


# Wrist and Hand Ultrasound

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Syllabus PDF

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## Disclosures

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

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Fundamentals of Musculoskeletal Ultrasound are  
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## Pathology:

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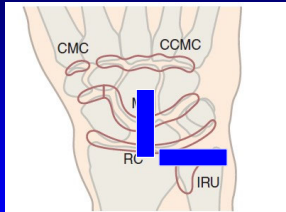
- Joint effusion and synovitis
- Tendon abnormalities
- Nerve entrapment
- Ligament, cartilage, and osseous injury
- Cysts and masses

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## Joint Assessment: dorsal

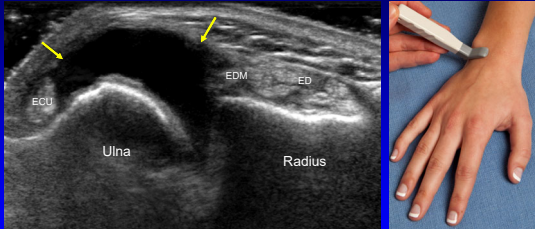

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- Wrist:
  - Radiocarpal joint (RC)
  - Midcarpal joint (MC)
  - Distal or inferior radioulnar joint (IRU)
- Hand:
  - MCP and PIP joints
  - 1<sup>st</sup> CMC (if symptomatic)



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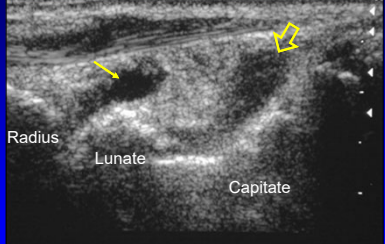
## Joint Effusion: distal radioulnar joint

Transverse

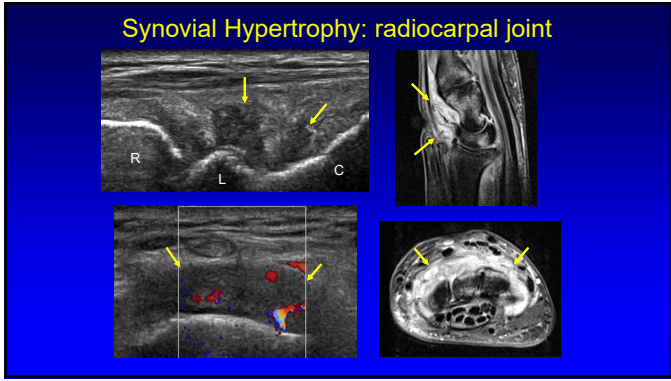
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## Synovitis and Effusion: dorsal wrist

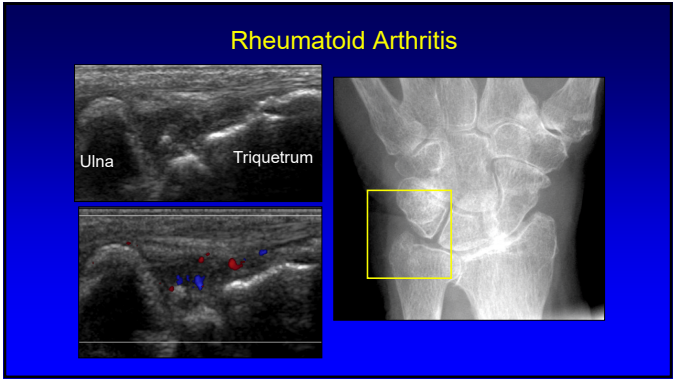


Sagittal

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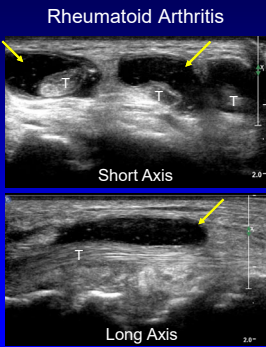
### Pathology:

- Joint effusion and synovitis
- **Tendon abnormalities**
- Nerve entrapment
- Ligament, cartilage, and osseous injury
- Cysts and masses

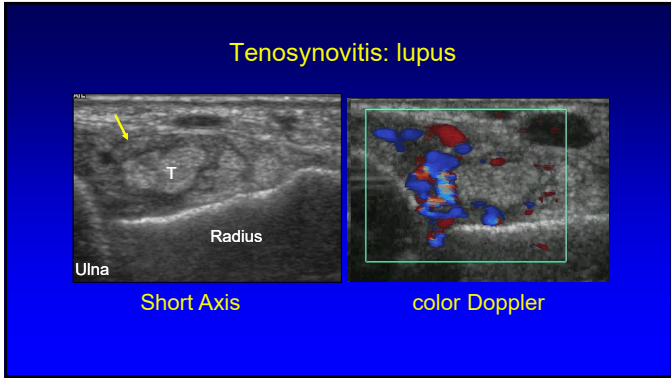
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### Tenosynovitis (paratenonitis):

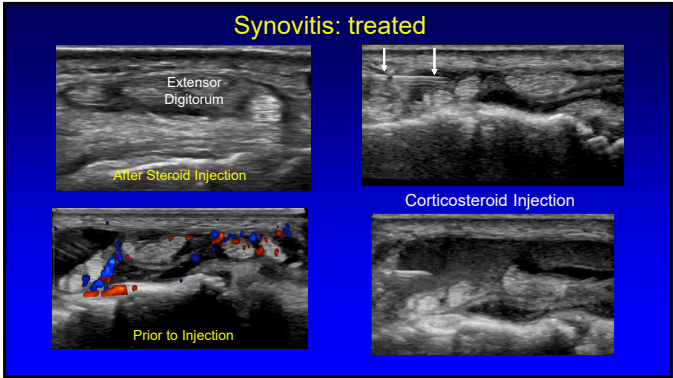
- Simple fluid: anechoic
- Complex fluid: mixed echogenicity
- Synovitis:
  - Hypoechoic
  - Echogenic if gout
  - Possible hyperemia
- Stenosing



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### de Quervain Tenosynovitis

- Stenosing tenosynovitis
  - Overuse, primary care givers
- 1st dorsal wrist compartment:
  - Extensor pollicis brevis + abductor pollicis longus
- Ultrasound findings:
  - Thick synovial sheath
  - Tendinosis
  - Cortical irregularity, hyperemia

J Ultrasound Med 1997; 16:685

**Pertinent Exam Findings:**  
What the #@!\$% are you doing to me? You're killing me!

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### De Quervain's Tenosynovitis

Long Axis

Short Axis

Axial PDw

Axial T2w

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### Pitfall Alert! Pseudo-tenosynovitis

- Extensor retinaculum
- Hypoechoic due to anisotropy
- Characteristic location
- Up to 1.7 mm thick and 23 mm in width

Radius

Lunate

Anisotropy

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### Pitfall Alert! Pseudo-tenosynovitis

- Hypoechoic muscle
- Musculotendinous junction
- Confirmed in long axis
- Normal tapering of muscle

Short Axis

Long Axis

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### Tendon Tear

- Hypoechoic or anechoic
- Disruption of tendon fibers
- Retraction: full-thickness
  - Dynamic imaging

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### Flexor Carpi Radialis

- Courses volar to triscaphe joint (scapho-trapezium-trapezoid compartment)
- FCR tendinosis and tear
- Associated triscaphe osteoarthritis

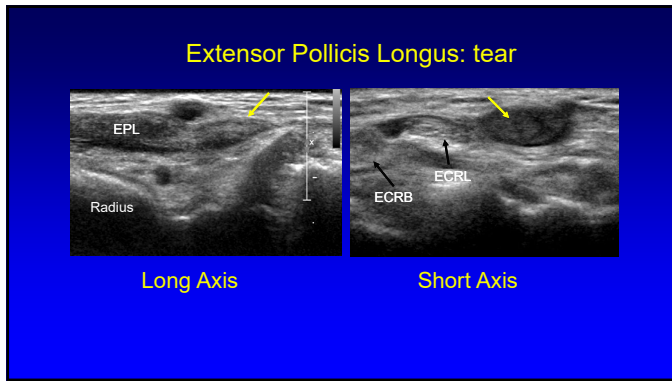
Radius

Scaphoid

Trapezium

Parellada et al. Skeletal Radiol 2006; 35:572

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### Pitfall Alert! Pseudo-tendon Tear

- Multiple tendon fascicles
- Abductor pollicis longus
  - Incidence: 80%
  - Up to 4 fascicles
- Extensor pollicis brevis
  - Incidence: 7%
  - Up to 2 fascicles
  - May be absent
- "Lotus Root Sign"
  - Seen best distal to radius

Rousset et al. Radiology 2010; 257:427  
Choi et al. Radiology 2011; 260:480

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### Pitfall Alert! Pseud-tendon tear

- Extensor carpi ulnaris
- 6<sup>th</sup> extensor compartment
- Short axis: hypoechoic cleft
- Due to ground substance in between two heads of extensor carpi ulnaris

Ulna                      Short Axis

Ali S et al. Skelet Radiol 2015; 44:1735  
Chiavaras MM et al. AJR 2014; 203:531

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### Intersection Syndrome

- Distal forearm
  - 1<sup>st</sup> wrist compartment tendons (APB/EPL) cross over 2<sup>nd</sup> wrist compartment tendons (ECRB/L)
  - Swollen, possible edema
- Snapping with supination and pronation

From: AJR 2003; 181:1245

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### Intersection Syndrome

1st compartment      2nd                      Long Axis                      Short Axis

1st compartment      2nd                      Radius                      Abnormal                      Normal

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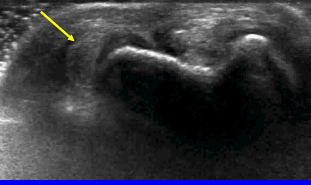
### Calcific Tendinosis: extensor carpi ulnaris

ECU                      Pisiform                      Long Axis

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### Extensor Carpi Ulnaris

- 6<sup>th</sup> extensor wrist compartment
- Dislocation:
  - Dynamic
  - Supination/pronation
  - Subsheath tear or dysfunction
- Predisposes to tendon tear and tenosynovitis

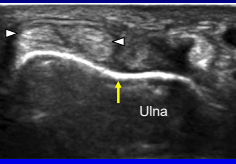


Campbell D et al. Br J Sports Med 2013; 47:1105

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### Pitfall Alert! Pseudo-subluxation

- Extensor carpi ulnaris
- 6<sup>th</sup> extensor wrist compartment
- Asymptomatic subluxation
  - Supination
  - Up to 50% out of groove
  - No tear or tenosynovitis

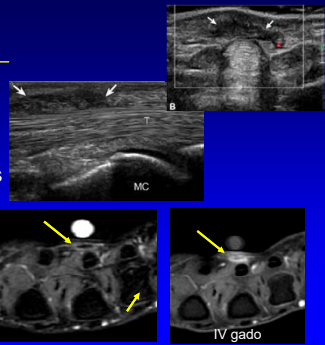


Lee KS et al. AJR 2009; 193:651

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### Dupuytren Contracture

- Palmar fibromatosis
- Palmar fascia
- Cord-like thickening
- Superficial to flexor tendons
- Digits: 4<sup>th</sup> > 3<sup>rd</sup> > 5<sup>th</sup>
- Most common proximal to MCP joint



Morris G. et al. J Ultrasound Med 2019; 38:387

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### Pathology:

- Joint effusion and synovitis
- Tendon abnormalities
- **Nerve entrapment**
- Ligament, cartilage, and osseous injury
- Cysts and masses

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### Carpal Tunnel Syndrome:

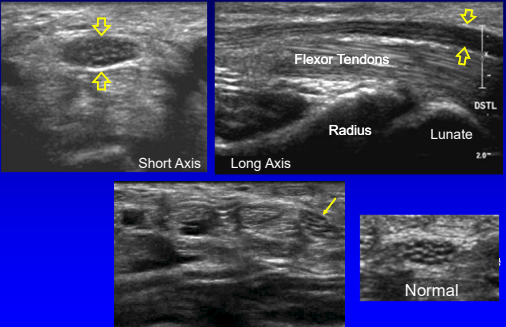
- Proximal median nerve swelling
  - Area: circumferential trace
  - Normal: < 6 mm<sup>2</sup>
  - Borderline: 9 – 12 mm<sup>2</sup>
  - Abnormal: > 12 mm<sup>2</sup>
    - 12.8 mm<sup>2</sup> = moderate (83% sens, 95% spec)
    - 14.0 mm<sup>2</sup> = severe (77% sens, 100% spec)



Peetrons et al. Sem Musculoskel Rad 2013; 17:28  
Ooi et al. Skeletal Radiol 2014; 43:1387

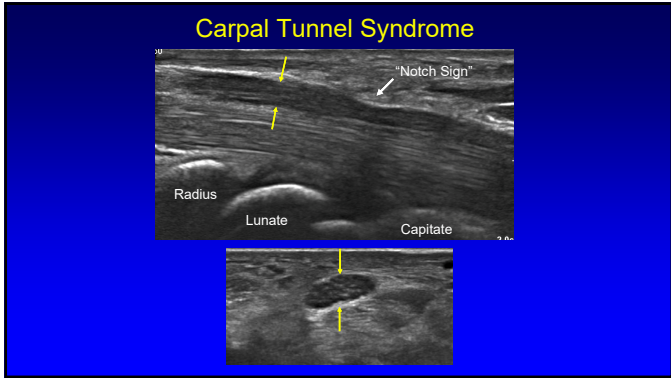
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### Carpal Tunnel Syndrome



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### Median Nerve: how to measure

- Short axis
- Toggle transducer: defined borders
- Site of maximal enlargement
- Circumferential trace
- Inner border of hyperechoic epineurium

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### Carpal Tunnel Syndrome

- Compare areas:
  - Proximal: pronator quadratus
  - Distal: carpal tunnel
- $\geq 2 \text{ mm}^2$  = carpal tunnel syndrome
  - 99% sensitivity
  - 100% specificity<sup>1</sup>
- $> 6 \text{ mm}^2$  = moderate
- $> 9 \text{ mm}^2$  = severe<sup>2</sup>

<sup>1</sup>Klauser et al. Radiology 2009; 250:1712  
<sup>2</sup>Klauser et al. Eur Radiol 2015; 25:2419

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### Carpal Tunnel Syndrome

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### Carpal Tunnel Syndrome: ulnar bursa distention

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### Postoperative Carpal Tunnel

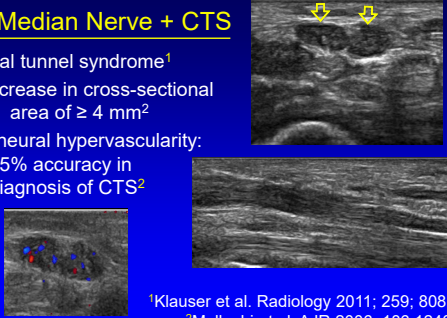
- Discontinuous or thickened transverse carpal ligament
- Anterior displacement of transverse carpal ligament<sup>1</sup>
- Median nerve size:
  - May decrease<sup>2</sup>
  - Does not correlate with success<sup>3</sup>

<sup>1</sup>Lee CH et al. Ann Plast Surg 2005; 54:143  
<sup>2</sup>Abicalaf CA et al. Clin Radiol 2007; 62:891  
<sup>3</sup>Naranjo A et al. Scand J Rheum 2010; 39:49

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### Bifid Median Nerve + CTS

- Carpal tunnel syndrome<sup>1</sup>
  - Increase in cross-sectional area of  $\geq 4 \text{ mm}^2$
- Intraneural hypervascularity: 95% accuracy in diagnosis of CTS<sup>2</sup>




<sup>1</sup>Klauser et al. Radiology 2011; 259; 808  
<sup>2</sup>Mallouhi et al. AJR 2006; 186:1240

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### Guyon's Canal:

- Ulnar tunnel syndrome
  - Ulnar nerve compression
  - Accessory Abductor Digiti Minimi<sup>1</sup>
    - Variant: up to 24% of wrists
- Hypothenar hammer syndrome<sup>2</sup>
  - Trauma
  - Ulnar artery thrombosis + distal emboli

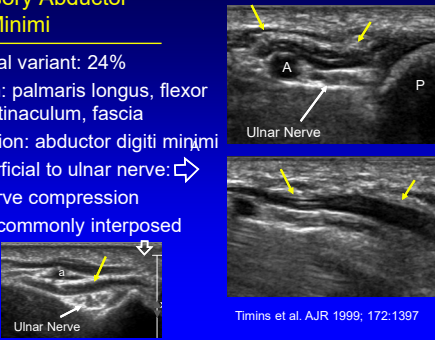


<sup>1</sup>AJR 1999; 172:1397  
<sup>2</sup>J Vasc Surg 1987; 5:838

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### Accessory Abductor Digiti Minimi

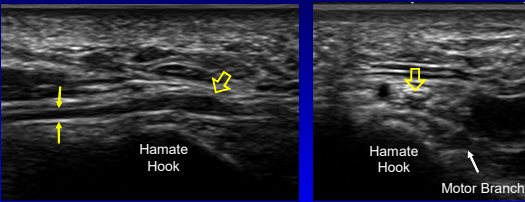
- Normal variant: 24%
- Origin: palmaris longus, flexor retinaculum, fascia
- Insertion: abductor digiti minimi
- Superficial to ulnar nerve:
  - Nerve compression
  - Uncommonly interposed



Timins et al. AJR 1999; 172:1397

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### Ulnar Nerve: cyclist wrist



Longitudinal      Transverse

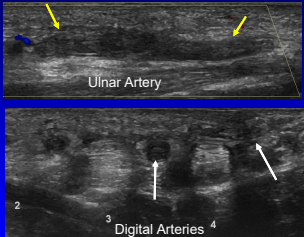
Sensory branch impingement between hook of hamate and bicycle handlebar

Courtesy of EFW Radiology, Calgary, Alberta, Canada

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### Hypothenar Hammer Syndrome

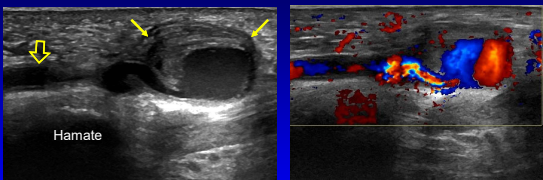
- Ulnar artery thrombosis
  - Level of hamate hook
- Distal emboli
- Post-traumatic



J Vasc Surg 1987; 5:838

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### Ulnar Artery Aneurysm



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### Pathology:

- Joint effusion and synovitis
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- Nerve entrapment
- **Ligament, cartilage, and osseous injury**
- Cysts and masses

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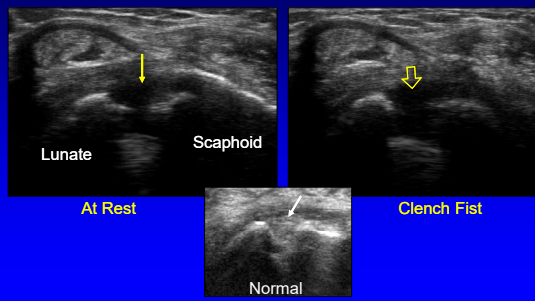
### Scapholunate Ligament Tear

- Normal hyperechoic ligament not seen
- Abnormal hypoechogenicity
- Wide scapholunate space
- Dynamic imaging: fist clench

AJR 2002; 179:523

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### Scapholunate Ligament Tear



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### Extrinsic Dorsal Ligament Injury

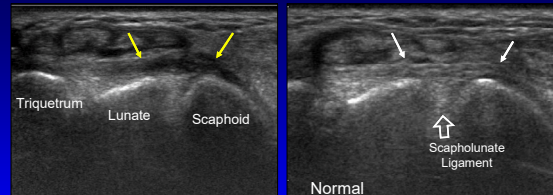


Diagram from: Theumann Radiology 2003; 226:171

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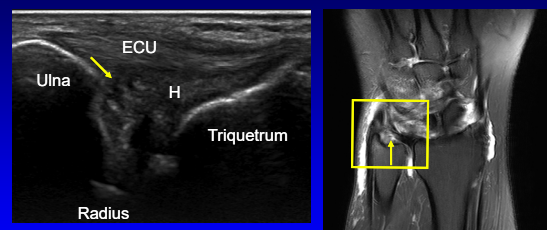
### Triangular Fibrocartilage:

- Normal: hyperechoic, difficult to see
- Abnormal:
  - Abnormal thinning <2.5 mm\*
  - Complete absence
  - 68% sensitivity, 85% accuracy

\*J Ultrasound Med 1998; 17:41

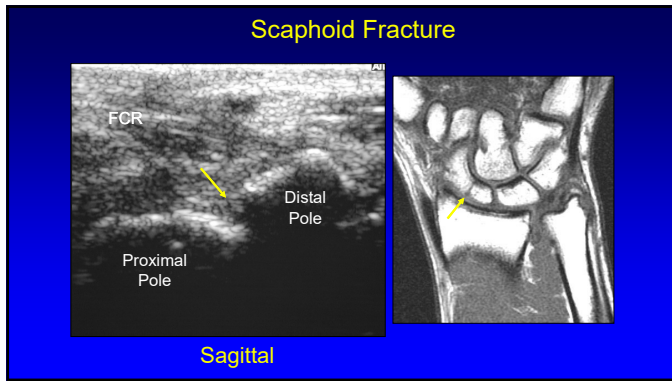
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### Triangular Fibrocartilage Tear

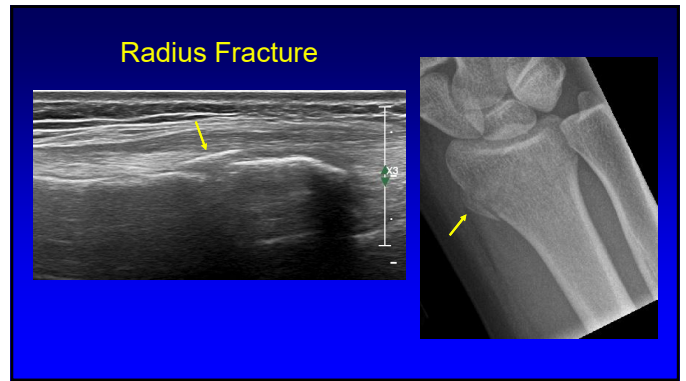


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- ### Pathology:
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  - Tendon abnormalities
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  - Ligament, cartilage, and osseous injury
  - **Cysts and masses**

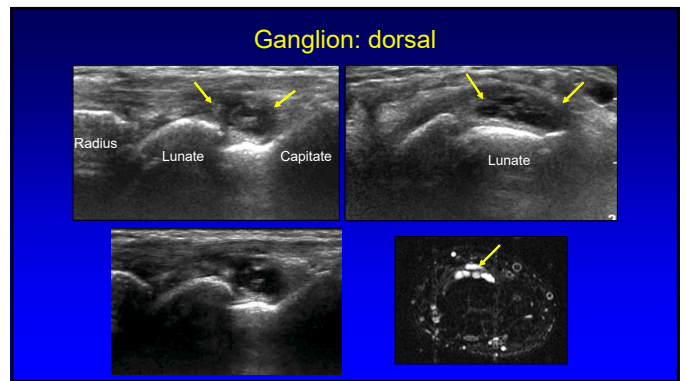
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- ### Soft Tissue Mass: wrist ganglia
- Most wrist masses are ganglion cysts
  - Volar (69%): radial artery & flexor carpi radialis
    - Proximal from radioscapoid joint capsule
  - Dorsal: scapholunate ligament
    - Not compressible (unlike joint recess)
- Zhang A et al. J Ultrasound Med 2019; 38:2155

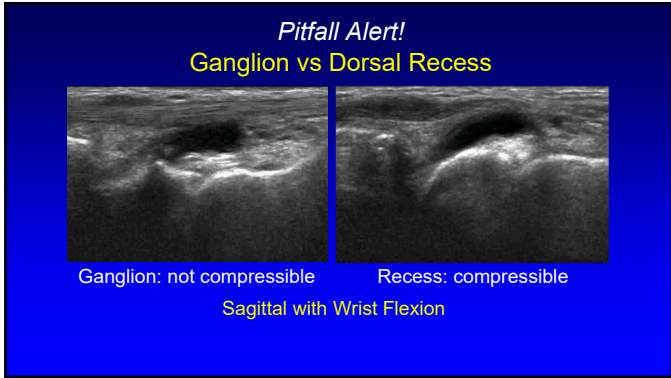
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- ### Ganglion: wrist
- Anechoic or hypoechoic
  - Multilocular (except digits)
  - Non-compressible
  - Joint or tendon sheath communication
  - <10 mm: hypoechoic without posterior acoustic enhancement
- \*Wang et al. J Ultrasound Med 2007; 26:1323
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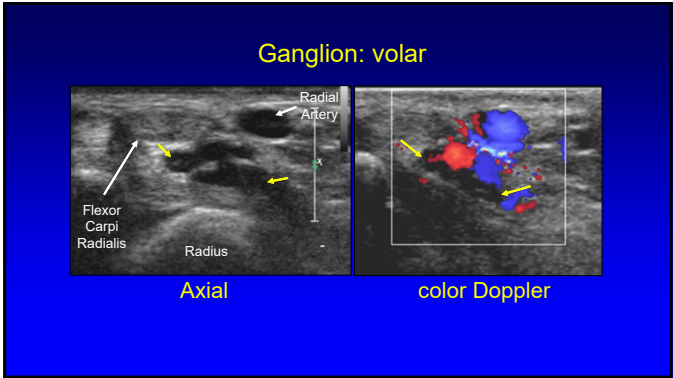
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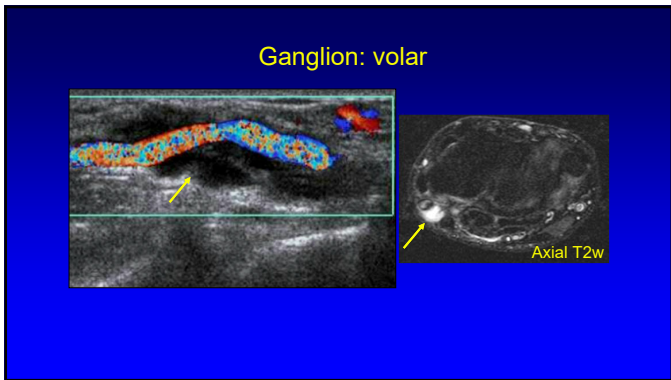
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**Soft Tissue Foreign Bodies**

- Wood and plastic: not radiopaque on radiographs
- **Echogenicity:** initially hyperechoic
  - Pitfall: anisotropy
- **Halo:** hypoechoic inflammation
- **Artifact:**
  - Smooth and flat: reverberation
  - Irregular surface: shadowing

Radiology 1998; 206:45

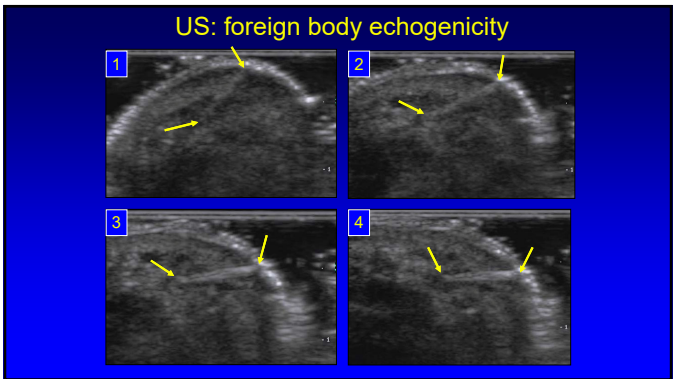
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**Glass Foreign Body**

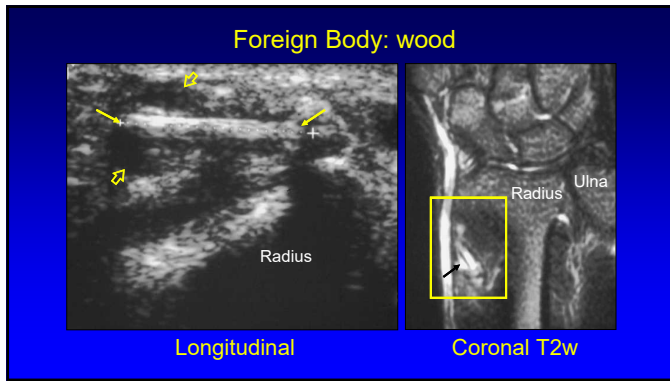
- Glass:
  - Opaque
  - Regardless of tint or color

Radiology 1998; 206:45

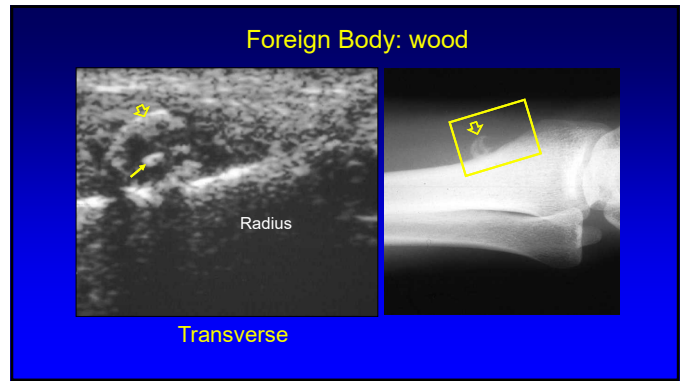
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**Take Home Points:**

- Arthritis: emphasize synovitis
- Nerve: swelling at entrapment site
- Stener:
  - Proximal to MCP joint and aponeurosis
  - Dynamic imaging
- Ganglion cysts:
  - Volar at FCR and radial artery
  - Dorsal over SL ligament

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Thank you!

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

Twitter handle: @jjacobsn

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