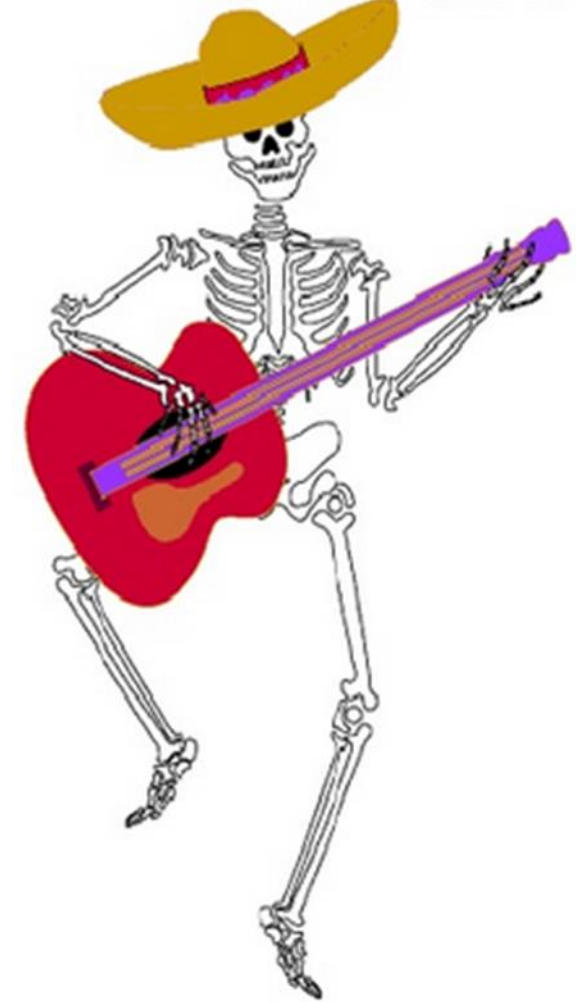




# Regional and functional anatomy of Shoulder and Arm



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The upper limb consists of four major segments

- Shoulder
- Arm
- Forearm
- Hand

- The upper limb consists of four major segments:

**Hand:** part of the upper limb distal to the forearm that is formed around the carpus, metacarpus, and phalanges. It is composed of the **wrist, palm, dorsum of hand, and digits**

**Forearm:** It extends between and connects the elbow and wrist and includes **anterior and posterior regions of the forearm** overlying the radius and ulnar bones.

- **Arm:** first segment of the limb. It extends between and connects the shoulder and the elbow, and consists of **anterior and posterior regions of the arm**, centered around the humerus.

**Shoulder:** proximal segment of the limb that overlaps parts of the trunk (thorax and back) and lower lateral neck

The **pectoral girdle (shoulder girdle)** is a bony ring, incomplete posteriorly, formed by the *scapulae* and *clavicles*, and completed anteriorly by the *manubrium of the sternum*

# BONES OF UPPER LIMB

The pectoral girdle and bones of the free part of the upper limb form the **superior appendicular skeleton**.

The superior appendicular skeleton articulates with the axial skeleton only at the **sternoclavicular joint**

# Clavicle (collar bone)

- Connects the upper limb to the trunk
- Has the appearance of an elongated capital S
- Subcutaneous and palpable throughout its length and is often used as a landmark for clinical procedures
- Transmits shocks (traumatic impacts) from the upper limb to the axial skeleton.

# Clavicle

- Serves as a moveable, crane-like strut (rigid support) from which the scapula and free limb are suspended, keeping them away from the trunk so that the limb has maximum freedom of motion.
- Forms one of the bony boundaries of the *cervico-axillary canal* (passageway between the neck and arm), affording protection to the important neurovascular bundle supplying the upper limb.

It is considered as a long bone, but it has no medullary (bone marrow) cavity. Its medial end "Sternal end" is enlarged & triangular. Its lateral end "Acromial end" is flattened.

The **medial 2/3** of the shaft **is convex** forward.

The **lateral 1/3** is **concave** forward. These curves give the clavicle its appearance of an elongated capital (S).

It has two surfaces:

- Superior: smooth as it lies just deep to the skin.
- Inferior: rough because strong ligaments bind it to the 1st rib.

# Clavicle

- shaft of the clavicle
- sternal end
- acromial end
- superior surface of the clavicle
- inferior surface of the clavicle
- conoid tubercle\*
- trapezoid line\*
- subclavian groove\*
- impression for the costoclavicular ligament



## Fractures of the Clavicle

- Falling. "Commonly in children"
- The **weakest part** of the clavicle is the junction of the **middle and lateral thirds**.
- After fracture, the medial fragment is elevated(by the **sternomastoid muscle**).
- The lateral fragment drops because of the weight of the upper limb.
- It may be pulled medially by the adductors of the arm.

# JOINTS

The **sternoclavicular joint** is a saddle type of synovial joint but functions as a ball-and-socket joint.

The SC joint is divided into two compartments by an *articular disc*.

The disc is firmly attached to the *anterior* and *posterior sternoclavicular ligaments*, thickenings of the fibrous layer of the joint capsule, as well as the *interclavicular ligament*.

# JOINTS

The costo-clavicular ligament anchors the inferior surface of the sternal end of the clavicle to the 1st rib and its costal cartilage, limiting elevation of the pectoral girdle.

# Scapula

The primary function of the scapula is to attach the upper arm to the thorax, or trunk of the body. This connection stabilizes the arm and provides for arm movement at the shoulder

# Scapula

- ❖ The scapula is a flat triangular bone
- ❖ Lies on the posterior chest wall between the 2<sup>nd</sup> & 7<sup>th</sup> ribs
- ❖ In its posterior surface the **spine of the scapula** projects backwards

# Scapula

- ❖ The anterior surface of the scapula is concave and form the shallow **subscapular fossa**
- ❖ The **coracoid process** projects upward and forward above the glenoid cavity. It provides attachment for muscles and ligaments
- ❖ **Suprascapular notch**

## JOINTS

The **acromioclavicular joint** is a plane type of synovial joint

The **acromioclavicular ligament** is a fibrous band extending from the acromion to the clavicle that strengthens the acromioclavicular joint superiorly

The very strong **coracoclavicular ligament** extends from the coracoid process to the undersurface of the clavicle. It has **trapezoid** and **conoid** parts; It is largely responsible for suspending the weight of the scapula and the upper limb from the clavicle.

# JOINTS

**The glenohumeral ligaments** are three weak bands of fibrous tissue that strengthen the front of the capsule.

**The transverse humeral ligament** strengthens the capsule and bridges the gap between the two tuberosities.

**The coracohumeral ligament** strengthens the capsule above and stretches from the root of the coracoid process to the greater tuberosity of the humerus .

**The coracoacromial ligament** extends between the coracoid process and the acromion. Its function is to protect the superior aspect of the joint.



## Movements of the shoulder joint

- The shoulder joint has a wide range of movement
- The following movements are possible:
  - **Flexion:** by the anterior fibers of the deltoid, pectoralis major (clavicular head), biceps, and coracobrachialis muscles.
  - **Extension:** by the posterior fibers of the deltoid, latissimus dorsi, and teres major muscles.
  - **Abduction:** by supraspinatus to 18° and deltoid to 90°
  - **Adduction:** by the pectoralis major, latissimus dorsi, teres major, and teres minor muscles.
  - **Lateral rotation:** by the infraspinatus, the teres minor, and the posterior fibers of the deltoid muscle.
  - **Medial rotation:** by the subscapularis, the latissimus dorsi, the teres major, and the anterior fibers of the deltoid muscle.
  - **Circumduction:** This is a combination of the above movements

# Humerus

- ❖ Articulate with the Scapula at the shoulder joint and with the Radius and Ulna at the elbow joint
- ❖ It is a long bone with 2 ends (Upper & Lower) and a shaft

## Fractures of the Humerus

- Most common fractures of the **surgical neck** especially in elder people with osteoporosis.
- The fracture results from falling on the hand (transmission of force through the bones of forearm of the extended limb).
- In younger people, fractures of the **greater tubercle** results from falling on the hand when the arm is abducted .
- The body of the humerus can be fractured by a direct blow to the arm or by indirect injury as falling on the outstretched hand.

# JOINTS

The **elbow joint**, a hinge type of synovial joint, is located 2–3 cm inferior to the epicondyles of the humerus

The spool-shaped ***trochlea*** and spheroidal ***capitulum*** of the humerus articulate with the ***trochlear notch of the ulna*** and the slightly concave superior aspect of the ***head of the radius***, respectively; therefore, there are humero-ulnar and humeroradial articulations

# JOINTS

The lateral, fan-like **radial collateral ligament** extends from the lateral epicondyle of the humerus and blends distally with the **anular ligament of the radius**, which encircles and holds the head of the radius in the radial notch of the ulna, forming the proximal radio-ulnar joint and permitting pronation and supination of the forearm

The medial, triangular **ulnar collateral ligament** extends from the medial epicondyle of the humerus to the coronoid process and olecranon of the ulna

## **FASCIA of the UPPER LIMB**

- Deep fascia of the pectoral region is called the ***pectoral fascia*** and inferiorly blends with the fascia of the anterior abdominal wall
- Pectoral fascia also continues with the ***axillary fascia*** that forms the inferior wall of the axilla
- **Deltoid fascia**
- Deep fascia of the arm is called the ***brachial fascia***

# MUSCLES of the UPPER LIMB

## Scapulohumeral Muscles

# Deltoid muscle

- Lateral third of clavicle, acromion and spine of the scapula
- Deltoid tuberosity on the anterolateral surface of the humerus
- Axillary nerve
- Anterior fibers flex and medially rotate the arm, middle fibers abduct the arm above 15 degrees/up to 90 degrees, posterior fibers extend and laterally rotate the arm



### Injury to the axillary nerve

- Axillary nerve may be damaged following the fracture of the proximal end and the surgical neck of the humerus, as well as dislocation of the shoulder joint
  - Due to denervation, deltoid muscle undergoes atrophy and rounded contour of the shoulder disappears
  - Abductions of the arm is greatly weakened
  - There is also anaesthesia (loss of sensation) on a small area around the upper lateral part of the arm
- \* Deltoid muscle is a common site for *intramuscular injections*

## **Teres major**

- Dorsal surface of the inferior angle of scapula
- Medial lip of the intertubercular groove
- Subscapular nerve
- Adduction and medial rotation of the arm

## Rotator cuff muscles

Teres minor, supraspinatus, infraspinatus and subscapularis muscles help to hold the head of the humerus in the glenoid cavity

These four muscles are called the ***rotator cuff muscles*** because they form a musculotendinous rotator cuff around the glenohumeral joint

All of the rotator cuff muscles, except the supraspinatus, are rotators of the humerus

## **Teres minor**

- Superior part of the dorsal surface of the lateral border of scapula
- Greater tubercle of humerus (lower part)
- Axillary nerve
- Laterally rotates the humerus

## **Supraspinatus**

- Medial part of the supraspinous fossa of scapula
- Greater tubercle of humerus (upper part)
- Suprascapular nerve
- Abducts the humerus (starts the abduction up to 15 degrees)

## **Infraspinatus**

- Infraspinous fossa
- Greater tubercle (middle part)
- Suprascapular nerve
- Lateral rotation of the humerus

## **Subscapularis**

- Subscapular fossa
- Lesser tubercle
- Subscapular nerve
- Medial rotation of the humerus

## CLINICAL NOTE

### Injury to the rotator cuff

- Injury often results from a fall on the hand with the arm abducted
- There is tenderness around the greater tubercle with passive abduction of the arm about 45 degrees
- Tears of the tendons may be seen in shoulder dislocations and in a forceful throwing movement
- Tears of the tendons cause a sharp pain in the anterosuperior part of the shoulder

## MUSCLES OF THE ARM

- There are four muscles in the arm (brachium)
- Three of them are in the anterior compartment and they are flexors (innervated by musculocutaneous nerve)
  - Biceps brachii, brachialis and coracobrachialis
- One is in the posterior compartment and it is extensor (innervated by radial nerve)
  - Triceps brachii

# Biceps brachii

- Short head: tip of coracoid process,  
Long head: supraglenoid tubercle
- Tuberosity of radius, deep fascia of the forearm through the bicipital aponeurosis
- Musculocutaneous nerve
- Primary supinator of the forearm (powerful especially in flexion - turning a screw), flexes the supinated forearm, long head helps the flexion of the arm



## Brachialis

- Distal half of the ant surface of humerus
- Coronoid proc and tuberosity of ulna
- Musculocutaneous nerve
- Primary flexor of the forearm

# Coracobrachialis

- Tip of the coracoid process
- Middle third of the medial surface of the body of the humerus
- Musculocutaneous nerve (the nerve pierces it)
- Helps in flexion and adduction of the arm

# CLINICAL NOTE

## Injury to the musculocutaneous nerve

- Is uncommon due to its protected position
- Injury causes the paralysis of biceps brachii, coracobrachialis and brachialis muscles
- Flexion and supination of the forearm are greatly weakened but not lost
  - Because, brachioradialis and supinator muscles are functioning (both of these are supplied by the radial nerve)
  - Because, flexor compartment muscles of forearm are functioning (innervated by median and ulnar nerves)
- Loss of sensation on the lateral surface of the forearm will be observed

# Triceps brachii

- Long head: infraglenoid tubercle, Lateral head: post surface of the humerus, Medial head: post surface of humerus
- Proximal end of the olecranon
- Radial nerve
- Chief extensor of the forearm (long head aids in extension and adduction of the arm)

\* Triceps muscle is a common site for ***intramuscular injections***

Two spaces are defined at the upper part of the arm

## **Quadrangular space (humerotricipital space)**

- Laterally – humerus
- Medially – long head of triceps
- Inferiorly – teres major
- Sup – teres minor

Transmits: axillary nerve, posterior circumflex humeral artery and vein

## **Triangular space (scapulothoracic space)**

- Laterally – long head of triceps
- Inferiorly – teres major
- Superiorly – teres minor

Transmits: circumflex scapular artery and vein

# AXILLA

## (AXILLARY FOSSA - ARMPIT)

The axillary fossa localized between the lateral part of the thorax, upper part of the humerus and lower part of the shoulder

Axilla is the passageway for the vessels and nerves from trunk to reach to the upper limb.

It is roughly pyramidal in shape, having an apex, a floor and four walls.

# WALLS of the AXILLA

## Anterior

- pectoralis major, pectoralis minor muscles, and pectoral and clavipectoral fasciae

## Posterior

- subscapularis, teres major and latissimus dorsi muscles

## Medial

- 1st – 4th ribs (and associated intercostal muscles) and serratus anterior muscle

## Lateral

- Proximal end of the humerus

## WALLS of the AXILLA (continued)

### Apex

Anterior --- clavicle

Posterior --- superior margin of the scapula

Medial --- first rib

### Floor

- Base is directed inferiorly and formed by the fascia and skin.



# CONTENTS of the AXILLA

- Axillary artery and its branches
- Axillary vein and its branches
- Axillary lymph nodes
- Brachial plexus

## CUBITAL FOSSA

- The cubital fossa is the depression on the anterior part of the elbow
- Borders of the cubital fossa
  - **Superior** Imaginary line connecting the epicondyles
  - **Medial** Pronator teres muscle
  - **Lateral** Brachioradialis muscle
  - **Floor** Brachialis and supinator muscles
  - **Roof** Deep fascia and bicipital aponeurosis



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