of Arthritis

Jon A. Jacobson, M.D.
Professor of Radiology
Director, Division of Musculoskeletal Radiology
University of Michigan

Disclosures:
- Consultant: BioClinica
- Advisory Board: Philips
- Book Royalties: Elsevier
- Not relevant to this talk

Note: all images from the textbook
Fundamentals of Musculoskeletal Ultrasound are copyrighted
by Elsevier Inc.

Outline: arthritis
- Rheumatoid arthritis
- Seronegative spondyloarthritis
- Gout
- Osteoarthritis

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: dorsal wrist
Sagittal Plane: Radiocarpal and Mid-carpal Joints

Synovitis: MCP joint
Sagittal Plane: 2nd MCP Joint
Pitfall Alert! Normal Joint Capsule Appearance

- 200 hands/wrists
- Dorsal capsule thickness:
  - Metacarpal 1: 6 mm
  - Metacarpal 2: 4 mm
  - Metacarpal 3-5: 3 mm
  - Radiocarpal joint: 4 mm
  - Midcarpal joint: 3 mm
- Do not interpret as abnormal synovial hypertrophy

*Unpublished Data

Arthritis: bone

- Ultrasound not very good for erosions:
  - Better than radiographs
  - 40% sensitivity, 29% false positives
  - Very non-specific, time consuming
- Adjacent synovitis adds specificity
- Correlate with radiographs, labs, distribution

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

Cortical Irregularity

Psoriatic Arthritis

Osteoarthritis

Rheumatoid Arthritis

Normal

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
Pitfall Alert! Pseudoerosions Are Everywhere!

- 200 hands/wrists
- Pseudoerosions: 100%
- Metacarpal heads: all
  - 2nd: 92%
  - 3rd: 86%
- Carpal bones:
  - Lunate: 82%
  - Triquetrum: 84%
  - Distal ulna: 22%

*Unpublished Data

*Note lack of adjacent synovitis

Rheumatoid Arthritis

Erosion + Synovitis

5th MT erosion: 69% sensitivity, 85% specificity for RA


Bursitis and Erosion: Rheumatoid Arthritis

• Achilles
• Calcaneus

Tenosynovitis: rheumatoid arthritis

Short Axis
Long Axis: color Doppler

Outline: arthritis

- Rheumatoid arthritis
- Seronegative spondyloarthritis
- Gout
- Osteoarthritis

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

Psoriatic Arthritis: collateral ligament finger

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

Ankylosing Spondylitis

Outline: arthritis

- Rheumatoid arthritis
- Seronegative spondyloarthritis
- Gout
- Osteoarthritis
Gout: \textit{intra-articular}

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

\textsuperscript{1}Thiele RG, Rheumatol Int 2010; 30:495
\textsuperscript{2}Miguel et al. Ann Rheum Dis 2012; 71:157

---

Tibiotalar Joint Effusion: gout

- Sagittal
- Axial

---

Gout

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

\textsuperscript{2}Thiele RG, Rheumatol Int 2010; 30:495

---

Gout: Double Contour Sign

- Normal
- Gout
- CPPD

\textsuperscript{From: Thiele RG, Rheumatology 2007; 46:1116}

---
Gout: Double Contour Sign

1st MTP Joint  Ankle Joint

Gout: tophus

1st Metatarsophalangeal Joint

Gout: tophus and intra-articular microtophi

1st Metatarsophalangeal Joint

Gout: tibialis posterior tendon

Gout: patellar tendon

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

Gout: knee

- 29% with asymptomatic hyperuricemia have tophi about the knee
- Patellar tendon (especially distal): May present clinically as a mass
- Popliteus tendon
  - 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
- Seronegative spondyloarthritis
- Gout
- Osteoarthritis

Osteoarthritis: ultrasound

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

First CMC Joint: Thumb

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!

Take Home Points
- 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

Take Home Points
- 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, first 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.jacobsonmskus.com

Twitter handle: @jacobsn