

Clavipectoral fascia

- ✓ Membranous layer of deep fascia between pectoralis minor & subclavius
- ✓ The fascia splits to enclose each muscle.
- ✓ The fascia is continuous laterally with the axillary fascia.
- ✓ It's pierced by:
 - Arcomiothoracic trunk
 - Cephalic vein
 - Lateral pectoral nerve
 - Lymphatics

Rotator cuff muscles: Surround the shoulder joint & include:

1. Subscapularis.
2. Supraspinatus.
3. Infraspinatus.
4. Teres minor.

Anastomosis around the scapula: between 3 arteries

1. Supra scapular (from thyrocervical trunk from the first part subclavian artery).
 2. Descending scapular/deep branch of the transverse cervical artery (From thyrocervical trunk from first part subclavian artery).
 3. Subscapular artery (From the third part axillary artery).
- ✓ This anastomosis forms an important indirect connection between the first part subclavian artery and the third part axillary artery
 - ✓ Thus in case of obstruction of the artery between these two regions the blood can still pass to the rest of the upper limb.

Intermuscular spaces

Space	Boundaries	Contents
Quadrangular space	<ul style="list-style-type: none">○ Superiorly: Teres minor.○ Inferiorly: Teres major.○ Medially: Long head of triceps○ Laterally: Surgical neck of the humerus.	Transmits the axillary nerve and posterior circumflex humeral artery
Medial triangular space	<ul style="list-style-type: none">○ Inferiorly: Teres major○ Laterally: Long head of triceps○ Teres minor superiorly.	Circumflex scapular vessels
Lateral triangular space	<ul style="list-style-type: none">○ Teres major superiorly.○ Long head of the triceps medially.○ Humerus laterally.	Radial nerve and profunda brachii artery.

The axilla

- Four-sided pyramidal space between root of arm and chest wall
- Base directed downwards → formed by the axillary fascia
- Apex directed upwards posterior to the clavicle.
- Boundaries of apex :
 1. Clavicle Anteriorly
 2. Superior border of scapula posteriorly
 3. Outer border of 1st rib medially

The walls of the axilla.

- **Anterior wall**
 - = Pectoralis major and minor muscles, clavipectoral fascia and subclavius muscle
 - Lower border = anterior fold of the axilla → formed only by the pectoralis major
- **Posterior wall** is formed by the subscapularis muscle above and the latissimus dorsi and teres major muscles below.

The lower border of the posterior wall is called the posterior fold of the axilla and is formed by the latissimus dorsi and teres major muscles.

- **Medial wall** is formed of the thoracic wall with the serratus anterior muscle.
- **Lateral wall** is narrow and formed by the upper part of the shaft of the humerus.

Contents

1. Axillary artery and branches/vein & tributaries/Lymph nodes/ fat / tail of breast
2. Brachial plexus (cords and branches).
3. Lateral cutaneous branches of intercostal nerves.

Axillary lymph nodes: are arranged in the following groups:

- **Anterior (pectoral)** : related to the lateral thoracic artery
- **Posterior (subscapular)**: lie on lower margin of posterior wall of the axilla, along the course of subscapular artery
- **Lateral (brachial) lymph nodes**: along the lateral wall of the axilla.
- **Central lymph nodes**: in the adipose tissue at the base of the axilla.
- **Apical lymph nodes**: in the apex of the axilla.

Axillary artery

- Begins as continuation of subclavian artery at outer border of 1st rib
- Ends at lower border of teres major → continues as brachial artery
- Divided into 3 parts by pectoralis minor:

	1 st Part	2 nd Part	3 rd Part
Site	From lateral border of 1 st rib to upper border of pectoralis minor	Behind pectoralis minor	From lower border of pectoralis major To lower border of teres major
Anterior relations	<ul style="list-style-type: none"> • Pectoralis major • Subclavius • Clavipectoral fascia 	Pectoralis major/minor	<ul style="list-style-type: none"> • Pectoralis major • Medial root of median nerve
Posterior relations	<ul style="list-style-type: none"> • Medial cord of brachial plexus • Long thoracic nerve • Medial pectoral nerve • 1st i/c space • 1st digitation of serratus anterior 	<ul style="list-style-type: none"> • Posterior cord of brachial plexus • Subscapularis 	<ul style="list-style-type: none"> • Subscapularis • Latissimus dorsi • Teres major • Axillary nerve • Radial nerve
Lateral Relations	All 3 cords of brachial plexus	Lateral Cord of brachial plexus	<ul style="list-style-type: none"> • Musculocutaneous nerve • Median nerve
Medial Relations	Axillary vein	<ul style="list-style-type: none"> • Medial Cord of brachial plexus • Medial pectoral Nerve • Axillary vein 	Axillary vein Ulnar nerve Medial cutaneous nerve of forearm & arm
Branches	Superior thoracic artery.	<ul style="list-style-type: none"> • Thoracoacromial artery. • Lateral thoracic artery. 	<ul style="list-style-type: none"> • Subscapular artery • Anterior circumflex humeral artery • Posterior circumflex humeral artery

Brachial plexus

Plexus of spinal nerves supplying the upper limb

1- Roots: take origin in the neck from: Ventral rami of the lower 4 cervical nerves (C 5, 6, 7, 8) & 1st thoracic nerve (T1)

Branches: Dorsal scapular & long thoracic nerves

2- Trunks: Upper trunk, middle trunk & lower trunk.

Branches: Suprascapular nerve/ Nerve to subclavius

Roots & trunks are present in the posterior triangle of the neck.

3- Divisions: Each trunk divides into 2 divisions: anterior and posterior behind the clavicle

4- Cords: in the axilla:

	Lateral	Medial	Posterior
Origin	Anterior divisions of the upper and middle trunks: C 5, 6, 7	Anterior division of the lower trunk only: C8, T1	Posterior divisions of the 3 trunks; C5, 6, 7, 8, T1
Branches	<ol style="list-style-type: none">1. Medial cutaneous nerve of the arm.2. Medial cutaneous nerve of the forearm.3. Medial pectoral nerve.4. Medial root of median nerve.5. Ulnar nerve.	<ol style="list-style-type: none">1. Lateral pectoral nerve2. Lateral root of median nerve.3. Musculocutaneous nerve.	<ol style="list-style-type: none">1. Upper subscapular nerve.2. Lower subscapular nerve.3. Nerve to latissimus dorsi.4. Axillary nerve.5. Radial nerve.

Arm: divided into two compartments (anterior and posterior) by:

- Deep fascia of the arm.
- Humerus.
- Lateral and medial intermuscular septa.

Medial intermuscular septum	Lateral intermuscular septum.
Fascial sheet connecting medial supracondylar ridge of the humerus with deep fascia of the arm.	Fascial sheet that connects the lateral supracondylar ridge of the humerus with the deep fascia of the arm.
Pierced by ulnar nerve at the middle of the arm.	Pierced by radial nerve at the junction between middle and lower thirds of the arm.

Anterior compartment of the arm	Posterior compartment of the arm
<p>(3) Flexor Muscles: coracobrachialis, brachialis & biceps brachii.</p> <p>(3) Nerves: Musculocutaneous, Median & Ulnar (upper half of arm)</p> <p>(1) Artery: Brachial + 2 venae comitantes</p> <p>(1) Vein: Basilic (upper half of arm)</p>	<p>✓ Triceps muscle.</p> <p>✓ Radial nerve.</p> <p>✓ Profunda brachii vessels.</p> <p>✓ Superior ulnar collateral vessels.</p> <p>✓ Posterior branch of inferior ulnar collateral artery</p>

***** Changes that occur at the level of insertion of coracobrachialis.

1. **Median nerve:** crosses in front of brachial artery from lateral to medial.
2. **Ulnar nerve:** pierces medial intermuscular septum to reach the posterior compartment.
3. **Radial nerve & profunda brachii artery:** descend on back of humerus through the spiral groove.
4. **Basilic vein:** pierces deep fascia to ascend medial to brachial artery.
5. **Medial cutaneous nerve of the arm and forearm:** pierces deep fascia to pass through superficial fascia.
6. **Nutrient artery of the humerus** enters into the bone.

Brachial artery

- **Origin:** Begins at the lower border teres major muscle as a continuation of the axillary artery.
- **Termination:** The brachial artery ends opposite the neck of radius by dividing into its two terminal branches the radial and ulnar arteries.
- **Course & relations:**
 - Descends in anterior compartment of the arm accompanied with its 2 venae comitantes.
 - It's relatively superficial along its whole course
 - It's closely Related
 - Medially: to basilica vein in upper half of the arm
 - Laterally: to Median nerve
- **Branches:**
 - a) Profunda brachii artery
 - i. Largest branch
 - ii. Accompanies radial nerve in spiral groove
 - iii. Ends by giving anterior & posterior descending arteries → anastomosis around elbow.
 - b) Muscular branches
 - c) Nutrient artery to the humerus
 - d) Superior ulnar collateral artery
 - e) Inferior ulnar collateral artery
 - f) Terminal branches: radial and ulnar

Cubital fossa

- Triangular depression in the front of the elbow
- **Boundaries:**
 - ✓ Medially: pronator teres muscle.
 - ✓ Laterally: brachioradialis muscle.
 - ✓ Base: directed upwards – formed by an imaginary line connecting the 2 humeral epicondyles.
 - ✓ Apex: Directed downwards – formed by the point of overlap of brachioradialis over pronator teres.

Roof: is formed by:

- Skin.
- Superficial fascia containing
 - Median cubital vein
 - Parts of basilic and cephalic veins
 - Medial and lateral cutaneous nerves of forearm.
- Deep fascia.
- Bicipital aponeurosis.

Floor: Brachialis muscle (medially) and supinator muscle (laterally).

Contents: from lateral to medial:

- Biceps tendon.
- Brachial artery.
- Median nerve.

Flexors of the forearm

Superficial group of flexors of forearm	Deep group of flexors of forearm
(5) Muscles (lateral → medial) <ol style="list-style-type: none"> 1. Pronator teres. 2. Flexor carpi radialis. 3. Palmaris longus. 4. Flexor digitorum superficialis. 5. Flexor carpi ulnaris. 	<ol style="list-style-type: none"> 1. Flexor pollicis longus. 2. Flexor digitorum profundus. 3. Pronator quadratus.
✓ Mainly arise from common flexor origin → tendinous mass attached to front of medial epicondyle ✓ All have their nerve supply from the median nerve except flexor carpi ulnaris that take its supply from ulnar nerve.	

Nerves & vessels in the front of forearm.

Vessels in the front of forearm. Radial & Ulnar among their branches

Nerves. Median/ulnar nerves + their branches + Superficial terminal branch of radial nerve.

Extensors of the forearm

Superficial group of extensor muscles	Deep group of extensor muscles
<ol style="list-style-type: none"> 1. Brachioradialis. 2. Extensor carpi radialis longus. 3. Extensor carpi radialis brevis. 4. Extensor digitorum. 5. Extensor digiti minimi. 6. Extensor carpi ulnaris. 7. Anconeus. 	<ol style="list-style-type: none"> 1. Supinator. 2. Abductor pollicis longus. 3. Extensor pollicis brevis. 4. Extensor pollicis longus. 5. Extensor indicis.

The skeleton of the hand

- ✓ The carpus: Eight carpal bones made up of two rows of four
 - Proximal row: Scaphoid – Lunate – Triquetrum – Pisiform.
 - Distal row: Trapezium – Trapezoid – Capitate – Hamate.
- ✓ The **pisiform** is regarded as a sesamoid bone embedded in the tendon of the flexor carpi ulnaris.
- ✓ The **scaphoid** bone is the largest bone of the proximal row of wrist bones, is the most commonly fractured bone in the carpus.

Hand

Cutaneous nerve supply:

Palm of the hand	Dorsum of the hand
<ol style="list-style-type: none">1. Cutaneous branches of median nerve (lateral 2/3 and lateral 3 1/2 fingers)2. Cutaneous branches of ulnar nerve (medial 1/3 of palm and medial 1 1/2 fingers)	<ol style="list-style-type: none">1. Cutaneous branches of radial nerve (lateral 2/3 and lateral 3 1/2 fingers except the nail bed and adjacent skin by median nerve)2. Cutaneous branches of ulnar nerve (medial 1/3 and medial 1 1/2 fingers)3. Skin over the base of the thumb by musculocutaneous nerve

Deep fascia of the palm.

Flexor retinaculum

- Thick, strong fibrous band that bridges over the carpal groove (made by carpal bones)
- Converts carpal groove into an osseous-fibrous tunnel (carpal tunnel)
- Attached
 - Medially to pisiform and hamate
 - Laterally is attached to scaphoid and lunate.

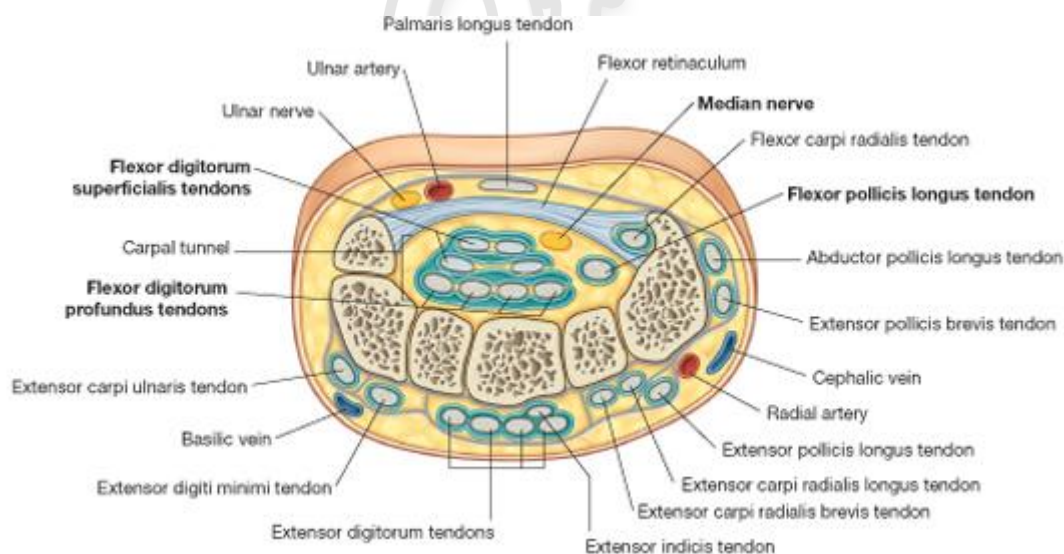
Structures superficial to flexor retinaculum	Structures deep to the flexor retinaculum
<ol style="list-style-type: none">1. Ulnar nerve.2. Ulnar vessels.3. Cutaneous branches of ulnar nerve.4. Cutaneous branch of median nerve.5. Tendon of palmaris longus.	<ol style="list-style-type: none">1. Median nerve.2. Tendons of flexors of the forearm that insert into the hand with their synovial sheaths3. Flexor carpi radialis.4. Flexor carpi ulnaris.5. Flexor digitorum profundus.6. Flexor digitorum superficialis.7. Flexor pollicis longus.

Palmar aponeurosis.

- ✓ Triangular thickening of deep fascia of the palm
- ✓ Apex is directed upwards – base is divided into 4 slips → each for each of the medial 4 fingers.
- ✓ **Function:** Protection of the underlying vessels and nerves of the palm of the hand

Extensor retinaculum

- ✓ A thickening of deep fascia at the back of the wrist
- ✓ Attached laterally to the anterior border of the radius and medially to the triquetral and pisiform bones
- ✓ Sends septa to the back of the lower end of the radius and ulna forming 6 extensor compartments
- ✓ First compartment lies on the lateral aspect of the styloid process of the radius and contains the abductor pollicis longus and the extensor pollicis brevis.



Extensor expansion

- ✓ It is the flattening of the tendons of extensors of the fingers.
- ✓ It gives attachment to the lumbricals and interossei.
- ✓ Through this attachment, the writing position can be done.

Nerve supply of the small muscles of the hand

All muscles of the hand are supplied by deep branch of ulnar nerve except:

- The first and second lumbrical → Median nerve
- The palmaris brevis → superficial branch of ulnar nerve
- 3 muscles of thenar eminence (flexor pollicis brevis, abductor pollicis brevis & opponens pollicis).

Vessels of the hand

- Radial/Ulnar artery and their branches
 - Superficial/Deep palmar arches
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- ✓ **Ulnar artery:** enters the hand superficial to flexor retinaculum & gives a deep branch then continues as the superficial palmar arch.
 - ✓ **Radial artery:** enters the hand by passing between the 2 heads of 1st dorsal interosseous then gives:
 - Princeps pollicis & Radialis indicis arteries
 - Deep palmar arch.
 - ✓ **Superficial palmar arch:** formed by the continuation of ulnar artery and a branch of radial artery & lies at the level of distal border of out stretched thumb.
 - ✓ **Deep palmar arch:** formed by continuation of radial artery and the deep branch of ulnar artery & lies at the level of proximal border of out stretched thumb.
 - ✓ **Nerves of the hand:** Median/Ulnar/Radial (Cutaneous Branches)
 - **Median nerve:** Enters hand by passing deep to flexor retinaculum then divides into medial & lateral branches.
 - **Ulnar nerve:** Enters the hand by passing superficial to the flexor retinaculum then divides into superficial and deep branches

Nerves of the upper limb

	Median nerve (c.5,6,7,8, t.1)	Ulnar nerve (c. 7,8, t.1)
Origin	<ul style="list-style-type: none"> Medial root; C8, T1 (from medial cord of brachial plexus). Lateral root; C5, 6, 7 (from lateral cord of brachial plexus). The two roots unite to form the median nerve lateral to 3rd part of axillary a. 	<ul style="list-style-type: none"> It is a branch of medial cord of brachial plexus. Fibers of C7 come from lateral root of median nerve.
Axilla & Arm 1. Course & relations	<ul style="list-style-type: none"> Descends lateral to 3rd part of axillary artery & upper half of brachial artery At the level of insertion of coracobrachialis, it crosses in front of the brachial artery Then descends medial to the artery down to the cubital fossa It enters the forearm by passing between the 2 heads of pronator teres 	<ul style="list-style-type: none"> Descends close to medial side of 3rd part of axillary artery & upper half of brachial artery. At the level of insertion of coracobrachialis it pierces the medial intermuscular septum to reach the posterior compartment It descends down to the back of medial epicondyle It enters the forearm by passing between the 2 heads of flexor carpi ulnaris muscle
2. Branches	None	None
Forearm 1. Course & relations.	<ul style="list-style-type: none"> Enters forearm by passing between the 2 heads of pronator teres. Then descends between flexor digitorum superficialis and profundus. 2 inches above the wrist, the nerve becomes superficial in position (critical position of the nerve). The nerve reaches the hand by passing deep to the flexor retinaculum. 	<ul style="list-style-type: none"> Enters forearm by passing between the 2 heads of flexor carpi ulnaris. Descends under cover of flexor carpi ulnaris In the lower part of the forearm it becomes superficial covered only by skin and fasciae In the lower part of the forearm, the nerve is closely accompanied by ulnar artery
2. Branches	<ol style="list-style-type: none"> Muscular branches → all superficial flexors except flexor carpi ulnaris. Articular branches → elbow and superior radioulnar joint. Anterior interosseus nerve → all deep flexors except medial half of flexor digitorum profundus. Palmar cutaneous nerve. 	<ol style="list-style-type: none"> Muscular branches → flexor carpi ulnaris and medial ½ of flexor digitorum profundus. Articular branches → elbow joint. Palmar cutaneous branch. Dorsal branch

Hand Course, Relations & Branches	<ul style="list-style-type: none"> • It enters the hand by passing deep to the flexor retinaculum • It then divides into medial and lateral branches. • The 2 branches give: <ol style="list-style-type: none"> 1. Cutaneous branches to the skin of: <ul style="list-style-type: none"> • Lateral 2/3 of the palm • Palmar aspect of the lateral 3 1/2 fingers • Nail beds & dorsum of terminal phalanges of these fingers 2. Muscular branches to muscles of thenar eminence and the lateral 2 lumbricals 	<ul style="list-style-type: none"> • It enters the hand by passing superficial to the flexor retinaculum. • It divides into superficial and deep branches. • The 2 branches give. <ol style="list-style-type: none"> a) Cutaneous branches → skin of: <ul style="list-style-type: none"> • Medial 1/3 of palm and dorsum of the hand • Medial 1 1/2 fingers (palmar and dorsal aspects) b) Muscular branches → all muscles of the hand except those which are supplied by median nerve
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Musculocutaneous nerve (C5, 6, 7)

- **Origin.** Branch of the lateral cord of brachial plexus
- **Termination.** by continuing as the lateral cutaneous nerve of the forearm
- **Course & relations.** descends lateral to 3rd part of axillary artery between it and coracobrachialis muscle then pierces the coracobrachialis
- **Branches. Muscular to.**
 1. 2 heads of biceps brachii.
 2. Coracobrachialis.
 3. The greater part of brachialis.

Radial nerve (C5, 6, 7, 8, T1)

- **Origin.** Posterior cord of brachial plexus.
- **In axilla and arm.**
 - a) **Course & relations.** Descends posterior to 3rd part of axillary artery and brachial artery, then in the spiral groove it lies between medial and lateral heads of triceps, and then pierces the lateral intermuscular septum to reach the front of arm then descends between the brachialis and brachioradialis muscles
 - b) **Branches**
 1. Muscular to the lateral and medial heads of triceps.
 2. Posterior & Lower lateral cutaneous nerves of the arm
- **In forearm**
 - Terminates in front of the lateral epicondyle by dividing into superficial and deep terminal branches

- **The superficial branch** continues under cover of brachioradialis then enters the dorsum of hand with no branches in forearm
- **The deep branch (posterior interosseous nerve)**, pierces the supinator muscle to continue at the back of the forearm where it supplies all the muscles at the back of forearm (extensor group).

Axillary nerve (circumflex nerve) (C5 & 6)

- Arises from the posterior cord of the brachial plexus and passes backwards through the quadriangular space to turn around the surgical neck of the humerus
- **Branches.**
 - 1) Muscular: to deltoid and teres minor
 - 2) Upper lateral cutaneous nerve of the arm → skin over the lower half of the deltoid
- in case of fracture surgical neck humerus, the axillary nerve will be injured which will result in.
 - a. Weakness of abduction of the arm
 - b. Wasting of the deltoid muscle (flat shoulder)
 - c. Loss of sensation over the lower half of deltoid.