

# Ultrasound of Common Elbow Pathology

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## Disclosures:

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

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Fundamentals of Musculoskeletal Ultrasound are copyrighted  
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## Pathology:

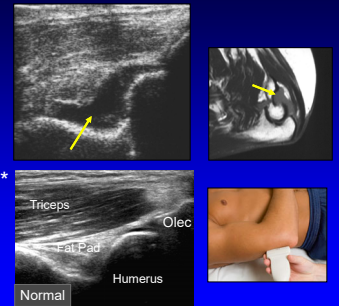
- Joint effusion and bursa
- Tendon abnormalities
- Ligament abnormalities
- Nerve abnormalities
- Soft tissue masses

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## Joint Effusion

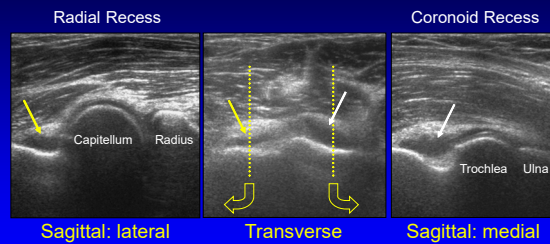
- Olecranon recess
- Displaced hyperechoic fat pad by anechoic / hypoechoic fluid
- Best place to look with US\*
- More sensitive than radiographs\*

De Maeseneer, Invest Radiol  
1998; 33:117



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## Joint Effusion: anterior elbow

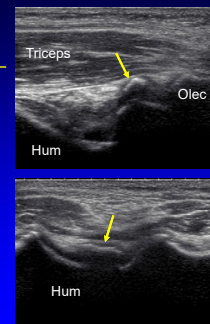


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## Intra-articular body

- Olecranon, coronoid, annular recess
- Calcified & ossified bodies: hyperechoic with shadowing
- Surrounded by joint fluid: intra-articular

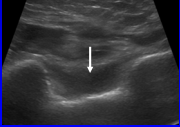
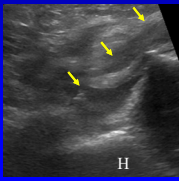
Frankel et al. Radiology 1998; 206:41



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### Elbow Joint

- Olecranon recess
- Elbow flexed
- In plane
- Lateral to medial

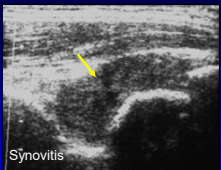
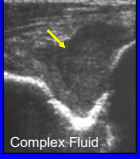



Invest Radiol 1998;33:117

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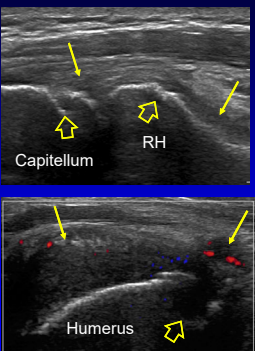
### Complicated Fluid vs. Synovium

- 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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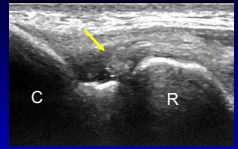
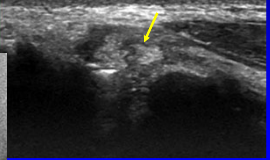
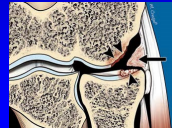
### Synovial Hypertrophy and Erosions

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### Synovial Fold Syndrome

- Normal capsular tissue
  - Hyperechoic, triangular
- Abnormal:
  - Thickened > 3 mm
  - Heterogeneous
  - Adjacent synovitis

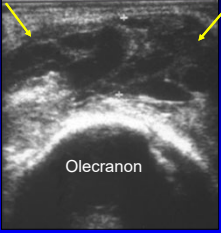




Cerezal et al. AJR 2013; 201:W88

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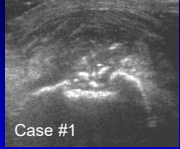

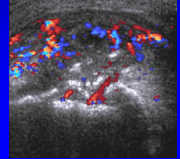

### Olecranon Bursitis:

- Over olecranon
- Anechoic or hypoechoic
- Well-defined
- Heterogeneous: complicated fluid



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### Olecranon Bursitis: Gout

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### Pathology:

- Joint effusion and bursa
- **Tendon abnormalities**
- Ligament abnormalities
- Nerve abnormalities
- Soft tissue masses

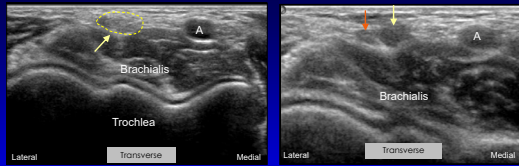
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### Tendon Abnormalities:

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

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### Biceps Brachii: terminal bifurcation

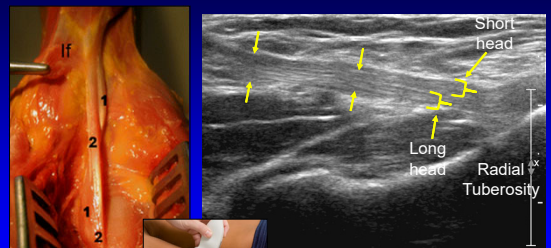


Note: toggling the transducer, which creates anisotropy allows visualization of two tendon heads



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### Biceps Brachii Tendon: distal



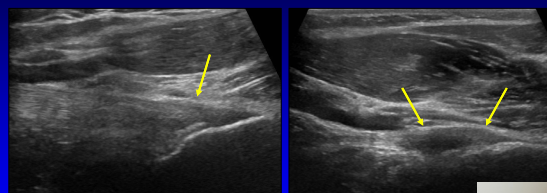
1 = long head  
2 = short head

Long Axis

Tagliafico A., et.al. Eur Radiol 2010

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### Biceps Brachii Tendon: tendinosis



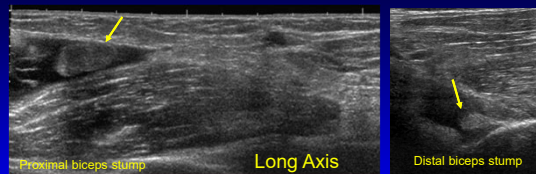
Anterior Approach

Medial Approach

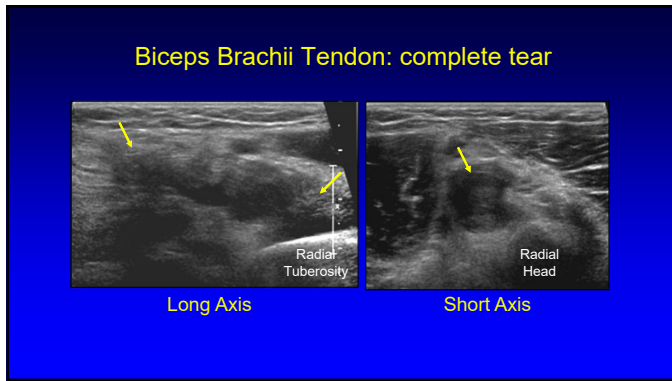


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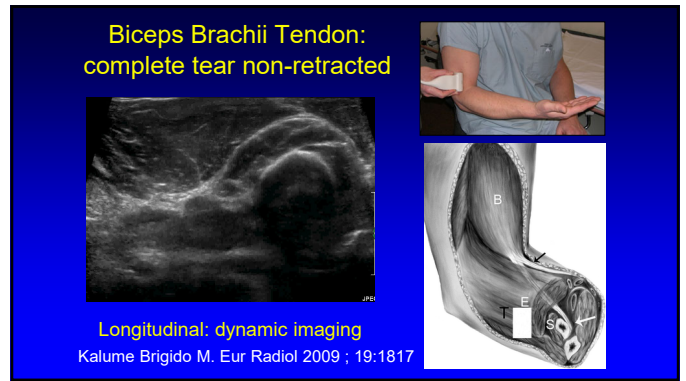
### Biceps Brachii Tendon: complete tear



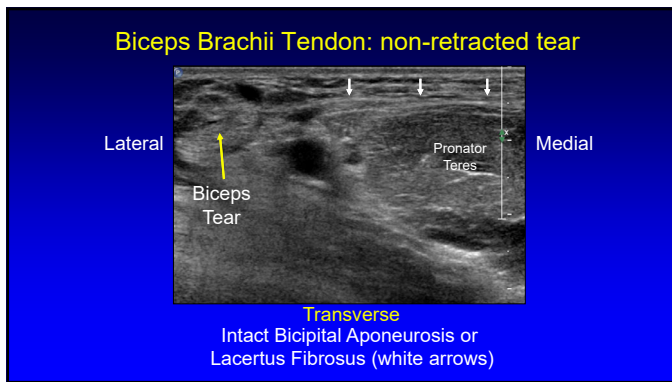
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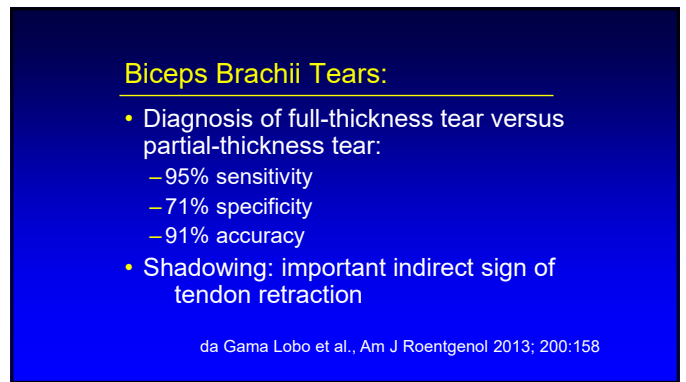
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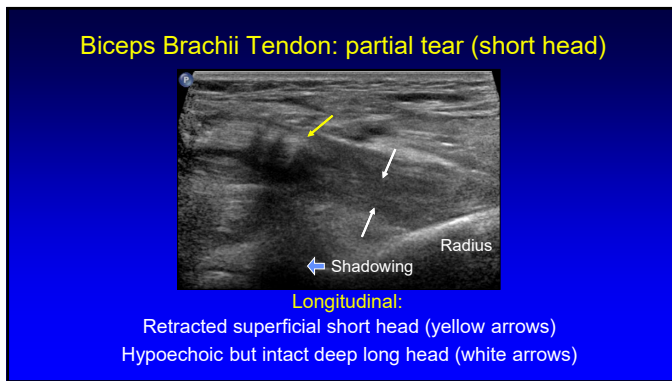
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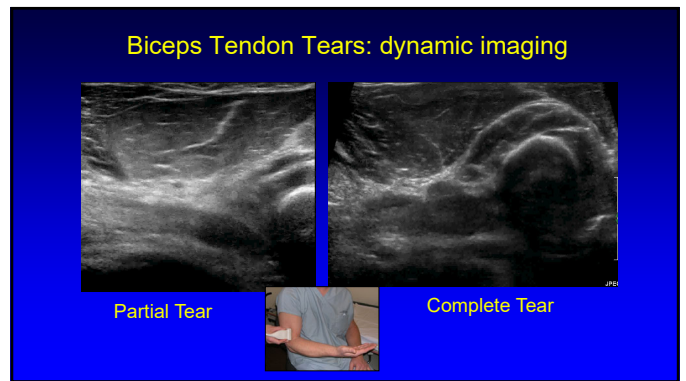
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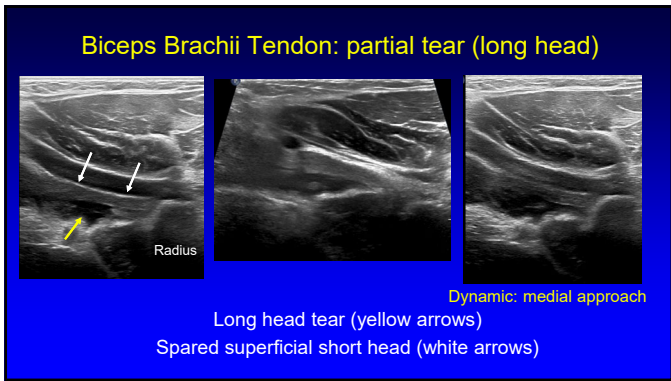
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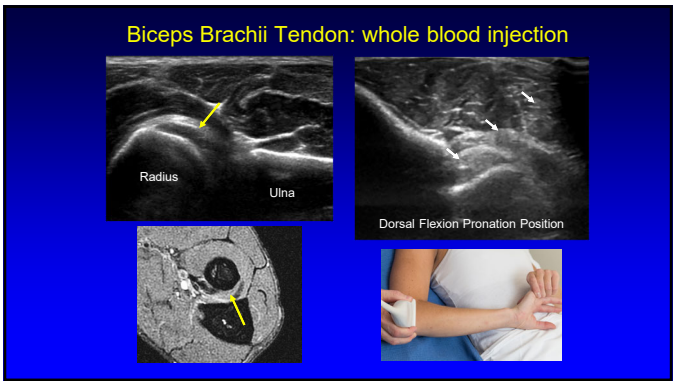
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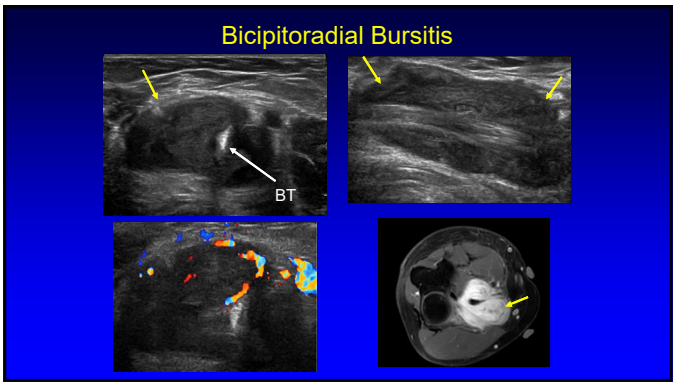
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### Bicipitoradial Bursa

- 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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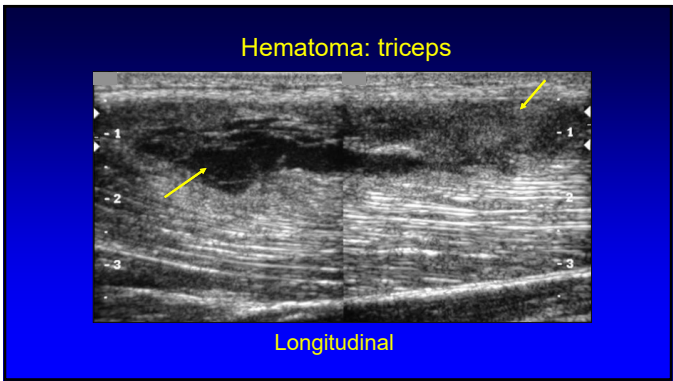


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### Triceps Tear:

- Muscle injury: contusion
  - Mixed echogenicity hemorrhage
- Distal tendon injury
  - Usually partial-thickness tear
  - Superficial aspect of tendon
  - Avulsion fracture of olecranon

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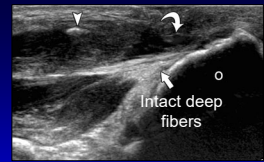
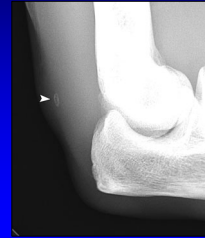
### Triceps Tear: partial thickness tear

- 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

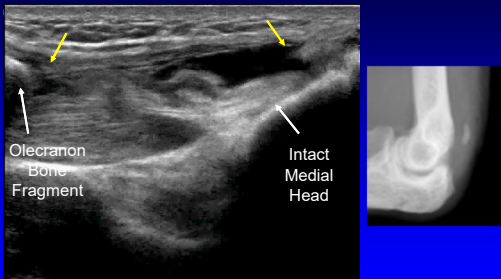
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### Triceps Tendon: partial tear + avulsion



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### Triceps Tendon: partial tear + avulsion



Long Axis (Sagittal Plane)

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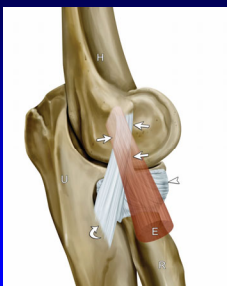
### Epicondylitis:

- 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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### Lateral Collateral Ligament Complex

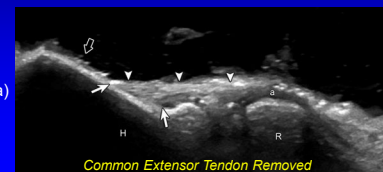
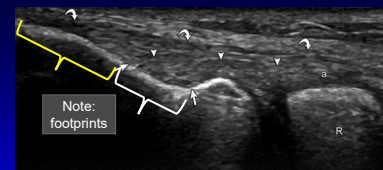


- Radial collateral ligament (arrows)
- Common extensor tendon (E)
- Annular ligament (arrowhead)
- Lateral ulnar collateral ligament (curved arrow)

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 2014; 33:1041

Common Extensor Tendon Removed

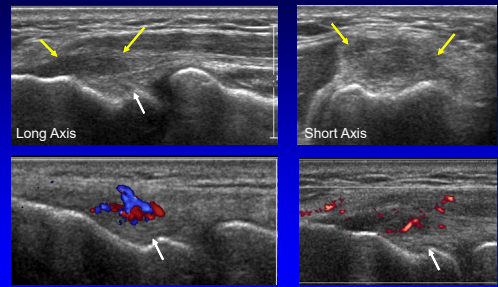
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### Common Extensor Tendon: elbow

- 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 inflammatory
- It is not a primary problem of the epicondyle

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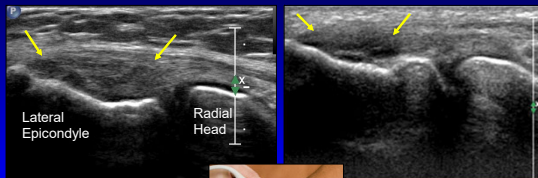
### Common Extensor Tendon: tendinosis



Note: normal radial collateral ligament (white arrow)

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### Common Extensor Tendon



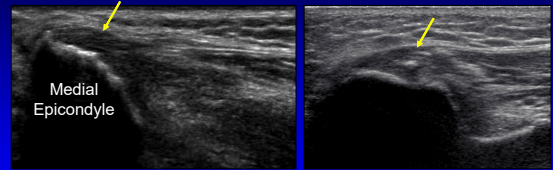
Patient #1  
Tendinosis



Patient #2  
Interstitial Tear

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### Common Flexor Tendon: tendinosis

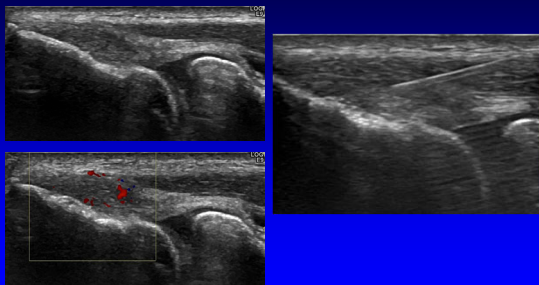


Patient #1

Patient #2

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### Tendon Fenestration

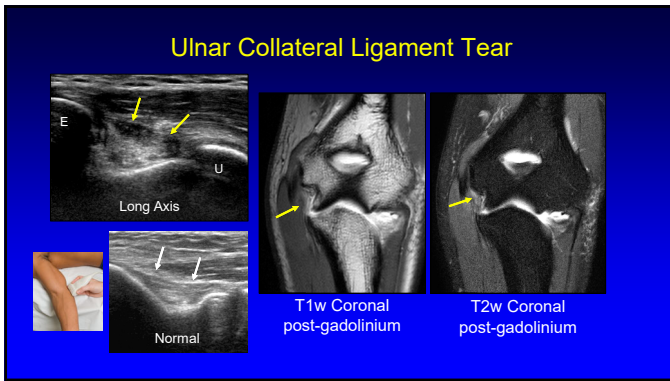


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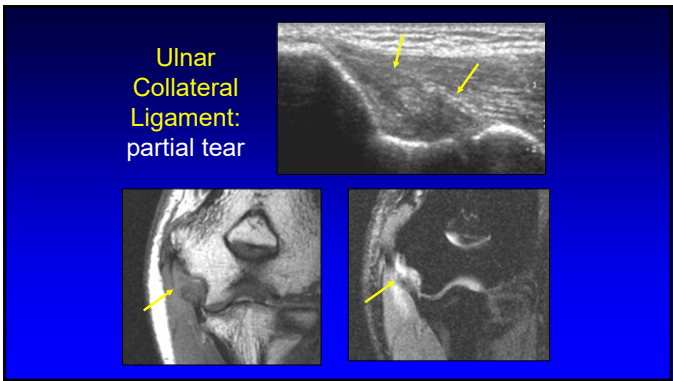
### Pathology:

- Joint effusion and bursa
- Tendon abnormalities
- Ligament abnormalities
- Nerve abnormalities
- Soft tissue masses

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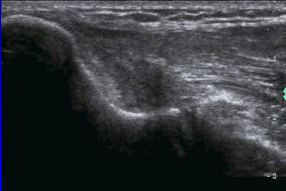
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### Ulnar Collateral Ligament

- Valgus stress: 30 degrees elbow flexion
  - Unlock the olecranon
  - Stress: UCL anterior bundle
- Gravity stress is adequate, equal to Telos<sup>1</sup>
- Ultrasound measurements:
  - Reliable and precise<sup>2</sup>



Ulnar Collateral Ligament: partial tear

<sup>1</sup>Harada M et al. J Sho Elb Surg 2014; 23:561  
<sup>2</sup>Bica 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

Roedl JB et al. Radiology 2016

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### Ulnar Collateral Ligament: laxity

With valgus stress

T2w fat sat

MIND THE GAP

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### Radial Collateral Ligament Complex: injury

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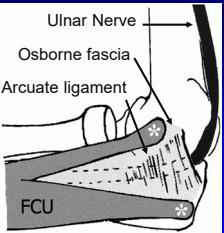
### Pathology:

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- Ligament abnormalities
- **Nerve abnormalities**
- Soft tissue masses

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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

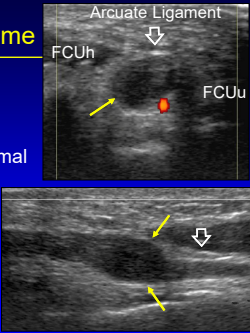


Martinoli, C. et al. Radiographics 2000;20:S199-S217

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### Ulnar Nerve: cubital tunnel syndrome

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

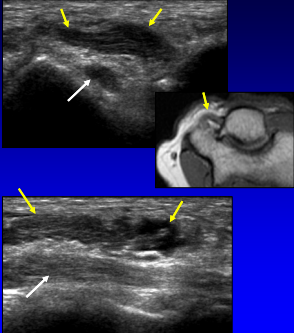


<sup>1</sup>Thoirs K et al. J Ultrasound Med 2008; 27:737  
<sup>2</sup>Yoon JS et al. Muscle Nerve 2008; 38:1231

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### Anconeus Epitrochlearis

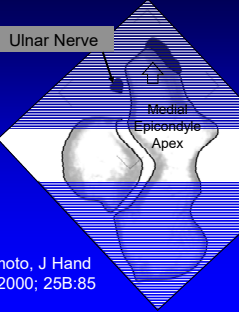
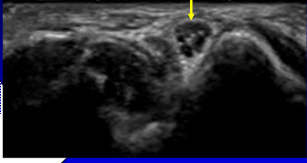

- Normal variant: 34% of population
- Roof of cubital tunnel:
  - Residual muscle
  - In absence of normal attrition forming Osborn fascia
- Secondary ulnar nerve entrapment
- **Diagnose in elbow extension!**



Sem Musculoskel Radiol 2000; 14:814-473

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### Isolated Ulnar Nerve Dislocation

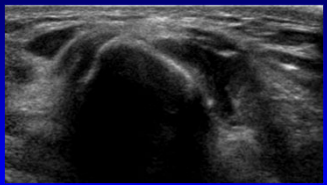
Okamoto, J Hand Surg 2000; 25B:85

\*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

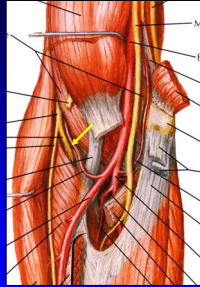


Jacobson JA et al. Radiology 2001; 220:601

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## Radial tunnel

- Radial nerve: deep branch
  - Originates from radial nerve between brachioradialis and brachialis
  - Passes between deep and superficial layers of supinator muscle
  - Exits as posterior interosseous nerve



Jacobson JA. et al. Sem Musculoskel Rad 2010; 14:473

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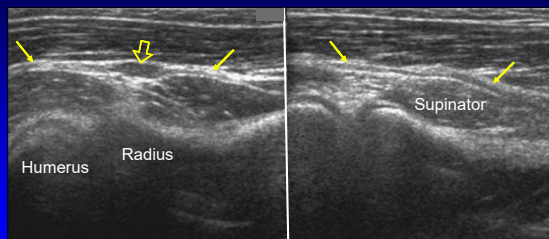
## Radial Nerve: deep branch

- Supinator syndrome:
  - Motor deficits (wrist, finger extension)
  - Abnormal electrodiagnostic studies
  - Nerve enlargement: entrapment
- Radial tunnel syndrome:
  - Pain, no motor deficits, normal EMG
  - Muscle denervation on MRI
  - No nerve enlargement

Ferdinand BD et al. Radiology 2006; 240:161

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## Supinator Syndrome: deep br. radial nv.



Abnormal

Normal

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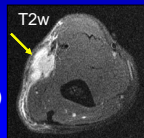
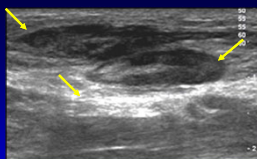
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## Cat scratch disease

- Animal scratch: usually a cat
  - Bartonella henselae
- Child or adolescent:
  - Most common
- Elbow:
  - Lymphadenopathy
  - Epitrochlear lymph node (medial)



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## Cat scratch fever = rock album



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### Take-home Points:

- Joint: aspirate if concern for infection
- Biceps and triceps:
  - Anatomy explains partial-thickness tears
- Nerves: don't forget to look
- Dynamic imaging
  - Ulnar nerve dislocation, snapping triceps
  - Ulnar collateral ligament evaluation

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[www.jacobsonmskus.com](http://www.jacobsonmskus.com)

Twitter handle: @jjacobsn

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