

Ultrasound Evaluation of Arthritis

Jon A. Jacobson, MD
FACR, FSRU, FAIM, RMSK

Musculoskeletal Radiologist
Lenox Hill Radiology, NYC

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Disclosures

- Book Royalties: Elsevier
- Consultant: Bioclinica
- Advisory Board: POCUSPRO
- Not relevant to this talk

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

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Arthritis: approach

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

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Inflammatory Arthritis:

- Non-specific findings:
 - Joint effusion
 - Synovitis and erosions
 - Tenosynovitis and bursitis
- Rely on history and distribution of abnormalities

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Inflammatory Arthritis:

- Rheumatoid arthritis:
 - MCP joints in hand
 - MTP joints (especially 5th)
 - PIP and 1st IP joints (great toe)
- Seronegative spondyloarthropathy
 - Variable distal joint distribution
 - Periosteal new bone formation
 - Inflammatory enthesopathy

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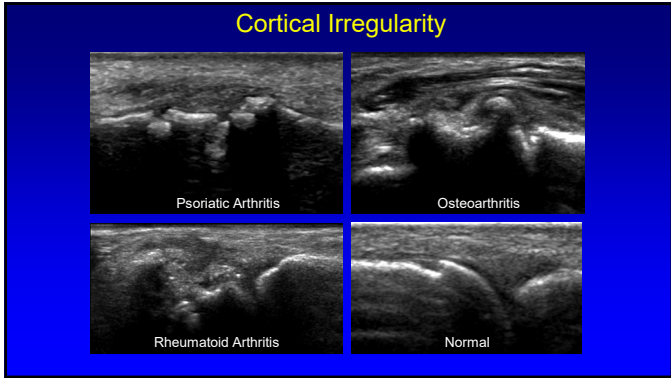
Arthritis: bone

- 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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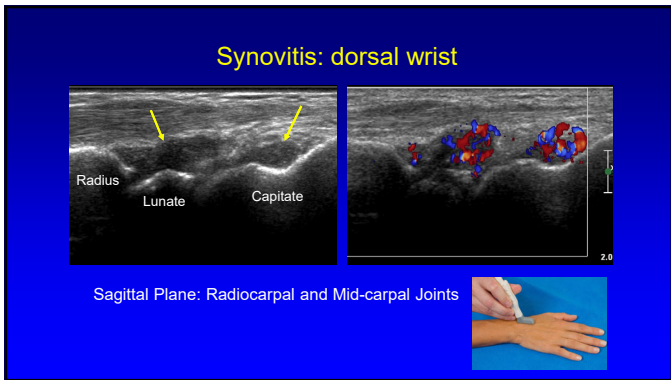
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Arthritis: synovitis

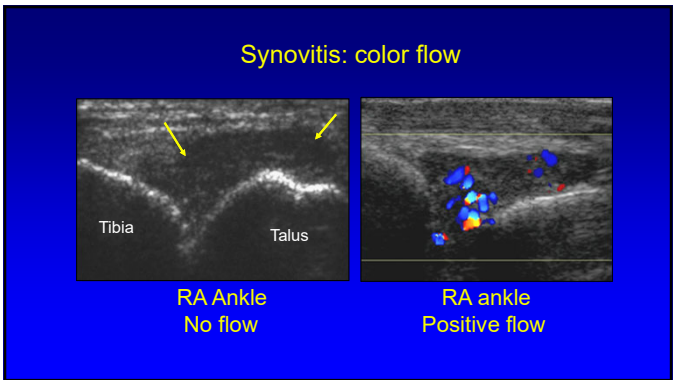
- Synovial locations:
 - Joint recess, bursa, tendon sheath
- Hypoechoic compared to adjacent subcutaneous fat
 - May be isoechoic or hyperechoic
- Hyperemia: variable
 - Represents activity of inflammation
 - Decreased: treatment (even NSAIDS)

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

The image contains two ultrasound panels of the DRUJ. The top panel shows the Radius and Ulna with yellow arrows pointing to a hypoechoic area. The bottom panel shows a similar area with a white arrow pointing to a more anechoic area labeled "Fluid".

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Outline: arthritis

- Rheumatoid arthritis
- Seronegative spondyloarthritis
- Gout
- Osteoarthritis

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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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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

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Synovitis: MCP joint

Sagittal Plane: 2nd MCP Joint

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Rheumatoid Arthritis

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Pitfall Alert! Normal Joint Capsule Appearance

- Dorsal capsule thickness:
 - MCP 1: 6 mm
 - MCP 2: 4 mm
 - MCP 3-5: 3 mm
 - RC joint: 4 mm
 - MC joint: 3 mm
- Do not interpret as abnormal synovial hypertrophy

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

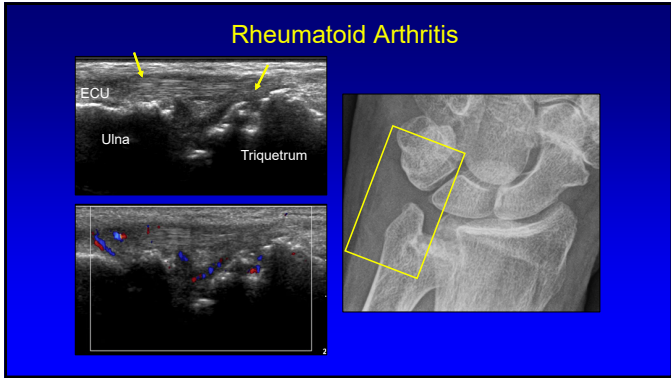
**Note normal echogenic triangular fibrocartilage (white arrow)*

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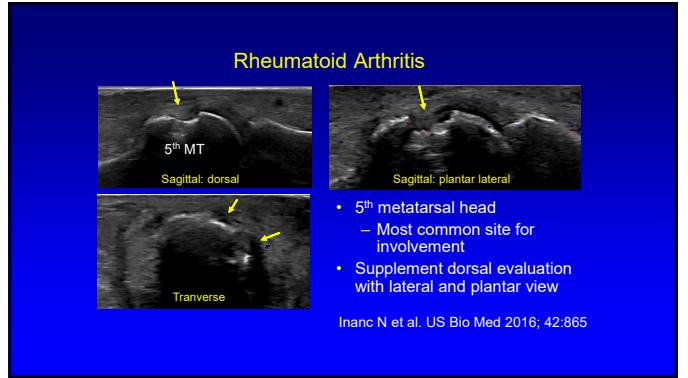
Rheumatoid Arthritis

2nd MCP

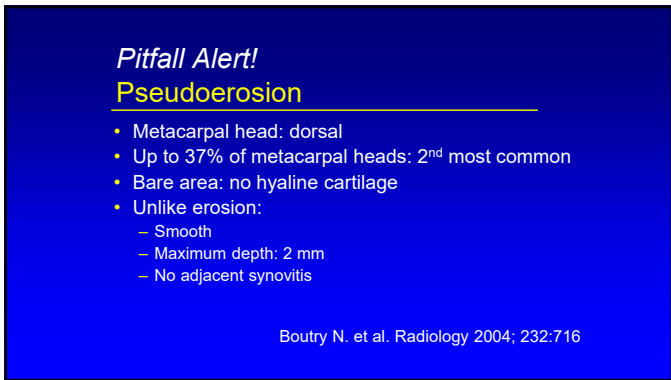
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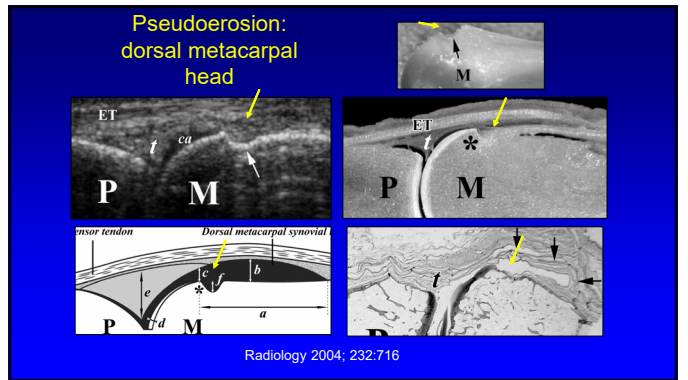
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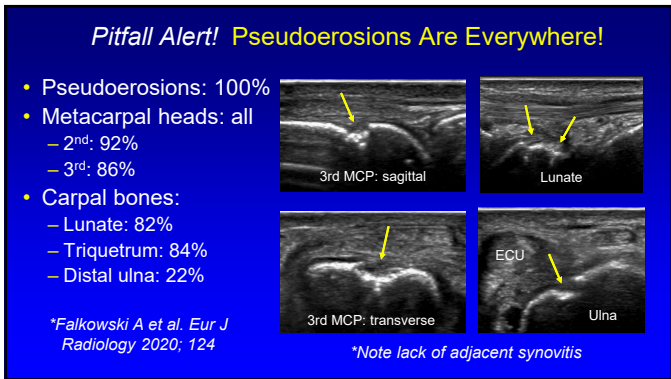
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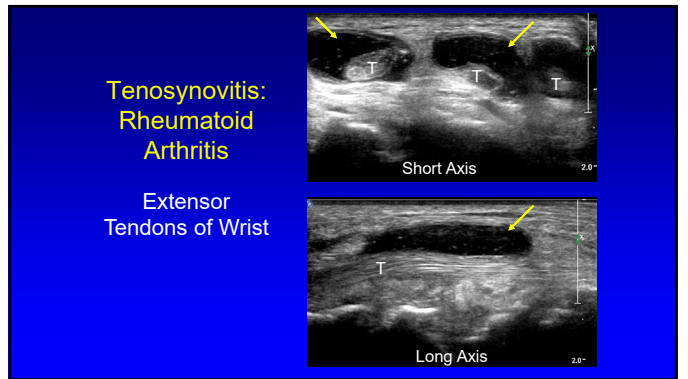
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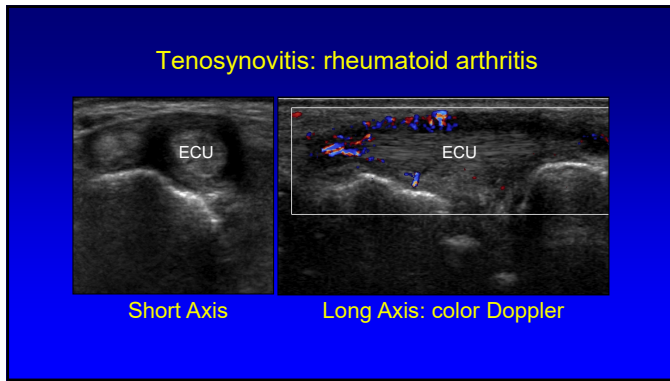
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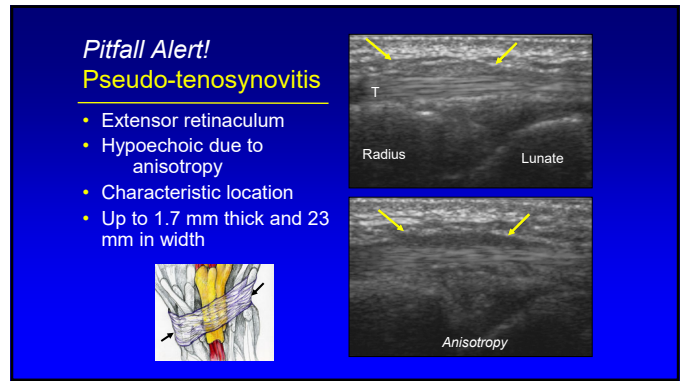
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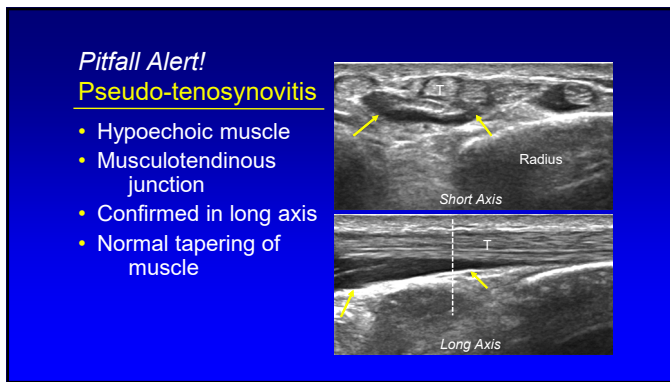
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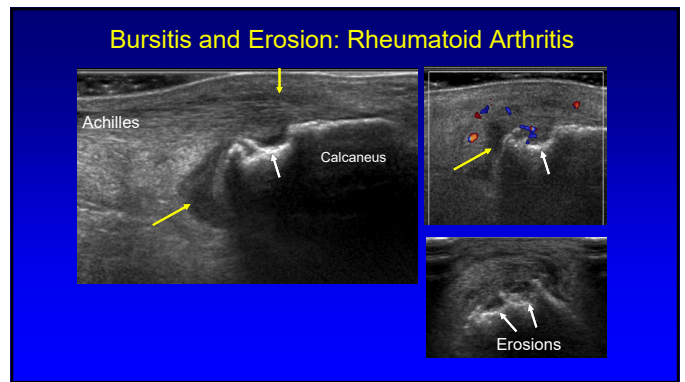
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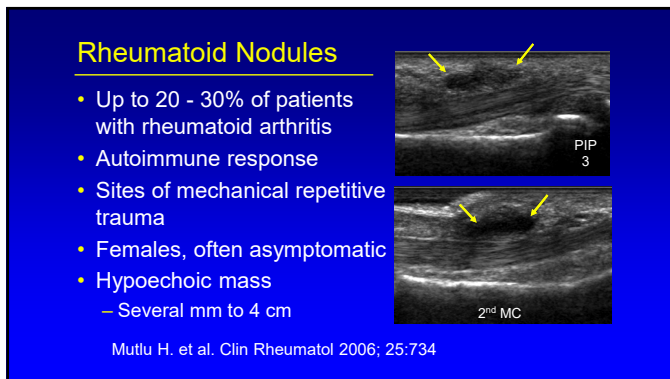
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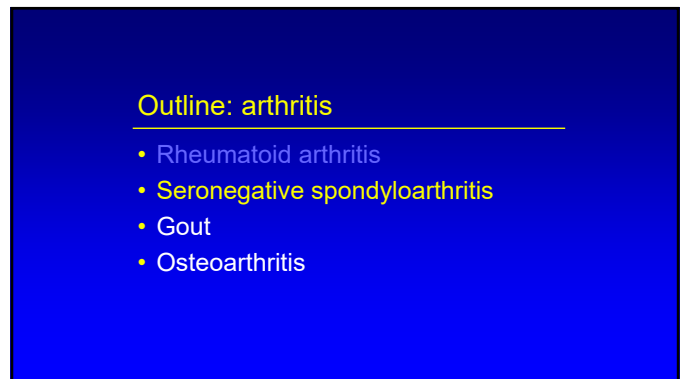
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Seronegative Spondyloarthritis

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

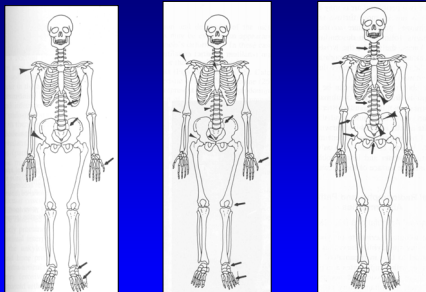
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Seronegative Spondyloarthritis

- 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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Seronegative Spondyloarthritis

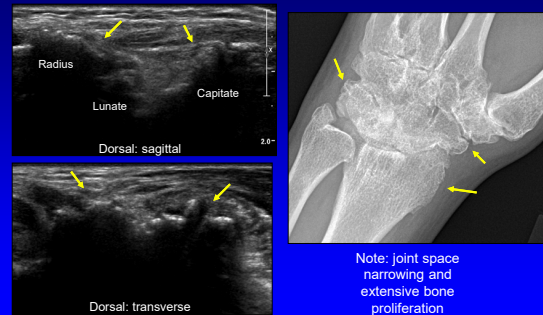


Psoriatic Arthritis Reactive Arthritis Ankylosing Spondylitis

From:
Resnick,
Diagnosis
of Bone
and Joint
Disorders

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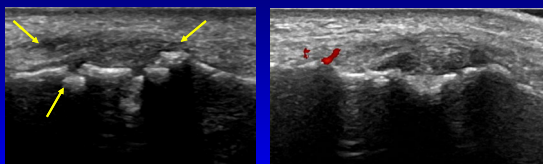
Psoriatic Arthritis



Note: joint space narrowing and extensive bone proliferation

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Psoriatic Arthritis: collateral ligament finger



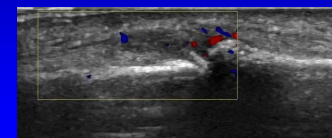
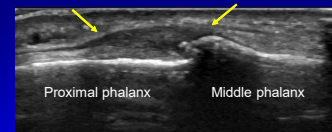
Note: erosions, enthesitis, thick ligament, adjacent edema, and hyperemia

Kaeley G Curr Rheumatol Exp 2011; 13:338

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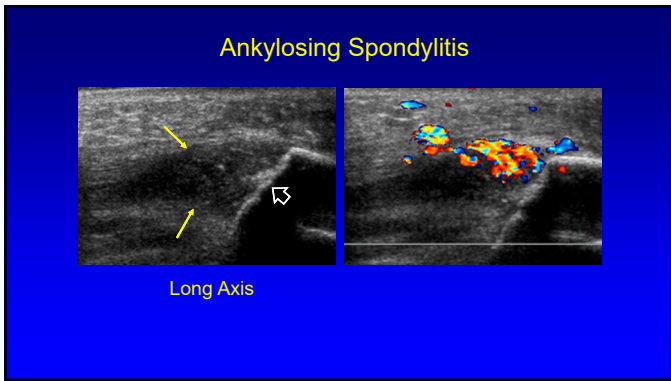
Psoriatic Arthritis: extensor tendon

- Enthesitis:
 - Thick tendon
 - Irregular bone
 - Hyperemia

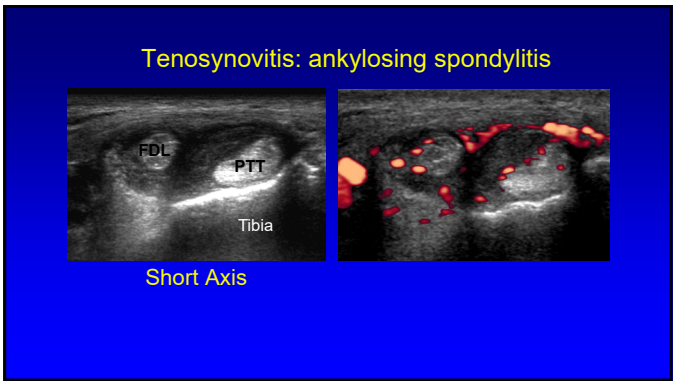


*Correlation with radiography is helpful to show "fuzzy" cortex with inflammatory enthesitis

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

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Gout: crystal deposition

- Monosodium urate: negative birefringence
- Intra-articular:
 - Effusion, synovitis
 - Microtophi: double contour sign
- Tophi:
 - Associated with erosions
 - First metatarsophalangeal joint

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Gout: Double Contour Sign

Normal

Gout

CPPD

Il knee transi supradat

From: Thiele RG, Rheumatology 2007; 46:1116

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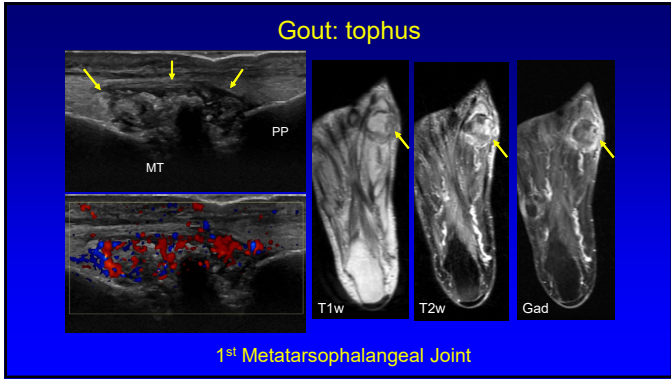
Tophi

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

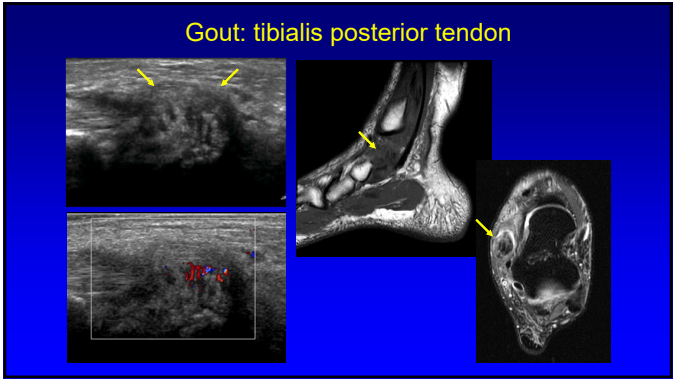
MT PP

Fernandes et al. Skeletal Radiol 2011; 40:309

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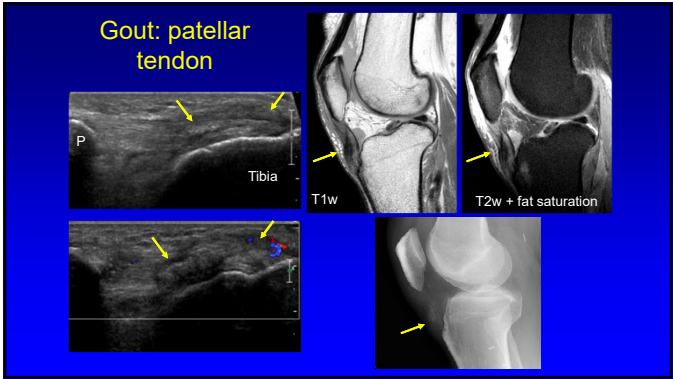
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Gout: knee

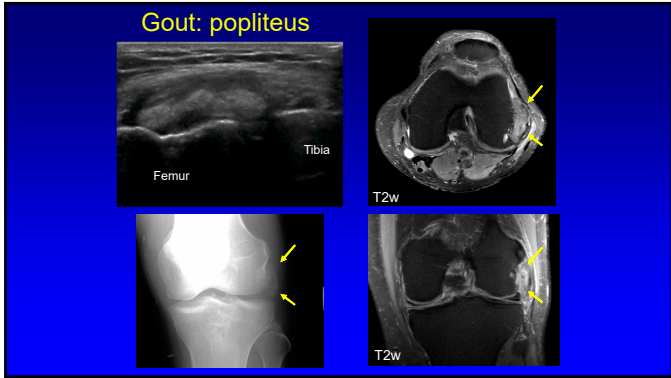
- 29% with asymptomatic hyperuricemia have tophi about the knee¹
- Patellar tendon (especially distal):
 - May present clinically as a mass
- Popliteus tendon²
 - May appear as tendinosis or tear (MRI)
 - Most common tendon site for gout in knee³
- Bursa and trochlear cartilage

¹Puig et al. Nucleosides Nucleotides and Nucleic Acids; 2008; 27:592
²Ko et al. J Clin Rheum 2010; 16:209
³Mallinson PI et al. Skeletal Radiol 2014; 43:277

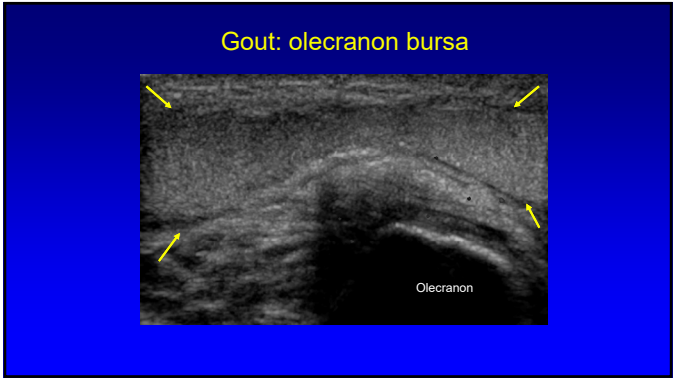
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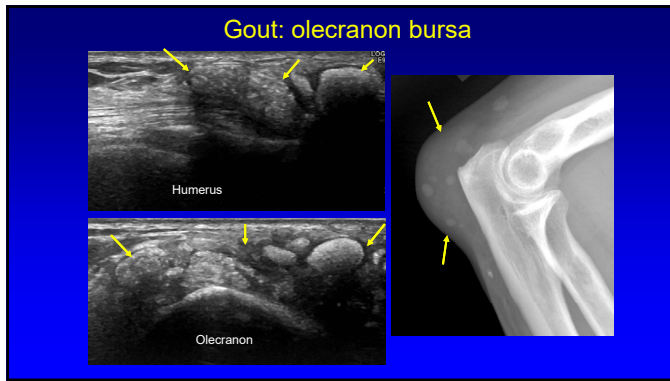
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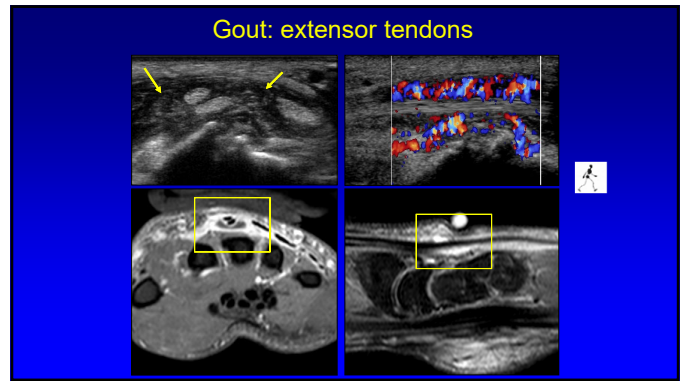
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- Outline: arthritis**
- Rheumatoid arthritis
 - Seronegative spondyloarthritis
 - Gout
 - **Osteoarthritis**

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

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

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

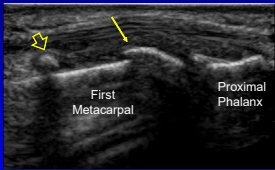
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Osteoarthritis: ultrasound

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

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

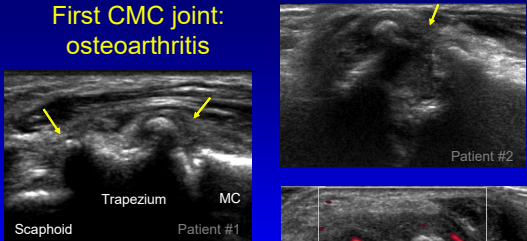
First CMC Joint: Thumb



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


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First CMC joint: osteoarthritis



Scaphoid Trapezium MC Patient #1

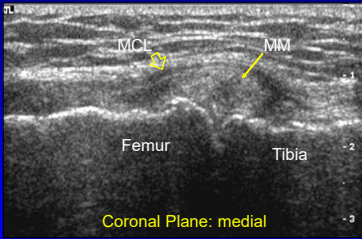
Patient #2



Patient #2

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Knee Osteoarthritis



MCL MM
 Femur Tibia

Coronal Plane: medial

Note: joint space narrowing, osteophytes, meniscal extrusion

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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

- 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

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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: radioulnar, radiocarpal, midcarpal
 - MCP/PIP: dorsal
 - Tendon sheaths: especially ECU
- Psoriatic: synovial + entheses
 - 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 + entheses
 - Ligament and tendon attachments
 - Focus where symptomatic or x-ray findings
- Gout: 1st metatarsal medial
- Osteoarthritis: 1st MTP joint

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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

Rosa J et al. J Clin Rheumatol 2016; 22: 179

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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

Twitter handle: @jjacobsn

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