

ELBOW MRI

BASICS

supine vs prone (superman) imaging
Coronal for collateral lig and bones
Sagittal for biceps/triceps tendons and cartilage
Axial for muscles and nerves
FABS (flexed elbow, abducted shoulder, and supinated forearm) axial/sag PD for biceps
Arthrogram (do for OCD, loose bodies, undersurface tears of radial/ulnar collateral lig)

BONES/CARTILAGE

-Capitellar pseudodefekt (posterior non-articular capitellum has abrupt notch-like slope on coronal image)
-Bare area "trochlear cortical notch or groove" (devoid of cartilage) and "transverse trochlear ridge" of olecranon seen on sagittal
-Radiocapitellar joint
-Ulnohumeral joint (ulnar coronoid → trochlea; olecranon process)
-Prox RUJ (radial head rotates w/in sigmoid notch of ulna for pronation/supination)

- Panner's (5-12yo; fragmented/mottled capitellar epiphysis w/ patchy low signal T1 w/ abnl contours & no loose body; resolve upon F/U w/ no residual deformity)
- OCL (12-16yo; anterior convex aspect of capitellum in dominant hand of thrower due to chronic microtrauma → assess for stability of fragment, loose body, and overlying hyaline cartilage integrity; F/U shows residual deformity)—unstable if surrounding T2 signal/cyst deep to fragment/T2 edema in fragment (do arthrogram)
-MIMIC=pseudodefekt posterior non-articular capitellum has abrupt notch-like slope on coronal image (but no edema)
- Epicondylitis (adults; medial>lateral; implies partial tear/tendinopathy); Apophysitis (kids; widening of physis on plain film c/w SH-I fx; "Little league" elbow)
- Stress fx (middle third of olecranon)
- Posterior dislocation (assoc w/ tear of radial collateral lig and common extensor tendon)

LIGAMENTS (coronal)

-**Radial (lateral) collateral ligaments** ("tennis elbow"; generally not torn unless posterior dislocation vs after radial head resection vs after common extensor tendon or tennis elbow release) RESIST VARUS STRESS

- **RCL** (radial collateral lig; coronal; triangular; arises from anterior aspect of epicondyle and inserts onto annular lig & fascia of supinator muscle; may be hard to distinguish from overlying common extensor tendon unless joint effusion or arthrogram)
- **LUCL** (lateral ulnar collateral lig; coronal; most important posterolateral stabilizer; located posterior and superficial; oriented obliquely; inserts onto crista supinatoris of ulna; absent in 10%; tear leads to posterolateral rotatory insufficiency → transient rotatory sublux ulnohumeral jt and secondary sublux/disloc of radiohumeral jt)
- **Annular ligament** (axial; arises and inserts on sigmoid notch of ulna; primary stabilizer of prox RUJ)
- Evaluate integrity of **common extensor tendon** (superficial to radial collateral lig)
- Lateral synovial fringe (radiocapitellar meniscus; seen on coronal)
- Tennis elbow (radial collateral lig injury + common extensor tendon injury esp partial avulsion of extensor carpi radialis brevis + lat epicondylitis)—MIMIC=radial nerve entrapment

-**Ulnar (medial) collateral ligaments**—more commonly injured (even though lateral epicondylitis more common) RESIST VALGUS STRESS

- **Anterior bundle UCL** (thicker and most imp; coronal; prox flared and distal tapered; from epicondyle to sublime tubercle of coronoid process which can avulse off; should be taut; normal to have sl signal w/in prox flared portion; midsubstance tear > distal > proximal; chronic degen or remodelling if thickened +/- dystrophic calc; partial-thickness deep undersurface tears very difficult w/o gad → subtle fluid beneath distal extent of bundle separating lig from bone "T-sign" on coronal c/w partial tear or stripping)—tears treated surgically only in elite athletes aka Tommy John's surgery (docking technique w/ autograft)
- Other 2 bundles not well seen (together form floor of cubital tunnel)
 - Posterior bundle** (fan-shaped; from epicondyle to olecranon; best seen when elbow flexed at 90deg)
 - Transverse bundle** (least imp; horizontal from olecranon to coronoid; join inf aspects of anterior and posterior bundles)
- Evaluate integrity of **common flexor tendon**
- Golfer's elbow (ulnar collateral lig injury + common flexor tendon injury + medial epicondylitis; "Little league elbow"=avulsion of medial epicondylar apophysis)

Valgus instability (etiologies include: medial epicondylar pathology; ulnar neuropathy; posteromedial olecranon impingement +/- loose bodies; radiocapitellar overload w/ OCD)

MUSCLES (axial and sagittal)

- **Anterior compartment**

-Biceps brachii tendon (short head inserts distally on radial tuberosity with larger footprint while long head inserts slightly proximally with smaller footprint; no synovial lining; bicipital aponeurosis aka lacertus fibrosus keeps it in place at antecubital fossa; distal tendon covered by extrasynovial paratenon; radiobicipital bursa underneath it at radial tuberosity normally not visualized; partial tear less common than complete tear; injury occurs with abrupt overloading of muscle at midflexion; complete tear at radial tuberosity → look for "popeye" prox retraction and integrity of aponeurosis; may not retract unless aponeurosis is torn) —mimickers of biceps tear include biceps tendonitis vs radiobicipital bursitis (usually seen with partial tear) vs lateral antebrachial cutaneous nerve entrapment

-Brachialis (deep to biceps; inserts on ulnar tuberosity; tendon surrounded by muscle so not commonly injured; tendonitis/sprain aka "climber's elbow")

- **Posterior compartment**

-Triceps brachii (broad insertion on prox olecranon; ok to have high T1/T2 signal striated signal at insertion; tendon rupture is least common; may have degeneration if associated olecranon bursitis; dialysis/lupus/HPT predispose to rupture; laxity of tendon ok if elbow fully extended)

-Anconeus (triangular/curvilinear; arises from posterior aspect of lateral epicondyle and inserts laterally on olecranon; helps identify lateral from medial elbow on axial)

- **Medial compartment** (more commonly injured than lateral compartment even though lateral epicondylitis more common)

-Common flexor tendon (conjoined tendon insert on medial epicondyle; disruption more common than common extensor tendon; "golfers" or "pitchers" elbow)

- Flexors of wrist/hand (deepest; flexor carpi radialis, flexor carpi ulnaris, flexor digitorum superficialis)

- Palmaris longus

- Pronator teres (most superficial)

- **Lateral compartment**

-Common extensor tendon (conjoined tendon inserts on lateral epicondyle)

- Extensors of wrist/hand (extensor carpi radialis brevis=most common culprit in lateral epicondylopathy, extensor digitorum, extensor digiti minimi, and extensor carpi

- ulnaris originate for lateral epicondyle however, extensor carpi radialis longus originates from lower supracondylar ridge of humerus)

- Supinator (wraps around radial neck)

- Brachioradialis (big muscle anterolateral; arises from upper supracondylar ridge of humerus)

NERVES (axial T1 and T2)

-Neuropathy (nerve=increased T2 signal, thickened nerve, indistinct fascicles, fluid around nerve; muscle=acute neurogenic edema, late fatty infiltration and muscle atrophy)

- **Ulnar nerve** (injury more common than other nerves; located posterior to medial epicondyle)

-Cubital tunnel (floor=post/transverse bundles of ulnar collateral lig; roof="proximally" by CT retinaculum aka Osborne lig extending from olecranon to medial epicondyle but it may be absent/incomplete and "distally" by flexor carpi ulnaris aponeurosis aka arcuate lig)

-Cubital tunnel syndrome=paraesthesia ring and little finger (thickened CT retinaculum; thickened ulnar collateral lig; bone spur at medial epicondyle; anomalous anconeus epitrochlearis muscle replacing CT retinaculum; anomalous lig of spinner; absent CT retinaculum resulting in subluxation/friction; thickened CT retinaculum; pressure from wheelchair or OR table compression; masses) → travels thru Guyon's canal in wrist

-Look for "surrounding" increased T2 signal with enlarged or flattened or irregular nerve (may have magic angle on PD imaging)

- **Median nerve (not important)**

-Best seen on prone imaging; located over brachialis muscle and deep to bicipital aponeurosis of biceps tendon → then passes btwn ulnar and humeral heads of pronator teres → then gives rise to anterior interosseous nerve branch (motor only) at inferior margin of pronator teres

-Pronator syndrome (dynamic compression btwn two heads of pronator teres muscle)

-Median neuropathy (pronator syndrome most common; other etiology includes thickened bicipital aponeurosis, biceps tears, radiobicipital bursitis, supracondylar process of humerus)

-Anterior interosseous syndrome (aka Kiloh-Nevin syndrome; rare; anterior interosseous nerve is motor branch of median nerve; cant flex distal joint of thumb/index, look for classic muscle edema of flexor pollicis longus, pronator quadratus, and a part of flexor digitorum profundus)

- **Radial nerve**

-Located btwn brachialis and brachioradialis muscle (anterior to lateral epicondyle); divides at elbow joint near capitellum into superficial radial nerve (sensory; superficial to supinator muscle; follows course of radial artery) and posterior interosseous nerve (motor; penetrates btwn deep and superficial fibers of supinator muscle to course along interosseous membrane); arcade of Frohse is fibrous arch btwn brachialis and brachioradialis seen in 35-50%

-Radial neuropathy (proximal to elbow joint; secondary to trauma, crutches, tourniquet etc; increased signal)

-Radial tunnel syndrome or Posterior interosseous syndrome (aka supinator syndrome or deep radial nerve syndrome; at elbow joint; motor only; secondary to thickened arcade of Frohse, fx/disloc of prox radius, abnormal recurrent vessel along interosseous membrane at elbow joint; increased signal seen w/in posterior compartment muscles w/ edema/fatty atrophy of deep fibers of supinator muscle)

MISCELLANEOUS

-Effusion

-Loose bodies (axial and sagittal views esp GRE; look for donor site and synovitis; may be secondary to OCD vs acute trauma vs posteromedial olecranon impingement in throwing athletes seen within post olecranon fossa)

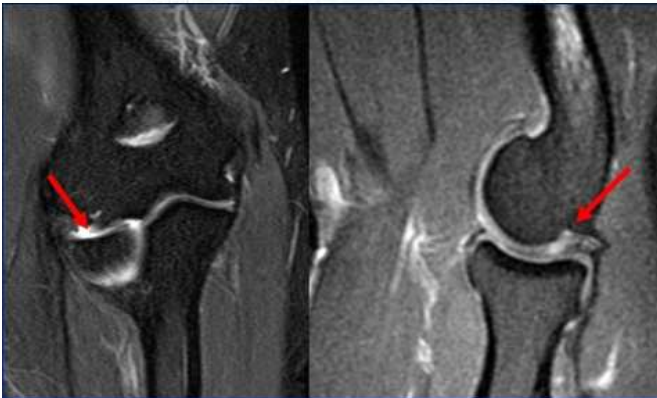
-Bursitis

- bicipitoradial bursa (BRB)=deep to biceps tendon (r/o radial artery aneurysm) AND interosseous bursa (IOB)=superficial to biceps tendon (both located in AC region on elbow; both communicate w/ each other and can affect median nerve or posterior interosseous branch of radial nerve)

- olecranon bursa (may be seen in Gout)

-Epitrochlear adenopathy (cat-scratch disease; Bartonella henselae)

-Steroid injection for epicondylitis (peritendinous approach); PRP injection (intratendinous approach)



Pseudodefekt of the capitellum



- Bare area of the trochlea: cortical notch & transverse trochlear ridge





Normal Anterior Bundle MCL (anterior)



Normal Anterior Bundle MCL (mid)



Normal Posterior Bundle MCL



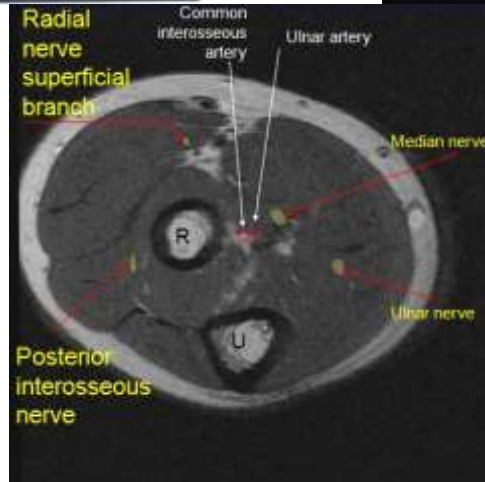
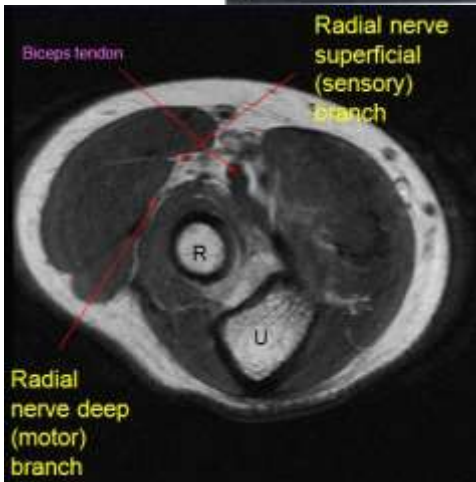
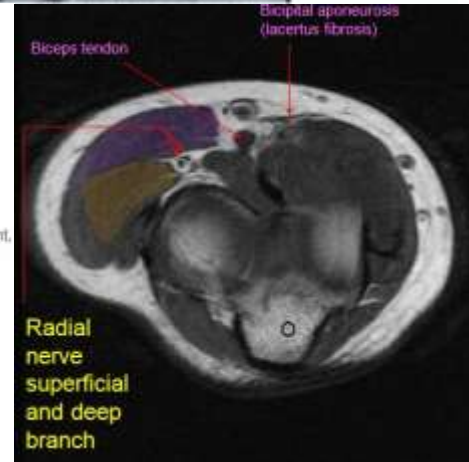
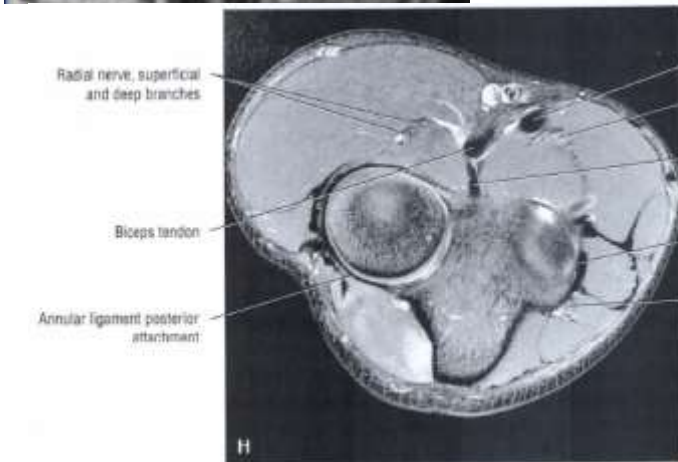
Radial Collateral Ligament

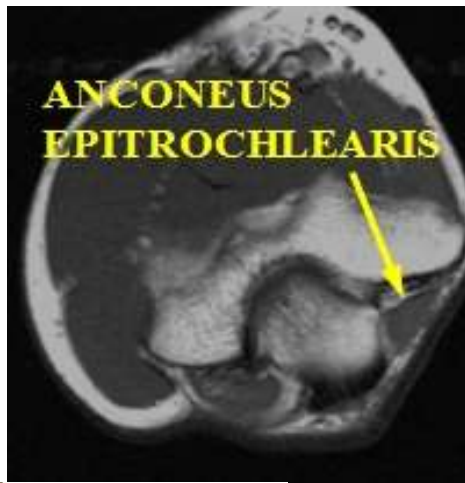
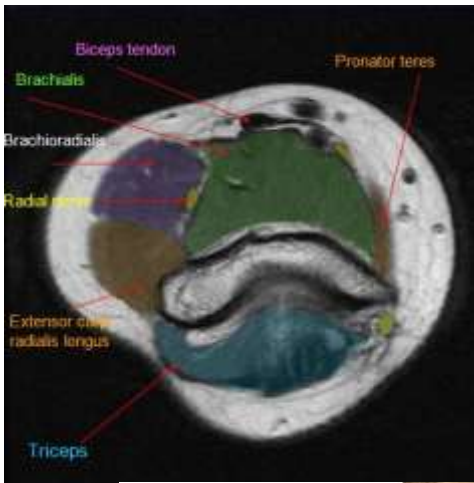


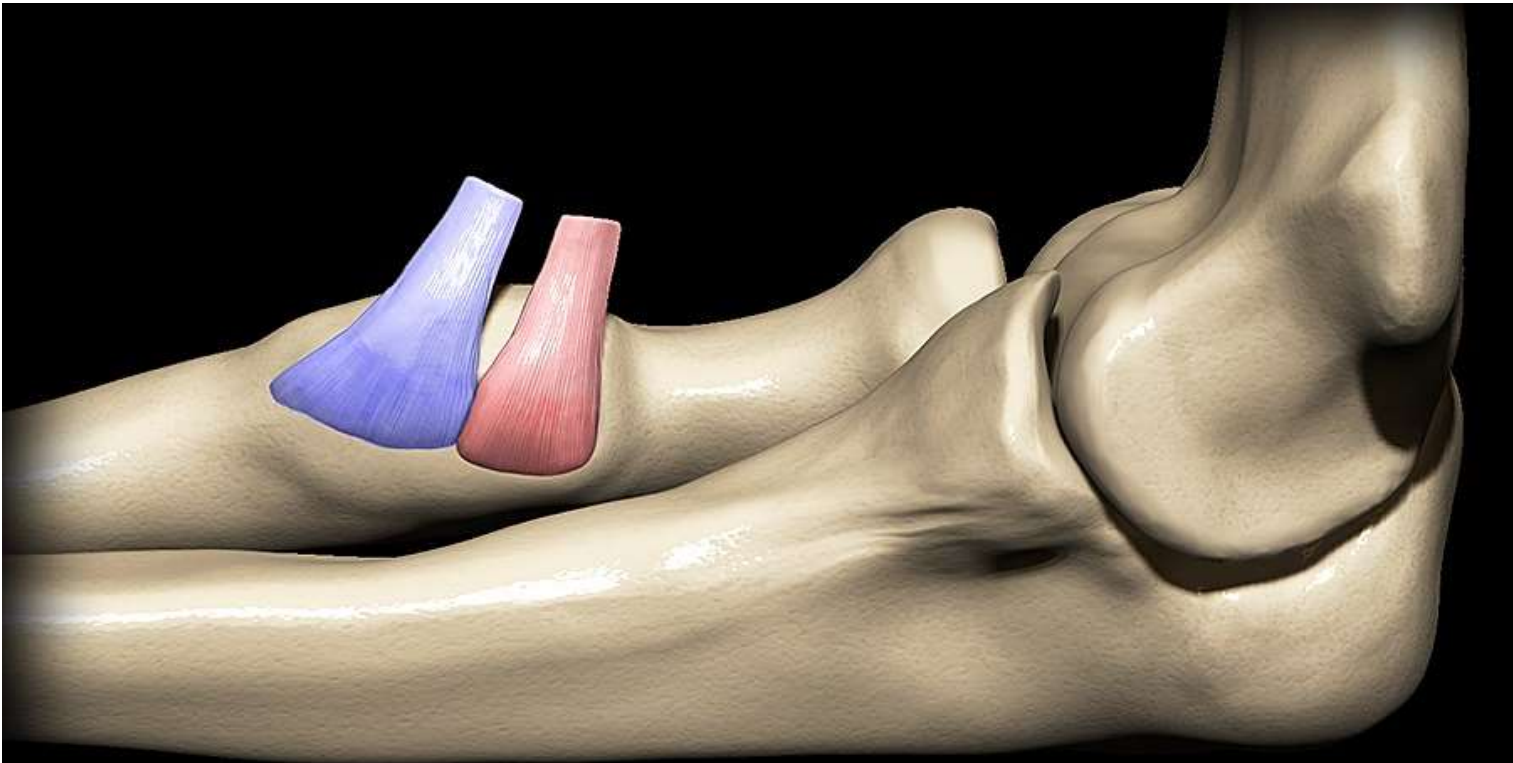
Lateral Ulnar Collateral Ligament Origin



Mid to Distal Lateral Ulnar Collateral Ligament







RED=LONG HEAD (INSERTS PROX INTO RADIAL TUB WITH SMALLER FOOTPRINT)
BLUE=SHORT HEAD (INSERTS DISTALLY WITH A LARGER FOOTPRINT)

