

THE UPPER ARM AND ELBOW JOINT

SHAFT AND DISTAL HUMERUS:

SHAFT OF HUMERUS:

- **Radial groove** – oblique groove on **posterior of humerus shaft**

DISTAL HUMERUS (ELBOW JOINT)

Anteriorly:

- Lateral and medial borders project as **lateral and medial epicondyles**
- Medial epicondyle is always more prominent.

Distal end of humerus

Viewed anteriorly:

- Lateral side: **capitulum**
 - Rounded
 - Articulates with head of radius (forearm bone)
 - Cannot be seen posteriorly
- Medial side: **trochlea**
 - Larger
 - Articulates with the ulna (forearm bone)
 - Continues onto posterior surface – can be seen posteriorly.
- 2 fossa above the capitulum and trochlea:
 - Above capitulum: **radial fossa**
 - Above trochlea: **coronoid fossa**

Viewed posteriorly:

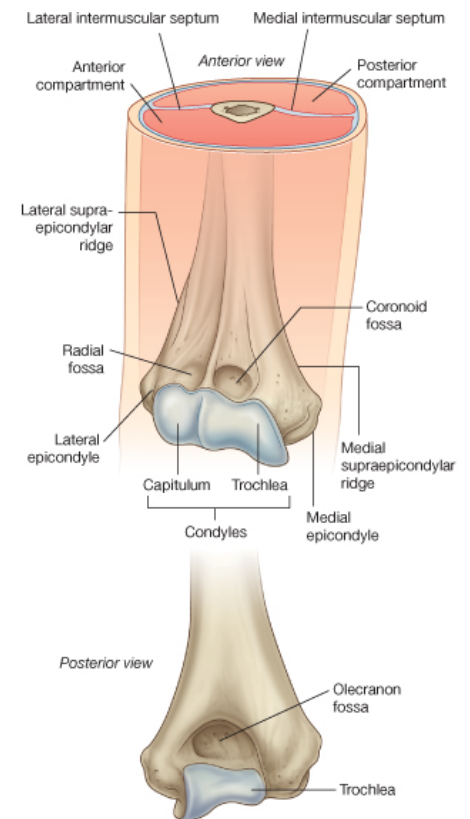
- Capitulum cannot be seen posteriorly
- Trochlea can be seen posteriorly
- There is **olecranon fossa** above the trochlea posteriorly

FOREARM BONES:

- **Radius and ulna**

RADIUS:

- **Head** at upper end:
 - Cylindrical
 - Cartilage-covered
 - Articulates with the capitulum
 - Also articulates with radial notch of ulna
- **Neck** below head
 - Constricted
- **Radial tuberosity**, distal to neck



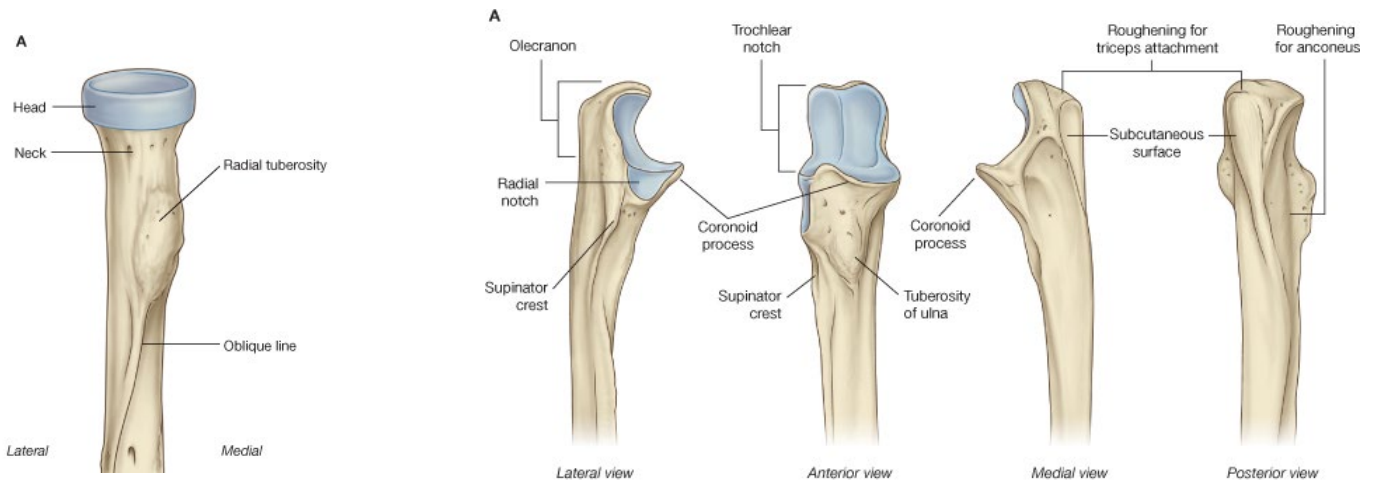
Drake et al: Gray's Anatomy for Students - www.studentconsult.com

ULNA:

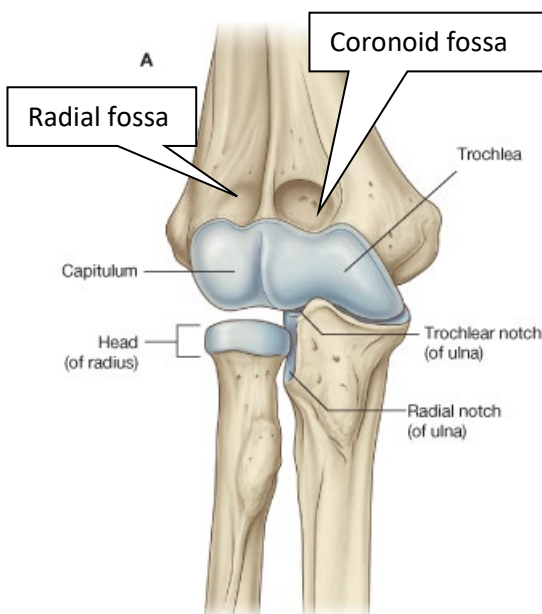
- Upper end clasps the trochlea:
 - Posterior part of the trochlea: articulates with **olecranon** of ulna
 - Anterior part of the trochlea: articulates with **coronoid process** of ulna.
- Below the coronoid process is a **tuberosity**.

Articulations of humerus and radius & ulna:

- Capitulum + upper surface of radial head
- Periphery of radial head fits into **radial notch** on side of ulna
- Both surfaces covered with articular cartilage.
- Trochlea + **trochlea notch** of ulna (between coronoid and olecranon processes)



SUPINATOR CREST below the RADIAL NOTCH

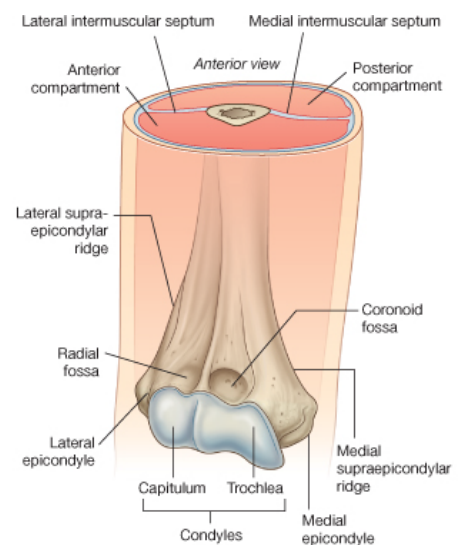


- When flexed completely:
 - the **coronoid process** fits into the **coronoid fossa** anteriorly
 - the **radius head** fits into the **radial fossa** anteriorly
- When completely extended:
 - the **olecranon process** fits into the **olecranon fossa** posteriorly
 - (note radius head doesn't reach as far back as olecranon process, so no radial fossa posteriorly).
- **These fossae are all intracapsular.**

MUSCLES OF THE UPPER ARM:

Surrounding the humerus:

- **FLEXOR MUSCLES:** on the front of the humerus
- **EXTENSOR MUSCLES:** on back of humerus
- Flexor and extensor muscles are separated by connective tissue, which run from the humerus to deep fascia of the upper arm:
 - **Medial intermuscular septa**
 - **Lateral intermuscular septa**
- Creates 2 compartments:
 - **Anterior flexor** compartment
 - **Posterior extensor** compartment



BRACHIAL INNERVATION OF MUSCLATURE:

- **Lateral (median) and medial (ulnar) cords: flexor**
- **Posterior cord (radial): extensor**
- In terms of upper arm: branch of **lateral** cord which supplies flexor – **musculocutaneous nerve** (rest of lateral and medial pass into flexor aspects of forearm and hand).
- In terms of upper arm: **radial nerve** supplies extensor (only remaining branch of posterior cord)

MUSCLES OF ANTERIOR (FLEXOR) COMPARTMENT:

3 MUSCLES IN ANTERIOR COMPARTMENT

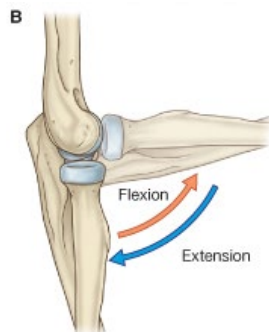
- **Coracobrachialis**
- **Biceps brachii**
- **Brachialis**

Coracobrachialis:

- Small & insignificant
- Coracoid process → ½ way down humerus shaft (medial side)
- Weak adductor of shoulder joint.

Biceps:

- Origin: has 2 heads
- **Long head:**
 - Arises from **supraglenoid tubercle** of scapula
 - Passes through capsule of shoulder joint – covered with synovial membrane
 - Passes **under transverse ligament** into intertubercular groove
- **Short head:**
 - Arises from **coracoid process** (with the coracobrachialis)
- The 2 heads unite in upper arm
- Inserts into both radius and ulna:
 - Mainly **radial tuberosity** by strong tendon (easily palpated)
 - **Bicipital aponeurosis** spreads from medial border of the above tendon, to blend with **periosteum of ulna**
- **Action of biceps:**
 - **Flexion** – by the tendon and bicipital aponeurosis pulling on forearm bones.
 - **Supination** – biceps pull on radius by tendon, uncrossing of radius and ulna to turn palm face-down → face-up (screwing something in)
 - Long head also helps keep humerus in glenoid cavity.



Brachialis:

- Origin: distal half of shaft of humerus and intermuscular septa
- Insertion: **coronoid process of ulna**
- Action: simple flexion

NEROVASCULAR OF ANTERIOR (FLEXOR) COMPARTMENT:

- At lower extremity of axilla, axillary artery is surrounded by cords of brachial plexus.
- (Cords, LMP, blood)

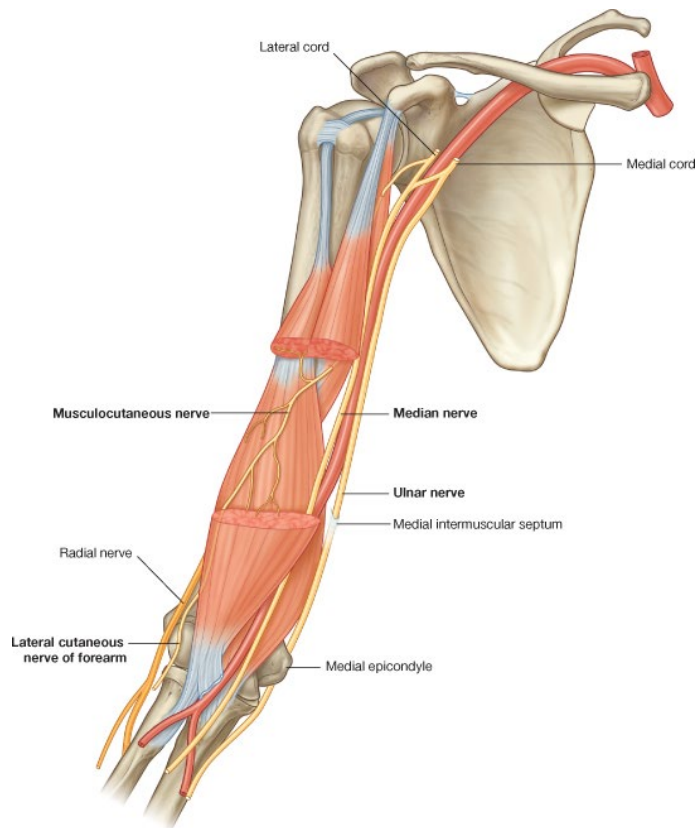
MUSCULOCUTANEOUS NERVE:

- All 3 of the muscles of the anterior compartment are supplied by the musculocutaneous nerve (a branch of lateral cord).
 - 1) Supplies coracobrachialis and biceps
 - 2) Then continues under biceps to brachialis muscle
 - 3) Then continues as a lateral cutaneous nerve from beneath lateral border of bicep to supply skin of forearm.

Musculocutaneous nerve (lateral cord) supplies anterior musculature of upper arm then emerges laterally to form a lateral cutaneous nerve.

ULNAR AND MEDIAN NERVE:

- (Arise from medial and lateral cords respectively)
- Descend into forearm to supply flexor muscles and skin of forearm & hand
- **Median + ulnar nerves have no branches in upper arm**
- **Ulnar nerve** wanders into posterior compartment in its passage through upper arm, to negotiate elbow joint (then returns to anterior compartment in forearm).
 - 1) **leaves medial side of axillary artery and passes through medial intermuscular septum**
 - 2) **Descends between medial septum and medial epicondyle of humerus (can be palpated as thick cord).**
- **Median nerve** remains in anterior compartment throughout
- Is covered in its course by the biceps, and rests on brachialis muscle.
- Accompanied by **brachial artery** (continuation of axillary artery as it passes the lower border of teres major)



Medial cord contribution to median nerve:

- Crosses in front of the axillary artery (forms M)

Lateral cord → median nerve:

- Upper ½ upper arm: lateral to artery
- Lower ½ of upper arm + ACF: medial to artery

Medial cord → ulnar nerve:

- Medial to artery

BRANCHES OF THE MEDIAL CORD:

- **Medial cutaneous nerve of the arm:** supplies skin of upper arm
- **Medial cutaneous nerve of the forearm:** supplies skin of forearm

(Musculocutaneous nerve → lateral cutaneous nerve of arm)

BRACHIAL ARTERY:

- Can be palpated at medial side of bicep (if bicep pushed away)
- Travels with the **median nerve**.
- Brachial artery and median nerve cross each other in their course BUT **at front of elbow, median nerve always lies medial to brachial artery.**
- Brachial artery supplies muscle in upper arm
- Also gives nutrient artery to humerus

- Most branches follow course of nerves, and anastomose with branches in the forearm at elbow joint – giving vascular network at elbow joint.
- Also gives branches which anastomose with circumflex vessels above.
- **Profunda brachii** is a branch of the brachial artery which accompanies the radial nerve into the posterior compartment.

BRACHIAL VEIN:

- **Venae comitantes** accompany the brachial artery, which receive superficial venous tributaries.
- At axilla, these venae comitantes have formed axillary vein, which lies medial to axillary artery (passes in front of anterior scalene)

NERVOVASCULAR OF POSTERIOR (FLEXOR) COMPARTMENT:

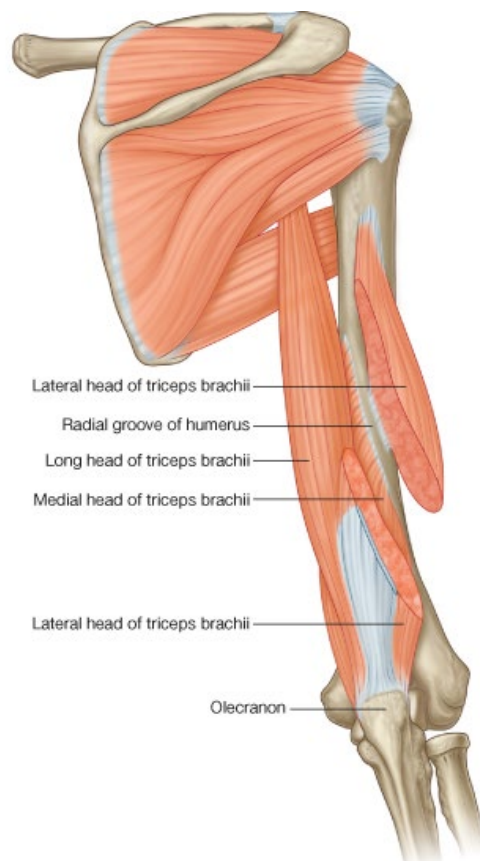
- **Triceps** is only muscle in the posterior compartment.
- Action:
 - **Extensor of the elbow joint**
 - Long head stabilises the shoulder joint when arm is abducted.
- Has **3 heads**:
 - 1 from scapula
 - 2 from back of humerus
- Muscle composed of 2 strata:
 - Superficial stratum: long and lateral heads
 - Deep stratum: medial head

SUPERFICIAL STRATUM:

- **Long head:**
 - Origin: **infraglenoid tubercle** (just below glenoid cavity on scapula)
- **Lateral head:**
 - Origin: back of humerus **just above radial groove**
- Long and lateral heads combine to form a muscle mass on the back of the arm.

DEEP STRATUM (deep to superficial stratum)

- **Medial (deep) head:**
 - Origin: **back of humerus and intermuscular septum beneath the radial groove**.
 - Origin corresponds to origin of brachialis on the front of arm.
- All 3 heads unite into a tendon which **inserts** into the **olecranon**.
- Small **bursa** separates the triceps from capsule of elbow joint.
- Because **extensor**, it is innervated by the **radial nerve** (posterior cord of the brachial plexus)

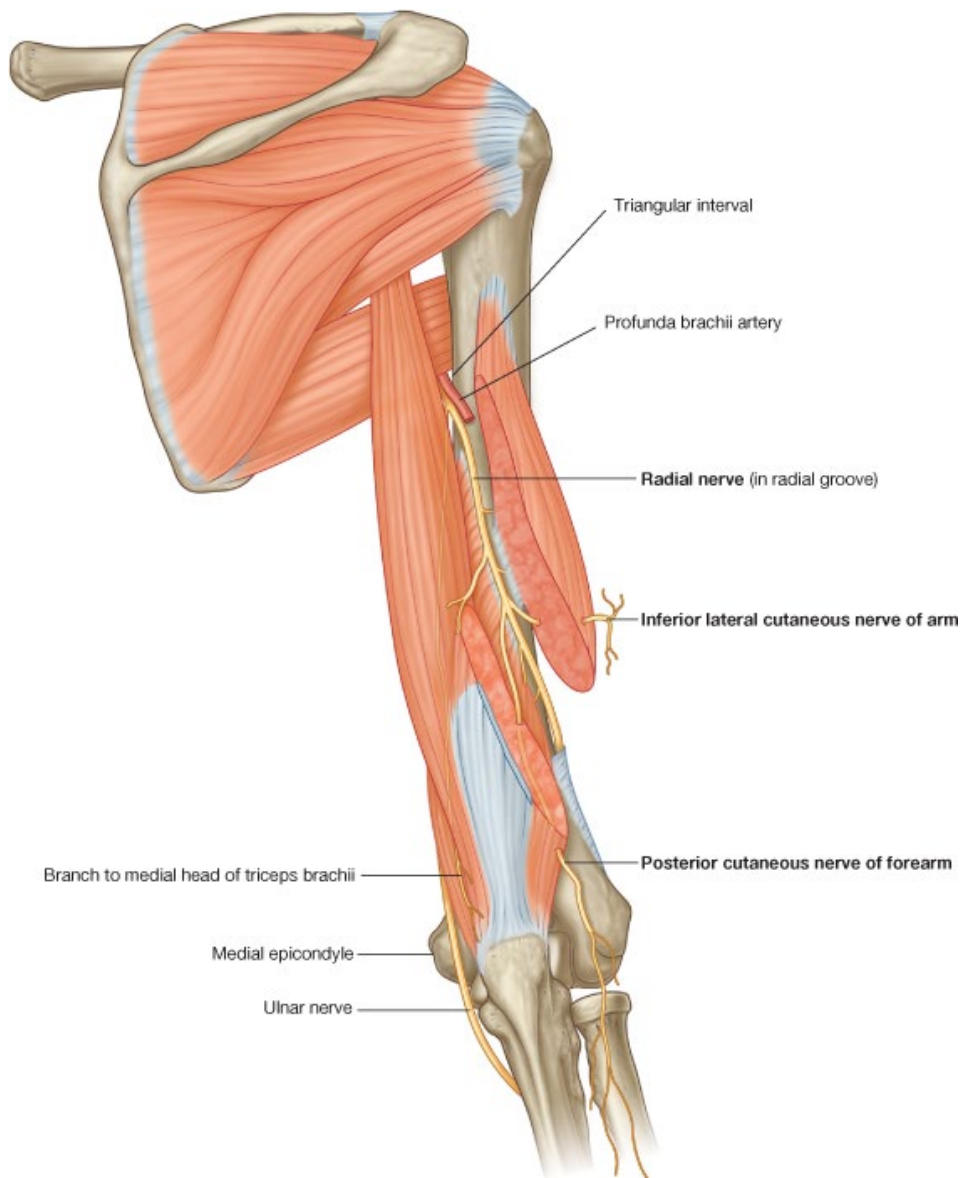


ANCONEUS

- Small muscle which contributes to triceps.
- Origin: **posterior of lateral epicondyle**
- Blends with tricep at origin
- Insertion: **lateral olecranon and posterior proximal ulna**
- Action:
 - Abducts ulna during pronation of forearm
 - Extends elbow joint (with tricep)
 - Stabilises elbow joint during flexion.
- Supplied by radial nerve.

COURSE OF THE RADIAL NERVE:

- **Radial nerve** leaves its position posterior to the axillary artery and passes to the back of the humerus (into posterior compartment) with the profunda brachii.
- On the back of the humerus, it lies beneath the **long and lateral heads** of the triceps.
- Travels obliquely along radial groove beneath long and lateral heads.
- Separated from humerus bone by few fibres of medial head of the humerus.
- Branches of radial nerve supply triceps and anconeus.
- It then passes back through the lateral intermuscular septum to re-enter the anterior compartment – passing into the forearm in front of the elbow.
- It then splits into **muscular and cutaneous branches**, which both re-enter the extensor compartment of the forearm & hand.
- (This is kinda the opposite of ulnae nerve on the medial side)

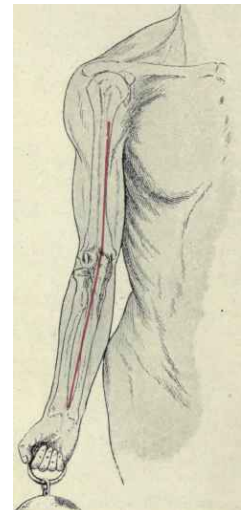


THE ELBOW JOINT

- Synovial
- Hinge
- Lower end of humerus and upper radius and ulna

Articulations of humerus and radius & ulna:

- Capitulum + upper surface of radial head
- Periphery of radial head fits into **radial notch** on side of ulna
- Both surfaces covered with articular cartilage.
- Trochlea + **trochlea notch** of ulna
- Medial flange of the trochlea is lower than the lateral Δ angle between upper arm and forearm – **the carrying angle**.
- Forearms angle outwards away from the body.



- Both the upper surface of the radial head and the trochlea are covered with **articular cartilage**.

PROXIMAL RADIOULNAR JOINT:

- Articulation between side of radial head and the radial notch on the ulna
- **Synovial**
- Not considered part of the elbow joint.
- This articulation is held together by a fibrous band which passes around head and neck of radius from the anterior and posterior edges of the radial notch – the **annular ligament**
- Annular ligament is attached loosely to the neck of the radius.
- Lower part of this synovial joint is weak Δ the small **quadrate ligament** links the lower margin of the radial notch to the neck of the radius.
- **Synovial membrane of elbow joint and proximal radioulnar joint are continuous Δ continuous cavities.**

proximal radio-ulnar joint

❖ Ligaments :

1) annular ligament

- strong curved
- form $\frac{3}{4}$ of the circle With radial notch

2) Quadrate ligament

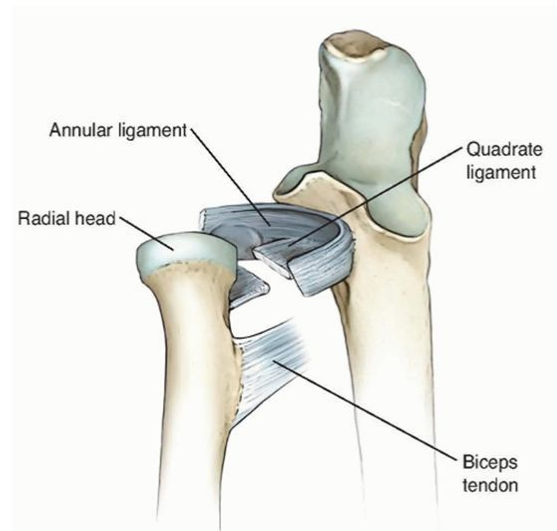
- thin quadrangular fibrous band
- extends from lower border of radial notch of ulna medially to the neck of radius laterally
- closing the joint infromedially

N.B:

cavity of proximal radioulnar joint is continuous with elbow joint cavity above

❖ Movement

- supination & pronation



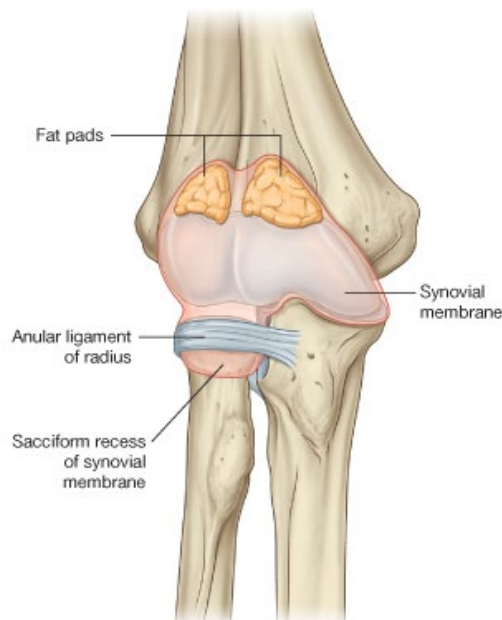
CAPSULE AND LIGAMENTS OF THE ELBOW JOINT:

- Hinge joint Δ
 - Capsule is strong at sides
 - Weaker anteriorly and posteriorly
- **Anterior fibres of capsule:**
 - Origin: epicondyles & upper margin of coronoid & radial fossae
 - Insertion: coronoid process and annular ligament
- **Δ coronoid and radial fossae are intracapsular.**
- **Posterior fibres of capsule:**
 - Origin: posterior of humerus above olecranon fossa
 - Insertion: olecranon process
- **Δ olecranon fossa is intracapsular.**

- A bursa separates posterior capsule from tendon of insertion of triceps (which inserts into olecranon)

Collateral ligaments:

- Strong ligaments either side of the joint
- **Radial collateral ligament:**
 - Origin: lateral epicondyle
 - Insertion: annular ligament
- **Ulnar collateral ligament:**
 - 2 bands
 - Origin: lateral epicondyle
 - **Anterior band:** inserts in coronoid process
 - **Posterior band:** fans out to insert into olecranon
 - Anterior band tightens in extension
 - Posterior band tightens in flexion.
- **Oblique band:** passes between olecranon and coronoid process – deepens the trochlea notch.
- The **ulnar nerve** sits on the **ulnar collateral ligament** as it passes behind the lateral epicondyle.
- **Synovial membrane** lines capsule and non-articular parts of joint.
- Δ synovial membrane covers the fossa.
- Also **fat pads** between the synovial membrane and capsule – which bulge into fossa when the bony processes are removed.
- **Synovial membrane of elbow joint is continuous with the inferior 'proximal radioulnar joint'** (between radial head and radial notch on ulna).



SUMMARY OF ELBOW MOVEMENTS:

- Flexion: biceps & brachialis (NOT coracobrachialis)
- Extension: triceps & anconeus.

APPLIED ANATOMY OF UPPER ARM AND ELBOW JOINT:

FRACTURES OF THE HUMERUS:

- 3 common sites:
 - **Surgical neck:**
 - May accompany dislocation of shoulder
 - **Axillary nerve and vascular leash travel around surgical neck.**
 - **Midshaft:**
 - **Radial nerve** may be injured as it passes along the radial groove on back of humerus.
 - **Radial nerve injury occurs in 8% of midshaft fractures.**
 - Must test radial nerve function:
 - Patient unable to use extensors of wrist and fingers – **wrist drop**.
 - Some sensory loss:
 - Sometimes:*
 - Radial nerve gives cutaneous branches to lateral arm and posterior forearm, as it passes along radial groove.
 - If the fracture damages the radial nerve above the level at which these cutaneous nerves branch off, there will be a loss of sensation.
 - Always:*
 - Radial nerve gives cutaneous branch to radial side of dorsum of hand.
 - This branch occurs in the forearm, so radial nerve damage due to humeral fracture will always lead to loss of sensation in dorsum of hand.
 - **Supracondylar:**
 - Most common in children, often due to a fall
 - Much swelling around fracture: if arm flexed to right angle, pressure from swelling can occlude brachial artery.
 - Must Δ regularly check pulse when arm is in sling.
 - **Median nerve** may be injured in a supracondylar fracture, as it passes in front of the elbow.
 - **Ulnar nerve** may be injured in isolated fracture of medial epicondyle.

DISLOCATION OF THE ELBOW:

- Trochlea notch slips backwards on trochlea

CONDITIONS OF THE OLECRANON:

- **Olecranon bursitis:** enlarged bursa due to trauma of resting elbows on table
- **Transverse fracture of olecranon:** triceps unable to extend the elbow (as it inserts into olecranon)

DAMAGE TO RADIAL NERVE:

- Midshaft humerus fracture (described above)
- Old-style crutches – compressed radial nerve as it left the axilla (triceps could lose nerve supply)
- ‘Saturday night paralysis’: excessive alcohol consumption followed by subject falling asleep with arm over back of chair → pressure on nerve.



- Bad placement of arm on operating table → pressure on nerve.
- Misplaced intramuscular injections.