

UPPER LIMB OVERVIEW

- **PALPATIONS**

1. The inferior angle of the scapula can be palpated easily in the living subject and marks the level of seventh rib and spine of seventh thoracic vertebrae
2. Acromion forms the easily palpable tip of the shoulder
3. The coracoid process can be palpated via deep pressure through the anterior part of the deltoid muscle, inferior to the lateral end of clavicle.
4. Lateral epicondyle is readily palpable.
5. Medial epicondyle is easily palpable and forms an important surface landmark in the arm
6. The ulnar nerve can be palpated and rolled against medial epicondyle
7. The olecranon is the easily palpable proximal end of the ulna that forms the “point” of the elbow
8. The posterior border of ulna is rounded and subcutaneous and easily palpable along its entire length
9. Upper Limb Arteries
 - The subclavian artery can be palpated in the root of posterior triangle of neck
 - The third part of axillary artery can be palpated in the arm as it lies on the brachialis and is overlapped from the lateral side by biceps brachii
 - The radial artery lies superficially in front of the distal end of the radius, between tendons of brachioradialis and flexor carpi radialis. This is where clinician takes the radial pulse.
 - The ulnar artery can be palpated as it crosses superficial to the flexor retinaculum in company with the ulnar nerve

- **QUADRANGULAR SPACE BOUNDARIES**

Above – Supscapularis

Teres minor

Capsule of shoulder joint

Below – Teres major

Medially – Long head of triceps brachii

Laterally – Surgical neck of humerus

- **CONTENTS OF QUADRANGULAR SPACE**

1. Axillary nerve
2. Posterior circumflex humeral artery

- **WALLS OF AXILLA**

1. Anterior Wall – Pectoralis major
Subclavius

- Pectoralis minor
- 2. Posterior wall – Subscapularis
 - Latissimus dorsi
 - Teres major
- 3. Lateral wall – Coracobrachialis
 - Biceps brachii
- 4. Medial wall – Upper four or five ribs
 - Intercostal spaces covered by serratus anterior

- **CONTENTS OF AXILLA**

- Axillary artery and its branches
- Axillary vein and its tributaries
- Axillary lymph nodes
- Brachial plexus
- Short head of biceps brachii
- Coracobrachialis

- **STRUCTURES PASSING THROUGH CLAVIPECTORAL TRIANGLE**

- Cephalic vein (enters)
- Medial and lateral pectoral nerves (leaves)

- **STRUCTURES PASSING THROUGH ANTERIOR OSSEOFACIAL COMPARTMENT OF ARM**

- Musculocutaneous nerve
- Median nerve
- Ulnar nerve
- Basilica vein
- Radial nerve (in lower part of compartment)

- **STRUCTURES PASSING THROUGH POSTERIOR OSSEOFACIAL COMPARTMENT OF ARM**

- Radial nerve
- Ulnar artery
- Profunda brachii vessels

- **CUBITAL FOSSA BOUNDARIES**

Laterally – Brachioradialis

Medially – Pronator teres

Base – Imaginary line drawn between two epicondyles of humerus

Floor – Supinator muscle laterally

Brachialis muscle medially

Roof – skin and fascia, reinforced by bicipital aponeurosis

- **CONTENTS OF CUBITAL FOSSA**

From medial to lateral (Mnemonic : Really Need Beer To Be At My Nicest)

- Radial Nerve
- Biceps Tendon
- Brachial Artery (Bifurcation of brachial artery into ulnar and radial artery)
- Median Nerve

- **BOUNDARIES OF ANATOMIC SNUFFBOX**

Medially – Tendon of extensor pollicis longus

Laterally – Tendon of abductor pollicis longus

Tendon of extensor pollicis brevis

- **CONTENTS OF ANATOMIC SNUFFBOX**

- Radial artery
- Superficial branch of radial nerve
- Cephalic vein

- Two osseofacial compartments in arm i.e. anterior and posterior

- Three osseofacial compartments in forearm i.e. anterior, lateral and posterior

- **STRUCTURES PASSING SUPERFICIAL TO FLEXOR RETINACULUM:**

- Flexor carpi ulnaris tendon
- Ulnar nerve
- Ulnar artery
- Palmar cutaneous branch of ulnar nerve
- Palmaris longus tendon
- Palmar cutaneous branch of median nerve

- **STRUCTURES PASSING DEEP TO FLEXOR RETINACULUM i.e. WITHIN CARPAL TUNNEL**

(From medial to lateral)

- Flexor digitorum superficialis tendons, and deep to these the four tendons of flexor digitorum profundus
- Median nerve
- Flexor pollicis longus tendon
- Flexor carpi radialis tendon
- Flexor carpi radialis tendon

- **STRUCTURES PASSING SUPERFICIAL TO THE EXTENSOR RETINACULUM**

(From medial to lateral)

- Dorsal (posterior) cutaneous branch of ulnar nerve
- Basilic vein

- Cephalic vein
 - Superficial branch of radial nerve
- **STRUCTURES PASSING DEEP TO EXTENSOR RETINACULUM WITHIN SIX EXTENSOR TENDONS**
(From medial to lateral)
 1. Extensor carpi ulnaris tendon
 2. Extensor digiti minimi tendon
 3. Extensor digitorum and extensor indices tendons
 4. Extensor pollicis longus tendon
 5. Extensor carpi radialis longus and brevis tendons
 6. Abductor pollicis longus and extensor pollicis brevis tendons
- The **thenar space** contains the first lumbrical muscle.
The **midpalmar space** contains the second, third and fourth lumbrical muscles.
- The lumbrical canal is a potential space surrounding the tendon of each lumbrical muscle and is normally filled with connective tissue
- **ROTATOR CUFF MUSCLES**
Mnemonic : SITS
 - Supraspinatus
 - Infraspinatus
 - Teres minor
 - Subscapularis
- The patient with a ruptured supraspinatus tendon is unable to initiate abduction of the arm. However, if the arm is passively assisted for the first 15° of abduction, the deltoid can take over and complete the movement to a right angle.
- The musculocutaneous nerve supplies the anterior compartment of arm, whereas the radial nerve innervates the posterior compartment of arm.
- The biceps brachii muscle is the chief supinator
- The muscles in anterior compartment of forearm produce mainly flexion or pronation. The muscles in lateral and posterior compartment of forearm produce mainly extension or supination.
- The median and ulnar nerves supply the anterior compartment of forearm.
The radial nerve innervates the lateral and posterior compartments of forearm.

- **MUSCLES IN PECTORAL REGION**

- Pectoralis major
- Pectoralis minor
- Serratus anterior
- Subclavius

- **EXTRINSIC MUSCLES OF SHOULDER**

SUPERFICIAL:

- Trapezius
- Latissimus dorsi

DEEP

- Levator scapulae
- Rhomboid major
- Rhomboid minor

- **INTRINSIC MUSCLES OF SHOULDER**

- Deltoid
- Teres major
- Supraspinatus
- Infraspinatus
- Subscapularis
- Teres minor

- **MUSCLES OF ARM**

- Biceps brachii
- Brachialis
- Coracobrachialis
- Triceps brachii (Posterior)

- Muscles of **anterior compartment of forearm** are arranged in three groups:

1. Superficial Group

- Flexor carpi ulnaris
- Palmaris longus
- Flexor carpi radialis
- Pronator teres

2. Intermediate Group

- Flexor digitorum superficialis

3. Deep Group

- Flexor digitorum profundus
- Flexor pollicis longus

- Pronator quadratus
- Muscles in **lateral compartment of forearm**
 - Brachioradialis
 - Extensor carpi radialis longus
- Muscles of **posterior compartment of forearm** are arranged in two groups:
 1. Superficial Group
 - Extensor carpi radialis brevis
 - Extensor digitorum
 - Extensor digiti minimi
 - Extensor carpi ulnaris
 - Anconeus
 2. Deep Group
 - Supinator
 - Abductor pollicis longus
 - Extensor pollicis brevis
 - Extensor pollicis longus
 - Extensor indices
- Both extrinsic and intrinsic muscles of hand are organized in five osseofascial compartments
 1. Thenar
 2. Hypothenar
 3. Central / Midpalmar
 4. Interosseous
 5. Dorsal / Extensor

The first four compartments are located in palmar aspects. While the dorsal compartment is in the dorsum of hand

- **THENAR COMPARTMENT** (innervated by median nerve)
 - Flexor pollicis brevis
 - Abductor pollicis brevis
 - Opponens pollicis
- **HYPOTHENAR COMPARTMENT**
 - Flexor digiti minimi
 - Abductor digiti minimi
 - Opponens digiti minimi
- **CENTRAL (MIDPALMAR) COMPARTMENT**
 - Tendons of flexor digitorum superficialis, flexor digitorum profundus and flexor pollicis longus
 - Lumbrical muscles

- **INTEROSSEOUS COMPARTMENT**
 - Adductor pollicis
 - Palmar interossei
 - Dorsal interossei
- **DORSAL (EXTENSOR) COMPARTMENT**
 - Tendons of long digital extensors
- Lumbricals – Four muscles
Dorsal interossei – Four muscles
Palmar interossei – Three muscles
- The brachial plexus and the axillary artery and vein are enclosed together in a connective tissue wrapping termed the **axillary sheath**.
- Brachial Plexus nerves arising from
 1. ROOTS
 - Dorsal scapular nerve (C₅)
 - Long thoracic nerve (C₅, C₆, C₇)
 2. UPPER TRUNK
 - Nerve to subclavius (C₅, C₆)
 - Suprascapular nerve (C₅, C₆)
 3. LATERAL CORD (Mnemonic : Lucy Loves Me)
 - Lateral pectoral nerve (C₅, C₆, C₇)
 - Musculocutaneous nerve (C₅, C₆, C₇)
 - Lateral root of median nerve (C₅, C₆, C₇)
 4. MEDIAL CORD (Mnemonic : M4U)
 - Medial pectoral nerve (C₈, T₁)
 - Medial cutaneous nerve of arm (C₈, T₁, T₂)
 - Medial cutaneous nerve of forearm (C₈, T₁)
 - Ulnar nerve (C₈, T₁)
 - Medial root of median nerve (C₅ – T₁)
 5. POSTERIOR CORD (Mnemonic : STAR)
 - Upper and lower subscapular nerves (C₅, C₆)
 - Thoracodorsal nerve (C₆, C₇, C₈)
 - Axillary nerve (C₅, C₆)
 - Radial nerve (C₅ – T₁)
- **Brachial plexus**
Mnemonic : Remember To Drink Cold Beer
 - Roots (C₅ – T₁)
 - Trunks

Upper Trunk (C₅, C₆)

Middle Trunk (C₇)

Lower Trunk (C₈, T₁)

- Divisions
 - Anterior and posterior divisions of each trunk
 - Cords
 - Lateral Cord: Anterior divisions of upper and middle trunks
 - Medial Cord: Anterior division of lower trunk
 - Posterior Cord: Poster
 - Branches
- **AXILLARY NERVE SUPPLIES**
 - Shoulder joint
 - Deltoid
 - Teres minor
 - Upper lateral cutaneous nerve of arm
 - The profunda brachii vessels accompany radial nerve in the radial groove
 - **RADIAL NERVE SUPPLIES**
 - Lateral and medial heads of triceps
 - Anconeus
 - Brachialis
 - Brachioradialis
 - Extensor carpi radialis longus
 - Lower lateral cutaneous nerve of arm supplies skin over lateral and anterior aspects of lower part of arm
 - Posterior cutaneous nerve of arm
 - Posterior cutaneous nerve of forearm
 - Elbow joint
 - Superficial branch of radial nerve is a posterior cutaneous nerve to the wrist and hand and supplies lateral two-third of dorsum of hand and posterior surface over proximal phalanges of lateral three and a half fingers
 - Deep branch supplies
 - Extensor carpi radialis brevis
 - Supinator
 - Extensor digitorum
 - Extensor digiti minimi
 - Extensor carpi ulnaris
 - Abductor pollicis longus
 - Extensor pollicis brevis

- Extensor pollicis longus
- Extensor indices

- The **median nerve** supplies all the muscles of the anterior compartment of forearm except the flexor carpi ulnaris and medial half of flexor digitorum profundus, which are supplied by ulnar nerve
In the palm, the median nerve supplies the muscles of the thenar compartment and the first two lumbricals and gives sensory innervation to the skin of the palmar aspect of lateral three and a half fingers, including nail beds of dorsum

- The **ulnar nerve** does not give off cutaneous or motor branches in the axilla or in the arm. It provides motor branches to the flexor carpi ulnaris and medial half of flexor digitorum profundus as it enters the forearm from behind the medial epicondyle.
Next, it gives off its palmar and posterior cutaneous branches in the distal third of the forearm. The palmar cutaneous branch supplies skin over the hypothenar eminence. The posterior cutaneous branch supplies skin over medial third of the dorsum of the hand and medial one and a half fingers. It does not supply skin over the distal part of the dorsum of these fingers.
Having entered the palm by passing superficial to the flexor retinaculum, the superficial branch of ulnar nerve supplies skin of the palmar surface of medial one half fingers, including their nail beds. It also supplies the palmaris brevis muscle.
The deep branch of the ulnar nerve supplies all the small muscles of hand except the muscles of thenar compartment and the first two lumbricals, which are supplied by median nerve

- **AXILLARY LYMPH NODES**

1. **Anterior (Pectoral) Group:**

This group receives vessels from:

- Lateral quadrants of breast
- Superficial vessels from anterolateral abdominal wall above the level of umbilicus

2. **Posterior (Subscapular) Group:**

This group receives lymph vessels from the back, down as far as the level of iliac crests

3. **Lateral Group:**

This group receives most of the lymph vessels from most of the upper limb (except the superficial vessels draining the lateral side)

4. **Central Group:**

This group receives lymph from the above three groups

5. **Infraclavicular (Deltopectoral) Group:**

This group receives superficial lymph vessels from lateral side of hand, forearm and arm

6. **Apical Group**

Receives lymph vessels from all other axillary nodes

- **TYPES OF JOINTS**

1. Sternoclavicular Joint – Synovial double-plane joint
2. Acromioclavicular Joint – Synovial plane joint
3. Glenohumeral Joint – Synovial ball-and-socket joint
4. Elbow Joint – Synovial hinge joint
5. Proximal radioulnar Joint – Synovial pivot joint
6. Distal radioulnar Joint – Synovial pivot joint
7. Wrist Joint – Synovial ellipsoid joint
8. Intercarpal Joints – Synovial plane joint
9. Carpometacarpal Joint of thumb – Synovial saddle-shaped joint
10. Metacarpophalangeal Joint – Synovial condyloid joint
11. Interphalangeal Joint – Synovial hinge joint

- **MUSCLE INNERVATIONS**

1. Pectoralis major – medial and lateral pectoral nerves
2. Pectoralis minor – medial pectoral nerve
3. Subclavius – Nerve to subclavius
4. Serratus anterior – Long thoracic nerve
5. Trapezius – Spinal accessory nerve
6. Latissimus dorsi – Thoracodorsal nerve
7. Levator scapula – Dorsal scapular nerve
8. Rhomboid minor - Dorsal scapular nerve
9. Rhomboid major - Dorsal scapular nerve
10. Deltoid – Axillary nerve
11. Supraspinatus – Suprascapular nerve
12. Infraspinatus - Suprascapular nerve
13. Teres major – Lower subscapular nerve
14. Teres minor – Axillary nerve
15. Subscapularis – Upper and Lower subscapular nerves
16. Biceps brachii – Musculocutaneous nerve
17. Coracobrachialis - Musculocutaneous nerve
18. Brachialis - Musculocutaneous nerve
19. Triceps brachii – Radial nerve
20. Pronator teres – Median nerve
21. Flexor carpi radialis - Median nerve
22. Palmaris longus - Median nerve
23. Flexor digitorum superficialis - Median nerve
24. Flexor carpi ulnaris – Ulnar nerve
25. Flexor pollicis longus – Anterior interosseous branch of Median nerve
26. Pronator Quadratus - Anterior interosseous branch of Median nerve
27. Flexor digitorum profundus – Ulnar (medial half) and median (lateral half) nerves
28. Brachioradialis – Radial nerve

29. Extensor carpi radialis longus – Radial nerve
30. All muscles of posterior forearm – Deep branch of radial nerve
31. Thenar compartment – Median nerve (Recurrent branch)
32. Hypothenar compartment – Ulnar nerve (Deep branch)
33. Central (Midpalmar) compartment – Median nerve, deep branch of ulnar nerve
34. Interosseous compartment – Deep branch of ulnar nerve
35. Dorsal (Extensor) compartment – No intrinsic motor nerves
36. Palmaris brevis – Superficial branch of ulnar nerve
37. Lumbricals – Median nerve supplies lateral two i.e. first and second lumbrical
Deep branch of Ulnar nerve supplies third and fourth lumbrical
38. Abductor pollicis brevis – median nerve
39. Flexor pollicis brevis – median nerve
40. Opponens pollicis – median nerve
41. Adductor pollicis – Deep branch of ulnar nerve

● **LIGAMENTS THAT STRENGTHEN DIFFERENT JOINTS:**

1. Sternoclavicular Joint
Ligament: Sternoclavicular ligament
Accessory ligament: Costoclavicular ligament
2. Acromioclavicular Joint
Ligaments: Superior and inferior acromioclavicular ligaments
Accessory ligament: Coracoclavicular Ligament
3. Glenohumeral Joint
Ligament: Glenohumeral Ligaments
Transverse humeral ligament
Coracohumeral Ligament
Accessory ligament: Coracoacromial ligament
4. Elbow Joint Ligaments
 - Lateral collateral ligament
 - Anular Ligament
 - Medial collateral Ligament
5. Proximal Radioulnar Joint Ligament
 - Anular Ligament
6. Distal Radioulnar Joint Ligaments
 - Anterior and posterior ligaments
7. Wrist Joint Ligaments
 - Anterior and posterior ligaments
 - Medial Ligament
 - Lateral Ligament
8. Intercarpal Joints Ligaments
 - Anterior, posterior, interosseous Ligaments
9. Metacarpophalangeal Joints Ligaments

- Palmar Ligaments
- Deep transverse metacarpal Ligaments
- Collateral Ligaments

- **PULSE POINTS**

Peripheral pulses can be felt at six locations in the upper limb

1. Axillary pulse
2. Brachial pulse in arm
3. Brachial pulse in cubital fossa
4. Radial pulse in distal forearm
5. Ulnar pulse in distal forearm
6. Radial pulse in anatomic snuffbox

- **BRANCHES OF BRACHIAL ARTERY**

- Muscular branches to anterior compartment of arm
- Nutrient artery to humerus
- Profunda brachii artery
- Superior ulnar collateral artery
- Inferior ulnar collateral artery

- **BRANCHES OF AXILLARY ARTERY**

- Superior thoracic artery
- Thoracoacromial artery
- Lateral thoracic artery
- Subscapular artery
- Anterior circumflex humeral artery
- Posterior circumflex humeral artery

- All muscles in anterior compartment of forearm are innervated by median nerve, except for flexor carpi ulnaris and medial part of flexor digitorum profundus which are innervated by ulnar nerve.
- The superficial group of muscles of anterior compartment of forearm possess a common tendon of origin, which is attached to medial epicondyle of humerus (Superficial muscles include pronator teres, flexor carpi radialis, palmaris longus, flexor carpi ulnaris)
- The superficial group of posterior compartment of forearm possess a common tendon of origin, which is attached to lateral epicondyle of humerus (these muscles include extensor digitorum, extensor digiti minimi, extensor radialis brevis, extensor carpi ulnaris, anconeus)

- **ULNAR NERVE**

Originates from medial cord of brachial plexus in the axilla. It runs downward on medial side of brachial artery as far as middle of arm. Here, at insertion of coracobrachialis, the nerve enters posterior compartment of arm. The nerve passes behind medial epicondyle of humerus.

Ulnar nerve crosses medial border of elbow joint and enters the front of forearm by passing between two heads of flexor carpi ulnaris. Ulnar nerve enters the palm of hand by passing in front of flexor retinaculum and lateral to pisiform bone

- **RADIAL NERVE**

On leaving the axilla, the radial nerve immediately enters the posterior compartment of arm and enters the anterior compartment just above the lateral epicondyle.

At the level of lateral epicondyle, it divides into superficial and deep branches.

Deep branch winds around neck of radius and enters posterior compartment

Superficial branch is the direct continuation of the radial nerve.

The superficial branch:

- Supplies lateral compartment of arm
- Reaches posterior surface of wrist
- Supplies lateral two-thirds of posterior surface of hand
- Posterior surface over proximal phalanges of lateral three and a half fingers

- **RADIAL ARTERY**

Radial artery arises from bifurcation of brachial artery in the cubital fossa. It runs distally on anterior part of forearm.

The radial artery enters the hand dorsally, crossing the floor of anatomic snuffbox.