

# Ultrasound Evaluation of Elbow Pathology

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## Disclosures

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

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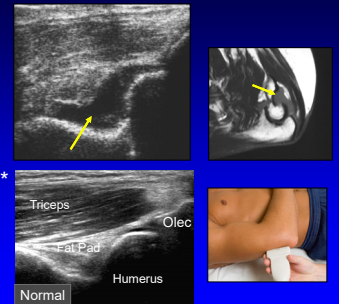
## Outline:

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

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## Joint Effusion

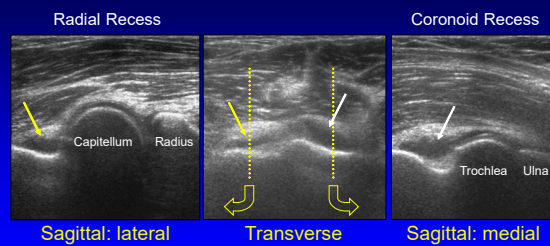
- Olecranon recess
- Displaced hyperechoic fat pad by anechoic / hypoechoic fluid
- Best place to look with US\*
- More sensitive than radiographs\*



De Maeseneer, Invest Radiol 1998; 33:117

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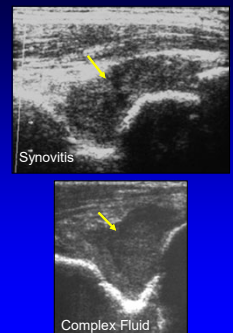
## Joint Effusion: anterior elbow



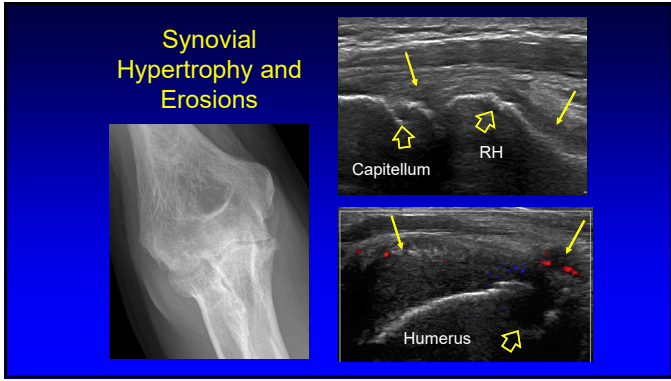
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## Complex Fluid vs. Synovium

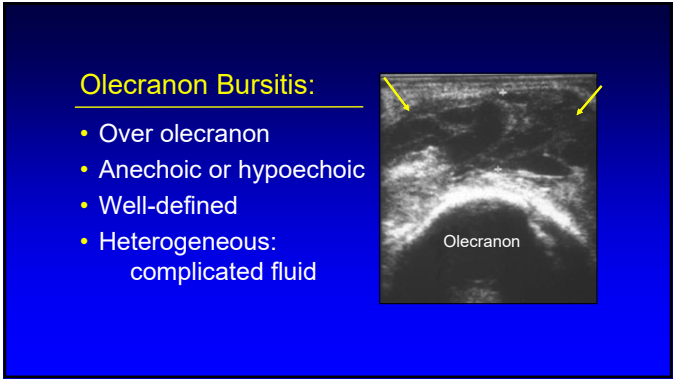
- Both may appear hypo- or isoechoic
- *Findings that suggest effusion:*
- Displacement with transducer pressure
- Joint recess collapse w/ joint movement
- Negative flow on color Doppler imaging
- Swirling with transducer pressure



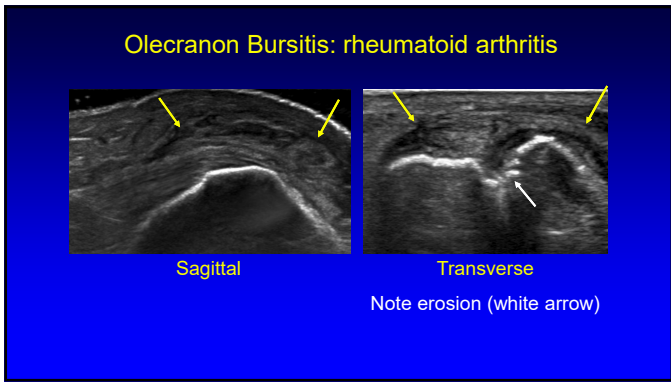
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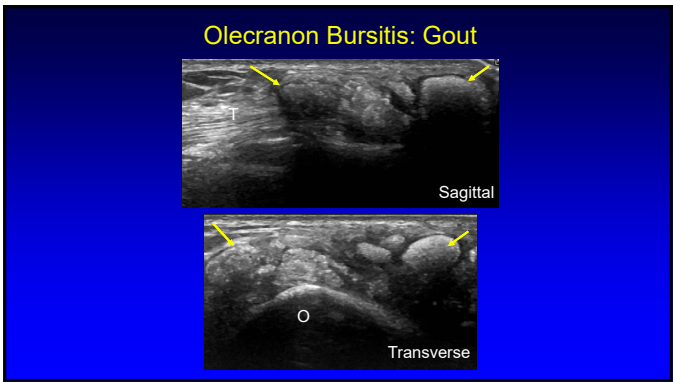
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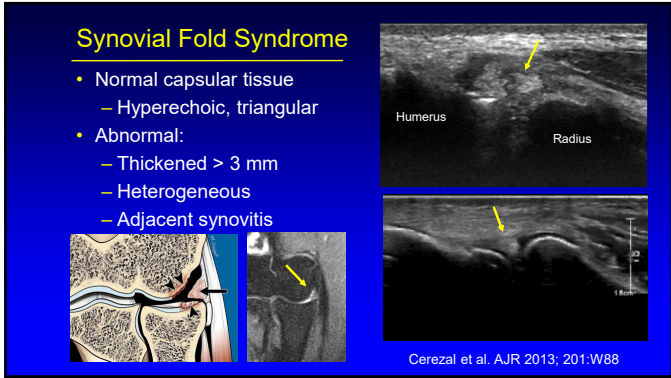
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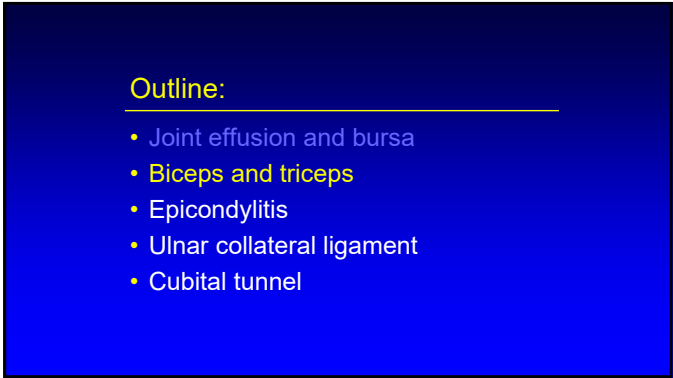
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### Biceps Brachii:

- 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

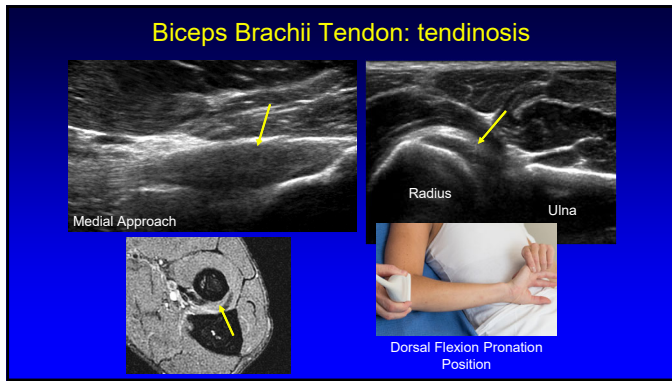
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### Biceps Brachii Tendon: tendinosis

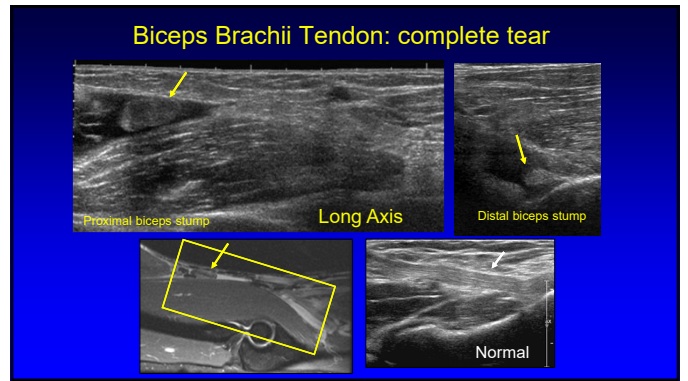
Anterior Approach

Medial Approach

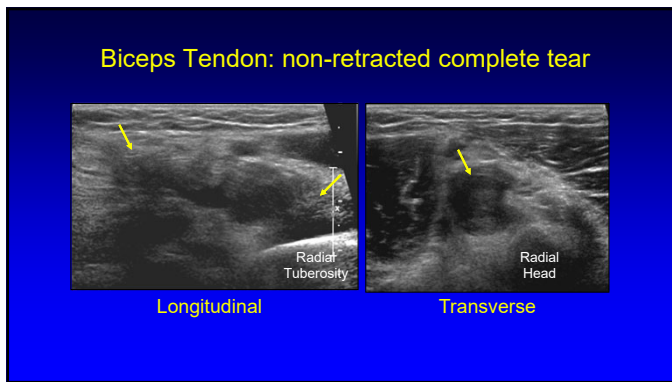
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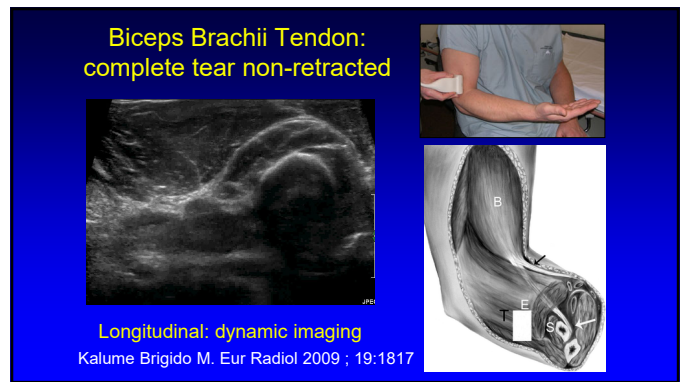
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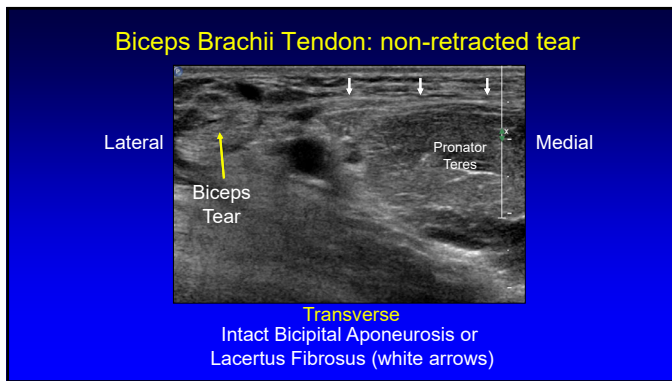
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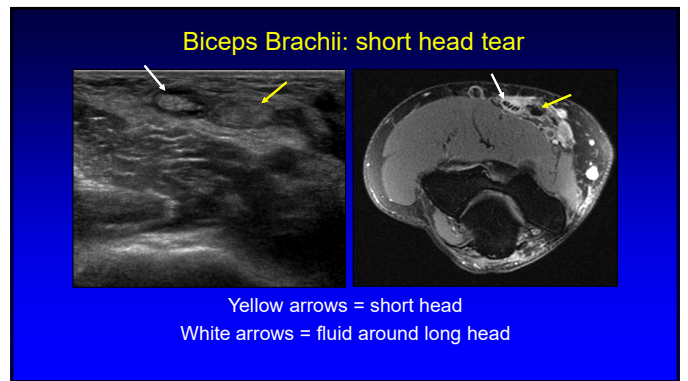
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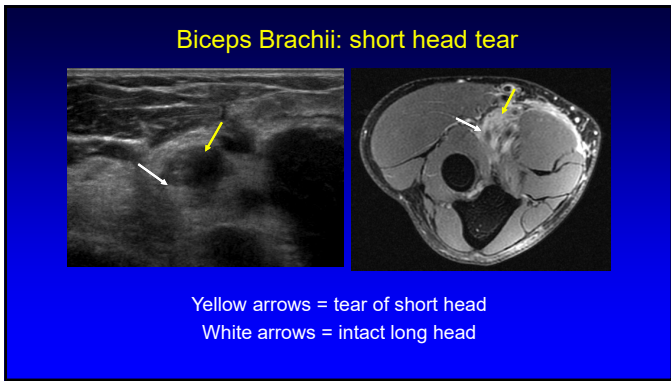
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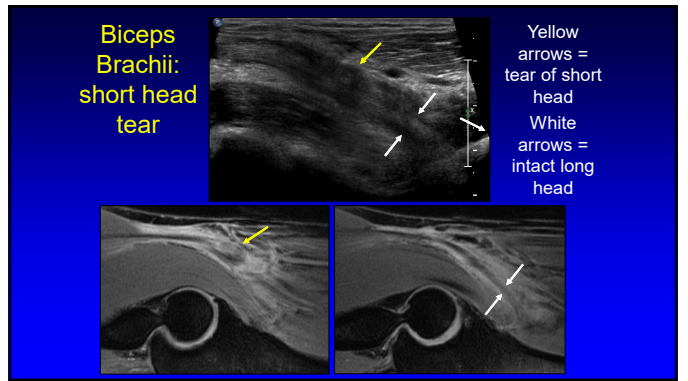
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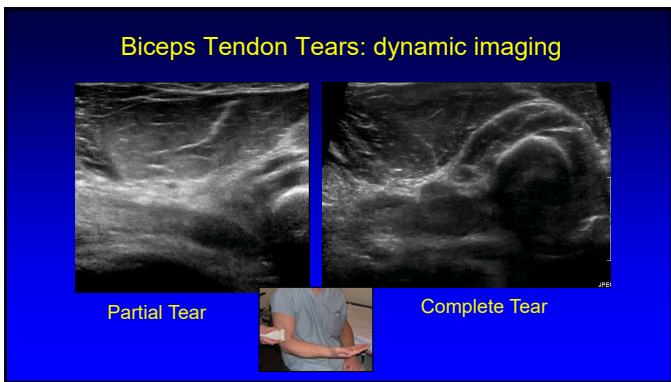
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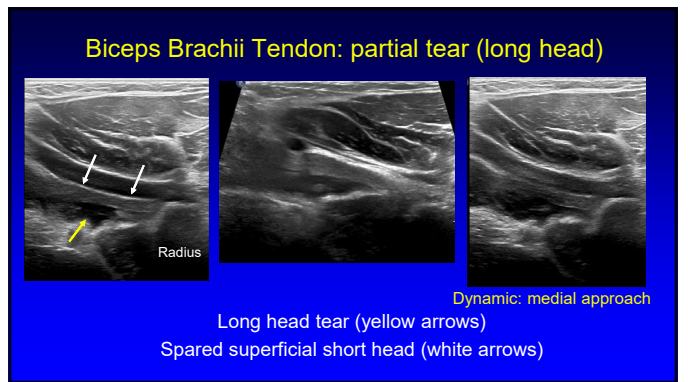
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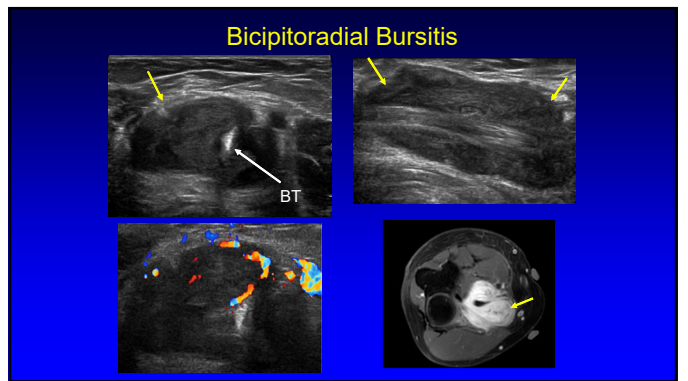
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### Bicipitoradial Bursa

- 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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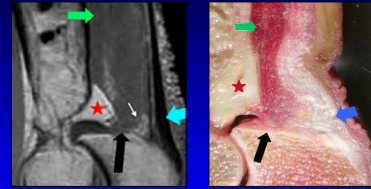
### Triceps Tear: partial thickness tear

- 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

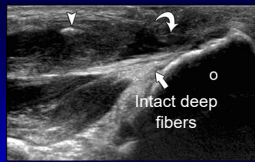
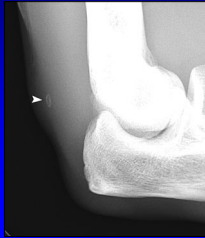


- Superficial (blue arrow): long + lateral heads
- Deep (black arrow): medial head
  - Primarily muscular insertion

\*From Resnick, Skeletal Radiol 2009; 38:171

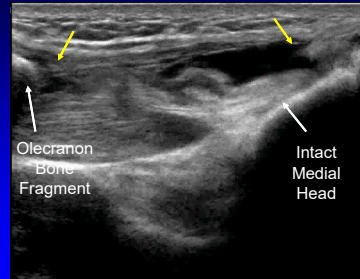
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### Triceps Tendon: partial tear + avulsion



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### Triceps Tendon: partial tear + avulsion



Long Axis (Sagittal Plane)

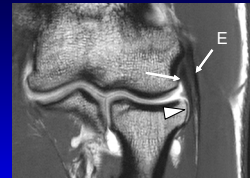
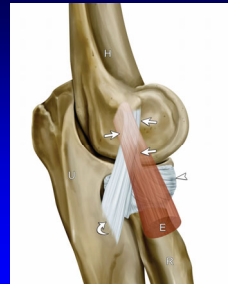
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### Outline:

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

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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)

Note: footprints

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
  - Mucoid 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

Long Axis      Short Axis

Note: normal radial collateral ligament (white arrow)

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### Common Extensor Tendon

Lateral Epicondyle      Radial Head

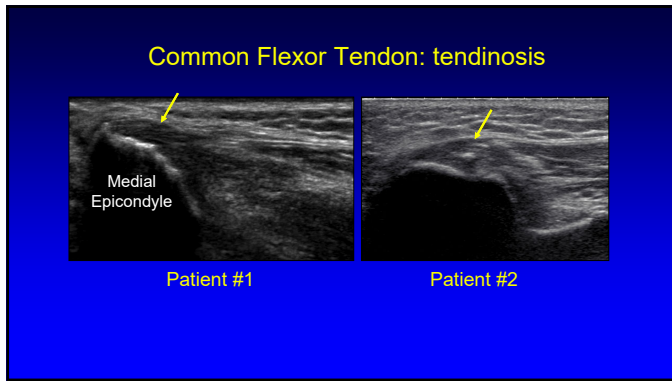
Tendinosis      Interstitial Tear

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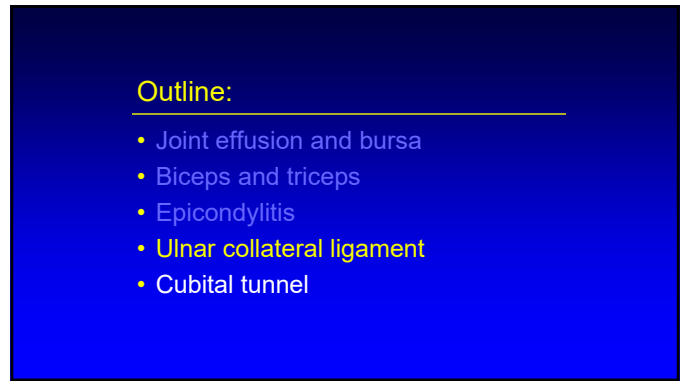
### Common Extensor Tendinosis + RCL Tear

Radial Head

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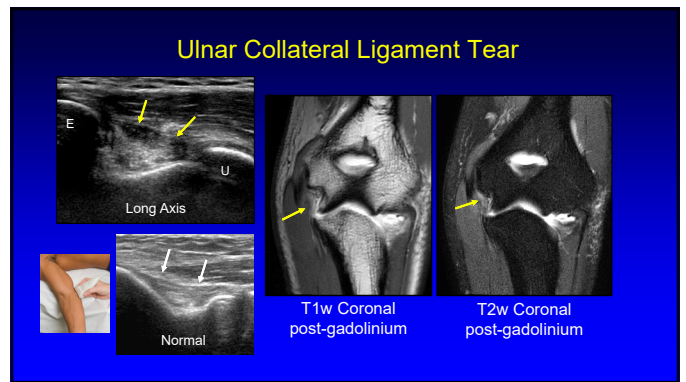
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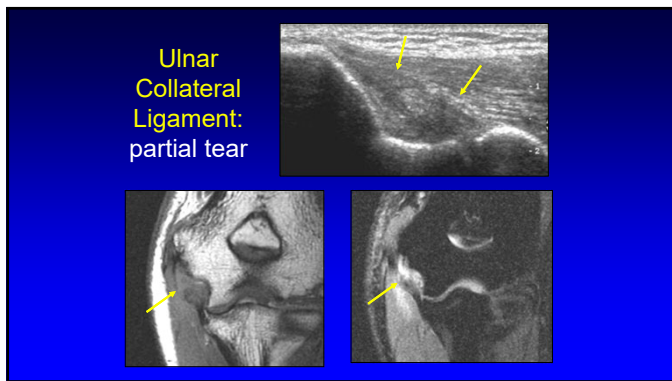
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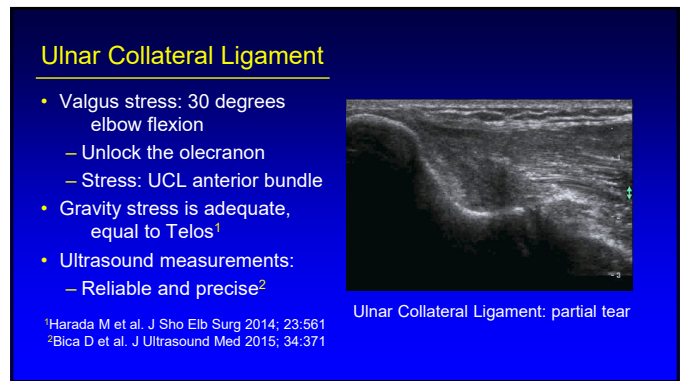
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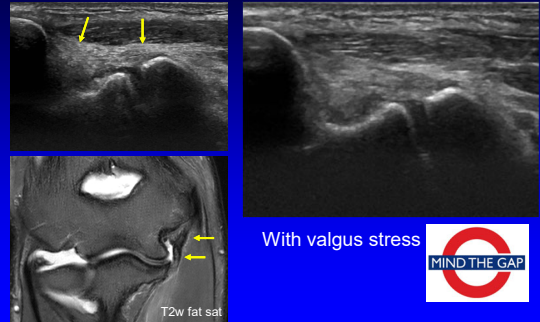
### Ulnar Collateral Ligament: valgus stress

- >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

Roedl JB et al. Radiology 2016

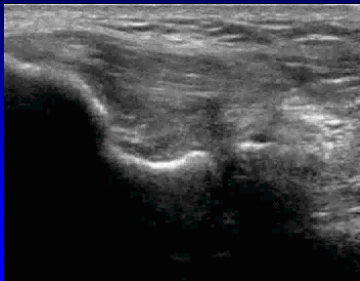
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### Ulnar Collateral Ligament: laxity



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### Ulnar Collateral Ligament: complete tear



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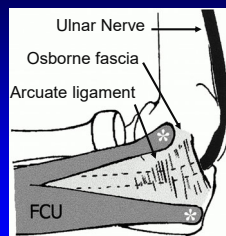
### Outline:

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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

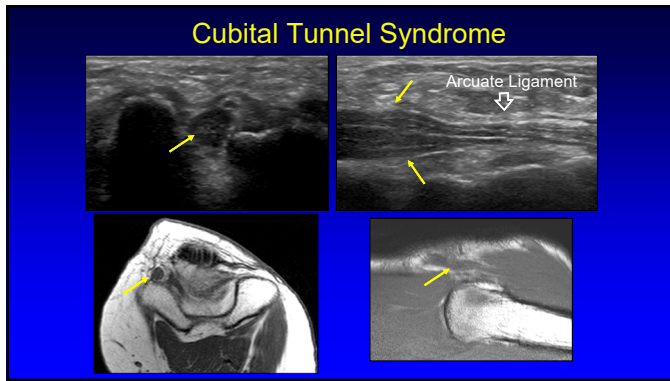
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### Ulnar Nerve: cubital tunnel syndrome

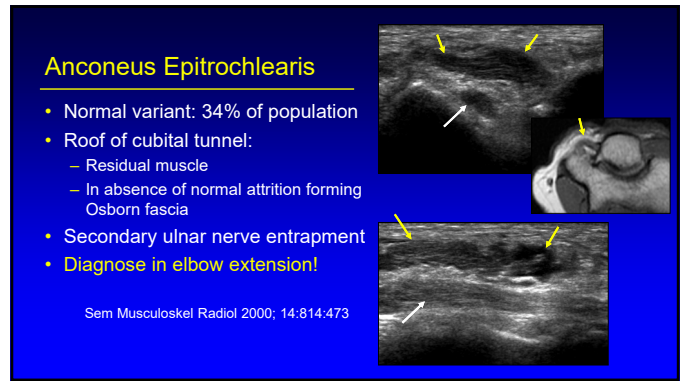
- Hypoechoic and enlarged
  - > 9 mm<sup>2</sup> area<sup>1</sup>
  - Ratio greater than 2.8 compared to proximal<sup>2</sup>
- Mild hypoechoogenicity alone: may be normal
- Causes:
  - Idiopathic, overuse, joint process
  - Anconeus epitrochlearis: compression
    - Normal variant accessory muscle

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

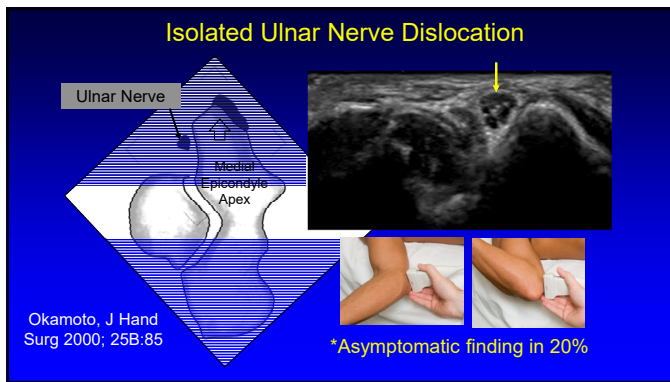
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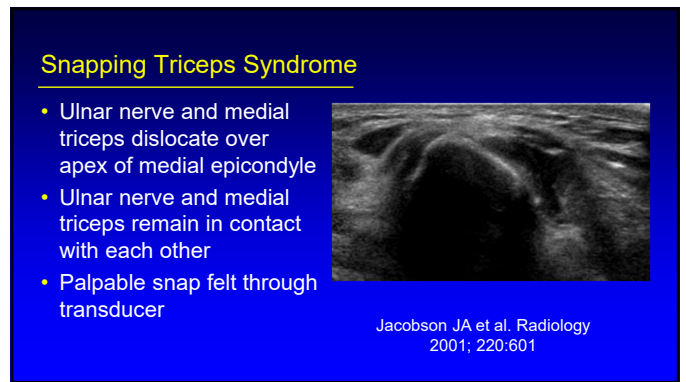
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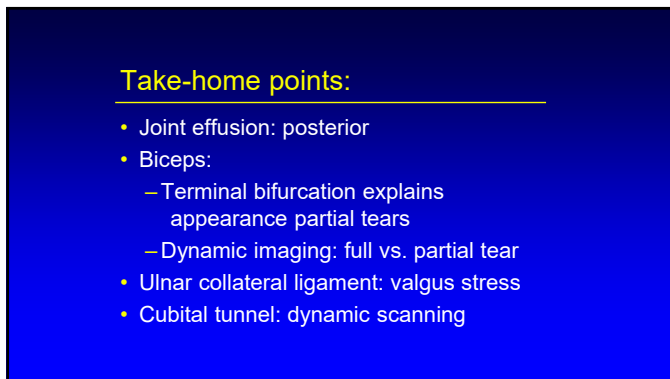
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