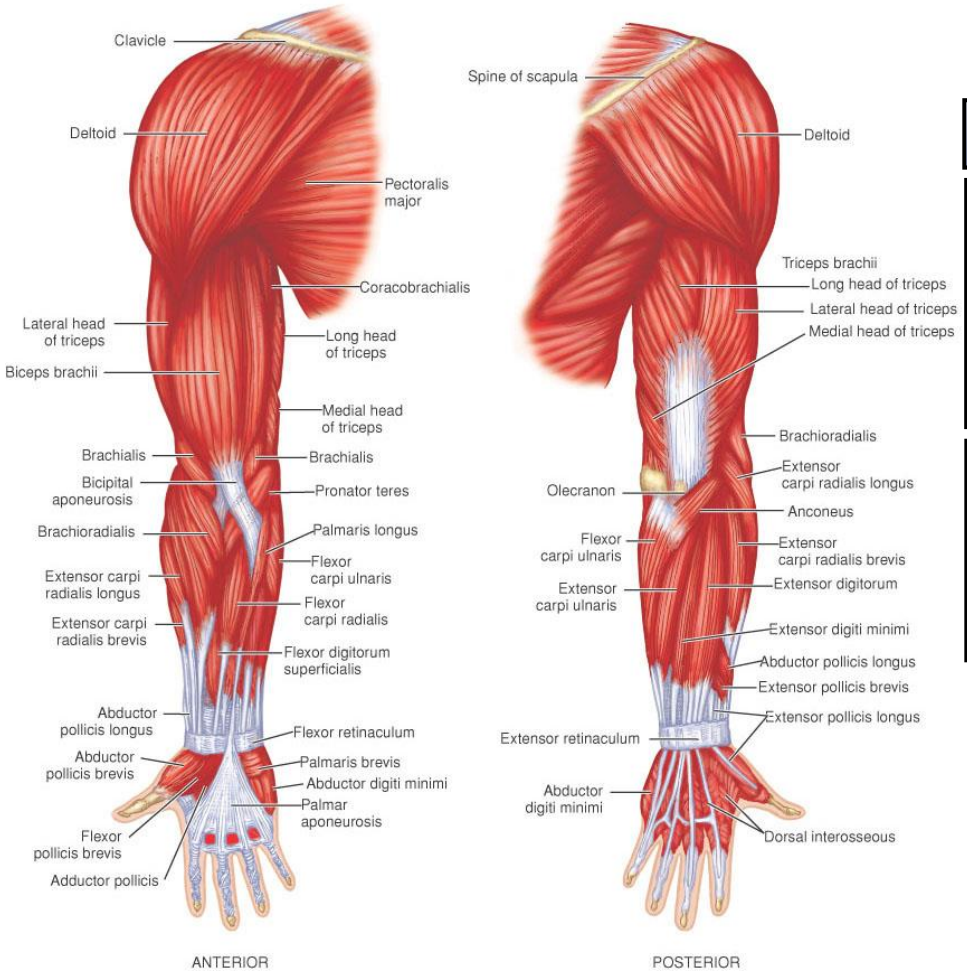
HUMAN ANATOMY



First Year MBBS

Note: Underlined and bold words are important and often asked by teachers in vivas. Some frequently asked questions are also mentioned here.

These are maximum clinicals of Upper limb put together from different books and internet by **Umer Shehroz Khan (Kemcolian)**

Upper Limb:

Bones of Upper Limb:

Clavicle:

- **Types of fractures:**

Clavicle fractures are classified into three types based on the location of the fracture:

1) near the sternum (least common)

2) near the acromioclavicular joint (AC) joint (second most common)

3) in the middle of the bone between the sternum and AC joint (most common)

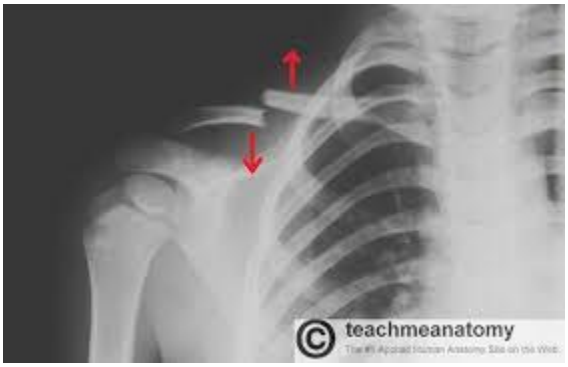
➢ Most common fracture:

The fracture in the middle of the bone between the sternum and AC joint which is the junction between two curvatures of the bone is the most common fracture of clavicle.

Cause:

- Fracture of the clavicle results from a fall on the shoulder or outstretched hand.
- When the infant presses against the maternal pubic symphysis during its passage through the birth canal.

Effects:



Its results in upward displacement of the proximal fragment by the sternocleidomastoid muscle and downward displacement of the distal fragment by the deltoid muscle and gravity. It may cause

1) injury to the **brachial plexus** (lower trunk), causing paresthesia (sensation of tingling, burning, and numbness) in the area of the skin supplied by medial brachial and antebrachial cutaneous nerves and

2) It may also cause fatal hemorrhage from the subclavian vein.

3) It is responsible for thrombosis of the subclavian vein, leading to pulmonary embolism.

➢ Cleidocranial dysostosis (CCD):

Cleidocranial dysostosis (CCD), also called **Cleidocranial dysplasia**, is a birth defect that mostly affects the bones and teeth. The clavicles may be congenitally absent, or imperfectly developed in this disease which allows the shoulders to droop or to be brought close together in front of chest.

Scapula:

➢ Winging of scapula (Back palsy):

When **serratus anterior** gets paralyzed due to damage to the **long thoracic nerve**, the patient is unable to do the pushing actions and he cannot abduct his arm beyond 90°. Any attempt to do these movements makes the medial border and inferior angle of scapula unduly prominent, this is called winging of scapula.

- In a developmental anomaly called scaphoid scapula, the medial border is concave.

Humerus:

- Fracture of the greater tuberosity occurs by direct trauma or by violent contractions of the supraspinatus muscle. The bone fragment has the attachments of the **SITS**.
- Fracture of the lesser tuberosity accompanies posterior dislocation of the shoulder joint, and the bone fragment has the insertion of the subscapularis tendon.
- The head of the humerus normally dislocates **anteroinferiorly** due to the laxity of joint capsule of shoulder at this point.
- The three bony points of the normal elbow form the equilateral triangle in a flexed elbow and are in one line in an extended elbow.

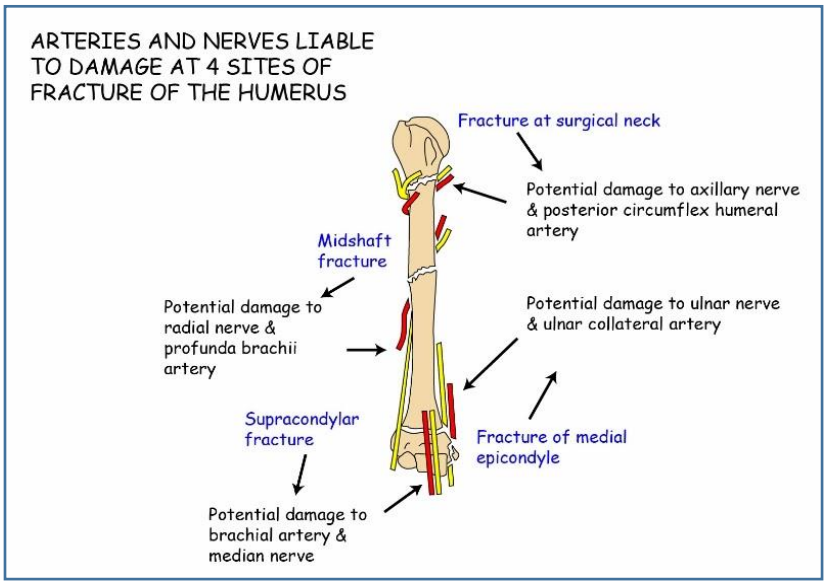
➢ Types of fractures:

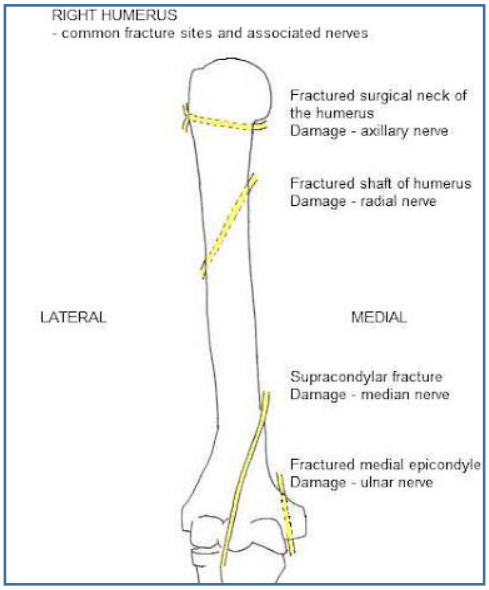
1) Fracture of the surgical neck may injure the axillary nerve and the posterior humeral circumflex artery.

2)Fracture of the shaft may injure the radial nerve and deep brachial artery in the spiral groove.

3)Supracondylar fracture is a fracture of the distal end of the humerus; it is common in children and occurs when the child falls on the outstretched hand with the elbow partially flexed and may injure the median nerve.

4) Fracture of the medial epicondyle may damage the ulnar nerve. This nerve may be compressed in a groove behind the medial epicondyle, and produce tingling sensations, **"funny bone**," causing numbness. (That is why the bone is called Humerus).

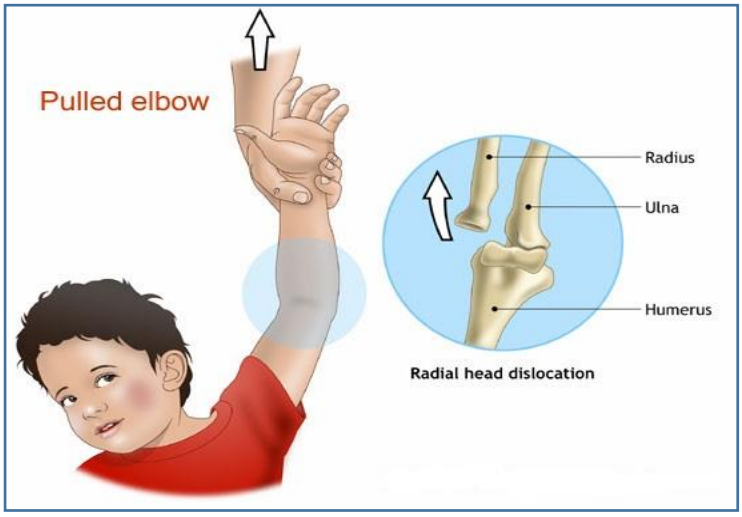


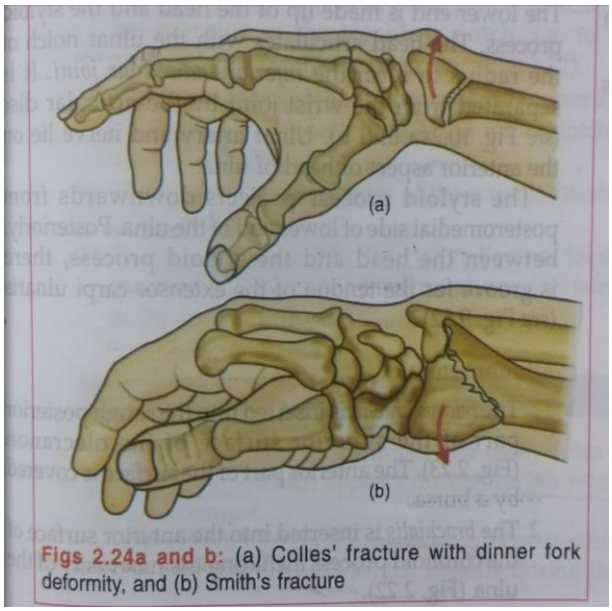


Radius:

➢ Pulled elbow:

A pulled elbow, also known as a radial head subluxation, is when the ligament that wraps around the radial head (**annular ligament**) slips off which results in dislodging the head of the radius from the grip of annular ligament. It may be due to a sudden powerful jerk on the hand of the child.





Figs 2.24a and b: (a) Colles' fracture with dinner fork deformity, and (b) Smith's fracture

➢ Colles's fracture:

Colles's fracture of the wrist is a distal radius fracture in which the distal fragment is displaced (tilted) upward and backward and the radial styloid process comes to lie proximal to the ulnar styloid process, producing a characteristic bump described as dinner (silver) fork deformity because the forearm and wrist resemble the shape of a dinner fork.

➢ Smith's fracture:

If the distal fragment is displaced anteriorly, it is called a Smith's fracture (reverse Colles's fracture). This fracture may show styloid processes of the radius and ulna line up on a radiograph.

Ulna:

- The ulna is the stabilizing bone of the forearm, with its trochlear notch gripping the lower end of humerus. Dislocation of elbow is produced by fall on outstretched hand with the elbow slightly flexed.
- In an extended elbow, the tip of the olecranon lies in a horizontal line with the two epicondyles of the humerus; and in the flexed elbow the three bony points from an equilateral triangle. These relations are disturbed in elbow dislocation.
- Fracture of the olecranon is common and is caused by a fall on the point of the elbow. Fracture of the coronoid process is uncommon, and usually accompanies dislocation of the elbow.
- **Radioulnar synostosis** is also a rare condition in which the radius and ulna are fused.

➢ Madelung's deformity:

It is dorsal subluxation (displacement) of the lower end of the ulna, due to retarded growth of the lower end of the radius.

Hand:

- The **scaphoid** is most likely to be fractured among carpals.
- Fracture of the scaphoid occurs after a fall on the outstretched hand, shows a deep tenderness in anatomical snuffbox, and damages the **radial artery** and cause avascular necrosis of the bone and degenerative joint disease of the wrist.
- The **lunate** is most likely to be dislocated among carpels.
- Dislocation of lunate is produced by a fall on the acutely dorsiflexed hand with the elbow joint flexed. This displaces the lunate anteriorly which can compress median nerve and leads to the **carpel tunnel syndrome like features.**
- Fracture of the hamate may injure the ulnar nerve and artery because they are near the hook of the hamate.
- The metacarpals can be fractured by the direct or indirect violence. Direct violence usually displaces the fractured segment forward while indirect violence displaces them backward.
- Pisiform bone is a sesamoid bone in the tendon of flexor carpai ulnaris muscle.
- Third metacarpal is the longest and the axis of abduction and adduction passes through its center.
- Fracture of the distal phalanx of middle finger is commonest. It is treated by buddy splint.
- Fractured toe is bandaged with the adjacent toe, this is called as **buddy splint**.

Bennett's fracture:

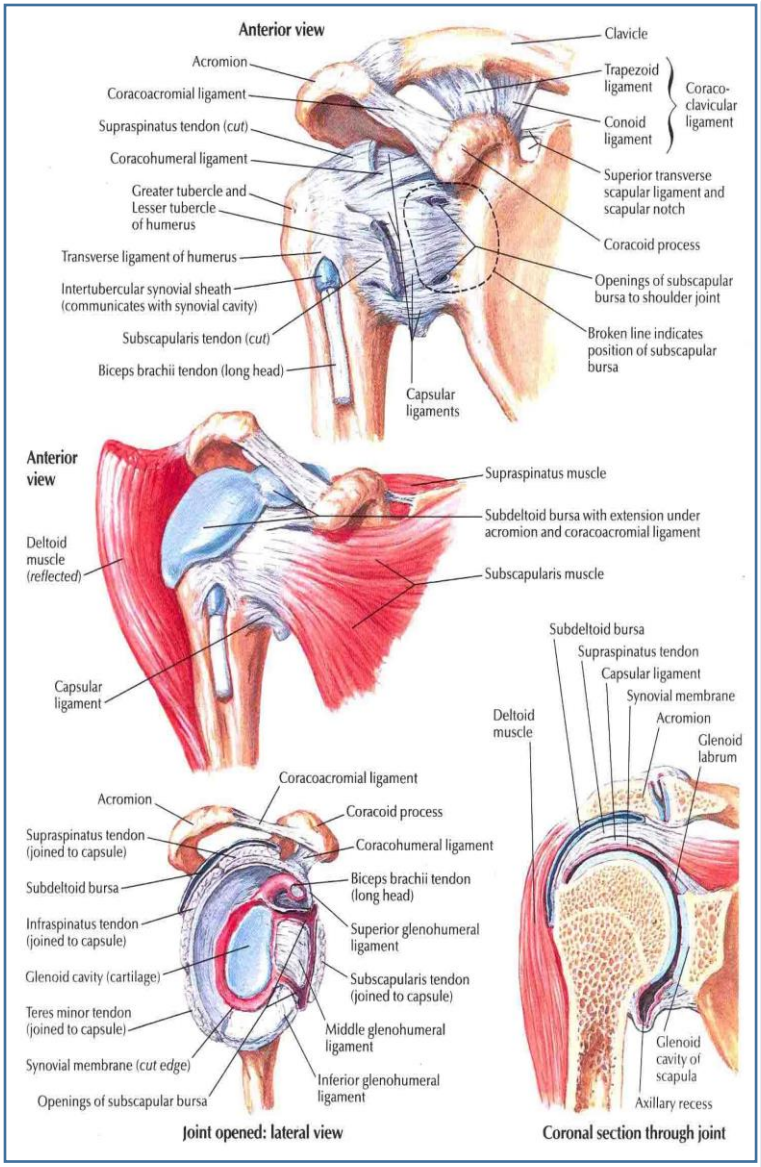
Bennett's fracture is a fracture of the base of the metacarpal of the thumb (1st metacarpal). It involves the anterior part of the base and is caused by a force along its long axis. The thumb is forced into a semi-flexed position and cannot be opposed. The fist cannot be clenched.

Boxer's fracture:

It is a fracture of the necks of the second and third metacarpals, seen in professional boxers, and typically of the fifth metacarpal in unskilled boxers.

Joints of Upper Limb:

Shoulder joints:



Q. Which joint in the body is more prone to dislocation and Why?

A. The <u>shoulder joint</u> is more prone to dislocation than any other joint. This is due to:

1) Laxity of the capsule

2) Disproportionate area of the articular surfaces. The glenoid cavity is too small and shallow to hold the head of humerus in place. The head of humerus is about 4 times the size of glenoid cavity.

Q. Which factors provide stability to shoulder joint?

A. The factors which provide stability to shoulder joint includes:

1) The <u>coracoacromial arch</u> or secondary socket for head of humerus.
2) <u>Musculotendinous cuff</u> of the shoulder.
3) Glenoidal labrum.
4) Muscles attaching the humerus to pectoral girdle.
5) Atmospheric pressure also stabilizes the shoulder joint.

➢ The clavicle may be dislocated at either of its ends:

- At medial end it is dislocated <u>forward</u>. Backward dislocation is rare as it is prevented by costoclavicular ligament.
- At the lateral end i.e. the acromioclavicular joint, it dislocates <u>upward</u> because it overrides the acromion.

➢ Dislocation of the **acromioclavicular joint** results from a fall on the shoulder with the impact taken by the acromion or from a <u>fall on the outstretched arm</u>. It is called a **shoulder separation**

because the shoulder is separated from the clavicle with rupture of the coracoclavicular ligament.

- Dislocation of shoulder joint usually occurs when the arm is abducted. Dislocation occurs in the anterioinferior direction because of lack of support of SITS tendons, & this may damage axillary nerve and posterior humeral circumflex vessels. Thus almost always the dislocation is primarily subglenoid. the arm is abducted by 45-90 degrees to treat it.

- The shoulder joint is most commonly approached (surgically) from the front. However, for aspiration the needle may be introduced either anteriorly through the deltopectoral triangle (closer to the deltoid), or laterally just below the acromion

➢ Shoulder tip pain:

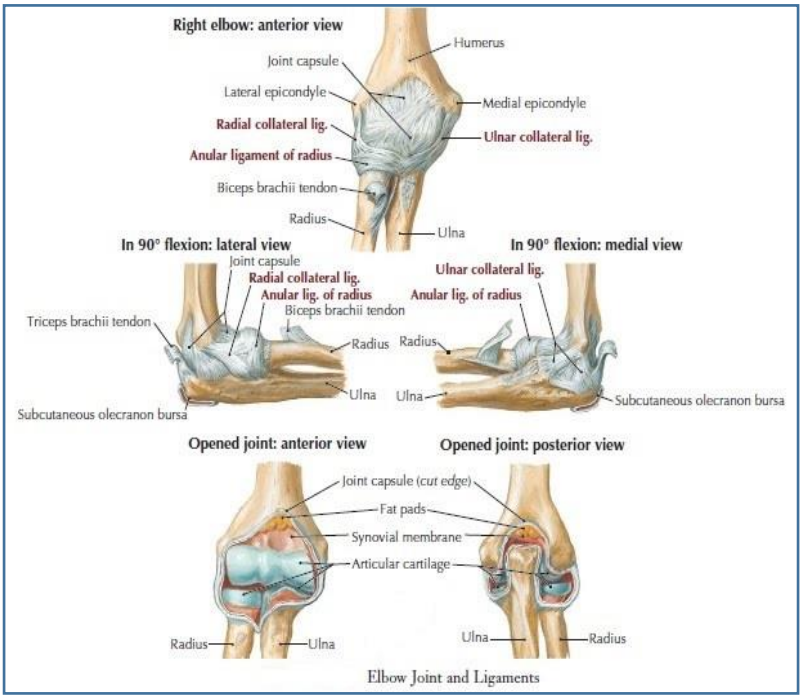
Irritation of the diaphragm from any surrounding pathology causes referred pain in the shoulder. This is so because the **phrenic nerve** (supplying the diaphragm) and the **supraclavicular nerves** (supplying the skin over the shoulder) both arise from the same spinal segments **C3, C4**.

➢ Frozen shoulder:

The two layers of the synovial membrane become adherent to each other. Clinically, the patient (usually 40-60 years of age) complains of progressively increasing pain in the shoulder, stiffness in the joint and restriction of all movements. The surrounding muscles show disuse atrophy. The disease is self-limiting and the patient may recover spontaneously in about two years

Elbow joint:

- Aspiration is done posteriorly on any side of the olecranon because here the capsule is weak and the covering deep fascia is thin.
- Dislocation of the elbow is usually posterior, and is often associated with fracture of the coronoid process. The triangular relationship between the olecranon and the two humeral epicondyles in flexed position is lost.
- The optimal position of elbow is flexion between 30 and 40 degrees which is sufficient to perform common activities of daily living.



Elbow Joint and Ligaments

➢ Pulled Elbow:

A pulled elbow, also known as a radial head subluxation, is when the ligament that wraps around the radial head (**annular ligament**) slips off which results in dislodging the head of the radius from the grip of annular ligament (The head of the radius slips out from the annular ligament.) It may be due to a sudden powerful jerk on the hand of the child.

➢ Tennis Elbow:

Tennis elbow (**lateral epicondylitis**) is a painful condition that occurs when tendons in your elbow, attached to lateral condyle of humerus i.e. **common extensor origin** are overloaded, usually by repetitive motions of the wrist and arm. Despite its name, athletes aren't the only people who develop tennis elbow. Tennis elbow results from Abrupt pronation may lead to pain and tenderness over the lateral epicondyle. This is possibly due to:

1. Sprain of radial collateral ligament.

2. Tearing of fibers of the extensor carpi radialis brevis.

➢ Golfer's Elbow:

Golfer's elbow is a condition that causes pain where the tendons of your forearm muscles attach to the bony bump (**medial epicondyle**) on the inside of your elbow. The pain might spread into your forearm and wrist. It is Inflammation, irritation or trauma of medial epicondyle of humerus (**common flexor origin**). Treatment may include injection of glucocorticoids into the inflamed area.

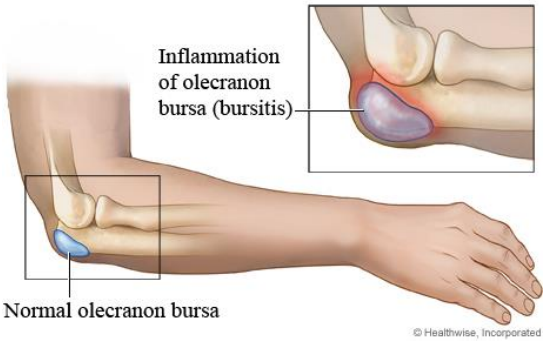
Q. What is difference between tennis elbow and golfers elbow?

A. 1) The tennis elbow occurs on the outside of the elbow I.e. at lateral epicondyle while golfer's elbow occurs on the inside of the elbow I.e. at medial epicondyle.

2) In tennis elbow extensors of forearm are affected while in golfer's elbow the flexors of forearm are affected.

➢ Student's elbow (or Miner's elbow) or (dart thrower elbow) (Olecranon Bursitis):

Student's elbow is a condition where a bursa over the subcutaneous posterior surface of olecranon process (tip of shoulder) becomes inflamed and swollen. It is subcutaneous olecranon bursitis (inflammation of bursa). Students during lectures support their head (for sleeping) with their hands with flexed elbows that is why it is called as student elbow.

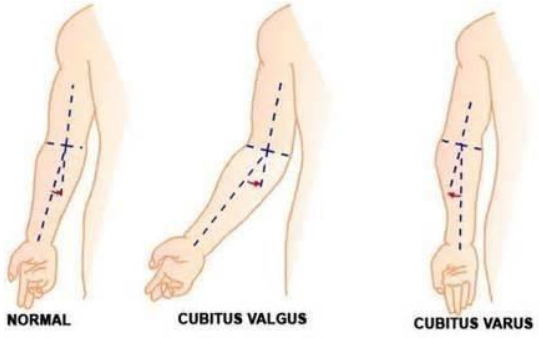


➢ Cubital valgus:

Increase in carrying angle (greater than 13) is called as cubitus valgus. It is a medical deformity in which the forearm is angled away from the body to a greater degree than normal when fully extended. In it, **ulnar nerve** may get stretched leading to weakness of intrinsic muscles of hand.

➢ Cubital Varus:

Decrease in carrying angle (less than 13) is called as cubitus varus. Cubitus varus (varus means a deformity of a limb in which part of it is deviated towards the midline of the body) is a common deformity in which the extended forearm is deviated towards midline of the body. Cubitus varus is often referred to as "Gunstock deformity", due to the crooked nature of the healing.



Wrist and Hand joints:

- Flexion and abduction of wrist occurs at mid carpal joints.
- Extension and adduction of wrist occurs at wrist joint.
- Wrist joint &interphalangeal joints are involved in rheumatoid arthritis.

- **Ganglion** is a cystic swelling containing mucinous fluid. It results from mucoid degeneration of synovial sheaths around tendons. Flexion makes cyst enlarge & may be painful. It occurs on wrist dorsum or distal attachment of ECRB tendon to 3rd metacarpal. It can compress median nerve causing pain.
- The wrist joint can be aspirated from posterior surface between tendons of extensor pollicis longus and the extensor digitorum.
- The wrist joint becomes immobilized in optimum position of 30 degrees' extension.

de Quervains tenosynovitis:

It is inflammation of synovial lining of tendon of extensor pollicis longus & abductor pollicis longus causing pain.

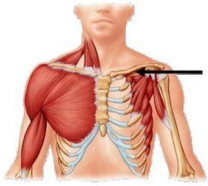
- **Bull rider's thumb** refers to a sprain of radial collateral ligament & avulsion fracture of lateral part of proximal phalanx of thumb
- **Skier's thumb** (game keeper's thumb) refers to rupture of collateral ligament of 1st MP joint. It results from hyper-abduction of MP joint of thumb.

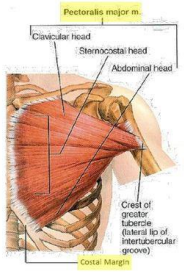
Pectoral region:

Muscles of the Pectoral Region

There are two parts of the pectoral region:

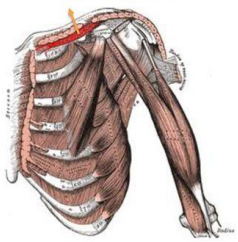
1. **Superficial** (female breast).
2. **Deep** (three main muscles).
   1. Pectoralis Major muscle
   2. Pectoralis Minor muscle
   3. Subclavius muscle





Pectoralis Minor

Subclavius muscle



Injury to the Nerve to Serratus Anterior:

Causes:

1. Sudden pressure on the shoulder from above.
2. Carrying heavy loads on the shoulder.

Deformity:

Winging of the scapula (Back Palsy), i.e. excessive prominence of the medial border of the scapula and inferior angle. Normally, the pull of the muscle keeps the medial border against the thoracic wall.)

Disability:

1. Loss of pushing and punching actions.

2. Arm cannot be raised beyond 90° (i.e. overhead abduction which is performed by the serratus anterior is not possible).

- **Poland syndrome:**

Both pectoralis major and minor are absent, breast hypoplasia & absence of 2 to 4 ribs are seen are seen in this condition.

- 75% of lymph from mammary gland drains into axillary lymph nodes, 20% into parasternal and 5% into intercostal lymph nodes.

Breast:

- **Polymastia** is development of supernumery breasts with rudimentary nipple and areola.
- **Polythelia** is a condition of accessory nipples which may occur in axillary fossa or anterior abdominal wall.
- **Amastia** is no breast development.
- **Gynecomastia** is breast development in males which occurs Kleinfelter Syndrome.
- **Mastectomy** is the surgical removal of breast (mammary gland).
- Incisions into the breast are usually made **radially** to avoid cutting the lactiferous duct.
- Breast cancer occurs in the upper lateral quadrant (approximately 60% of cases) and forms a palpable mass in advanced stages. Cancer cells may infiltrate the suspensory ligaments. The breast then becomes fixed. Contraction of the ligaments can cause retraction or puckering (folding) of the skin. Infiltration of lactiferous ducts and their consequent fibrosis can cause retraction of the nipple. Obstruction of superficial lymph vessels by cancer cells may produce edema of the skin giving rise to an appearance like that of the skin of an orange (**peau d' orange appearance**).
- Cancer can spread into following structures:

1. Because of communications of the superficial lymphatics of the breast across the midline, cancer may spread from one breast to the other.

2. Because of communications of the lymph vessels with those in the abdomen, cancer of the breast may spread to the liver.
3. Cancer cells may drop into the pelvis producing secondaries there.
4. It can spread into shoulder.
5. Apart from the lymphatics cancer may spread through the veins. In this connection, it is important to know that the veins draining the breast communicate with the vertebral venous plexus of veins. Through these communications cancer can spread to the vertebrae and to the brain.

- **Mammography** is a radiographic examination of the breast to screen tumors and cysts. (A **mammogram** is an X-ray picture of the breast.)

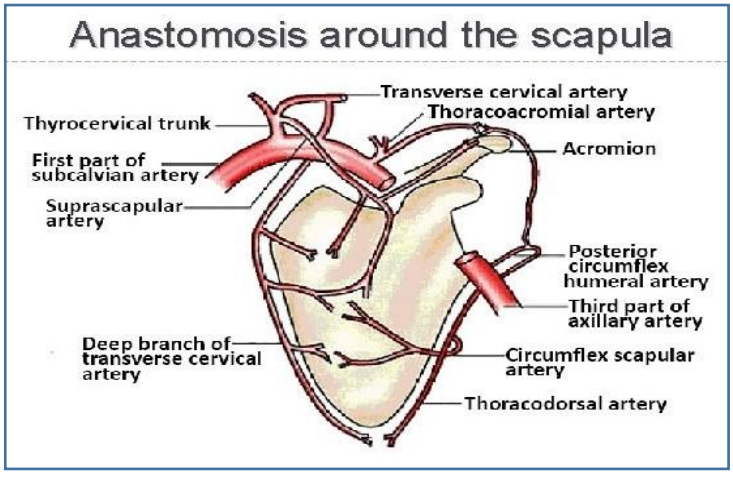
- **Sentinel node** (biopsy) procedure is a surgical procedure to determine the extent of spread or the stage of cancer (most commonly breast cancer) by use of an isotope injected into the tumor region. The sentinel lymph node is the first lymph node(s) to which cancer cells are likely to spread from the primary tumor.
- **Radical mastectomy** is the extensive surgical removal of the breast and its related structures, including the pectoralis major and minor muscles, axillary lymph nodes and fascia, and part of the thoracic wall. It may injure the long thoracic and thoracodorsal nerves and may cause postoperative swelling (edema) of the upper limb as a result of lymphatic obstruction caused by the removal of most of the lymphatic channels that drain the arm or by venous obstruction caused by thrombosis of the axillary vein. Modified radical mastectomy involves excision of the entire breast and axillary lymph nodes, with preservation of the pectoralis major and minor muscles. (The pectoralis minor muscle is usually retracted or severed near its insertion into the coracoid process.) Lumpectomy (tylectomy) is the surgical excision of only the palpable mass in carcinoma of the breast.

Axilla:

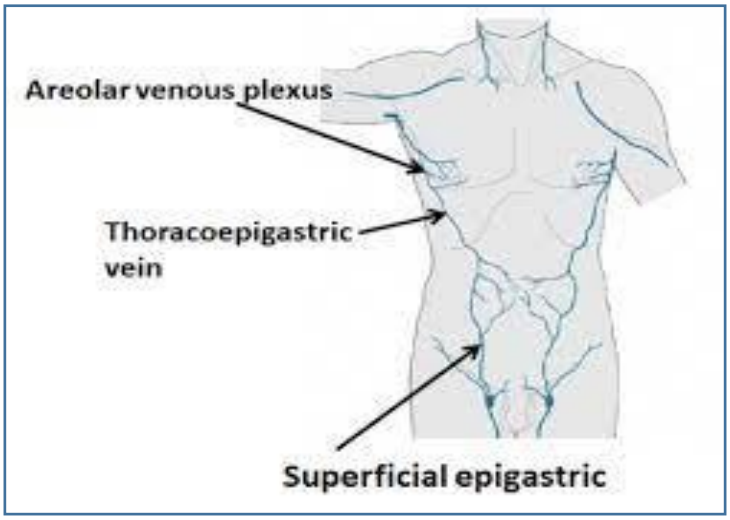
- If the axillary artery is ligated between the thyrocervical trunk and the subscapular artery, then the blood from anastomoses in the scapular region arrives at the subscapular artery.

- The axilla has abundant axillary hair. Infection of the hair follicles and sebaceous glands gives rise to boils which are common in this area.

- When axillary artery is blocked, a collateral circulation is established through anastomosis around scapula which links the first part of subclavian artery with the third part of axillary artery.



- In case of **blockage of inferior vena cava**, the blood returns from lower limbs to heart via **thoracoepigastric vein** which is a communication between lateral thoracic vein of upper limb and superficial epigastric vein of lower limb. The direction of blood flow will be upward in this vein in this case. In blockage of superior vena cava, vice versa occurs.



- The axillary lymph nodes drain lymph from 1) upper limb 2) breast and 3) the anterior and posterior body walls above the level of the umbilicus. Therefore, infections or malignant growths in any part of their territory drainage give rise to involvement of the axillar lymph nodes.

- An abscess in the axilla may arise from infection and suppuration of particular groups of lymph nodes& it can be incised through floor of axilla midway between anterior & posterior axillary folds nearer to medial wall in order to avoid injury to vessels

- Axillary arterial pulsations can be felt against the lower part of the lateral wall of the axilla. In order to check bleeding from the distal part of the limb (in injuries, operations and amputations) the artery can be effectively compressed against the humerus in the lower part of the lateral wall of the axilla. Next to the popliteal artery, the axillary artery is the second most common artery of the body to be lacerated by violent.

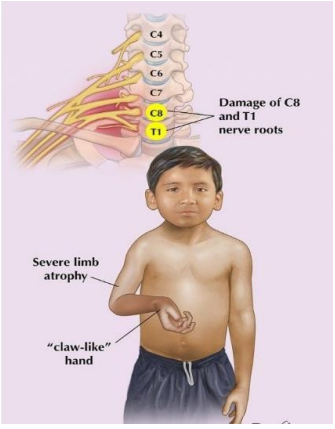
- Apex of axilla is called as **cervico-axillary canal** and gives passage to axillary vessels and lower part of brachial plexus. Axillary sheath is derived from prevertebral fascia.

Brachial plexus:

Prefixed brachial plexus: When superior most root of plexus is C4 & inferior most root is C8.

Postfixed brachial plexus: When superior root is C6 & inferior root is T2.

	Erb's paralysis:	Klumpke's Paralysis:
Site of injury:	The region of the upper trunk of the brachial plexus where six nerves meet is called Erb's point. Injury to the upper trunk causes Erb's paralysis.	Lower trunk of the brachial plexus

Cause of injury:	Undue separation of the head from the shoulder, which is commonly encountered in: (i) birth injury, (ii) fall on the shoulder, and (iii) during anesthesia.	Undue abduction of the arm, as in clutching something with the hands after a fall from a height, or sometimes in birth injury.
Nerve roots involved:	Mainly C5 and partly C6.	Mainly Tl and partly C8.
Muscle Paralyzed:	Mainly biceps brachii, deltoid, brachialis and brachioradialis. Partly supraspinatus, infraspinatus and supinator.	1.Intrinsic muscles of the hand (Tl). 2.Ulnar flexors of the wrist and fingers (C8).
Deformity:	Arm Hangs by the side; it is adducted and medially rotated. Forearm: Extended and pronated. The deformity is known as 'policeman's tip hand' or 'porter's tip hand'	Claw hand due to the unopposed action of the long flexors and extensors of the fingers. In a claw hand there is hyperextension at the metacarpophalangeal joints and flexion at the interphalangeal joints.
Disability:	The following movements are lost. **1.** Abduction and lateral rotation of the arm (shoulder). **2.** Flexion and supination of the forearm. **3**.Biceps and supinator jerks are lost. **4.**Sensations are lost over a small area over the lower part of the deltoid.	**1.** Complete Claw hand. **2.**Cutaneous anesthesia and analgesia in a narrow zone along the ulnar border of the forearm and hand. **3.**Horner's syndrome. **4.** Biceps and supinator jerks are lost Vasomotor changes: The skin areas with sensory loss is warmer due to arteriolar dilation. It is also drier due to the absence of sweating as there is loss of sympathetic activity. Trophic changes: Long-standing case of paralysis leads to dry and scaly skin. The nails crack easily with atrophy of the pulp of fingers
		

➢ Horner's syndrome:

If **T1** is injured proximal to white ramus communicans to first thoracic sympathetic ganglia, there is ptosis, miosis, anhydrosis, enophthalmos, and loss of ciliospinal reflex—may be associated. It is caused by damage to the sympathetic nerves of the face and neck that leave the spinal cord through T1.

- **Back packer's(hikers)palsy** is injury to superior trunk from carrying heavy backpack, can produce motor & sensory deficits in distribution of musculocutaneous & radial nerve.
- **Hyperabduction syndrome** results from compression of axillary vessels & nerves and cords of brachial plexus (which are compressed between coracoid process Pectoralis Minor tendon) due to prolonged Hyperabduction during performance of overhead task such as painting a ceiling.
- Acute brachial plexus neuritis(neuropathy) is neurologic disorder characterized by sudden pain around shoulder. Pain begins at night &causes muscular atrophy. Inflammation (brachial neuritis) results from upper respiratory infection, vaccination or trauma.

Back:

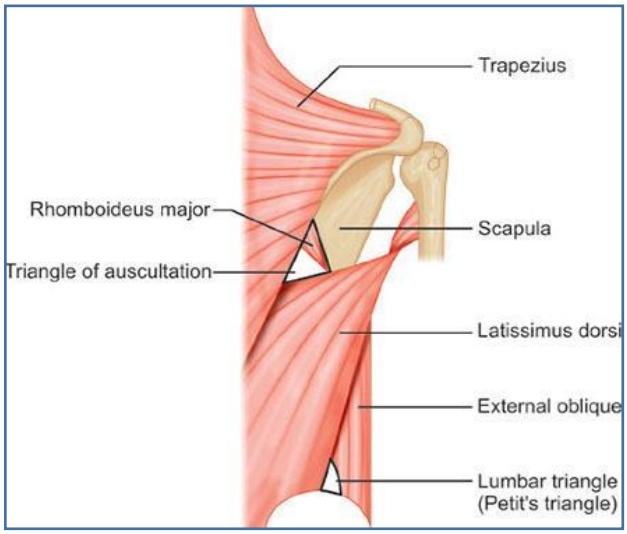
- The abduction up to 15^{o} is done by Supraspinatus muscle.
- The abduction of 15^{o} to 90^{o}, is done by Deltoid muscle.
- The abduction of 90^{o} to 180^{0}, is done by Trapezius and serratus anterior muscles.
- The trapezius is called as climbing, swimmer's and shrugging muscle.

➢ Triangle of Auscultation:

It is a small triangular interval bounded medially by the lateral border of the trapezius, laterally by the medial border of the scapula, and inferiorly by the upper border of the latissimus dorsi. The floor of the triangle is formed by the seventh rib, sixth and seventh intercostal spaces, and the rhomboid major. Respiratory sounds are best heard through a stethoscope here. On the left side, the cardiac orifice of the stomach lies deep to the triangle, and in days before X-rays were discovered the sounds of swallowed liquids were auscultated over this triangle to confirm **esophageal tumor**.

➢ Lumbar triangle of petit:

Lumbar triangle of petit is a small triangular space bounded medially by the lateral border of latissimus dorsi, laterally by the posterior border of external oblique abdominus muscle, and inferiorly by the iliac crest which forms its base. The hernia that occurs through this space is called as **lumbar hernia**.



- Injury to thoracodorsal nerve causes paralysis of latissimus dorsi & person is unable to raise the trunk with upper limb during climbing and cannot use an axillary crutch.

Scapular region:

- **Intramuscular injections** are given in the lower half of the **deltoid** to avoid injury to the axillary nerve.
- Injury to the axillary nerve is caused by a fracture of the surgical neck of the humerus or inferior dislocation of the humerus. It results in weakness of lateral rotation, loss of rounded contour of shoulder and paralysis of deltoid with loss of abduction of the arm beyond 90 degrees. (The supraspinatus can abduct the arm but not to a horizontal level)
- **Regimental badge:**

  The axillary nerve also carries sensory information from the shoulder joint. It also innervates the skin covering the inferior region of the deltoid muscle, known as the regimental badge area. This is innervated by the superior lateral cutaneous nerve which is the branch of the axillary nerve

- **Dawbarn's sign:**

  In subacromial bursitis, pressure of the deltoid below the acromion causes pain. However, when the arm is abducted pressure over the same point causes no pain, because the bursa disappears under the acromion. This is called Dawbarn's sign.
- Inflammation and calcification of subacromial bursa (calcific scapulohumeral bursitis) & Deposition of calcium in supraspinatus tendon causes inflammation of subacromial bursa (subacromial bursitis) causes pain and irritation.

- **Painful arc syndrome** occurs during abduction because during this arc, supraspinatus

tendon comes in contact with inferior surface of acromion causing pain. During adduction, painful lesion is away from acromion.

- Rupture of rotator cuff may occur by a chronic wear and tear or an acute fall on the outstretched arm and is manifested by severe limitation of shoulder joint motion, chiefly abduction. A rupture of the rotator cuff, most frequently attrition of the supraspinatus tendon by friction among middle-aged persons may cause degenerative inflammatory changes (degenerative tendonitis) of the rotator cuff, resulting in a painful abduction of the arm or a painful shoulder.
- Calcification of the superior transverse scapular ligament may trap or compress the suprascapular nerve as it passes through the scapular notch under the superior transverse scapular ligament, affecting functions of the supraspinatus and infraspinatus muscles.

Arm/ Brachium:

- **Injury to the musculocutaneous** nerve results in weakness of supination (biceps) and flexion (biceps and brachialis) of forearm and loss of sensation on the lateral side of forearm.
- In **radial nerve injuries** in the arm, the triceps brachii usually escapes complete paralysis because the two nerves supplying it, arise in the axilla.
- **Brachial pulsations** are felt or auscultated in front of the elbow just medial to the tendon of biceps for recording the blood pressure.

Popeye's deformity:

When a tendon of biceps muscle tears, due to forceful flexion, the muscle can bunch up and form a large, painful ball on upper arm. This bulge is called a Popeye deformity or Popeye sign. It's named after the ball-shaped biceps of a popular cartoon character i.e. Popeye.

Possible causes of Popeye deformity include:

Overuse of your biceps muscle, repetitive motion of your biceps, sports injury, injury from a fall.

Symptoms may include:

- hearing or feeling a pop when the tendon breaks away from the bone
- a sudden, sharp pain in your arm
- bruising, soreness, or tenderness in your upper arm
- weakness in your shoulder and elbow

➢ **Arterial blood pressure** is determined by occluding & opening the brachial artery with the help of rotator cuff.

➢ Venipuncture of the upper limb is performed on veins by applying a tourniquet to the arm, when the venous return is occluded and the veins are distended and are visible and palpable. Venipuncture may be performed on the axillary vein to locate the central line, on the median cubital vein for drawing blood, and on the dorsal venous network or the cephalic and basilic veins at their origin for long-term introduction of fluids or intravenous feeding.

Q. Why median cubital vein is important clinically?

A. The median cubital vein is important clinically because of following reasons:

1. It is used for intravenous injections.
2. It is used for cardiac catherisation.
3. It is used to withdraw blood.

If it is absent, basilic vein is preferred

➢ In all these cases, **Radial nerve palsy, musculospiral nerve palsy, crutch paralysis, Saturday night palsy, honeymoon palsy and wrist drop**, **radial nerve** gets damaged near the axilla in arm. So, they have similar symptoms.

➢ Saturday Night Palsy:

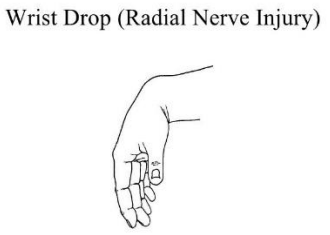
Sleeping in an armchair with the limb hanging by the side of the chair can compress or damage the radial nerve in the region of the radial (spiral) groove. This is called as Saturday night palsy.

➢ Crutch Paralysis:

The pressure of crutches can also compress or damage the radial nerve in the region of the radial (spiral) groove. So all the muscles supplied by radial nerve below this level becomes paralyzed and relative movements get lost. This is called as crutch paralysis.

➢ Wrist drop:

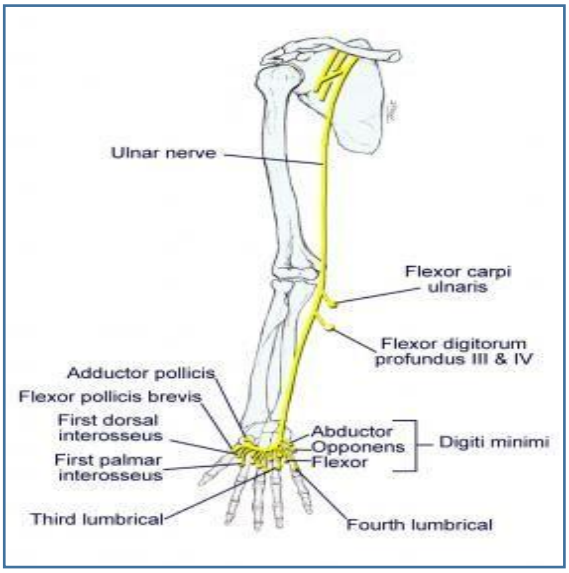
Wrist drop is a medical condition which is caused by radial nerve injury. In it, the wrist and the fingers cannot extend at the metacarpophalangeal joints. The wrist remains partially flexed due to an opposing action of flexor muscles of the forearm. As a result, the extensor muscles in the posterior compartment remain paralyzed.



Forearm:

- The flexor digitorum profundus is most powerful and bulky muscle of forearm. It provides main gripping power to hand. It is a hybrid muscle as it is supplied by two nerves.
- The radial artery is used for feeling the arterial pulse at wrist.

❖ The **ULNAR NERVE** is often called the **'musician's nerve'** because it controls fine movements of the fingers. The ulnar nerve is most commonly injured at following 3 sites



1. At elbow behind medial epicondyle which results in:

1)Flexor carpi ulnaris & medial half of flexor digitorum profundus are paralysed.

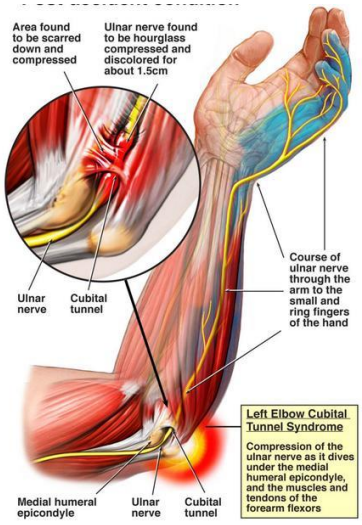
2)medial border of forearm becomes flattened.

3)An attempt to produce flexion results in abduction.

4)Flexion of terminal phalanges of ring and little finger is lost

2. Cubital tunnel syndrome:

It is a condition that results from compression on the ulnar nerve in the cubital tunnel (behind the medial epicondyle (funny bone), between two heads of the flexor carpi ulnaris muscle). Its signs and symptoms are same as ulnar nerve lesion behind medial epicondyle.



3. An ulnar nerve lesion at the wrist which results in:

1)It produces **'ulnar claw-hand'**, involving mainly the ring and little fingers. Ulnar claw-hand is characterized by the following signs.

(a)Hyperextension at the metacarpophalangeal joints and flexion at the interphalangeal joints, involving the ring and little fingers—more than the index and middle fingers. The little finger is held in abduction by extensor muscles. The intermetacarpal spaces are hollowed out due to wasting of the interosseous muscles. Claw-hand deformity is more obvious in wrist lesions as the profundus muscle is spared: this causes marked flexion of the terminal phalanges (action of paradox).

(b)Sensory loss is confined to the medial one-third of the palm and the medial one and a half fingers including their nail beds.

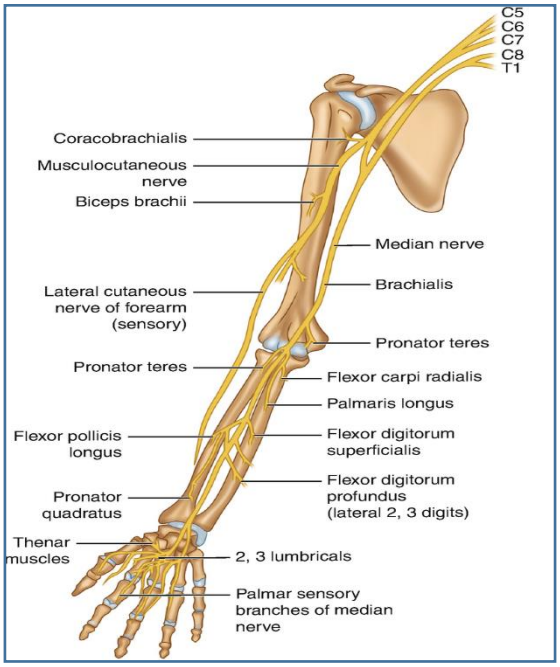
(c)Vasomotor changes: The skin areas with sensory loss is warmer due to arteriolar dilatation; it is also scaly and dry due to absence of sweating due to loss of sympathetic supply.

(d) The nails crack easily with atrophy of the pulp of fingers.

(e) The patient is unable to spread out the fingers due to paralysis of the dorsal interossei. The power of adduction of the thumb, and flexion of the ring and little fingers are lost. Ulnar nerve injury at the wrist can be excluded by Froment's sign, or the book test which tests the adductor pollicis muscle. When the patient is asked to grasp a book firmly between the thumb and other fingers of both the hands, the terminal phalanx of the thumb on the paralysed side becomes flexed at the interphalangeal joint.

- If the ulnar artery arises high from the brachial artery and runs invariably superficial to the flexor muscles, then when injecting, the artery may be mistaken for a vein for certain drugs, resulting in disastrous gangrene with subsequent partial or total loss of the hand. The ulnar artery may be compressed or felt for the pulse on the anterior aspect of the flexor retinaculum on the lateral side of the pisiform bone.

  - **MEDIAN NERVE** controls coarse movement of hand i.e. supplies most of long muscles of forearm. It is called **labourer's nerve** or **eye of hand** as it is sensory to most of the hand. It is injured at



1. Above the elbow (supracondylar fracture of humerus) which results in:

a) Flexor pollicis longus & lateral half of flexor digitorum profundus are paralysed. Patient is unable to bend terminal phalanx of thumb, index finger& middle phalanx.

b) forearm is kept in supine position due to paralysis of pronators

c) hand is adducted due to paralysis of flexor carpai radialis.

d) flexion at wrist is weak

e) Flexion at interphalangeal joints of index & middle finger is lost so that index and middle finger remain straight while making a fist. This is known as pointing index finger.

f) ape or monkey thumb deformity is present due to paralysis of thenar muscles.

g) skin on lateral three and half digit is dry, warm & scaly.

2. Carpal tunnel syndrome:

Injury to median nerve in carpal tunnel at wrist results in carpal tunnel syndrome which results in:

a) ape like hand

b) loss of sensation on lateral 3 & 1/2 digits.

c) palmar cutaneous branch does not suffer because it arises in forearm.

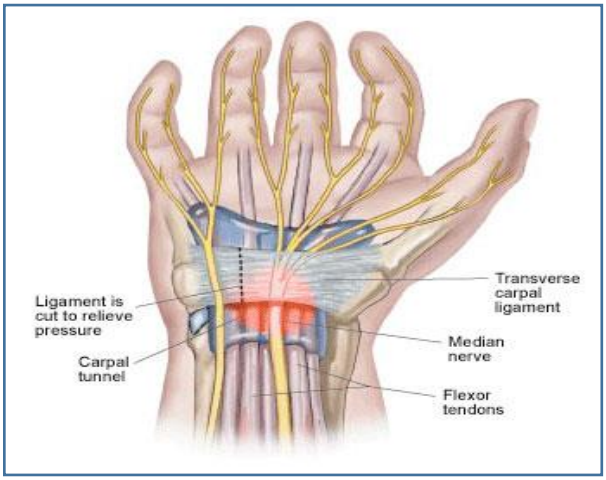
d) thumb cannot be opposed.

e) weak abduction & flexion of thumb.

f) patient is unable to hold book with thumb (forment's test).

g) median claw hand at 2nd&3rd finger due to paralysis of 1st&2nd lumbricals.

Note: There are abnormal sensations in lateral 3 and half digits, but there is no loss of sensations over lateral two and half of palm. Because this area is supplied by **palmar cutaneous branch** of median nerve which passes superficial to the flexor retinaculum.



- **Phalen's Test:**
  - It is performed to test for **carpal tunnel syndrome** (CTS).
  - Procedure: The patient places his flexed elbows on a table, allowing his wrists to fall into maximum flexion. The patient is asked to push the dorsal surface of his hands together and hold this position for 30-60 seconds. This position will increase the pressure in the

carpal tunnel, in effect compressing the median nerve between the transverse carpal ligament and the anterior border of the distal end of the radius.

- A positive phalen's test is defined as the occurrence of pain or paresthesia in at least one finger innervated by the median nerve.

- When anterior interosseous nerve is injured, paralysis of FDP & FPL occurs. When person attempts to make "okay" sign, opposing the tip of thumb & index finger in a circle; a pinch posture of hand results due to absence of flexion of distal interphalangeal joint of index & thumb (anterior interosseous syndrome.)

3. Pronator syndrome:

Compression of median nerve near the elbow between heads of pronator teres as a result of trauma or muscle hypertrophy results in pronator syndrome.

a) pain in forearm

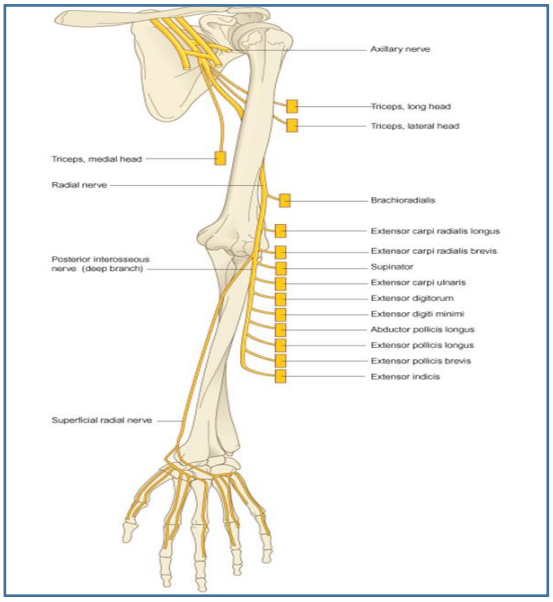
b) loss of sensation of radial 3&1/2 digits and adjacent skin.

c) repeated pronation occurs

If both median and ulnar nerves are paralysed, the result is complete claw-hand.

➢ **PULSE RATE** is determined by palpating radial artery at wrist between tendons of FCR & APL because here it lies on flat radius.

❖ Injury to the **RADIAL NERVE** **in Radial nerve palsy, musculospiral nerve palsy, crutch paralysis, Saturday night palsy, honeymoon palsy and fractures of the shaft of the humerus** results in:



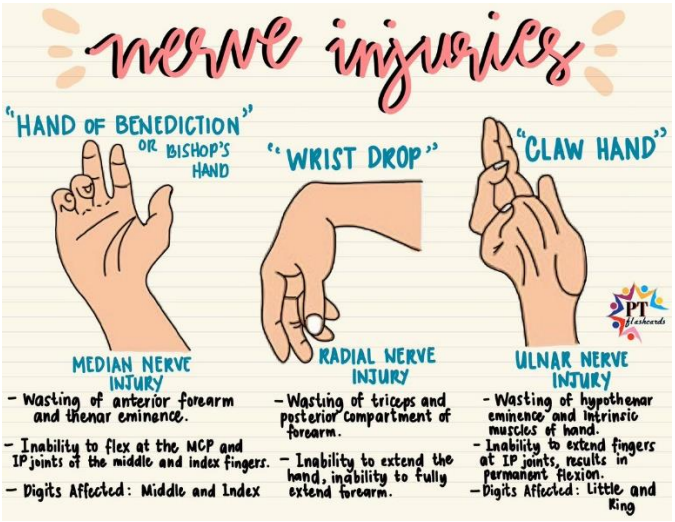
a) Weakness or loss of power of extension at the wrist (**wrist drop**)

b) sensory loss over a narrow strip on the back of forearm, and on the lateral side of the dorsum of the hand.

c) It results in loss of function in the extensors of the forearm, hand, metacarpals, and phalanges.

d) Triceps is not completely paralysed but only weakened because only medial head is affected.

e) It produces a weakness of abduction and adduction of the hand.



Hand:

- **Thenar eminence** include abductor pollicis brevis, flexor pollicis brevis and opponens pollicis. It does not include adductor pollicis muscle.

- **Allen test:**
  - The Allen test is used to assess the **arterial blood supply** of the hand.
  - Procedure: The radial artery is located by palpation at the proximal skin crease of the wrist and then compressed with three digits. The ulnar artery is similarly located and then compressed with three digits. With both arteries compressed, the subject is asked to clench and unclench the hand 10 times. The hand is then held open, ensuring that the wrist and fingers are not hyperextended and splayed out. The palm is observed to be blanched. The ulnar artery is released and the time is taken for the palm and especially the thumb and thenar eminence to become flush is noted. If the capillary refill time is less than 6 seconds, the test is considered positive. The test is then completed with the radial artery tested in a similar fashion. Both hands should be tested for comparison
  - A positive Allen test means that the patient does not have an adequate dual blood supply to the hand, which would be a negative indication for catheterization, removal of the radial artery, or any procedure which may result in occlusion of the vessel.

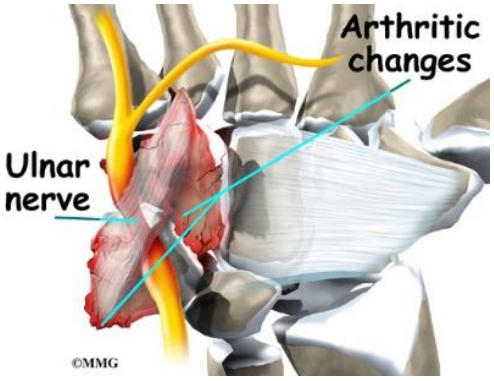
➢ Dupuytren's contracture/ Viking disease:

It is the inflammation involving the ulnar side of palmar aponeurosis. There is thickening and contracture of the aponeurosis. As a result, the proximal phalanx and later the middle phalanx becomes flexed and cannot be straightened. The terminal phalanx remains unaffected. The ring finger is most commonly affected. Its treatment involves surgical excision of all fibrotic parts of palmar fascia or aponeurosis to free fingers.

➢ Guyon's canal (ulnar canal) syndrome:

I t is an entrapment of the ulnar nerve in the Guyon's canal, which causes pain, numbness, and tingling in the ring and little fingers, followed by loss of sensation and motor weakness. Its symptoms are similar to injury of ulnar nerve at wrist. It can be treated by surgical decompression of the nerve. The anatomic boundaries of Guyon canal include:

- Volar carpal ligament - the "roof"
- Transverse carpal ligament - the "floor"
  - Note that the transverse carpal ligament spans Guyon canal as the floor at the ulnar side of the hand/wrist before seamlessly transitioning to its position as the "roof" of the carpal tunnel
- Pisiform, Pisohamate ligament, abductor digiti minimi - ulnar boundary
- The hook of hamate - radial boundary



- People who ride long distances on bicycles with their hands in an extended against the hand grips put pressure on the hook of hamate, which compresses ulnar nerve. This is called handlebar neuropathy results in sensory loss on medial side of hand &weakness of intrinsic muscles of hand.

➢ Volkmann' contracture:

Volkmann contracture is a permanent shortening of forearm muscles, usually resulting from injury, that gives rise to a claw like deformity of the hand, fingers, and wrist. It is more common in children. It is an ischemic muscular contracture (flexion deformity) of the fingers and sometimes of the wrist, resulting from ischemic necrosis of the forearm flexor muscles, caused by a pressure injury, such as compartment syndrome, or a tight cast. The muscles are replaced by fibrous tissue, which contracts, producing the deformity.

➢ Tenosynovitis:

It is an inflammation of the tendon and synovial sheath, and puncture injuries cause infection of the synovial sheaths of the digits. The tendons of the second, third, and fourth digits have separate synovial sheaths so that the infection is confined to the infected digit, but rupture of the proximal ends of these sheaths allows the infection to spread to the midpalmar space. The synovial sheath of the little finger is usually continuous with the common synovial sheath (ulnar bursa), and thus, tenosynovitis may spread to the common sheath and thus through the palm and carpal tunnel to the forearm. Likewise, tenosynovitis in the thumb may spread through the synovial sheath of the flexor pollicis longus (radial bursa)

➢ Raynaud syndrome:

It is ischemia and cyanosis of digits accompanied by pain due to anatomical abnormality or underlying disease. It is a rare disorder of the blood vessels, usually in the fingers and toes. It causes the blood vessels to narrow when you are cold or feeling stressed. When this happens, blood can't get to the surface of the skin and the affected areas turn white and blue

➢ Trigger finger:

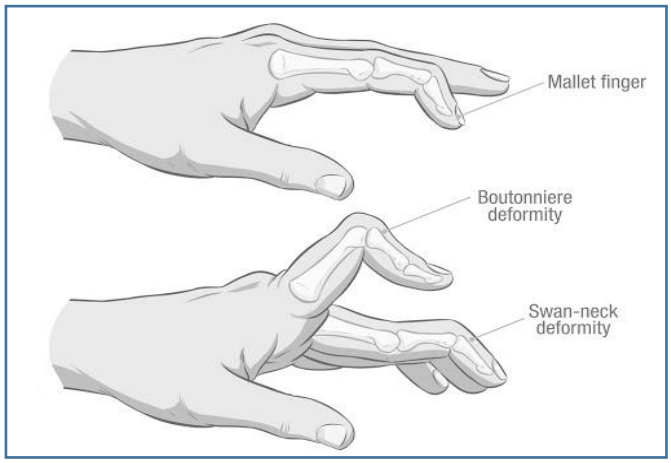
Trigger finger is a condition in which one of your fingers gets stuck in a bent position. Your finger may bend or straighten with a snap like a trigger being pulled and released. Trigger finger is also known as **stenosing tenosynovitis**. It occurs when the flexor tendon develops a nodule or swelling that interferes with its gliding through the pulley, causing an audible clicking or snapping. Symptoms are pain at the joints and a clicking when extending or flexing the joints.

➢ Mallet finger (baseball finger):

It is a finger with permanent flexion of the distal phalanx due to an avulsion of the lateral bands of the extensor tendon to the distal phalanx. It is seen in basketball players while catching a ball.

➢ Hammer finger (Boutonniere deformity):

It is a finger with abnormal flexion of the middle phalanx and hyperextension of the distal phalanx due to an avulsion of the central band of the extensor tendon to the middle phalanx or rheumatoid arthritis.



➢ Weight Transmission in Upper limb:

The weight from hand is first transmitted to radius through wrist joint, then from radius to ulna through radio-ulnar joints, then from ulna to humerus through elbow joint, then from humerus to scapula through shoulder joint, then to clavicle through acromioclavicular ligament and, then finally from clavicle to sternum through sternoclavicular joint.