

Ultrasound Evaluation of Elbow Pathology

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Disclosures

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

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Fundamentals of Musculoskeletal Ultrasound are
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Outline:

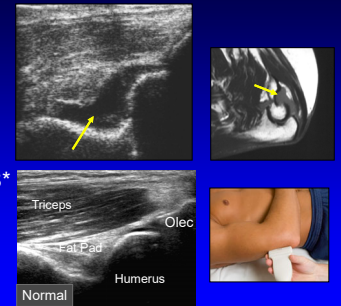
- Joint effusion and bursa
- Biceps and triceps
- Epicondylitis
- Ulnar collateral ligament
- Cubital tunnel

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Joint Effusion

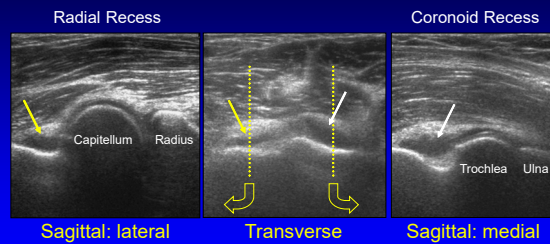
- Olecranon recess
- Displaced hyperechoic fat pad by anechoic / hypoechoic fluid
- Best place to look with US*
- More sensitive than radiographs*

De Maeseneer, Invest Radiol
1998; 33:117



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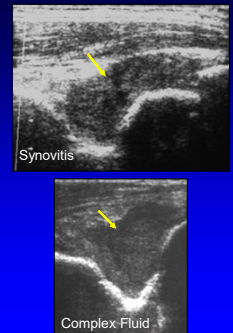
Joint Effusion: anterior elbow



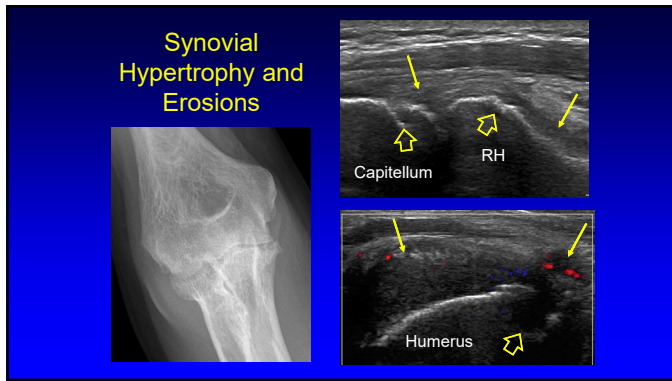
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Complex Fluid vs. Synovium

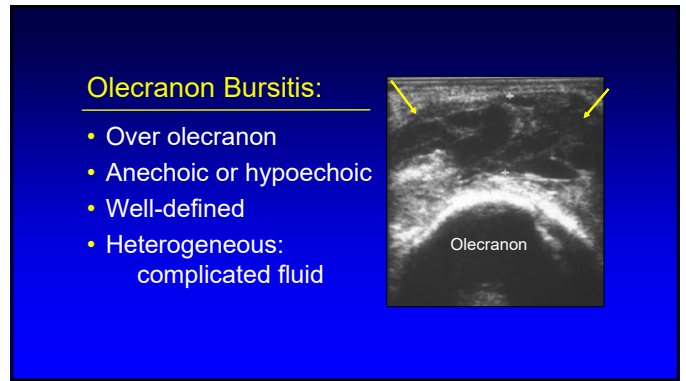
- Both may appear hypo- or isoechoic
- *Findings that suggest effusion:*
- Displacement with transducer pressure
- Joint recess collapse w/ joint movement
- Negative flow on color Doppler imaging
- Swirling with transducer pressure



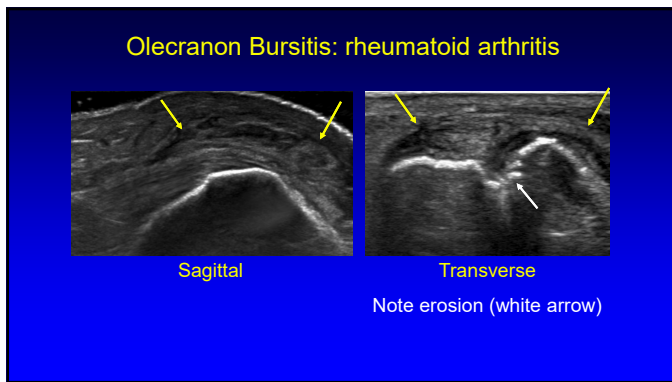
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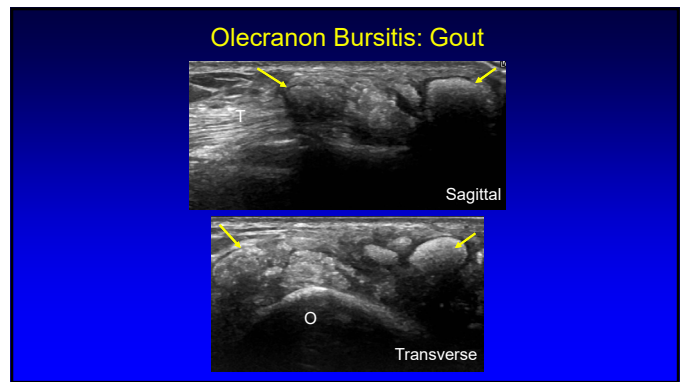
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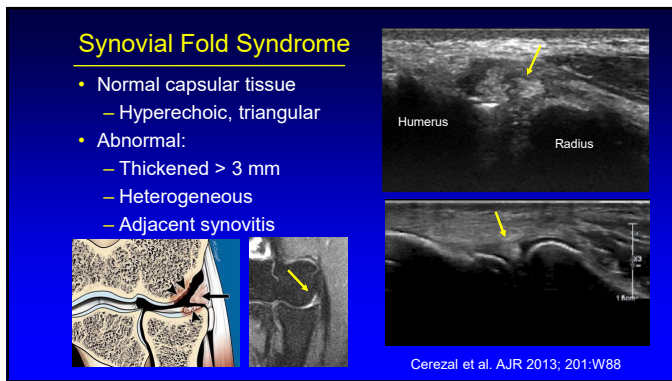
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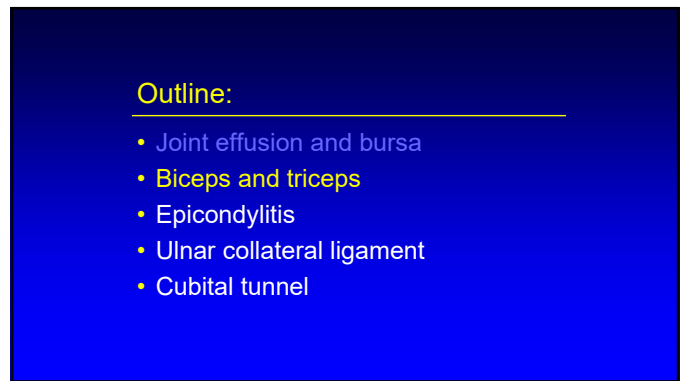
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Biceps Brachii:

- Insertion: radial tuberosity
 - Short head: superficial, distal
 - Long head; deep, proximal
- No synovial sheath
- Bicipitoradial bursa

From: Eames M. et al. J Bone Joint Surg 2007;89:1044

JBS

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Biceps Brachii: Terminal Bifurcation

Note: endotenon septum (asterisk and arrows)

From: Blasi M., et al. Surg Radiol Anat 2014; 36:17

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Biceps Brachii: terminal bifurcation

Note: toggling the transducer, which creates anisotropy allows visualization of two tendon heads

Courtesy of M. Chiavaras, Hamilton, Ontario

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Biceps Brachii Tendon: distal

1 = long head
2 = short head

Long Axis

Tagliafico A., et al. Eur Radiol 2010

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Tendon Abnormalities:

- Tendinosis: hypoechoic, swollen
- Partial-thickness tear: anechoic focus, no retraction
- Full-thickness tear: discontinuity
 - Dynamic imaging: retraction

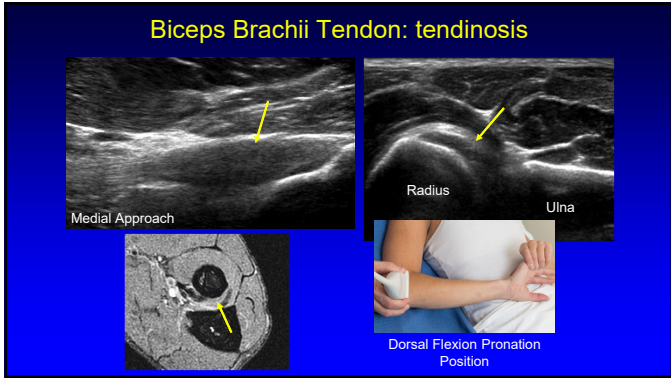
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Biceps Brachii Tendon: tendinosis

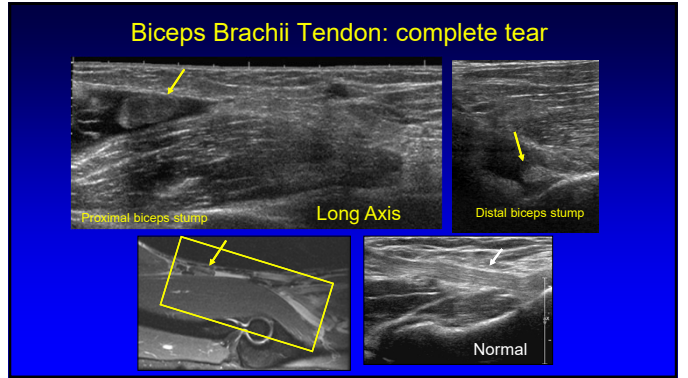
Anterior Approach

Medial Approach

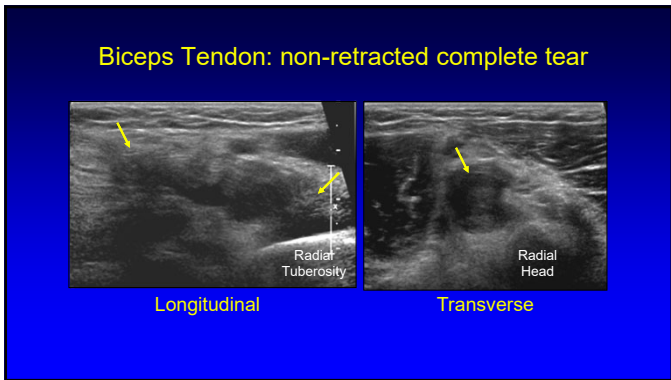
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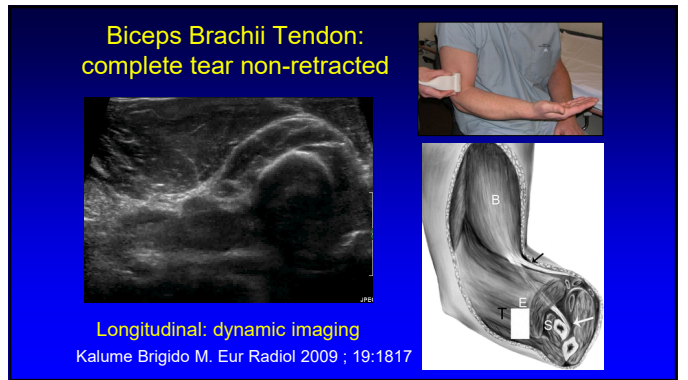
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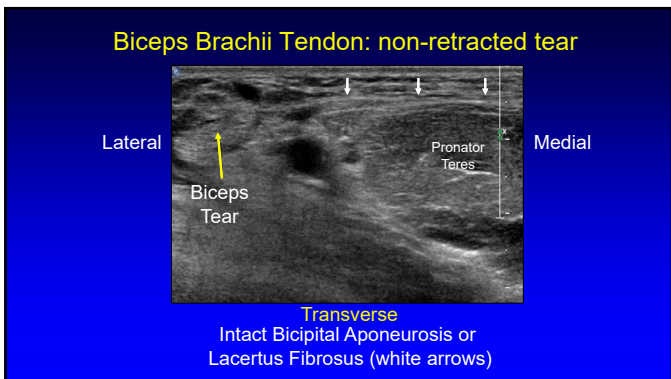
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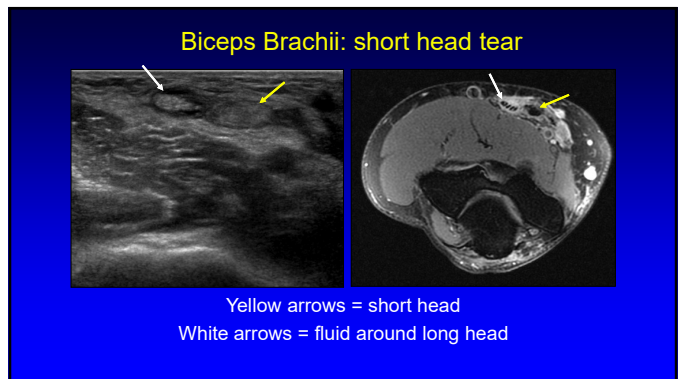
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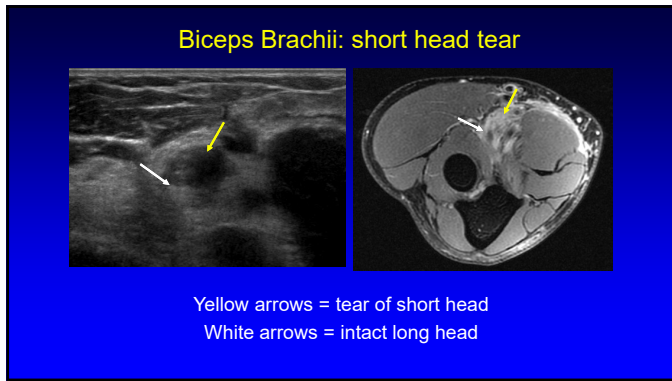
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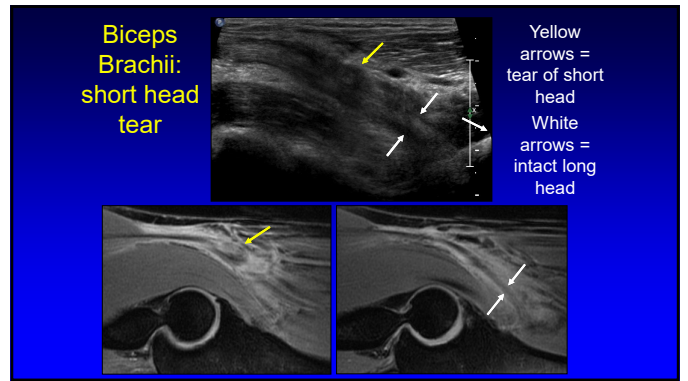
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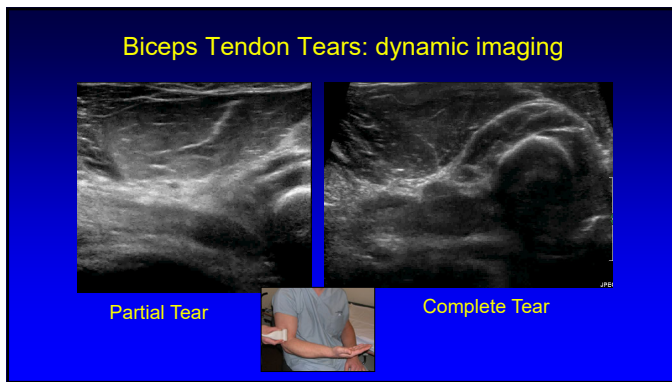
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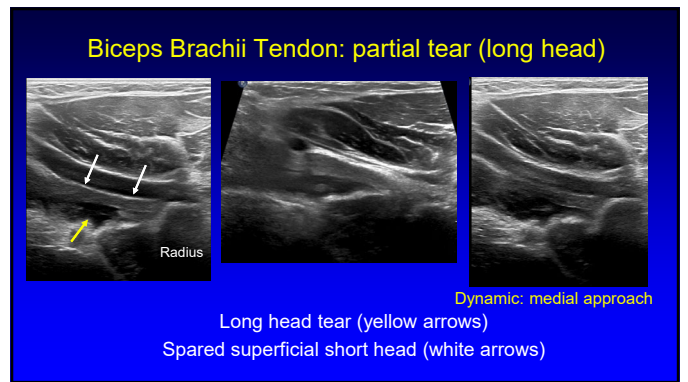
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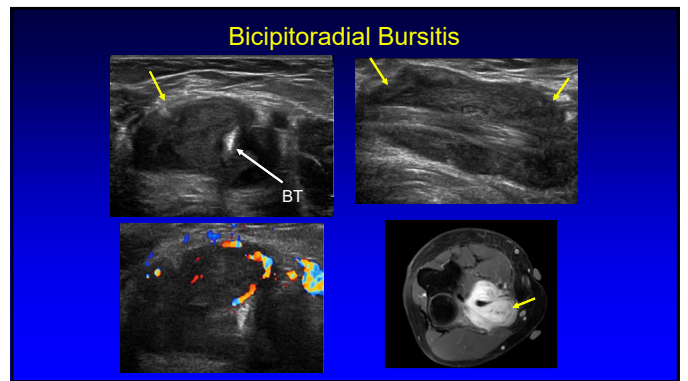
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Bicipitoradial Bursa

- Surrounds distal biceps
 - Does not communicate to elbow joint
 - No distal biceps tendon sheath
- If distended:
 - Mechanical, inflammatory
 - Characteristic "U" shape
 - Average: 1.8 – 2.5 cm in size
 - May displace deep branch of radial nerve

Skaf AY, Radiology 1999; 212:111

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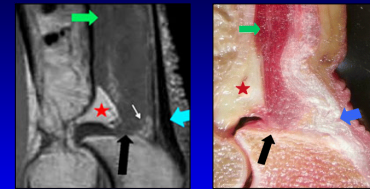
Triceps Tear: partial thickness tear

- Superficial layer torn
 - Long and lateral heads
- Intact deep layer (medial head)
- Associated enthesophyte bone fragment
 - 1 – 2 cm in size
 - 2.5 – 4 cm retraction
 - No donor site

J Ultrasound Med 2011; 30:1351

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Anatomy of the Distal Triceps Brachii

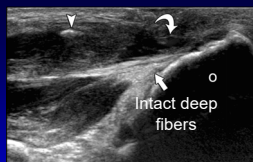
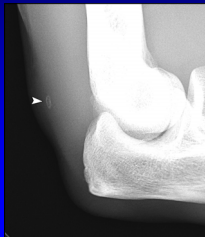


- Superficial (blue arrow): long + lateral heads
- Deep (black arrow): medial head
 - Primarily muscular insertion

*From Resnick, Skeletal Radiol 2009; 38:171

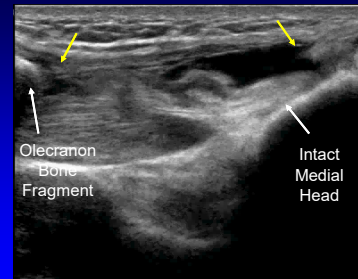
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Triceps Tendon: partial tear + avulsion



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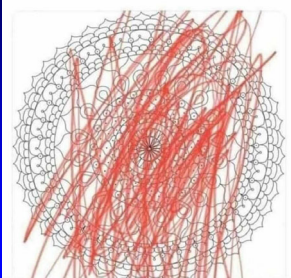
Triceps Tendon: partial tear + avulsion



Long Axis (Sagittal Plane)

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I have started coloring to manage my stress and anxiety.



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Lateral Collateral Ligament Complex

- Radial collateral ligament (arrows)
- Common extensor tendon (E)
- Annular ligament (arrowhead)
- Lateral ulnar collateral ligament (curved arrow)

Jacobson J. et al. J Ultrasound Medicine 2013; 33:1041

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Lateral Collateral Ligament Complex

- Common extensor tendon (curved arrows)
- Radial collateral ligament (arrowheads)
- Annular ligament (a)

Jacobson J. et al. J Ultrasound Medicine 2013 (in print)

Common Extensor Tendon Removed

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Epicondylitis:

- Common flexor and extensor tendons
- Abnormal hypoechogenicity
 - Mucoïd degeneration, tendinosis
- Anechoic: partial-thickness tear
- No inflammatory cells*

Potter, Radiology 1995; 196:43
Connell, AJR 2001; 176:777

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Common Extensor Tendon: elbow

- Often called “tennis elbow” or “lateral epicondylitis” or “epicondylosis” or
- All terms are misnomers
- Those inflicted usually do not play tennis (professionally or correctly)
- It is not primarily an inflammatory process
- It is not a primary problem of the epicondyle

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Common Extensor Tendon: tendinosis

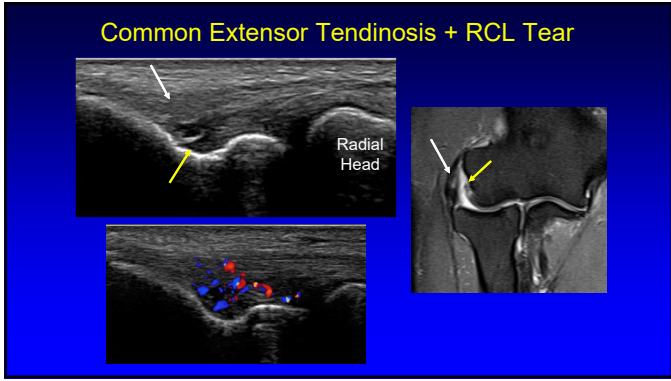
Note: normal radial collateral ligament (white arrow)

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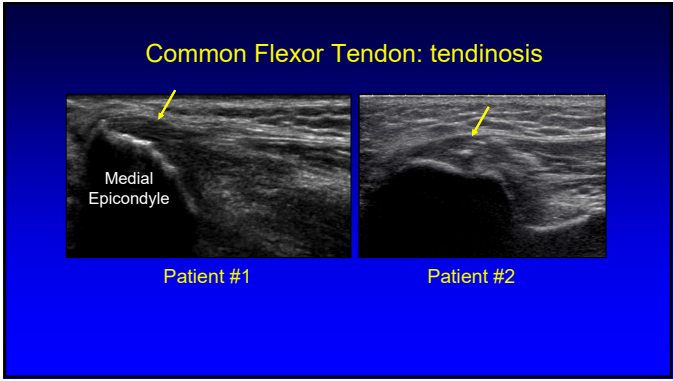
Common Extensor Tendon

Tendinosis Interstitial Tear

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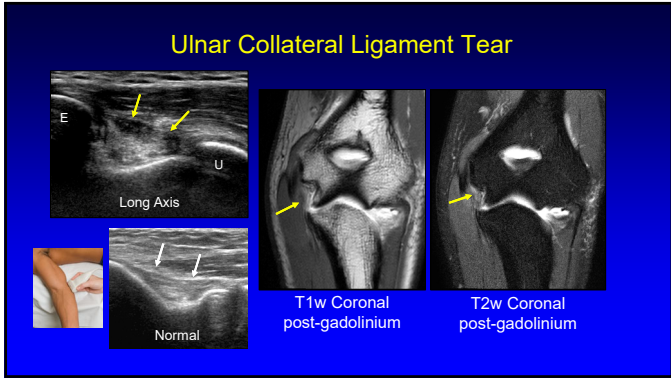
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- ### Outline:
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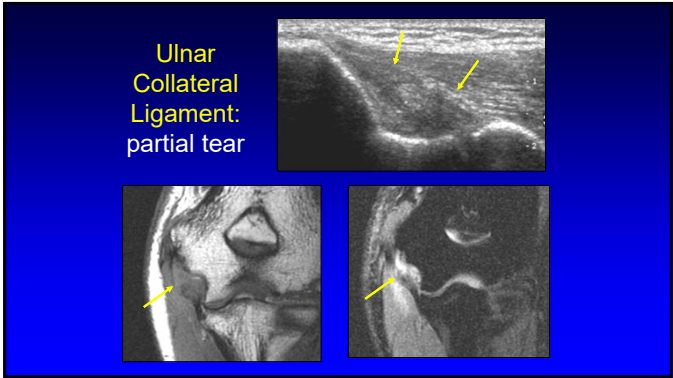
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- ### Collateral Ligament Tear
- Partial tear: hypoechoic, thickened
 - Complete tear: anechoic fluid tracking through ligament defect
 - Dynamic examination: stress
- Miller et al. Skeletal Radiol 2004; 33:386

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Ulnar Collateral Ligament

- Valgus stress: 30 degrees elbow flexion
 - Unlock the olecranon
 - Stress: UCL anterior bundle
- Gravity stress is adequate, equal to Telos¹
- Ultrasound measurements:
 - Reliable and precise²



Ulnar Collateral Ligament: partial tear

¹Harada M et al. J Sho Elb Surg 2014; 23:561
²Bica D et al. J Ultrasound Med 2015; 34:371

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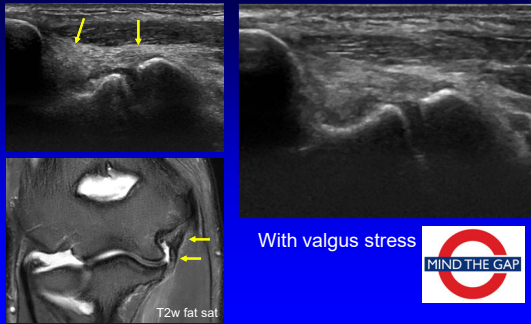
Ulnar Collateral Ligament: valgus stress

- >1 mm asymmetric gapping = 87% accuracy in diagnosis of UCL tear
 - MR arthrography accuracy = 88%
 - US + MR arthrography: accuracy = 98%
- Asymmetric joint space widening with stress:
 - Normal: 1.3 mm or less
 - Partial tear: 1.2 – 3.0 mm
 - Full thickness tear: 2.8 – 4.8 mm

Roedel JB et al. Radiology 2016

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Ulnar Collateral Ligament: laxity

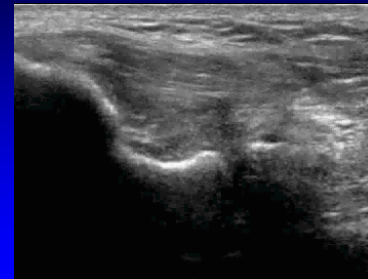


With valgus stress



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Ulnar Collateral Ligament: complete tear



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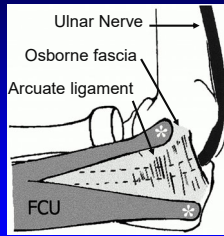
Outline:

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- **Cubital tunnel**

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Ulnar Nerve: anatomy

- Behind medial epicondyle of humerus:
 - Cubital tunnel retinaculum or Osborne fascia
- Distal to epicondyle:
 - True cubital tunnel
 - Between ulnar and humeral heads: flexor carpi ulnaris
 - Under arcuate ligament



Martinoli, C. et al. Radiographics 2000;20:S199-S217

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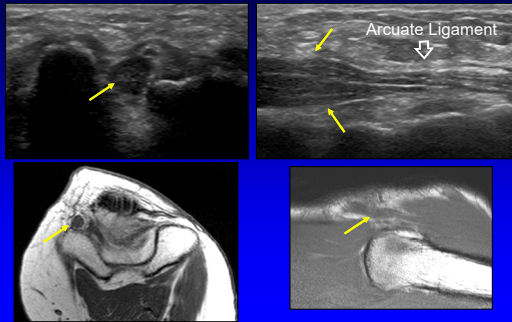
Ulnar Nerve: cubital tunnel syndrome

- Hypoechoic and enlarged
 - > 9 mm² area¹
 - Ratio greater than 2.8 compared to proximal²
- Mild hypoechoogenicity alone: may be normal
- Causes:
 - Idiopathic, overuse, joint process
 - Anconeus epitrochlearis: compression
 - Normal variant accessory muscle

¹Thoirs K et al. J Ultrasound Med 2008; 27:737
²Yoon JS et al. Muscle Nerve 2008; 38:1231

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Cubital Tunnel Syndrome

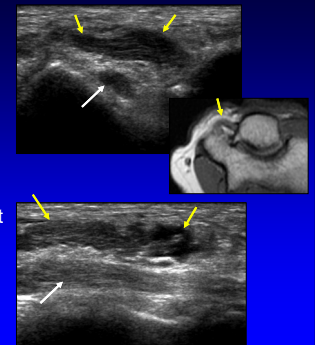


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Anconeus Epitrochlearis

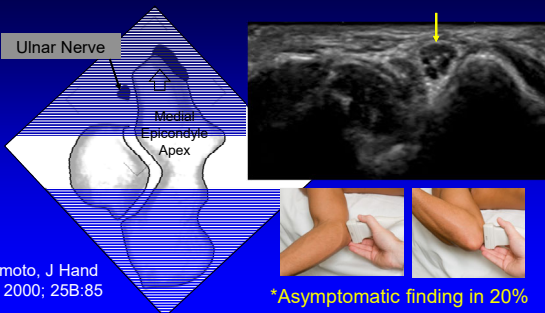
- Normal variant: 34% of population
- Roof of cubital tunnel:
 - Residual muscle
 - In absence of normal attrition forming Osborne fascia
- Secondary ulnar nerve entrapment
- **Diagnose in elbow extension!**

Sem Musculoskel Radiol 2000; 14:814-473



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Isolated Ulnar Nerve Dislocation



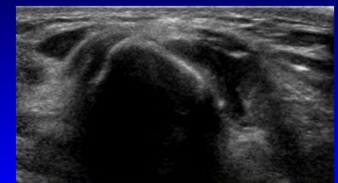
Okamoto, J Hand Surg 2000; 25B:85

*Asymptomatic finding in 20%

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Snapping Triceps Syndrome

- Ulnar nerve and medial triceps dislocate over apex of medial epicondyle
- Ulnar nerve and medial triceps remain in contact with each other
- Palpable snap felt through transducer



Jacobson JA et al. Radiology 2001; 220:601

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Take-home points:

- Joint effusion: posterior
- Biceps:
 - Terminal bifurcation explains appearance partial tears
 - Dynamic imaging: full vs. partial tear
- Ulnar collateral ligament: valgus stress
- Cubital tunnel: dynamic scanning

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Thank you!

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

Twitter handle: @jjacobsn

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