

Ultrasound of Common Elbow Pathology

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Disclosures

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

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Fundamentals of Musculoskeletal Ultrasound are
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Pathology:

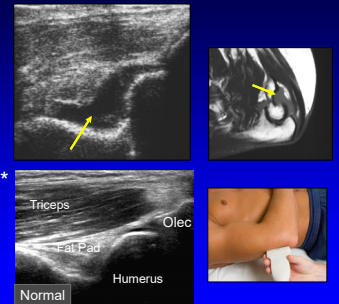
- Joint effusion and bursa
- Tendon abnormalities
- Ligament abnormalities
- Nerve abnormalities
- Soft tissue masses

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Joint Effusion

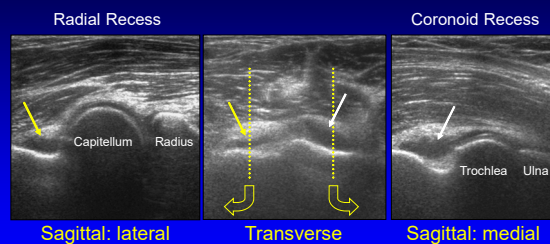
- Olecranon recess
- Displaced hyperechoic fat pad by anechoic / hypoechoic fluid
- Best place to look with US*
- More sensitive than radiographs*

De Maeseneer, Invest Radiol
1998; 33:117



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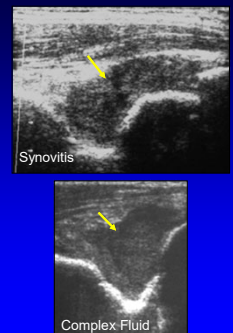
Joint Effusion: anterior elbow



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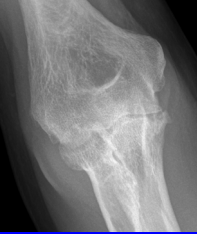
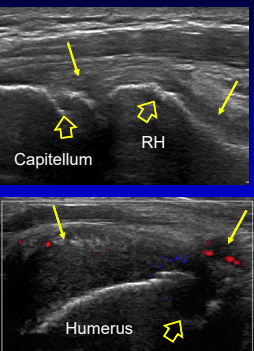
Complicated Fluid vs. Synovitis

- 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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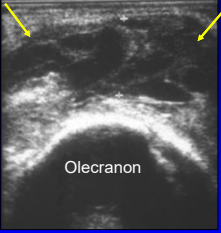
Synovial Hypertrophy and Erosions

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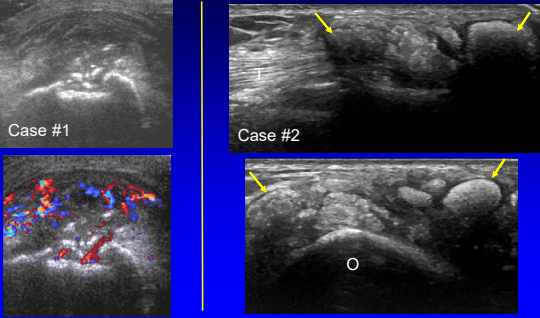
Olecranon Bursitis:

- 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

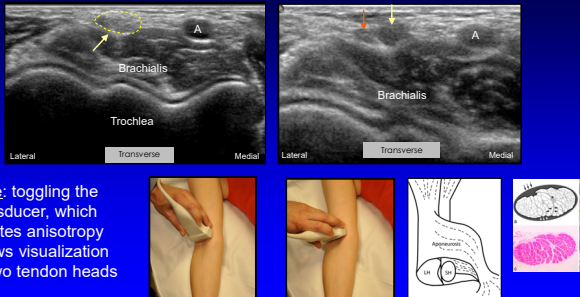
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Tendon Abnormalities:

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

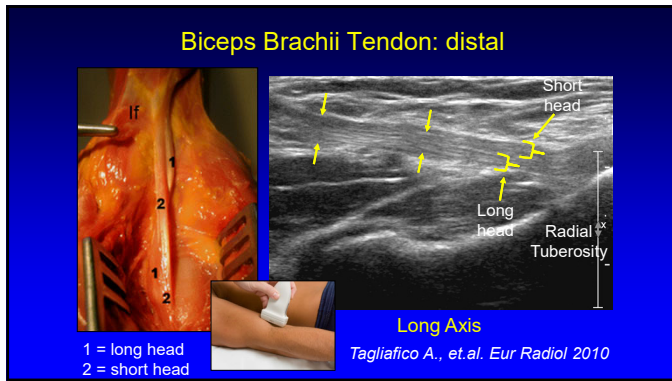
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Biceps Brachii: terminal bifurcation

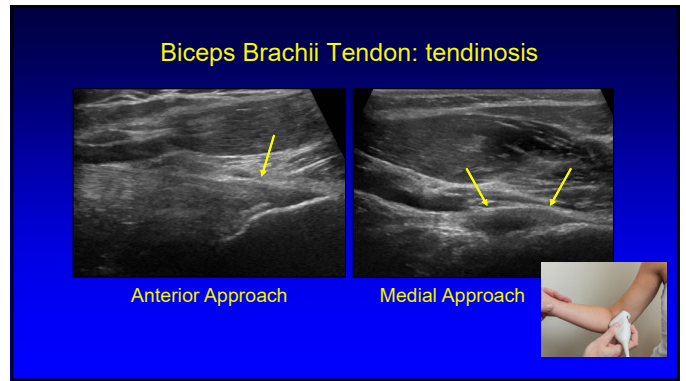


Note: toggling the transducer, which creates anisotropy allows visualization of two tendon heads

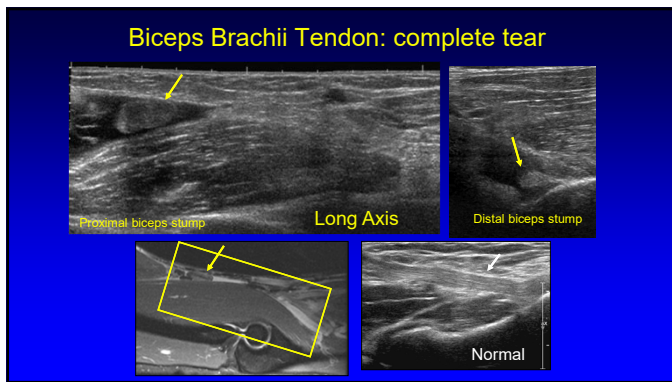
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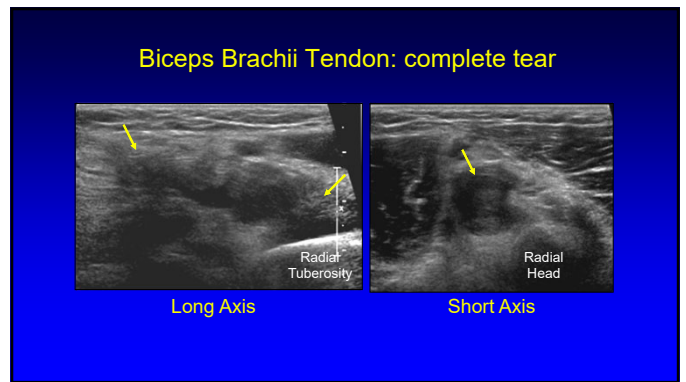
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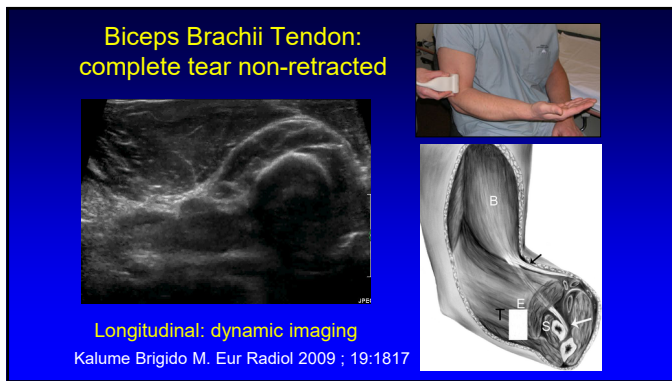
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Biceps Brachii Tears:

- 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

BT

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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

Triceps
Fat Pad
Humerus

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

Intact deep fibers

Intact deep fibers

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Triceps Tendon: partial tear + avulsion

Olecranon Bone Fragment

Intact Medial Head

Long Axis (Sagittal Plane)

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Epicondylitis:

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

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

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Common Extensor Tendon: elbow

- Often called “tennis elbow” or “lateral epicondylitis” or “epicondylosis” or
- All terms are misnomers
- Those inflicted usually do not play tennis (professionally or correctly)
- It is not 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
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Ulnar Collateral Ligament Tear

Long Axis

Normal

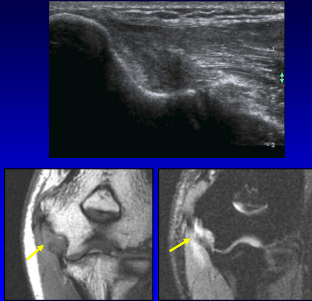
T1w Coronal post-gadolinium

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 Telos¹
- Ultrasound measurements:
 - Reliable and precise²



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

Ulnar Collateral Ligament: partial tear

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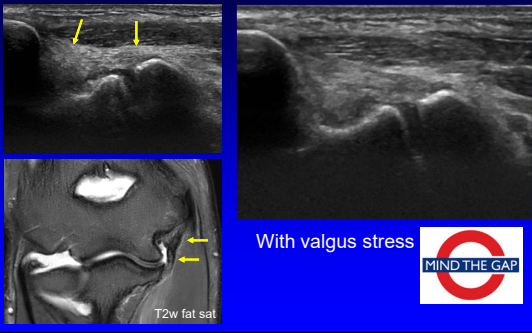
Ulnar Collateral Ligament: valgus stress

- >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



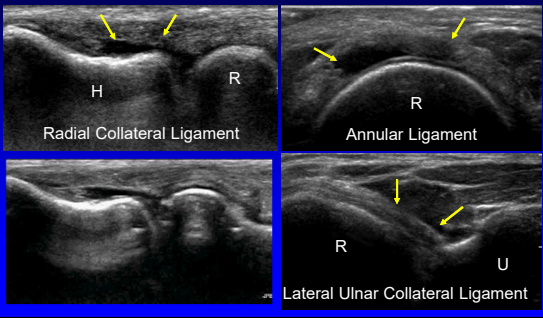
With valgus stress

T2w fat sat

MIND THE GAP

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Radial Collateral Ligament Complex: injury



H R
Radial Collateral Ligament

R
Annular Ligament

R U
Lateral Ulnar Collateral Ligament

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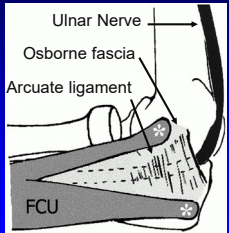
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- Soft tissue masses

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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



Ulnar Nerve

Osborne fascia

Arcuate ligament

FCU

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

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Ulnar Nerve: cubital tunnel syndrome

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

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

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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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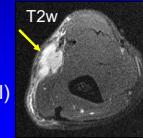
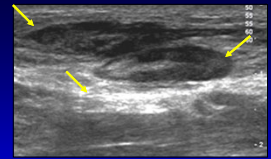
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- **Soft tissue masses**

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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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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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