Nerve Injury

- Every nerve goes to muscle or skin so if the nerve is injured this will cause paralysis in the muscle supplied from that nerve (paralysis means loss of function) then other muscles and other nerve supply take its action which is called opposite action."E.g. instead of extension, flexion takes place "

- You should know the **nerve distribution**, **the muscles supplied and its action** and if the nerve is cutaneous (cutaneous means injury of the nerve will cause loss of sensation and this will lead the doctor to diagnose the injury also from the muscle paralysis)

* Brachial plexus injury :

- we already know that the brachial plexus consist of: i) Roots ii) Trunks iii)Divisions, then it gives 3 cords lateral, medial and posterior. These cords give nerves "referring to brachial plexus lecture 5" each nerve as motor and cutaneous.
- Complete lesions involving all the roots of the plexus are rare, usually upper trunk (c5, c6) or lower trunk (C8, T1) so its partial.

- Individual nerves can be divided by stab wounds.

1) Upper Lesions of the Brachial Plexus called Erb- Duchene Palsy or syndrome.

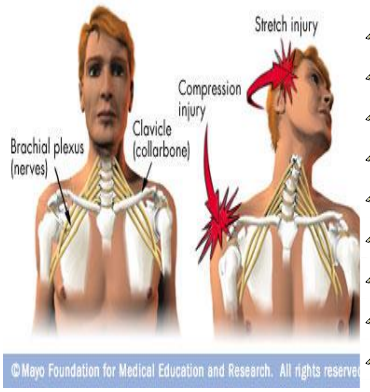
- Erb- Duchene (German) who discover the injury of upper trunk (C5, C6).

- **Nerve injured**: There are some nerves which take place at the upper trunk such as: Axillary nerves, suprascapula nerve, nerve to subsclavius and musculocutaneous nerve.

- It occurs in infants during a difficult frank delivery (sometime if the traction increase may cause injury in the upper trunk or lower trunk), 90% of delivery is cephalic (from the head) but sometimes the baby comes from his foot, hand or buttock.

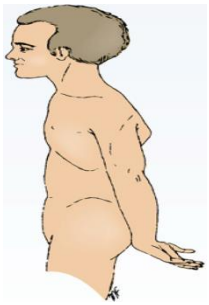
-The reasons behind brachial plexus injury may be delivery or outstretch hand (when somebody stretches his hand then falls on it while stretched)

-This picture means that the muscles, which are supplied by the nerves, are paralyzed and do opposite action.



- **Muscles affected and there action:** 1) the supination of the forearm, which is by biceps, will become pronation. 2) The abduction of the shoulder, which is by the middle fibers and supraspinatus (that performs initiation), will become adduction. 3) the lateral rotation of the shoulder, which is by teres minor, will become medial rotation. 3) Instead of flexion in biceps it becomes extension.

- This position called policeman direction or waiter tip deformity, adduction, pronation, extension and medial rotation. Also there is loss of sensation in axillary upper lateral cutaneous of the arm and lateral cutaneous nerve of forearm.



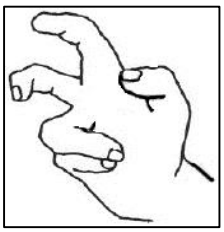
2) Lower Lesions of the Brachial Plexus (Klumpke Palsy).

- Also the lower trunk (C8, T1), which gives anterior division (shares anterior cord) and posterior division (posterior shares the posterior cord), injury by delivery.

- **Nerves injured**: The ulnar nerve and median nerve are the most commonly injured nerves in lower lesions (specially, those heading to the hand).

Note: the C8 and T1 branches cutaneously to the medial side of the hand, forearm and arm.

- So there is a loss of sensation of the arm, forearm and hand because of injury of the previous nerves (ulnar and median).



- **muscles supplied and its function**: Moreover, there is a loss of function in the small muscles of the hand and you will find thenar muscle, hypothenar muscles and interossi muscles having an atrophy as they are supplied by ulnar and median nerve, this leads to paralysis in the muscles and this state is called “the claw hand” (see the picture).

Note: the claw hand (lower trunk paralysis) means extension in metacarpophalangeal joint, flexion in Interphalangeal joints and the thumb will be between the state of adduction and abduction.

- Lower lesions of the brachial plexus can also be produced by the presence of a cervical rib (C7), which can be bone, cartilage and membrane, or malignant metastases from the lungs in the lower deep cervical lymph nodes.

3) Long Thoracic Nerve :

- Long thoracic nerve originates from roots of C5, 6 and 7, which supply only serratus anterior muscle (its function: it pulls the scapula toward the ribs and helps trapezius in the movement of putting the hand over the head).

- Long thoracic nerve can get injured from radical mastectomy

- When long thoracic nerve is injured, it causes winging of scapula (this means when you ask a patient to push on the wall, the scapula will get away from the ribs).

- Winged means that there is a space between the scapula and the ribs when the patient push the wall.

- Patient who have the injury of long thoracic nerve can't move their hand above their head or may have some difficulties in doing that.

4) Axillary Nerve:

- The axillary nerve which arises from the posterior cord of the brachial plexus (C5 and 6), can be injured by the pressure of a badly adjusted crutch pressing upward into the armpit (**site of injury**).

-**Muscles supplied and its function**: The axillary nerve which supplies the deltoid, teres minor muscles and upper lateral cutaneous of the arm. The axillary nerve injured by dislocation of shoulder joint and Saturday night palsy. Furthermore, you will find the deltoid paralyzed and with an atrophy, also abduction between 15 and 90 will be effected by middle fibers of deltoid.

- Patient will lose the sensation in the upper lateral skin of the arm.

5) Radial Nerve:

- Radial nerve injury is common, if the nerve has been injured in the axilla or in spiral groove will lead to hand drop or wrist drop because it gives the deep branch of radial or posterior interosseous nerve which supplies all the extensor muscle.

** Note: "The extensor muscles extend the hand and against the extension is the drop".

- **Muscles supplied and its function**: Radial nerve consists of three branches in axilla and one of them is for triceps (Function of triceps is extension) so when it's paralyzed, the elbow joint extend by gravity not by patient himself because the triceps are responsible of extension.

- Radial nerve gives off four branches in the spiral groove of the humerus:

1- The lower lateral cutaneous nerve of the arm.

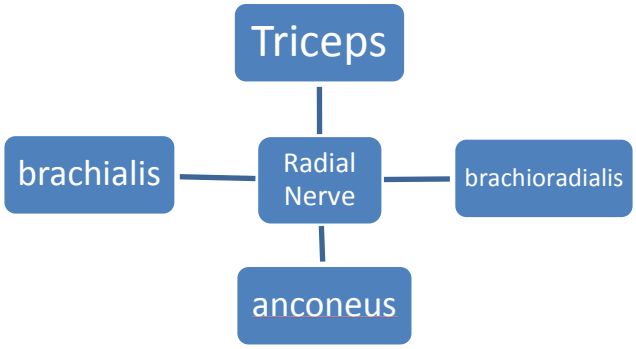
2- The posterior cutaneous nerve of the forearm.

3- The nerve to the lateral head of the triceps.

4- The nerve to the medial head of the triceps and the anconeus.

- **common site of injury** is in the spiral groove and in this case the triceps won't get paralyzed as it innervates high up while the brachioradialis and extensor carpi radialis longus will be paralyzed.

- Injury of the deep branch of Radial nerve at the level of neck of radius "common site of injury "will lead to finger drop, this injury won't affect carpi radialis longus which prevents wrist drop.



- The area on the dorsum of the hand makes the shape of the hand abnormal in the case of injury of radial nerve.

6) Musculocutaneous Nerve:

- Musculocutaneous nerve branch from the lateral cord, it supplies the coracobrachialis.

- Musculocutaneous nerve passes between biceps and brachialis and it ends in the forearm as lateral cutaneous nerve of the forearm.

- It's less often to be injured because it is found between the muscles.

-**Site of injury**: It can be injured by stabbing in specific area.

- **Muscles supplied and its function**: If it is injured, coracobrachialis and part of brachialis will paralyze accompanied with loss of sensation.

7) Median Nerve:

- Median nerve comes from (1) medial cord and (2) lateral cord.

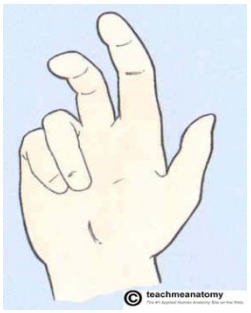
- Median nerve has No branches in the arm, but it appears in the cubital fossa, then it passes between the two heads of pronator teres and in the forearm it lies between flexor digitorum profundus and flexor digitorum superficialis.

- Deep to the flexor retinaculum, it passes to the carpal tunnel and before that it gives palmar branch to the skin of palm (lateral two third of the palm).

- In the hand, it supplies five muscles (3 thenar and 2 lumbrical) and digital to three and a half fingers to the radial side of the ring (palmar and dorsal to the proximal phalanges).

- **common sites of injury**: 1- supratrochlear above the trochlea of humerus (which means in the elbow). 2- in front of the rest joint.

- **Muscles supplied and its function**: Injury in median nerve causes the ape hand. Ape hand means: thumb adducted, extension at rest joint and ulnar deviation. The muscles will act in opposite ways. (The index and middle fingers instead of flexion of metacarpophalangeal joint, they will extend and instead of extension of Interphalangeal joint, it will be flexion). if there is injury at rest joint that means flexor muscles are not affected, but the thenar muscle and 2 lumbrical will be affected. You can check it by asking the patient to do opponents and he won't be able to do so.



- In this case, there is loss of sensation in three and a half fingers and the medial two third of the palm.

8) Carpal Tunnel Syndrome:

- **Nerves injured**: It will cause pressure on the median nerve in the carpal tunnel.

-The patient, in this case, will complain of shaking in three and a half fingers.

- It is also called “paresthesia”, and here the palmar side will not be affected, because the palmar branches of the median nerve take places before the carpal tunnel.

** Vasomotor changes dependent on sympathetic.

9) Ulnar nerve:

- Ulnar nerve is a branch from medial cord of brachial plexus and is considered as a continuation of medial cord.

- Ulnar nerve gives no branch in the arm.

- It enters the forearm from behind the medial epicondyle and it is common to get fractured.

-**site of injury**: fracture happens in the medial epicondyle

- **Muscles supplied and its function**: leads to paralyze the one and a half muscles (the flexor carpi ulnaris and the medial half of the flexor digitorum profundus) supplied by ulnar nerve. This is called claw hand.

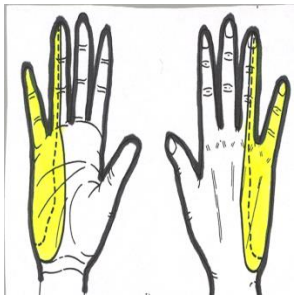
- Claw hand: metacarpophalangeal extended instead of flexion, Interphalangeal flexed instead of extension, affecting all the hypothenar muscle and all the muscle of the hand (except the 3 thenar and 2 lumbrical supplied by median).

- when you ask a patient to putt a paper between his index and middle finger , by this test you will be able to diagnose him returning to claw hand.

- Another test by holding the paper between the index and middle finger “smoking position” not being able to do that test too gives you a clear diagnosis for claw hand case. (The patient will be able to hold the paper between his index and thumb fingers, because the thumb is moved by flexor pollices longus which is supplied by the median nerve),

- **Another site of injury** of ulnar nerve is in front of wrist joint and all the 15 muscle will be affected.

- The claw hand is much more obvious in wrist lesions because the flexor digitorum profundus muscle is not paralyzed, and marked flexion of the terminal phalanges occurs.



- The loss of sensation of the ulnar nerve will be in the one and half finger

** Vasomotor Changes:

The skin areas involved in sensory loss are warmer and drier than normal because of the arteriolar dilatation and absence of sweating resulting from loss of sympathetic control.

- Unlike median nerve injuries, lesions of the ulnar nerve leave a relatively efficient hand.

- Although there is some weakness owing to loss of the adductor pollicis.

We were hoping that the sheet will be better than this but the time doesn’t help us.

G☺☺D Luck