

Ultrasound of Arthritis: Pathology and Scanning Protocol

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Disclosures

- Consultant: Bioclinica
- Advisor: Philips
- Book Royalties: Elsevier
- Not relevant to this lecture

*Note: all images from the textbook
Fundamentals of Musculoskeletal Ultrasound are
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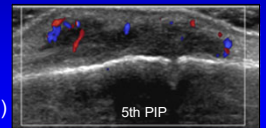
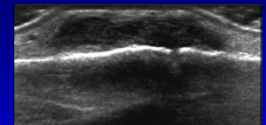
Arthritis: approach

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

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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)

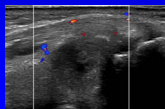
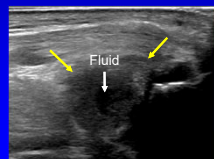
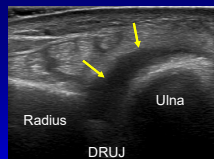


Backhaus M, Arthritis and Rheum 1999; 42:1232

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Joint Effusion vs Synovial Hypertrophy

- Anechoic: fluid
 - Hypoechoic:
 - Effusion vs. synovial hypertrophy
 - Compressible: fluid
 - Internal hyperemia: synovitis
- *flow may be absent

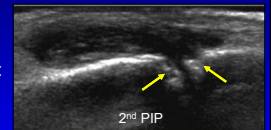


AJR 2000; 174: 1353

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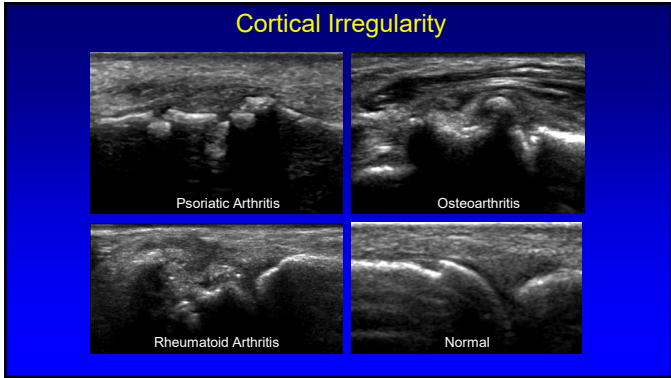
Erosions

- Disrupted cortex in 2 planes
- Ultrasound not very good for erosions:
 - Better than radiographs
 - 40% sensitivity¹, 29% false positives²: wrist/hand compared with CT
 - 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

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Outline: arthritis

- Rheumatoid arthritis
- Spondyloarthropathy
- 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

Radius Lunate Capitate

Rheumatoid Arthritis

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Joint Assessment: dorsal

- Wrist:
 - Radiocarpal joint (RC)
 - Midcarpal joint (MC)
 - Distal or inferior radioulnar joint (IRU)
- Hand:
 - MCP and PIP joints
 - 1st CMC (if symptomatic)

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Synovitis: MCP joint

MC2 PP

Sagittal Plane: 2nd MCP Joint

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Pitfall Alert! Normal Joint Capsule Appearance

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

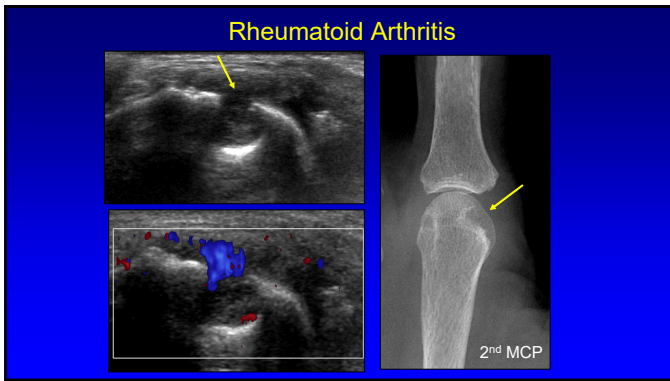
** Falkowski A et al. Eur J Radiology 2020; 124*

MCP2 PP

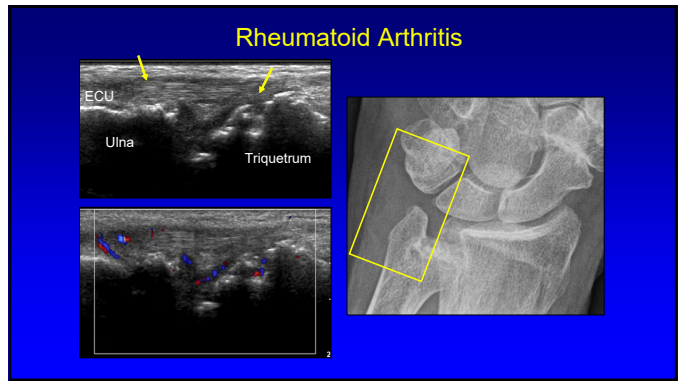
Radius Lunate Capitate

**Note normal echogenic triangular fibrocartilage (white arrow)*

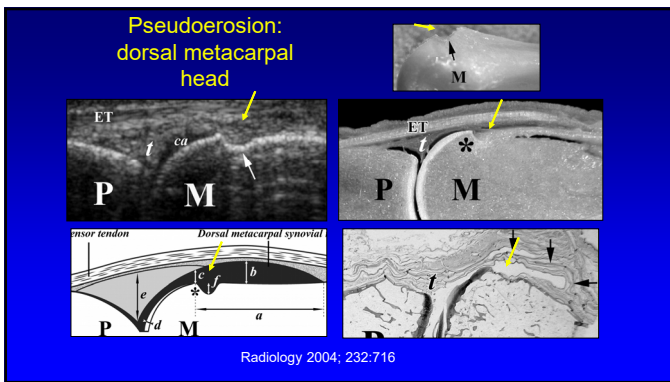
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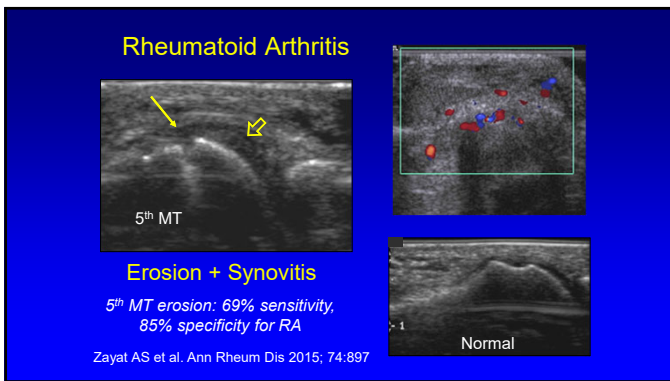
Pitfall Alert! Pseudoerosions Are Everywhere!

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

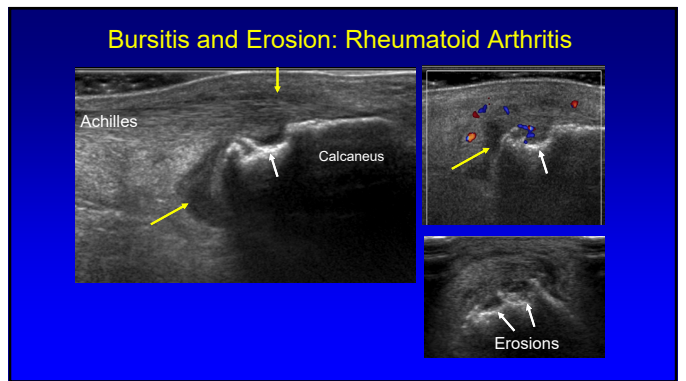
**Falkowski A et al. Eur J Radiology 2020; 124*

**Note lack of adjacent synovitis*

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Tenosynovitis (paratenonitis):

- Simple fluid: anechoic
- Complex fluid: mixed echogenicity
- Synovitis:
 - Hypoechoic
 - Echogenic if gout

Rheumatoid Arthritis

Short Axis

Long Axis

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Tenosynovitis: rheumatoid arthritis

Short Axis

Long Axis: color Doppler

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Outline: arthritis

- Rheumatoid arthritis
- Spondyloarthropathy
- Gout
- Osteoarthritis

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Spondyloarthropathy

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

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Spondyloarthropathy

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

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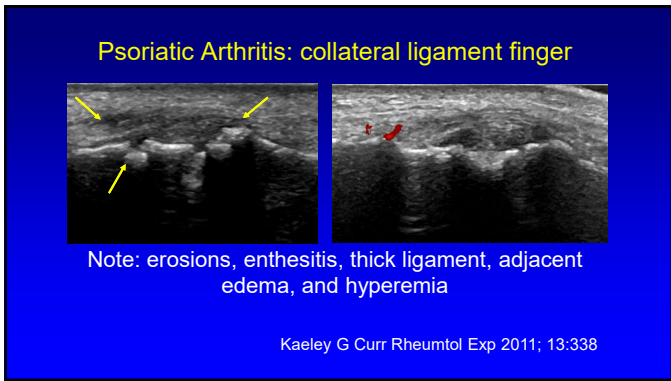
Psoriatic Arthritis

Dorsal: sagittal

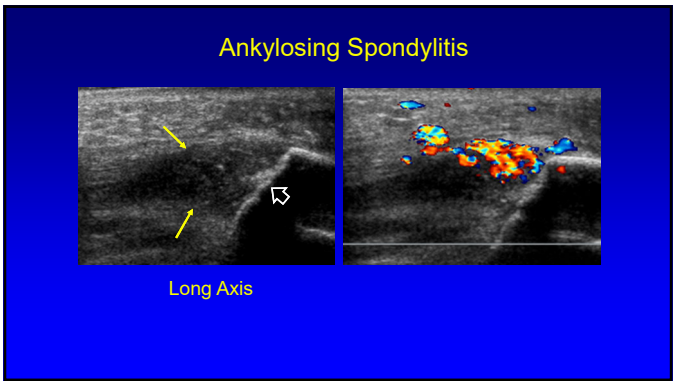
Dorsal: transverse

Note: joint space narrowing and extensive bone proliferation

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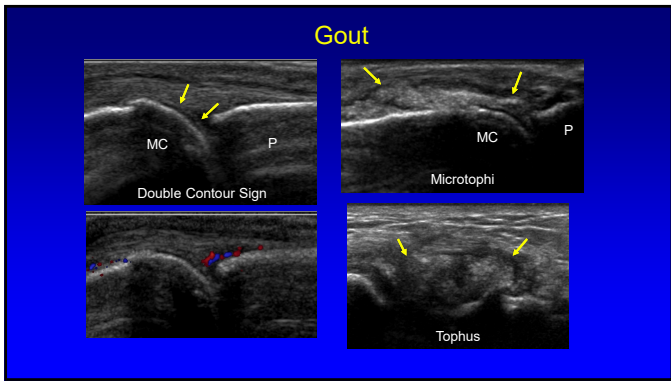
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- ### Outline: arthritis
- Rheumatoid arthritis
 - Spondyloarthropathy
 - **Gout**
 - Osteoarthritis

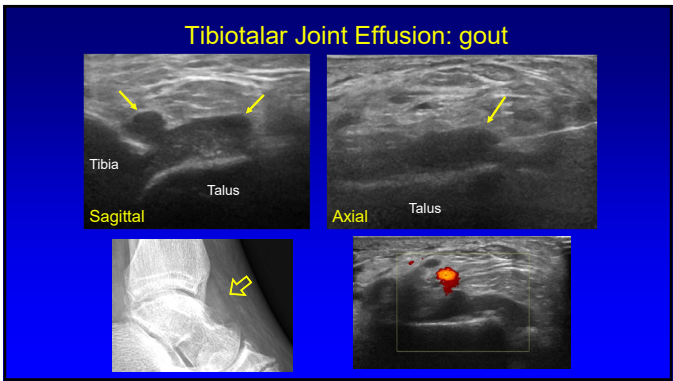
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- ### Gout: *intra-articular*
- Monosodium urate crystal deposition in joint
 - Joint effusion¹:
 - Microtophi
 - Cartilage icing: double contour sign (ultrasound)
 - Synovitis
 - Erosions
 - Knee: common site²
- ¹Thiele RG, Rheumatol Int 2010; 30:495
²Miguel et al. Ann Rheum Dis 2012; 71:157

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Gout: Double Contour Sign

Normal

Gout

CPPD

From: Thiele RG, Rheumatology 2007; 46:1116

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Tophi

- Hyperechoic heterogeneous with hypoechoic rim
- Tiny internal speckles*
- “wet clump of sugar” appearance
- Variable shadowing: even without calcification

MT PP

Fernandes et al. Skeletal Radiol 2011; 40:309

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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

²Ko et al. J Clin Rheum 2010; 16:209

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Gout: patellar tendon

P Tibia T1w T2w + fat saturation

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Gout: popliteus

Femur Tibia T2w T2w

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Gout: olecranon bursa

Olecranon

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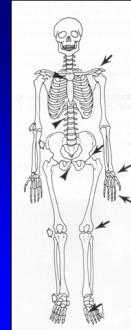
Outline: arthritis

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Osteoarthritis:

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

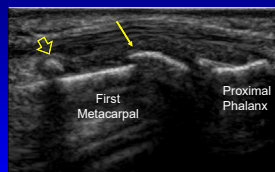


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Osteoarthritis: ultrasound

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

First CMC Joint: Thumb



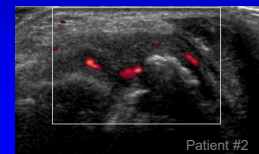
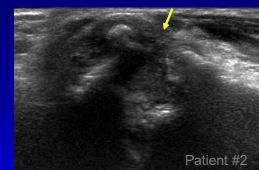
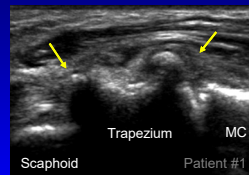
Sagittal Plane: dorsal

Note: osteophytes (arrow) and intra-articular body (open arrow)

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

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First CMC joint: osteoarthritis



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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!

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Take Home Points

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

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Inflammatory Arthritis: wrist / hand

- Rheumatoid: **synovial**
 - Wrist (dorsal): radioulnar, radiocarpal, midcarpal
 - MCP/PIP: dorsal 2nd and 3rd MCP joints
 - Tendon sheaths: especially ECU
- Psoriatic: **synovial + enthesitis**
 - Ligament and tendon attachments
 - Focus where symptomatic or abnormal x-rays
- Osteoarthritis: **DIP, first CMC**

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Inflammatory Arthritis: ankle / foot

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

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Ultrasound: arthritis diagnosis

- To add specificity of ultrasound findings:
 - Correlate with history
 - Correlate with lab values
 - Review radiographs!
 - Look at distribution

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Thank you!



Syllabus on line and other educational material:
www.jacobsonmskus.com



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