Joint Pathology, Screening For Synovitis, and Pulley Injuries

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Joint Effusion: wrist
• Radiocarpal joint
• Midcarpal joint
• Distal radioulnar joint

Joint Effusion and Synovitis
• Distention of joint recesses
  – Anechoic: simple fluid
  – Other: complicated fluid or synovium
• Sonography cannot differentiate sterile from septic joint fluid

AJR 2000; 174: 1353
**Inflammatory Arthritis: role**

- Identify synovitis and erosions
  - Prior to initiating treatment
- Determine activity: hyperemia
- Aspirate or inject
- Follow-up after therapy
  - Decreased hyperemia and synovial thickness
  - Lack of synovial thickness improvement at 3 months predicts progression*

*Chen YC et al J Clin Rheum 2017; 23:73

**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)

Backhaus M, Arthritis and Rheum 1999; 42:1232

**Synovitis: dorsal wrist**

- Sagittal Plane: Radiocarpal and Mid-carpal Joints

**Synovitis: MCP joint**

- Sagittal Plane: 2nd MCP Joint

**Synovitis: US and MRI**

- Many studies limited
  - Clinical exam as gold standard
- Both US and MRI more sensitive compared to radiography
- Both can show activity of disease
  - US: color and power Doppler
  - MRI: enhancement
- US equal compared to MRI

Backhaus M, Arthritis and Rheum 1999; 42:1232

**Rheumatoid Arthritis**

- Sagittal Plane: 5th PIP
Gout

- Double Contour Sign
- Tophus

Erosions

- Cortex and subchondral bone plate: normally smooth and echogenic
- Erosions:
  - Disrupted cortex, two planes
  - Adjacent synovitis (if active)
- US better than radiographs
- 29% false-positive rate compared to CT

Finzel S. et al. Arth Rheumatism 2011; 63:1231

Rheumatoid Arthritis

- Erosions: US and MRI
  - Many studies limited
    - Variable or absent gold standards
  - MCP joints (CT as gold standard):
    - Radiography 19% sensitivity
    - MRI: 68% sensitivity
    - US: 42% sensitivity
  - Limitations: access to erosions

Dohn UF M, Arthritis Res Ther 2006; 8:1

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
**Psuedoerosion:**
dorsal metacarpal head

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**Psuedoerosions**

3rd MCP: sagittal
Lunate

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**Psoriatic Arthritis**

Radius
Capitate
Lunate

Dorsal: transverse
Dorsal: sagittal

Note: joint space narrowing and extensive bone proliferation

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**Cortical Irregularity**

Psoriatic Arthritis
Osteoarthritis

Rheumatoid Arthritis
Normal

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**Erosions: specificity**

- To add specificity to bone irregularity:
  - Correlate with history
  - Correlate with lab values
  - Review radiographs!
  - Look at distribution
  - Evaluate for adjacent synovitis (if acute)

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**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
- Osteoarthritis: DIP, first CMC
**Synovitis:** screening (<10 minutes)

- **Hand and wrist:** (6 joints – actually 10)
  - Radiocarpal, midcarpal, distal radioulnar (dorsal)
  - MCP2 and 3 (dorsal): transverse and sagittal
  - Any symptomatic site
  - Cine: flexor and extensor tendons (short axis)
- **Ankle and Foot:**
  - Ankle joint
  - MTP5 (dorsal and plantar)
  - Any symptomatic site


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**Pulley Tear**

- **A2 and A4 pulleys:** most important
- Sagittal image
  - Bowstringing
  - Hypoechoic edema / hemorrhage
- Dynamic evaluation*

*Radiology 2002; 222:755

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**A2 – 4 Pulley Injury**

![Image of normal and injured phalanges](image)

**A4 Pulley Injury: bowstringing**

![Image of normal and injured phalanges](image)

Normal: < 1 mm, incomplete rupture: 1 – 3 mm, complete: 3 mm

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**Flexor Digitorum Longus Avulsion and Pulley A4 Tear**

![Image of normal and injured tendons](image)

**Trigger Finger:**

- Stenosing tenosynovitis: A1 pulley
- Thick and hypoechoic pulley
- Hyperemia: 91%
- Tendinosis: 48%
- Tenosynovitis: 55%

**Take Home Points**

- Joint evaluation: dorsal recesses
  - Fluid: compressible and not color flow
- Inflammatory arthritis:
  - Emphasize synovitis
  - Hyperemia
  - Erosions: many pitfalls
- Pulley injuries
  - Bowstringing

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