

# Ultrasound Evaluation of Arthritis

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1

## Disclosures

- Consultant: Bioclinica
- Contractor: POCUS PRO
- Advisory Board: Philips
- Book Royalties: Elsevier
- Not relevant to this lecture

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Fundamentals of Musculoskeletal Ultrasound  
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2

## Arthritis: approach

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

3

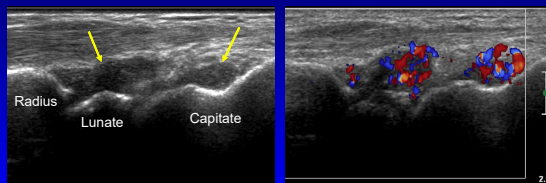
## Arthritis: synovitis

- 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

4

## Synovitis: dorsal wrist

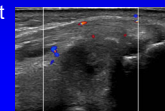
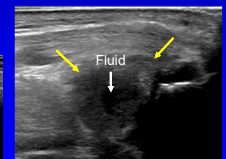
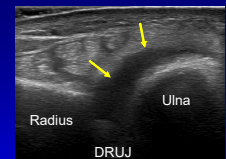


Sagittal Plane: Radiocarpal and Mid-carpal Joints

5

## 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

6

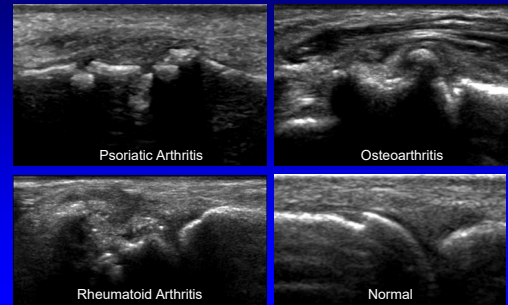
### Arthritis: bone

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

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

7

### Cortical Irregularity



8

### Outline: arthritis

- Rheumatoid arthritis
- Seronegative spondyloarthritis
- Gout
- Osteoarthritis

9

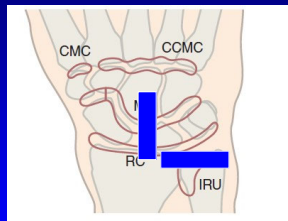
### Inflammatory Arthritis: role

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

10

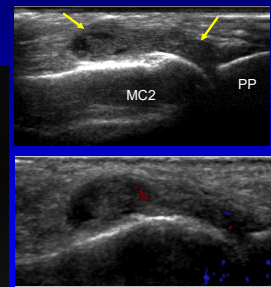
### Joint Assessment: dorsal

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



11

### Synovitis: MCP joint



Sagittal Plane: 2<sup>nd</sup> MCP Joint

12

**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*

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

13

**Rheumatoid Arthritis**

2<sup>nd</sup> MCP

14

**Rheumatoid Arthritis**

15

**Pitfall Alert! Pseudoerosion**

- Metacarpal head: dorsal
- Up to 37% of metacarpal heads: 2<sup>nd</sup> 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*

16

**Pseudoerosion: dorsal metacarpal head**

*Radiology 2004; 232:716*

17

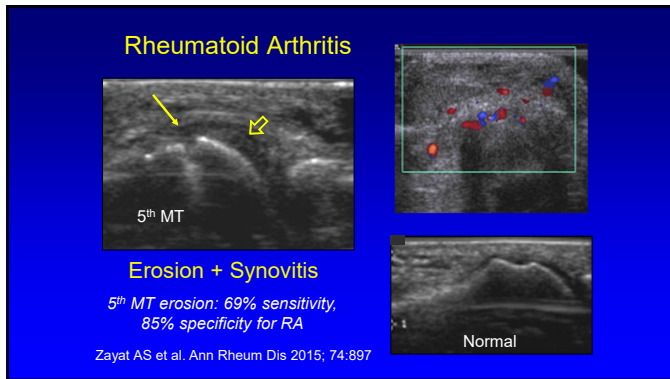
**Pitfall Alert! Pseudoerosions Are Everywhere!**

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

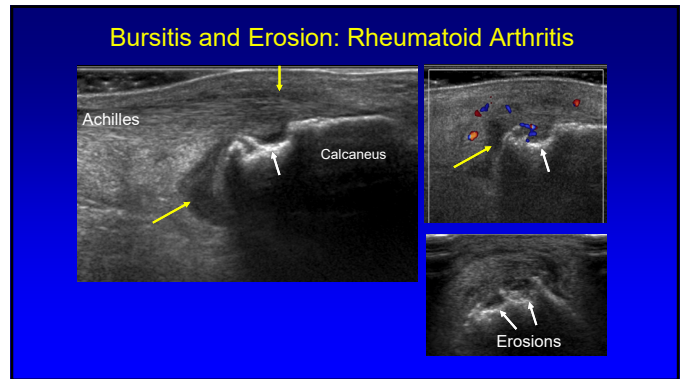
*\*Falkowski A et al. Eur J Radiology 2020; 124*

*\*Note lack of adjacent synovitis*

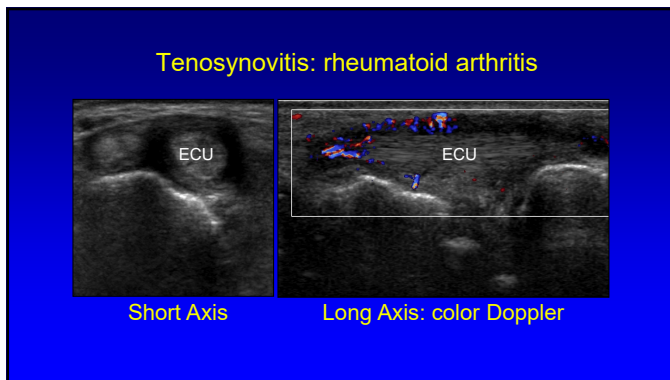
18



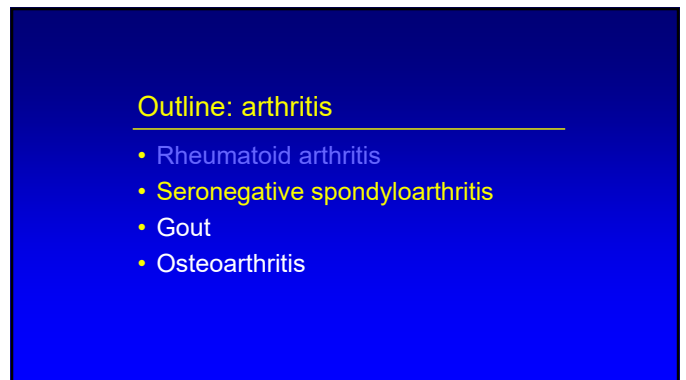
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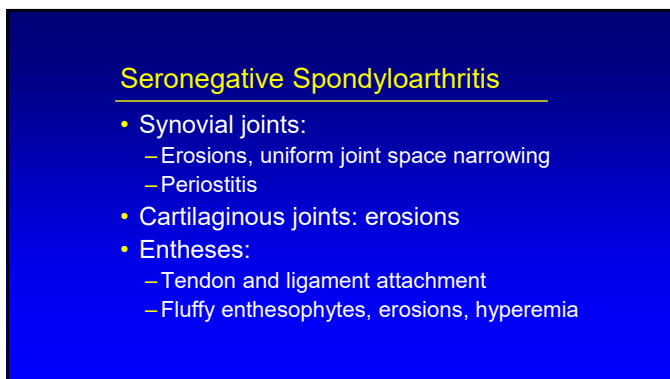
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21



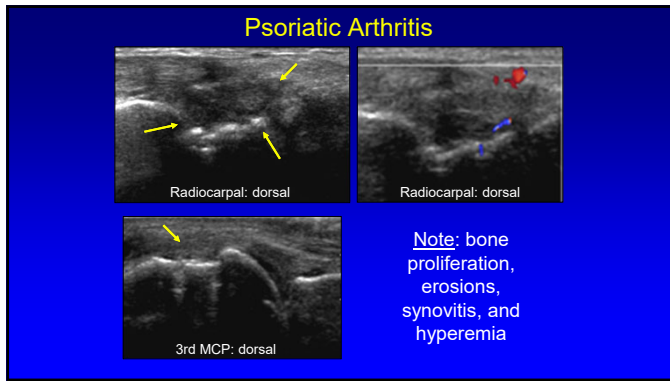
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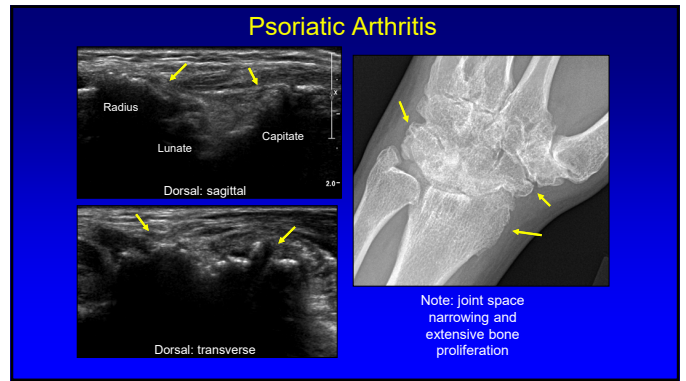
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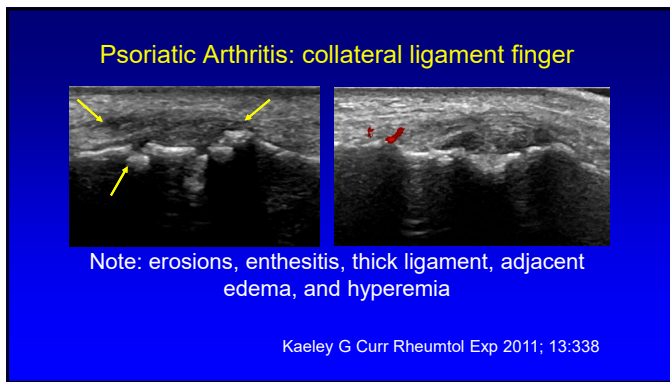
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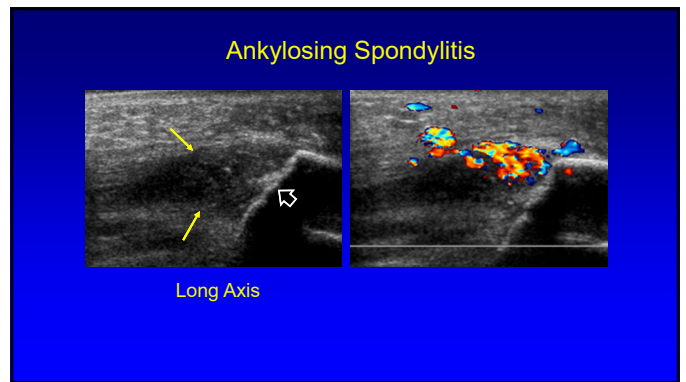
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26



27



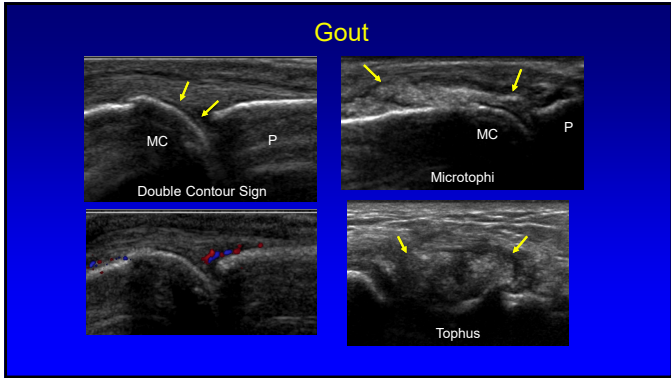
28

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

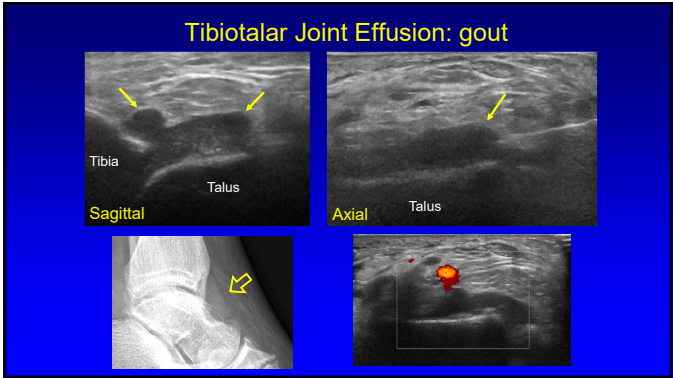
29

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

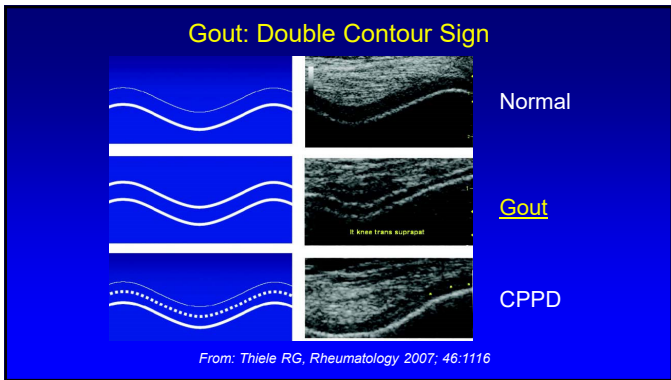
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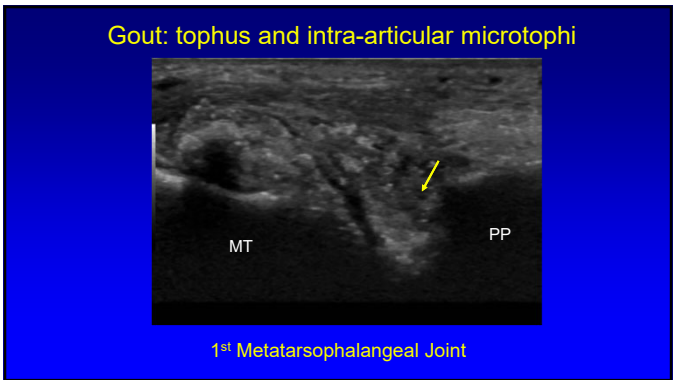
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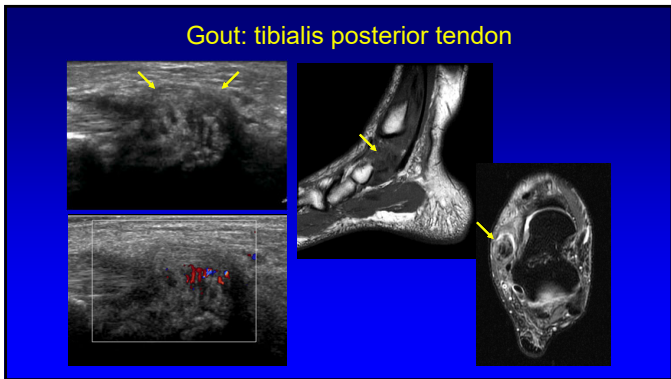
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33



34



35

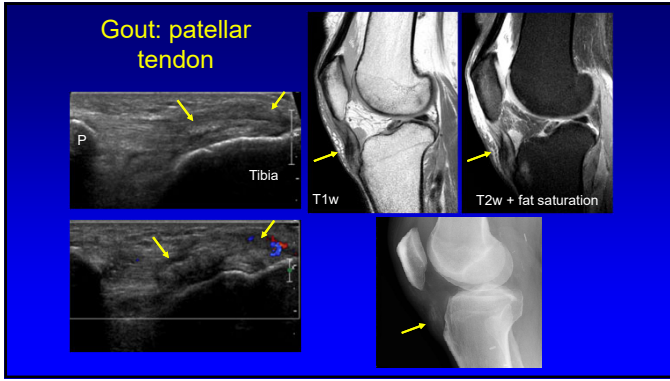
### Gout: knee

- 29% with asymptomatic hyperuricemia have tophi about the knee<sup>1</sup>
- Patellar tendon (especially distal):
  - May present clinically as a mass
- Popliteus tendon<sup>2</sup>
  - May appear as tendinosis or tear (MRI)
- Bursa and trochlear cartilage

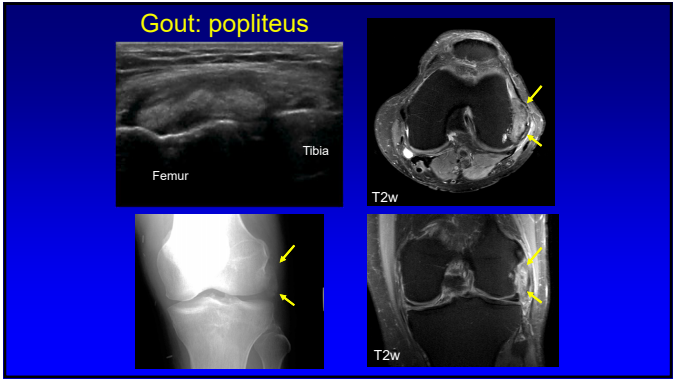
<sup>1</sup>Puig et al. Nucleosides Nucleotides and Nucleic Acids; 2008; 27:592  
<sup>2</sup>Ko et al. J Clin Rheum 2010; 16:209

36

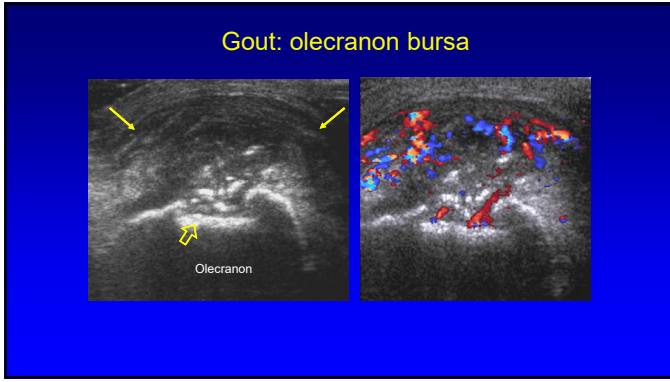




37



38



39

**Outline: arthritis**

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

40

**Osteoarthritis:**

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

41

**Osteoarthritis: ultrasound**

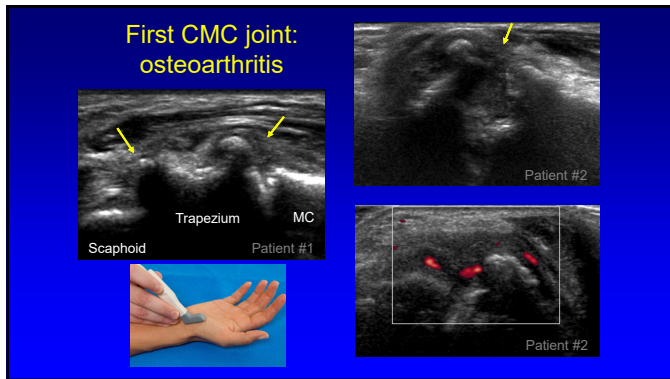
- Osteophytes
- Joint effusion
- Minimal synovial hypertrophy
- Variable hyperemia
- Possible intra-articular bodies

**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

42



43

**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!

44

**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

45

**Take Home Points**

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

46

**Inflammatory Arthritis: wrist / hand**

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

47

**Inflammatory Arthritis: ankle / foot**

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

48



### Ultrasound: arthritis diagnosis

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

49



Syllabus on line and other educational material:  
[www.jacobsonmskus.com](http://www.jacobsonmskus.com)

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50