Ultrasound of Elbow Pathology and Intervention

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Syllabus

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Disclosures

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

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Pathology:

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

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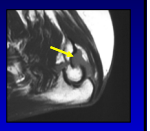
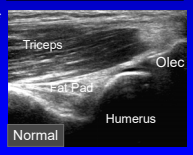
Joint Effusion

- 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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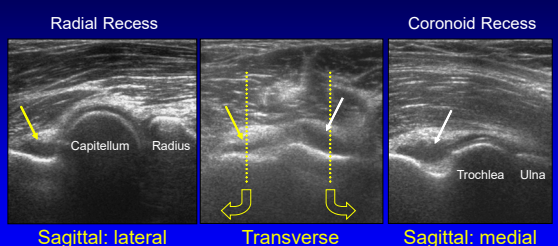
Joint Effusion: anterior elbow



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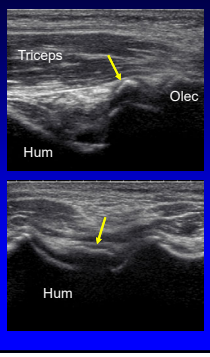
Intra-articular body

- 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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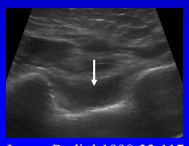
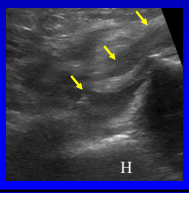
Elbow Joint

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



Invest Radiol 1998;33:117



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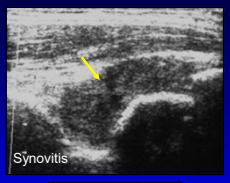
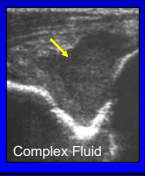
Complicated Fluid vs. Synovium

- 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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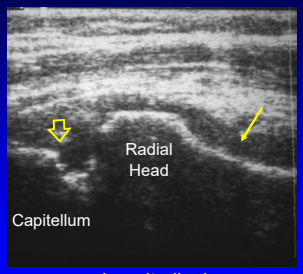
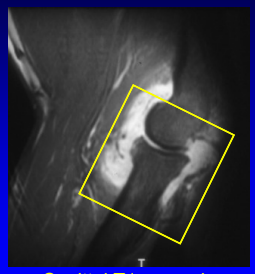
Septic Joint: Coccidiomycosis



Longitudinal



Sagittal T1w + gado

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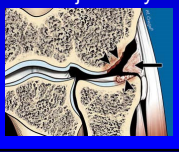
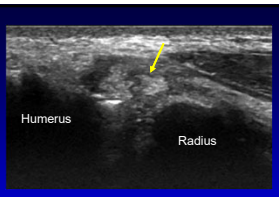
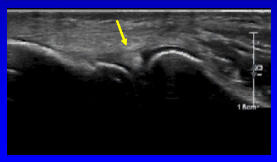
Synovial Fold Syndrome

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







Cerezal et al. AJR 2013; 201:W88

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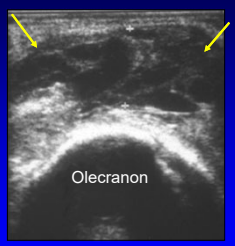
Olecranon Bursitis:

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



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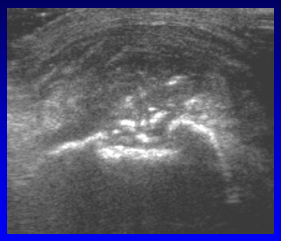
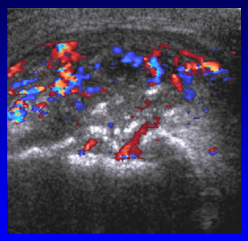
Olecranon Bursitis: Gout





Transverse

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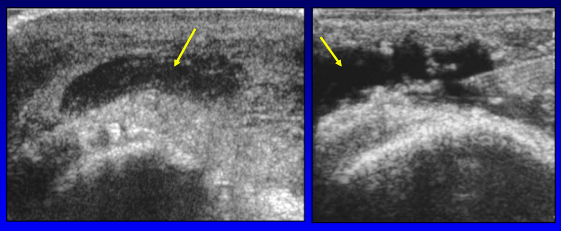
Olecranon Bursitis



Infection Traumatic

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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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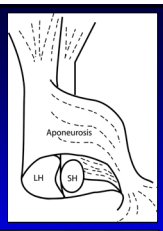
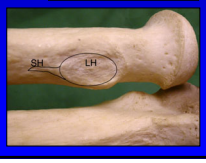
Biceps Brachii:

- 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

JBJS

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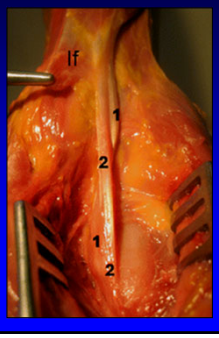
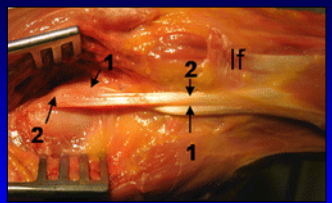
Biceps Brachii: long (1), short (2) heads





Note: long head (1) courses lateral to medial, deep to short head (2)

From: Tagliafico A., et.al. Eur Radiol 2010; 20:202

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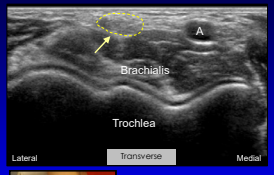
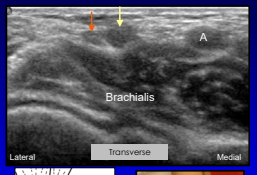
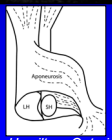
Biceps Brachii: terminal bifurcation





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



Courtesy of M. Chiavaras, Hamilton, Ontario

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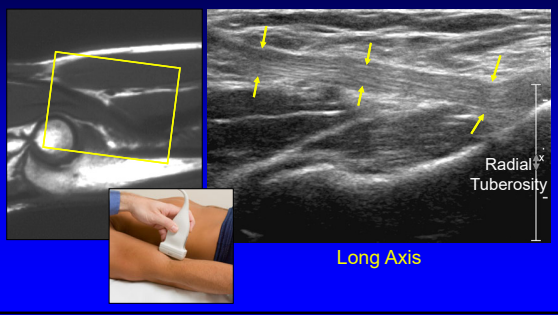
Biceps Brachii Tendon: distal



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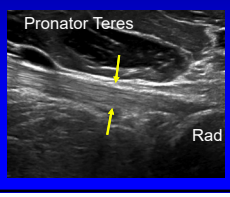
Biceps Tendon

- Medial approach
- "Pronator window"
- Transducer:
  - Distal aspect over medial epicondyle
  - Parallel to humerus
  - Slide transducer anterior

Smith J. et al. J Ultrasound Med 2010; 29:861



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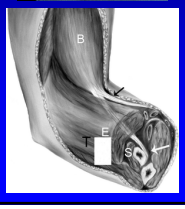
Biceps Brachii Tendon: lateral approach

Long Axis: dynamic imaging

Kalume Brigido M. Eur Radiol 2009 ; 19:1817



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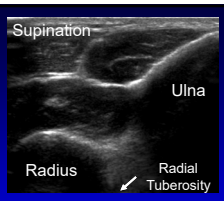
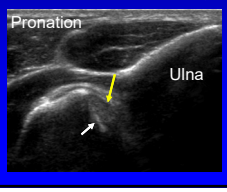
Biceps Tendon

- Flexion, pronation view
- Transverse: between radius and ulna
- Radial tuberosity rotated into view
- Limited diagnostic value
- Ideal biceps tendon injection





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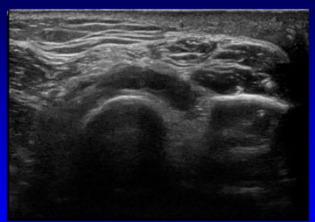
Snapping Biceps: dynamic evaluation



Dorsal Flexion Pronation

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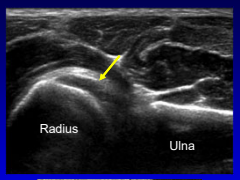
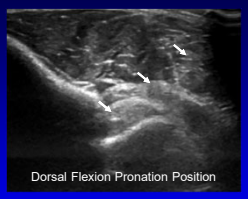
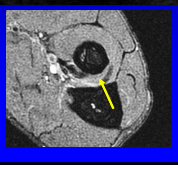
Biceps Brachii Tendon: whole blood injection







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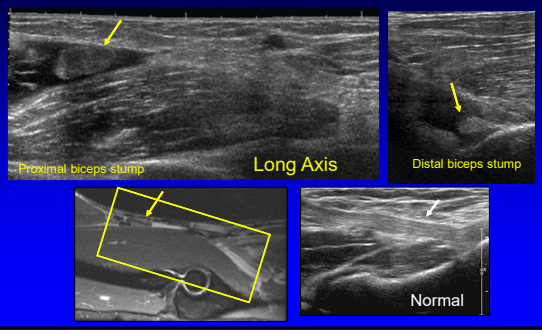
Biceps Brachii Tendon: complete tear



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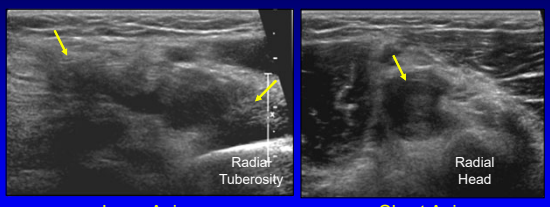
Biceps Brachii Tendon: complete tear



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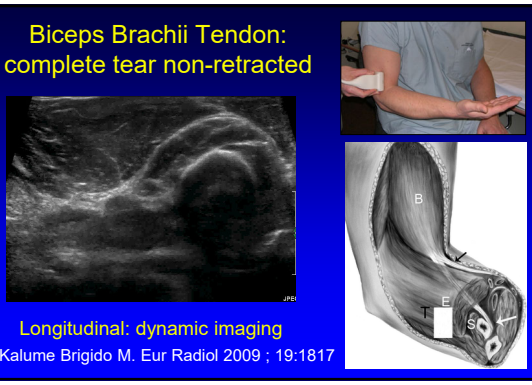
Biceps Brachii Tendon: complete tear non-retracted



Longitudinal: dynamic imaging

Kalume Brigido M. Eur Radiol 2009 ; 19:1817

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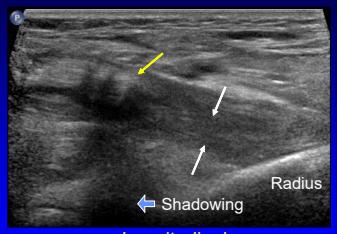
Biceps Brachii Tendon: partial tear (short head)



Longitudinal:

Retracted superficial short head (yellow arrows)

Hypoechoic but intact deep long head (white arrows)

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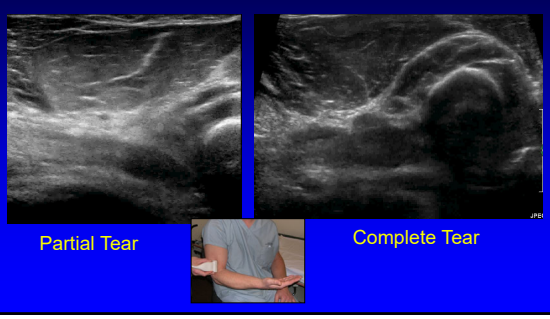
Biceps Tendon Tears: dynamic imaging



Partial Tear

Complete Tear

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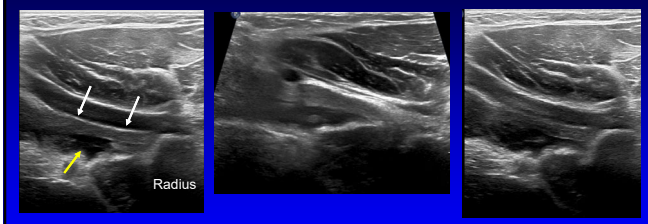
Biceps Brachii Tendon: partial tear (long head)



Dynamic: medial approach

Long head tear (yellow arrows)

Spared superficial short head (white arrows)

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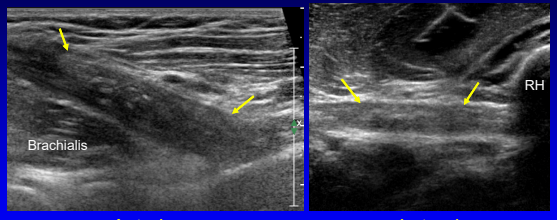
Biceps Brachii Tendon: repaired



Anterior Lateral

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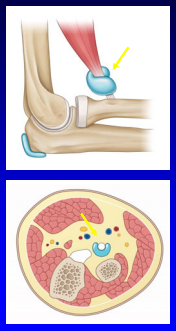
Bicipitoradial Bursa

- 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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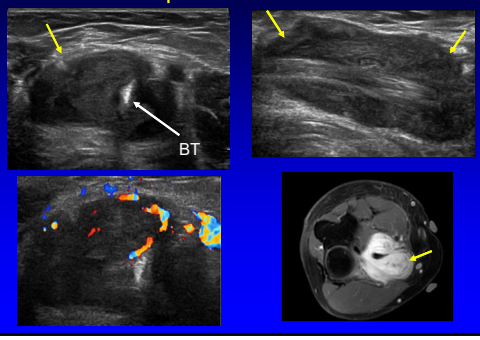
Bicipitoradial Bursitis



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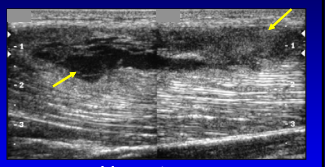
Triceps Tear

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



Hematoma

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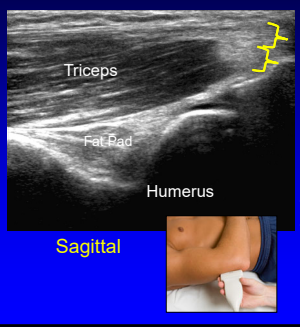
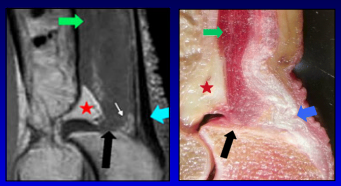
Triceps Brachii: insertion



Sagittal



- 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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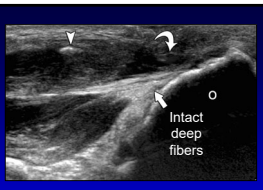
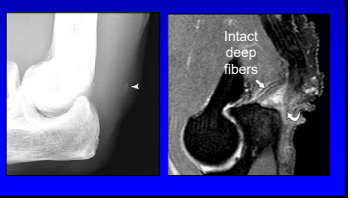
Triceps Tear: partial thickness tear

- 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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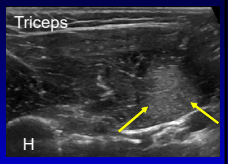
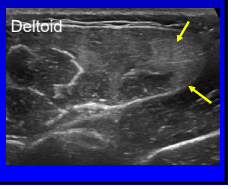
Muscle Injury: DOMS

- Delayed onset muscle soreness
- Type 1 muscle strain
- Pain after intense physical activity:
  - Microtrauma: inflammation, edema
  - Onset: day 1, peak day 2-3, resolves day 7
  - Possible increased creatine kinase
- Upper extremity: triceps, biceps, brachialis
- Muscle enlargement, Increased echogenicity

Longo V et al. J Ultrasound Med 2016; 35:2517





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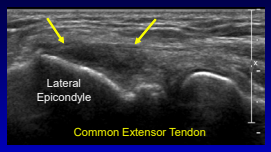
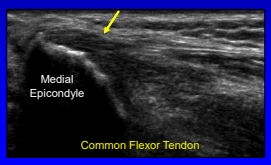
"Epicondylitis"

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

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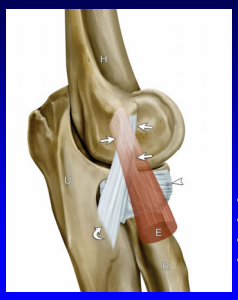
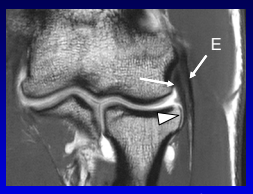
Lateral Collateral Ligament Complex





- 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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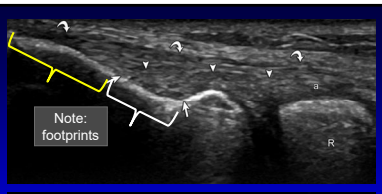
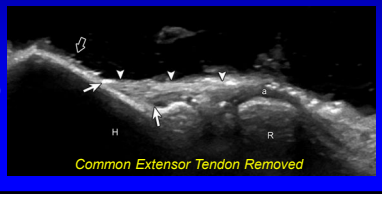
Lateral Collateral Ligament Complex

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

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





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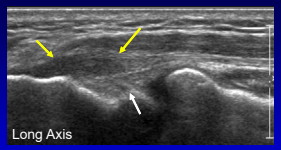
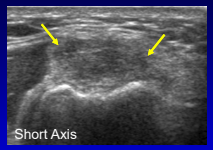
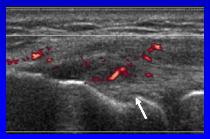
Common Extensor Tendon: tendinosis







Note: normal radial collateral ligament (white arrow)

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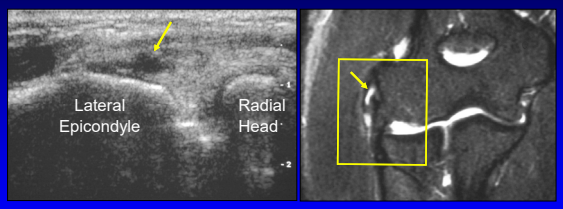
Common Extensor Tendon: partial tear



Longitudinal

Coronal T2w

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Common Extensor Tendon

- PRP (72%) vs fenestration (56%)
  - *Both improved*
  - Mishra, Am J Sports Med 2013
- PRP, fenestration, steroid (in tendon):
  - *No significant difference*
  - Krogh, Am J Sports Med 2013; 41:625
- PRP vs whole blood: *no difference*
  - Thanasas, Am J Sports Med 2011; 39:3120

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Pathology:

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

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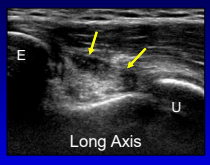
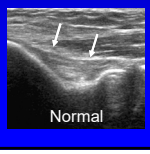
Ulnar Collateral Ligament Tear

T1w Coronal
post-gadolinium

T2w Coronal
post-gadolinium





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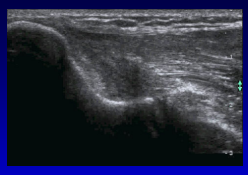
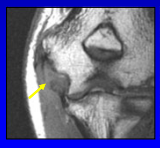
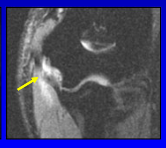
Ulnar Collateral Ligament

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

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







Ulnar Collateral Ligament: partial tear

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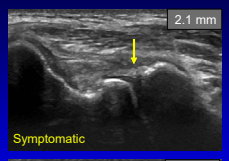
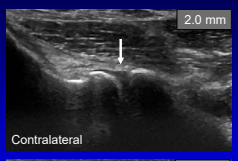
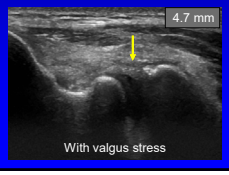
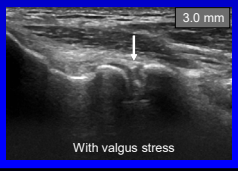
Ulnar Collateral Ligament: laxity









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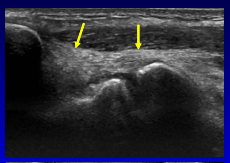
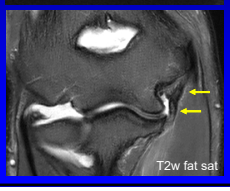
Ulnar Collateral Ligament: laxity





With valgus stress

MIND THE GAP

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PRP and Ligament Injection

- Ulnar collateral ligament: elbow
  - Partial tear on MRI
  - 34 athletes: followed for 70 weeks
  - 88% returned to play, average 12 weeks
  - Joint space widening:
    - Decreased from 28 to 20 mm
    - Change in widening: 7 to 2.5 mm

Podesta et al. Am J Sports Med 2013; 41:1689

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Radial Collateral Ligament Tear:

- Abnormal hypoechogenicity
- Can be difficult to demonstrate
- Lateral ulnar collateral ligament tear or thickening:
  - Associated with lateral epicondylitis

Bredella et al. AJR 1999; 173:1379

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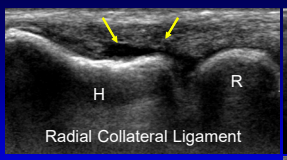
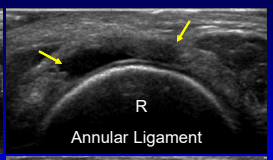
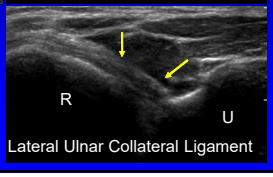
Radial Collateral Ligament Complex: injury







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Pathology:

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

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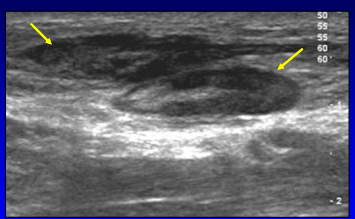
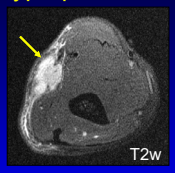
Epitrochlear Lymph Nodes: hyperplastic





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Cat scratch disease = infection

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

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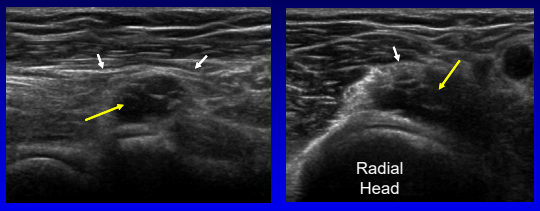
Ganglion Cyst: radial nerve compression



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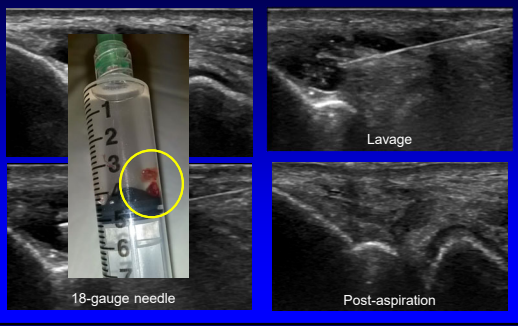
Ganglion Cyst (elbow): aspiration



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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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Thank you!

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

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