Elbow joint

- It is a hinge type of synovial joint and between the lower end of the humerus and upper ends of the radius and ulna.
- It actually includes two articulations:
  (a) **Humero-ulnar articulation:**
  - between the trochlea of the humerus and trochlear notch of the ulna.
  (b) **Humero-radial articulation:**
    - between the capitulum of the humerus and the head of radius.
Elbow joint

• On the surface, the joint line of elbow is situated 2 cm below the line joining the two epicondyles of humerus.

• The complexity of elbow joint is further increased by its continuity with superior radio-ulnar joint.

• There are three articulations in the elbow region, viz.
  (a) Humero-ulnar,
  (b) Humero-radial, and
  (c) Superior (proximal) radio-ulnar.

• Also called cubital articulations.
Articular surfaces

- **Upper articular surface:** formed by the capitulum and the trochlea of the lower end of the humerus.
- **Lower articular surface:** formed by the upper surface of the head of the radius and trochlear notch of the ulna.
Articular surfaces

• **Capitulum:**
  – It is a rounded hemispherical eminence and possesses smooth articular surface only on its anterior and inferior aspects.

• **Trochlea:**
  – It is medial to capitulum and resembles a pulley. The medial flange of trochlea projects to a lower level than its lateral flange.

• **Trochlear notch** of ulna:
  – It is formed by the upper surface of the coronoid process and anterior surface of the olecranon process.

• **Upper end of radius:**
  – It is circular in outline and slightly depressed in the center.
Ligaments

1) Capsular ligament (Joint capsule).
2) Medial ligament (Ulnar collateral ligament).
3) Lateral ligament (Radial collateral ligament).
Capsular ligament (Joint capsule)

- It is a fibrous sac enclosing the joint cavity.
- The inner surface of the capsule is lined by the synovial membrane.

**Attachment:**

**Above:**

- Medial epicondyle, upper margins of radial, coronoid, and olecranon fossae, and lateral epicondyle of the humerus, i.e., it encloses all the non-articular fossae at the lower end of the humerus.

**Below:**

- The anterior and medial margins of the coronoid process of ulna, upper margin of the annular ligament, and upper and medial margins of the olecranon process.
Medial ligament (Ulnar collateral ligament)

- Triangular in shape.
- With its apex attached to medial epicondyle of the humerus.
- With base to coronoid and olecranon processes of ulna.
- It is divided into three parts or bands, they are:
  a) Anterior
  b) Posterior
  c) Inferior
Medial ligament (Ulnar collateral ligament)

1) The anterior part is strongest and stiffest that extends from front of the medial epicondyle to a tubercle on the medial margins of the coronoid process.

2) The posterior part: Extends from back of the medial epicondyle of humerus to the medial margin of the olecranon process.

3) The inferior part or oblique band that extends between the olecranon and the coronoid process.

Between anterior and posterior bands, intermediate fibers descend from medial epicondyle to the oblique band.
Ulnar collateral (medial) ligament
Lateral ligament (Radial collateral ligament)

- It extends from lateral epicondyle of the humerus to the annular ligament with which it blends.
Relations

Anterior:
a) Brachialis muscle.
b) Median nerve.
c) Brachial artery.
d) Tendon of biceps brachii.

Posterior:
(a) Tendon of triceps
(b) Anconeus.
Relations of the elbow joint.
Relations

Medially:
(a) Flexor carpi ulnaris,
(b) Ulnar nerve (posteromedially)
(c) Common flexor origin of the muscles of forearm (anteromedially).

Laterally (posterolateral):
(a) Spinator
(b) common extensor origin of muscles of forearm muscles,
(c) Extensor carpi radialis brevis.
Bursae related to the elbow joint

• Four important bursae are present they are;
  1. **Subtendinous olecranon bursa**:  
     – a small bursa between triceps tendon and upper surface of the olecranon process.
  2. **Subcutaneous olecranon bursa**:  
     – a large bursa between skin and subcutaneous triangular area on the posterior surface of the olecranon.
  3. **Bicipitoradial bursa**:  
     – a small bursa separating biceps tendon from smooth anterior part of the radial tuberosity.
  4. A small **bursa separating the biceps tendon from the oblique cord**.
Bursa around elbow joint

- Triceps brachii
- Brachialis
- Subtendinous bursa of triceps brachii
- Fibrous layer of joint capsule
- Intratendinous olecranon bursa
- Fat pad in coronoid fossa
- Olecranon
- Synovial membrane
- Subcutaneous olecranon bursa
- Coronoid process of ulna
- Trochlea of humerus
- Trochlear notch of ulna

(C) Sagittal section
Stability of the elbow joint

1. Pulley-shaped trochlea of humerus fits properly into jaw-like trochlear notch of ulna.

2. Strong ulnar and radial collateral ligaments.
Arterial supply

• by arterial anastomosis around the elbow formed by the branches of brachial, radial, and ulnar arteries.

Nerve supply

• by articular branches from:

(a) **Radial nerve** (through its branch to anconaeus),
(b) **Musculocutaneous nerve** (through its branch to brachialis),
(c) **Ulnar nerve**, and
(d) **Median nerve**.
Movements

**Flexion:** (muscle)
- Brachialis
- Biceps brachii
- Brachioradialis

**Extension:** (muscle)
- Triceps
- Anconeus
Carrying angle

- The transverse axis of elbow joint is not transverse but oblique being directed downwards and medially.
- This is because medial flange of trochlea lies about 6 mm below its lateral flange.
- Consequently when the elbow is extended the arm and forearm do not lie in straight line, rather forearm is deviated slightly laterally.
- This angle of deviation of long axis of forearm from long axis of arm is termed **carrying angle**.
Carrying angle

• It disappears during pronation and full flexion of forearm.
• The forearm comes into line with the arm in the midprone position (which the hand is mostly used).
• The carrying angle varies from 5° to 15° and is more in females.
• The wider carrying angle in females avoids rubbing of forearms with the wider female pelvis while carrying loads, e.g., buckets filled with water from one place to another.
Applied anatomy

- Elbow effusion.
- Dislocation of elbow.
- Nursemaid’s elbow/pulled elbow (subluxation of head of radius).
- Tennis elbow (lateral epicondylitis).
- Golfer’s elbow (medial epicondylitis).
- Student’s elbow (Miner’s elbow).
- Nerve entrapments (compressions) around elbow.
Pulled elbow

- Subluxation of the radial head through the annular ligament arising from a sudden jerk on the arm.

A common injury in young children because the annular ligament has vertical sides in children compared with more funnel-shaped sides in adults.
• **Dislocation of elbow** in adults occurs posteriorly and may be associated with the fracture of coronoid process

• **Tennis elbow**:
  • Abrupt pronation during tennis play may produce sprain or partial tear of radial collateral ligament and manifest as tenderness over the lateral epicondyle
• **Golfer’s elbow**: 
  - Inflammation of common flexor tendon at medial epicondyle of humerus due to repetitive flexion and pronation of forearm
  - Malunion of supracondylar fracture may lead to cubital valgus (increase carrying angle) or cubital varus (decrease carrying angle)
Radio-ulnar joints

- It is a pivot type of synovial joint.
- Two joints between them; one at their upper ends and one at their lower ends.
- Superior radio-ulnar joints.
- Inferior radio-ulnar joints.
- Both these joints are synovial joints of pivot variety.
- Uniaxial joints permitting only rotation.
- Shaft of radius and ulna are connected to each other by interosseous membrane.
Superior radio-ulnar joint

**Articular surfaces**

(a) Circumference of radial head.
(b) Fibro-osseous ring made by radial notch of ulna and annular ligament.

**Ligaments**

1. Capsular ligament (joint capsule).
2. Quadrate ligament.
3. Annular ligament.
**Capsular ligament (joint capsule)**

- The fibrous capsule surrounds the joint.
- It is continuous with that of elbow joint and is attached to the annular ligament.

**Quadrate ligament**

- Thin, fibrous ligament
- Which extends from neck of radius to the upper part of supinator fossa of ulna just below the radial notch.
Annular ligament

- strong fibrous band.
- Encircles the head of radius and holds it against the radial notch of ulna.
- Forms about four-fifth of the fibro-osseous ring within which the head of radius rotates.
- Medially the annular ligament is attached to the margins of radial notch of ulna.
- The upper margin of the ligament is continuous with the capsule of the shoulder joint and its lower part becomes narrow and embraces the neck of radius.
- The inner surface of annular ligament is covered by a thin layer of cartilage.
- Laterally, it blends with the radial collateral ligament.
Annular ligament
Synovial membrane

- lines the inner aspect of the joint capsule and annular ligament of superior radio-ulnar joint and is continuous with the synovial membrane of the elbow joint. It is prevented from herniation by quadrate ligament.

**Relations**

Anteriorly and laterally: Supinatoe muscle.
Posteriorly: Anconeus muscle.
Blood supply

• By articular branches derived from arterial anastomosis on the lateral side of the elbow joint.

Nerve supply

• By articular branches from musculocutaneous, median, radial, and ulnar nerves.

Movements

• Supination
• Pronation
Inferior (distal) radio-ulnar joint

Articular surfaces

(a) Convex head of ulna, and
(b) Concave ulnar notch of radius.
Ligaments

1. Capsular ligament (joint capsule).
2. Articular disc.
3. Stability of elbow joint
Capsular ligament (joint capsule)

- a fibrous sac which encloses the joint cavity.
- Attached to the margins of articular surfaces.
- inner surface of the joint capsule is lined by synovial membrane.
- The synovial lining of the joint sends an upward prolongation in front of the lower part of the interosseous membrane called recessus sacciformis.
- Does not communicate with the synovial cavity of the wrist joint.
Articular disc

- a *triangular fibrocartilaginous* disc.
- Sometimes referred to by clinicians as *triangular ligament*.
- Its apex is attached to the base of the styloid process of ulna and its base to the lower margin of the ulnar notch of radius.
- The articular disc separates the inferior radio-ulnar joint from the wrist joint.
Stability of elbow joint

The main factors providing stability to elbow joint are:

(a) Wrench-shaped articular surface of the olecranon process of ulna and pulley-shaped trochlea of humerus.

(b) Strong medial and lateral collateral ligaments.
**Relations**

**Anteriorly:** Flexor digitorum profundus.

**Posteriorly:** Extensor digiti minimi.

**Blood supply**
By anterior and posterior interosseous arteries.

**Nerve supply**
By anterior and posterior interosseous nerves.

**Movements**
- Supination
- Pronation
Interosseous membrane of the forearm

- It is the fibrous sheet, which stretches between the interosseous border of the radius and ulna.
- holds these bones together and does not interfere with the movements, which take place between them.
- The oblique cord of fibrous tissue extending from lateral side of ulnar tuberosity to the lower end of radial tuberosity also helps to hold the radius and ulna together.
- sometimes termed middle radio-ulnar joint.
- This is a syndesmosis type of fibrous joint.
Middle radioulnar joint

- Capitulum
- Radial collateral ligament of elbow joint
- Annular ligament
- Head of radius
- Trochlear notch
- Radial notch of ulna
- Superior radio-ulnar joint
- Oblique cord
- Ulna
- Interosseous membrane
- Middle radio-ulnar joint
- Recessus sacciformis
- Inferior radio-ulnar joint
- Articular disc
Features of the interosseous membrane

1. Proximally it begins 2.3 cm below the tuberosity of the radius and distally it blends with the capsule of inferior radio-ulnar joint.

2. The fibers of the membrane run downwards and medially from radius to ulna.

3. The posterior interosseous vessels pass backwards through a gap between the upper border of interosseous membrane and oblique cord to reach the back of the forearm.

4. The anterior interosseous vessels enter the back of the forearm by piercing interosseous membrane 5 cm above its lower margin.
Relations

**Anteriorly:** Anterior interosseous artery and nerve.

**Posteriorly:** Anterior interosseous artery and posterior interosseous nerve.

**Functions:**

1. Holds the radius and ulna together.
2. Transmits compression forces from radius to ulna (provides the stable humero-ulnar joint).
3. Provides attachments to muscles.
Oblique cord

- It is a strong fibrous band which extends from medial side of the tuberosity of ulna to the lower part of the tuberosity of the radius.
- Its fibres are directed downwards and laterally, i.e. opposite to that of interosseous membrane.
Movements

Supination:
- Supinator.
- Biceps brachii supinates the forearm while the elbow is flexed.
- Brachioradialis supinates the pronated forearm to midprone position.

Pronation:
- Pronator teres
- Pronator quadratus
- Brachioradialis, pronates the supinated forearm to midprone position
Wrist (Radio-carpal) joint

A synovial joint of ellipsoid variety between lower end of radius and carpus.
Articular surfaces

• **Proximal articular surface**: inferior surface of the lower end of radius and inferior surface of the triangular articular disc of inferior radio-ulnar joint

• **Distal articular surface**: proximal surfaces of scaphoid, lunate and triquetral, bones
Ligaments

1. Capsular ligaments (joint capsule).
2. Radial collateral ligament.
3. Ulnar collateral ligament.
4. Palmar radio-carpal ligament.
5. Palmar ulnocarpal ligament.
6. Dorsal radio-carpal ligament.
Capsular ligament (joint capsule)

• The fibrous covering of the joint and is attached above to the distal ends of radius and ulna, and below to the proximal row of carpal bones.

• The synovial membrane lines the inner surface of the fibrous capsule and extends up to the margins of the articular surfaces.
Radial collateral ligament

- Extends from the tip of styloid process of radius to lateral aspects of scaphoid and trapezium. It is related to the radial artery.

Ulnar collateral ligament

Extends from the tip of styloid process of ulna to the medial aspects of the triquetral and pisiform bones.
Palmar radio-carpal ligament

- Extends from anterior margin of the lower end of radius to the anterior surfaces of the scaphoid, lunate, and triquetral bones.
- It is formed due to thickening of the lateral part of the anterior aspect of the fibrous capsule.

Dorsal radio-carpal ligament

Extends downwards and medially from the posterior margin of the lower end of radius to the dorsal surface of the scaphoid, lunate, and triquetral bones.
Palmar ulnocarpal ligament

- Extends vertically downwards from the base of styloid process and adjoining part of articular disc to the anterior surface of the lunate and triquetral.
- Formed due to thickening of the medial part of the anterior aspect of the fibrous capsule.
Relation

Anterior:

1. Tendons of flexor digitorum superficialis, flexor digitorum profundus and associated synovial sheath (ulnar bursa).
2. Tendon of flexor pollicis longus and associated synovial sheath (radial bursa).
3. Median nerve.
4. Tendon of flexor carpi radialis and associated synovial bursa.
5. Ulnar nerve.
Relations

Posterior:
1. Extensor tendons of wrist and fingers, and associated synovial sheaths.
2. Anterior interosseous artery.
3. Anterior interosseous nerve.

Lateral:
1. Radial artery (across the radial collateral ligament).
2. Tendon of abductor pollicis longus (APL).
3. Tendon of extensor pollicis brevis (EPB).

Medial: Dorsal cutaneous branch of ulnar nerve.
Movements

- Flexor carpi radialis
- Flexor carpi ulnaris
- Palmaris longus

Joint:
- Flexion
- Extension
- Adduction
- Abduction

Adduction:
- Flexor carpi ulnaris
- Extensor carpi ulnaris

Abduction:
- Flexor carpi radialis
- Extensor carpi radialis longus
- Extensor carpi radialis brevis
- Abductor pollicis longus

Extension:
- Extensor carpi radialis longus
- Extensor carpi radialis brevis
- Extensor carpi ulnaris
Applied anatomy

- **Ganglion** (*Gk = swelling or knot*): It is a non-tender cystic swelling, which sometimes commonly on dorsal aspect of wrist joint.