Ultrasound of Common Elbow Pathology

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Disclosures

- Consultant: Bioclinica
- Advisor: Philips
- 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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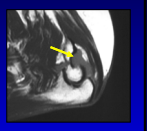
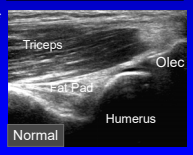
Joint Effusion

- 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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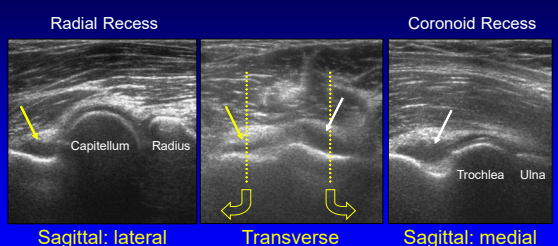
Joint Effusion: anterior elbow



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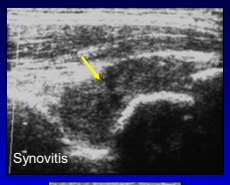
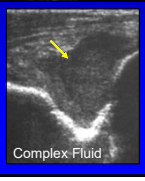
Complicated Fluid vs. Synovium

- 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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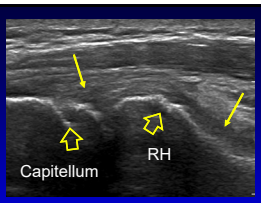
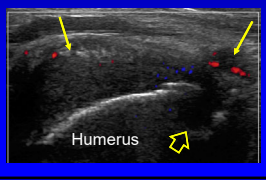
Synovial Hypertrophy and Erosions





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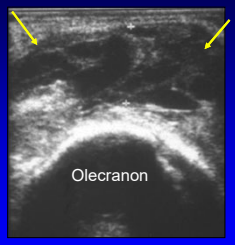
Olecranon Bursitis:

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



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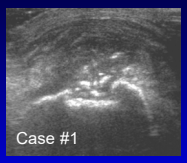
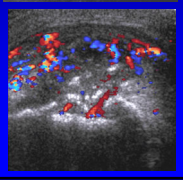
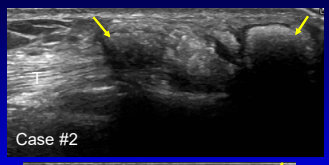
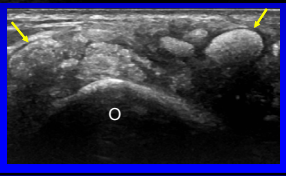
Olecranon Bursitis: Gout









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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, enlarged
- Partial-thickness tear: anechoic focus, no retraction
- Full-thickness tear: discontinuity
  - Dynamic imaging: retraction

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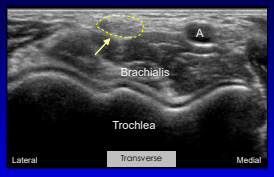
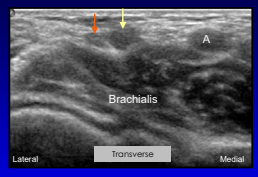
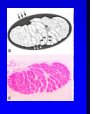
Biceps Brachii: terminal bifurcation





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



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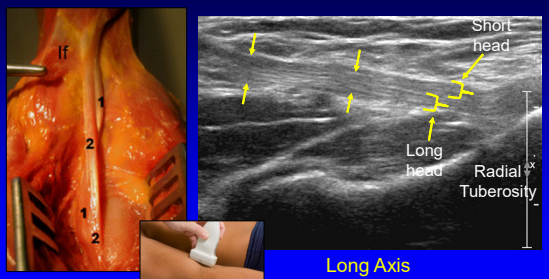
Biceps Brachii Tendon: distal



Long Axis

1 = long head
2 = short head

Tagliafico A., et.al. Eur Radiol 2010

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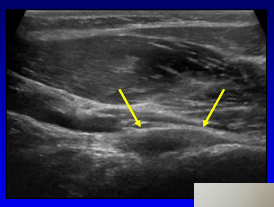
Biceps Brachii Tendon: tendinosis

Anterior Approach



Medial Approach

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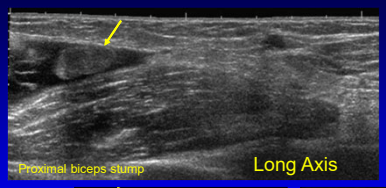
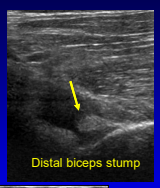
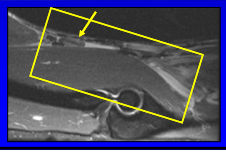
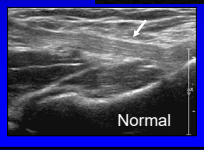
Biceps Brachii Tendon: complete tear



Long Axis







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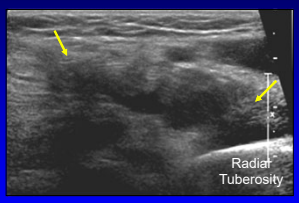
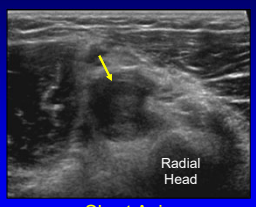
Biceps Brachii Tendon: complete tear



Long Axis



Short Axis

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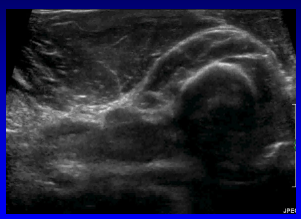
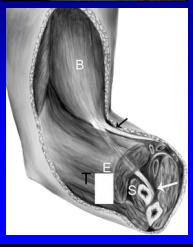
Biceps Brachii Tendon: complete tear non-retracted



Longitudinal: dynamic imaging

Kalume Brigido M. Eur Radiol 2009 ; 19:1817



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Biceps Brachii Tears:

- Diagnosis of full-thickness tear versus partial-thickness tear:
  - 95% sensitivity
  - 71% specificity
  - 91% accuracy
- Shadowing: important indirect sign of tendon retraction

da Gama Lobo et al., Am J Roentgenol 2013; 200:158

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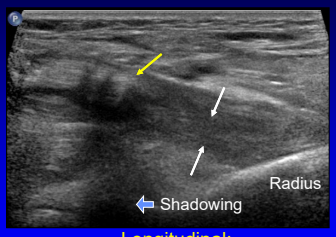
Biceps Brachii Tendon: partial tear (short head)



Longitudinal:
Retracted superficial short head (yellow arrows)
Hypoechoic but intact deep long head (white arrows)

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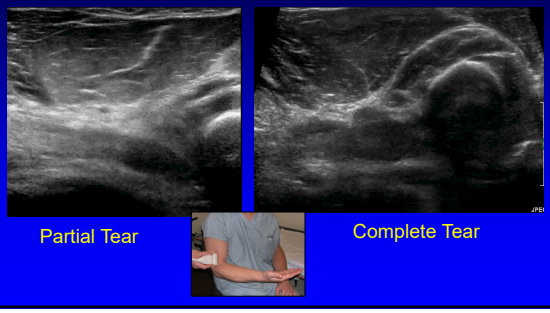
Biceps Tendon Tears: dynamic imaging



Partial Tear

Complete Tear

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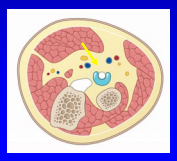
Bicipitoradial Bursa

- 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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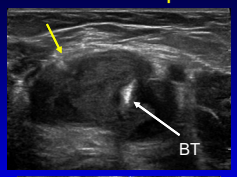
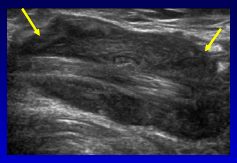
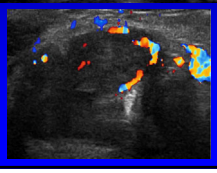
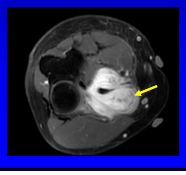
Bicipitoradial Bursitis









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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

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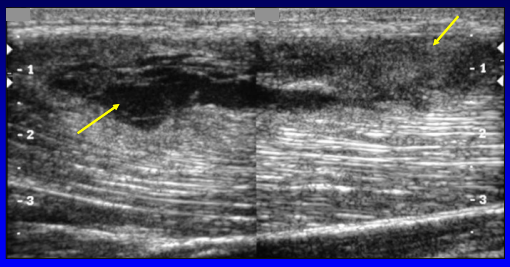
Hematoma: triceps



Longitudinal

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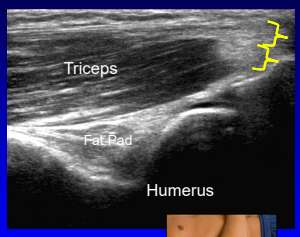
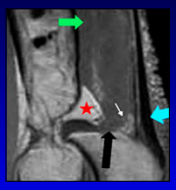
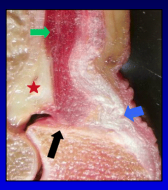
Triceps Brachii: insertion



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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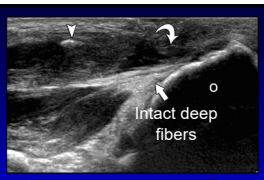
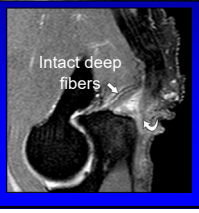
Triceps Tendon: partial tear + avulsion





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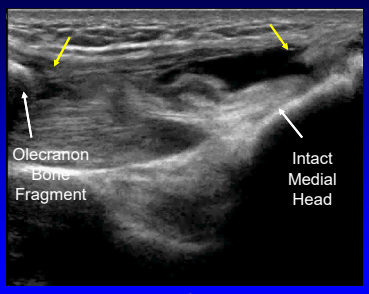
Triceps Tendon: partial tear + avulsion



Long Axis (Sagittal Plane)

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Epicondylitis:

- Common flexor and extensor tendons
- Abnormal hypoechogenicity
  - 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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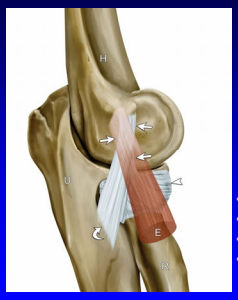
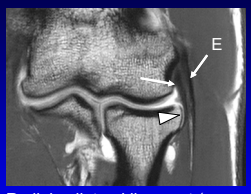
Lateral Collateral Ligament Complex





- 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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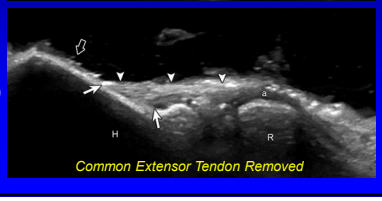
Lateral Collateral Ligament Complex

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

Jacobson J. et al. J Ultrasound Medicine 2014; 33:1041



Common Extensor Tendon Removed

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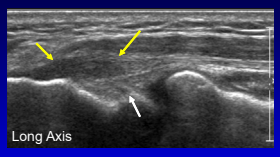
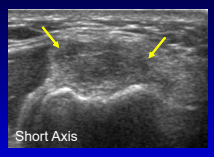
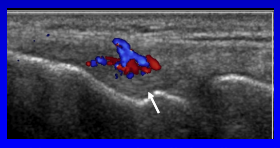
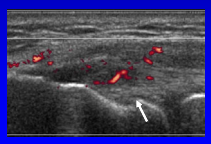
Common Extensor Tendon: tendinosis









Note: normal radial collateral ligament (white arrow)

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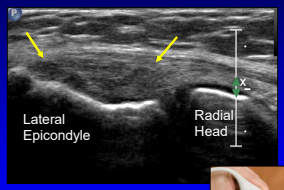
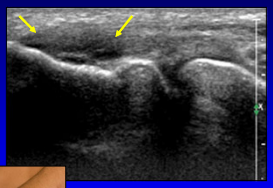
Common Extensor Tendon





Patient #1

Tendinosis

Patient #2

Interstitial Tear

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Pathology:

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

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One of the many causes for elbow injury

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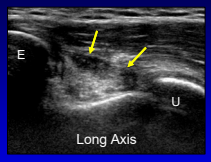
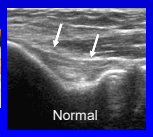
Ulnar Collateral Ligament Tear






T1w Coronal post-gadolinium


T2w Coronal post-gadolinium

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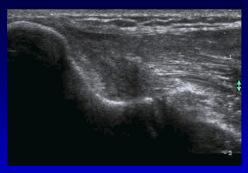
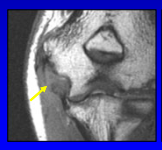
Ulnar Collateral Ligament

- 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: 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; 270.827

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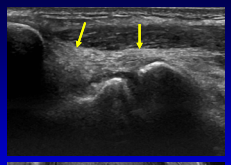
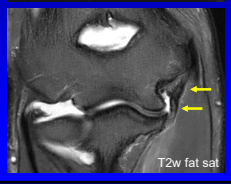
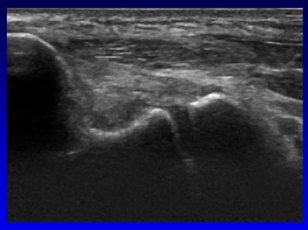
Ulnar Collateral Ligament: laxity







With valgus stress

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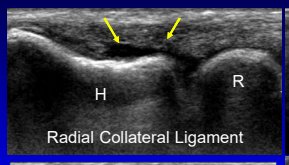
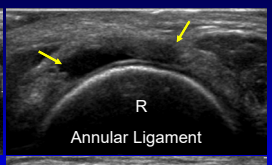
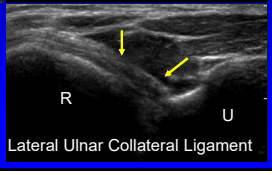
Radial Collateral Ligament Complex: injury







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Pathology:

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

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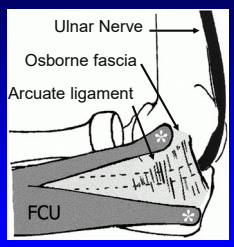
Ulnar Nerve: anatomy

- 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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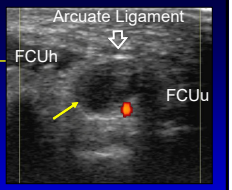
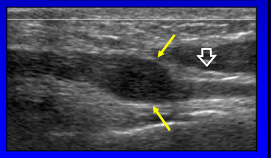
Ulnar Nerve: cubital tunnel syndrome

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





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

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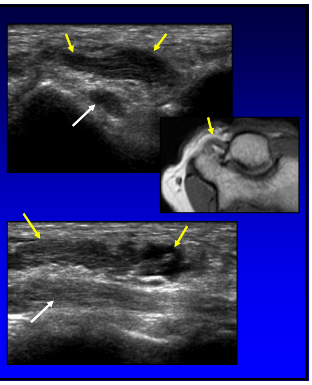
Anconeus Epitrochlearis

- 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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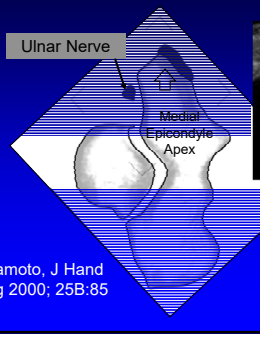
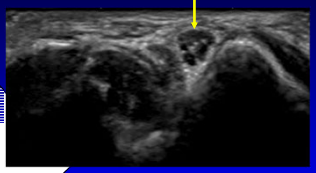
Isolated Ulnar Nerve Dislocation





Okamoto, J Hand Surg 2000; 25B:85

*Asymptomatic finding in 20%

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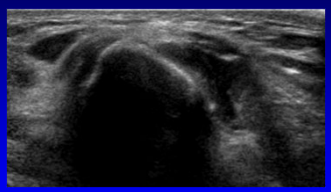
Snapping Triceps Syndrome

- 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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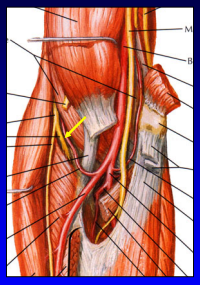
Radial Nerve: deep branch

- 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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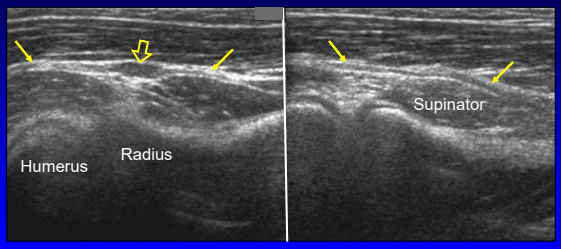
Supinator Syndrome: deep br. radial nv.



Abnormal Normal

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Pathology:

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

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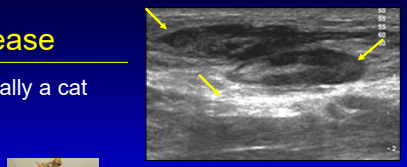
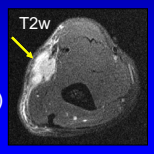
Cat scratch disease

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





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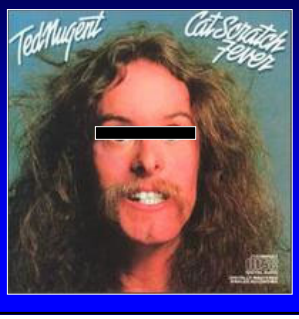
Cat scratch fever = rock album



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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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Thank you!

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

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