Ultrasound of the Elbow with MRI Correlation

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Fundamentals of Musculoskeletal Ultrasound are copyrighted by Elsevier Inc.

Pathology:
• Joint effusion and bursa
• Tendon abnormalities
• Ligament abnormalities
• Nerve abnormalities
• Soft tissue masses

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 Radiology 1998; 33:117

Olecranon Recess: joint effusion

Joint Effusion: anterior elbow

Olecranon Recess: joint effusion

Joint Effusion: anterior elbow

Sagittal: lateral
Transverse
Sagittal: medial
Olecranon Recess

Synovitis: seronegative arthritis
Complex Fluid: septic

Septic Joint: Coccidiomycosis

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

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

Biceps Brachii:
- Insertion: radial tuberosity
  - Short head: superficial, distal
  - Long head: deep, proximal
- No synovial sheath
- Bicipitoradial bursa

Biceps Brachii: terminal bifurcation

Biceps Brachii Tendon: distal

Biceps Brachii Tendon: tendinosis

Biceps Brachii Tendon: complete tear

Biceps Brachii Tendon: complete tear non-retracted

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

1 = long head
2 = short head

Medial Approach

Kalume Brigido M. Eur Radiol 2009; 19:1817

**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

**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: short head tear**

- Yellow arrows = short head
- White arrows = fluid around long head

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**Biceps Brachii: short head tear**

- Yellow arrows = tear of short head
- White arrows = intact long head
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

Bicipitoradial Bursitis

Triceps Tear:

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

Hematoma: triceps

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

Anatomy of the Distal Triceps Brachii

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

*From Resnick, Skeletal Radiol 2009; 38:171
Triceps Tendon:
- partial tear + avulsion
- Intact deep fibers

Long Axis (Sagittal Plane)

Epicondylitis:
- Common flexor and extensor tendons
- Abnormal hypoechoigenicity
  - Mucoid degeneration, tendinosis
- Anechoic: partial-thickness tear
- No inflammatory cells*

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

Common Extensor Tendon: elbow
- Often called “tennis elbow” or “lateral epicondylitis” or “epicondylodesis” 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

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

Lateral Ulnar Collateral Ligament (LUCL)

*LUCL attaches at crista supinator of ulna

Common Extensor Tendon: partial tear

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Ulnar Collateral Ligament Tear

Ulnar Collateral Ligament: partial tear
Ulnar Collateral Ligament

- Valgus stress: 30 degrees elbow flexion
  - Unlock the olecranon
  - Stress the UCL anterior band
- Gravity stress is adequate, equal to Telos\(^1\)
- Ultrasound measurements:
  - Reliable and precise\(^2\)

1Harada M et al. J Sho Elb Surg 2014; 23:561

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 Nerve: anatomy

- Behind medial epicondyle of humerus:
  - Cubital tunnel retinaculum or Osborn’s fascia
- Distal to epicondyle:
  - True cubital tunnel
  - Between ulnar and humeral heads: flexor carpi ulnaris
  - Under arcuate ligament

Ulnar Nerve: cubital tunnel syndrome

- Hypoechoic and enlarged
  - > 9 mm² area\(^1\)
  - Ratio greater than 2.8 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

Ulnar Nerve: dislocation

- 20% of asymptomatic volunteers
- Dynamic imaging:
  - Dislocates in anterior to medial epicondyle of humerus in elbow flexion
  - Reduces in extension (normal MRI)
- Transducer pressure may inhibit movement

Okamoto, J Hand Surg Br 2000; 25:499

Technique: ulnar nerve subluxation

Isolated Ulnar Nerve Dislocation
Snapping Triceps Syndrome: *dynamic imaging*

Anterior Posterior

Transverse

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

Supinator Syndrome: deep br. radial nv.

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Epitrochlear Lymph Node: hyperplastic

Cat scratch disease = infection

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

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

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