

In the name of Allah, Most gracious, Most merciful

Nerve Injuries

Quick revision:

The **brachial plexus**:

- 5 roots.
- 3 trunks; Upper, middle and lower.
- 3 anterior divisions.
- 3 posterior divisions.
- 3 cords; lateral, posterior and medial.
- Terminal nerves , e.g. median, radial, ulnar nerves.

Injuries of the brachial plexus:

General speaking:

There are certain results of the injury of one or all the nerves of the brachial plexus. For example:

- Nerve to subclavius; if it's cut/injured/damaged/compressed then the subclavius muscle will be paralyzed.
- If the **lateral cutaneous nerve of the forearm** which is the continuation of the musculocutaneous nerve is cut/ injured/damaged/compressed then the sensation of the skin on the **lateral side** of the forearm will be lost.

Causes:

- Traction, pressure, wounds and diseases at the posterior triangle of the neck or the axilla.
- For example: extensive and strong pulling of the arm can cause the brachial plexus to be stretched from its original roots somehow, thus causing a nerve injury.

Results:

- Effect on muscle movement: loss of muscle movement; paralysis. Which can either be **complete**: no muscular movement (rare) or **incomplete**: weak movement of the muscles (more common) and this movement may be gained again.
- Loss of skin sensation: **anesthesia**. Or numbness; pins and needles sensation and a sort of tingling feeling: **parasthesia**.

Recall when the median nerve is compressed in the carpal tunnel by the flexor retinaculum the patient either feels nothing or feels pins and needles in his hand.

Note the difference between **signs** and **symptoms**; signs are clearly **seen** on the patient. Whereas, symptoms are what a patient feels and constantly **complains** of.

1. Upper lesions of the brachial plexus (Erb-Duchenne's Palsy).

- An injury at the upper trunk of the brachial plexus. At the point where the nerve roots of C5 and C6 unite; Erb's point.
- **Causes:** excessive increase in the angle between the neck and shoulder on the same side. e.g. Falling off a horse.
- **Incidences:**
 1. In adults: after a propel or a fall on the shoulder.
 2. Infants: during a difficult delivery causing a stretch or tear in the neck region. Consequently causing an injury in the brachial plexus.
- **Results:**

Abstractly speaking: if an injury occurs at the upper trunk of the brachial plexus; then as a result it would definitely affect any division, cord or terminal nerve associated with the upper trunk.

In the "waiter tip position", we are concerned with the **suprascapular**, **musculocutaneous**, and **axillary** nerves.

- **The waiters tip position:** muscles supplied by the nerves coming from C5 and C6 roots are paralyzed, showing a certain characteristic picture of the limb.
 1. **The suprascapular nerve:** originates from the upper trunk.

If a nerve is injured then the muscles it supplies will be affected also. Meaning that a specific function done by a specific muscle supplied by a specific nerve will be disabled and the opposing function (e.g. adduction opposes abduction) will work unopposed.

- The **supraspinatus muscle:** abductor of the arm. Injury will cause the shoulder to be adducted.
- The **infraspinatus muscle:** lateral shoulder rotator. Injury will cause medial rotation of the shoulder.
 2. **The musculocutaneous nerve supplies:**
 - **Biceps:** primary supinator of the forearm and powerful flexor of the forearm at the **elbow joint**. An accessory flexor of the shoulder. Injury will cause pronation of the forearm.
 - **Brachialis:** primary flexor of the elbow joint. Injury will cause the elbow to be extended due to the effected biceps and brachialis muscles.
 - **Coracobrachialis:** flexor of the shoulder (flexor of the arm at the glenohumeral joint). Injury will cause weak flexion of the arm.
 - Because the arm is balanced by two opposing actions; if one action is derailed the opposing one dominates.
 3. **The Axillary nerve supplies:**
 - **Deltoid muscle:** major abductor of the shoulder. Like the supraspinatus muscle, an injury will cause the shoulder to be adducted.
- **Teres minor:** lateral rotator of the shoulder. Like the infraspinatus muscle, an injury will cause medial rotation of the shoulder.

The arm lifelessly will dangle or hang down. **Adducted**, **extended** at the elbow, **pronated** and **medially rotated**; medial rotators like the pectoralis major will work unopposed.

- **Loss of sensation:** along the lateral side of the arm. The axillary nerve supplies **2** muscles (Deltoid and teres minor) and **1 cutaneous** (sensory) nerve to the lower half of the skin over the deltoid which is named: **supper lateral cutaneous nerve of the arm.**

2. Lower lesions of the brachial plexus (Klumpke's Palsy):

- Less common.
- Injures lower trunk of brachial plexus.
- **Causes:**
 1. When the upper limb is suddenly pulled superiorly to break a fall.
 2. During baby delivery.
 3. Extra rib (**minus one** rib) before rib no.1, arises from the seventh cervical vertebra (C7). It is also called the **cervical rib**. In normal cases vital structures (Arteries, veins and nerves of the brachial plexus) are located over the **first rib**, and the **subclavius** muscle above them is for protection. Then the clavicle comes on top of them all.
So the due to the presence of the extra rib under the subclavius muscle, any movement of the arm will be responsible for:
 1. **A blue colour:** indicating pressure on the **subclavian** vein.
 2. **A yellow colour:** indicating pressure on the **subclavian** artery.
 3. **Numbness** indicating pressure on the nerve.
This extra rib may be:
Fibrous tissue (a mark showing that there's a rib) or cartilage or bone, each worse than the other.
 4. **Lung cancer** usually affects the apex of the lung which is close to the root of the neck near the brachial plexus, closest to it is the lower trunk.
Worst type of cancer for the male and female, because it is highly fast in spreading; thus the term: "**metastases**" of lung cancer.
- T1 nerve is more frequently ruptured because it is the first from the bottom.
- Nerve fibers from this segment run within the **median** and **ulnar** nerves, supplying all the small muscles of the hand. If T1 (most common) is injured the ulnar and median nerve are also injured. As a result the muscles of the hand lose their action meaning that they are paralyzed and these muscles are atrophied or withered.
- **Results:**
 1. **Claw hand** which is opposite to the writing position.
 - ✓ When we talk about the extensor expansion, and lumbricals, bear in mind that the flexion of the metacarpophalangeal joints and extension of the interphalangeal joints are the functions of the lumbricals.
 - ✓ Recall the function of **palmar Interossei Muscles:** Adduction of the fingers at the metacarpophalangeal joints. **Dorsal Interossei Muscles:** Abduction of the fingers at the metacarpophalangeal joints.
 - ✓ **Hyperextension** of metacarpophalangeal joints by the extensor digitorum unopposed by lumbricals and the interossei muscles.

- ✓ **Flexion** of the proximal and middle interphalangeal joints by flexor digitorum superficialis and flexor digitorum profundus, respectively. Unopposed by the lumbricals and interossei muscles.
- 2. **Loss of sensation** along the **medial** side of the arm if **T1** is injured; from the medial cord originates the medial cutaneous nerve of the **arm**. If **C8** is injured then the loss of sensation will include the medial side of the **forearm**, hand and medial two fingers, given that the medial cutaneous nerve of the forearm originates from the medial cord of the brachial plexus.

3. The long Thoracic nerve:

- Arises from C5, C6 and C7.
- Passes superficially on the **serratus anterior**; supplying it.
- **Causes:**
 1. A knife fight.
 2. A direct blow.
 3. A radical mastectomy. Mast meaning breast and ectomy meaning removal.
- **Results:**

Paralysis of the serratus anterior resulting:

1. The inability to rotate the scapula during abduction above a right angle.
2. Winged scapula: when the arm is raised or when one determines to push something, the medial border and inferior angle of the scapula pull away from the chest and project posteriorly. Because the serratus anterior muscle's function is to cause protraction and to rotate the scapula on the thoracic wall.

4. The axillary nerve:

- Originates from the posterior cord of the brachial plexus.
- Passes posteriorly around the surgical neck of the humerus.
- **Causes:**
 1. The **fracture** of the surgical neck of the humerus.
 2. A dislocation of the shoulder joint.
 3. The pressure of a crutch.
- **Results:**
 1. **Paralysis of the deltoid muscle:** no abduction of the shoulder.
 2. **Paralysis the teres minor** no lateral rotation of the shoulder.
 3. **Loss of sensation** of the skin of the lower half over the deltoid. Which is supplied by the **upper cutaneous nerve of the arm**.

5. The median nerve:

- Originates from the medial and lateral cords of the brachial plexus.
- Passes the anterior compartment of the forearm.
- Leaves through the medial intermuscular septum.

- Passes anteriorly to the **medial epicondyle**.
- Enters the **cubital fossa** between the two heads (ulnar and humeral) of the pronator teres muscle.
- Supplies all the muscle of the anterior compartment of the forearm except one and one half of a muscle: the flexor **carpi ulnaris** muscle and the lateral half of the flexor **digitorum profundus**.
- Gives rise to the palmar branch **above** the **flexor retinaculum** before passing below it.
- Passes **under** the flexor retinaculum through the carpal tunnel and enters the hand.
- At the palm of the hand it divides into a **recurrent branch** which innervates the three thenar muscles and the **palmar digital nerves** which innervate the skin in addition to the third and fourth lumbricals.

Notes:

- **Recall** the supraspinatus, infraspinatus and teres minor muscles **are rotator cuff muscles**.
- **Numbness** indicating pressure on the nerve; I'm not sure which specific nerve the doctor meant.
- The ulnar nerve can be felt as it winds behind the medial epicondyle. This superficial position of the ulnar nerve makes it vulnerable to blows or pressure with the familiar "**crazy bone**" tingling phenomenon resulting. If this bone (medial epicondyle) is fractured it may involve the median nerve from above and the ulnar nerve from below.
- Any mistakes committed were highly avoided. I am truly sorry for any scientific, spelling or grammatical errors. And any misunderstandings or vague information or misleading concepts are apologized for.
- At the very last seconds of the lecture, the doctor said things regarding the locations of the median nerve injuries in such an extremely quick manner. I couldn't catch up with him at all.

To some this is a genuine dream, to others a mere challenge and to a few an inevitable destiny in spite of any will. But no one graduates alone. In the summer of 2017 (insha'a Allah) with our chins up high, we graduate together. Throughout the wandering in the corridors of the "Tibiyeh", or the hallways of the hospital; the faces will remain unchanged. Whether whom you knew from school, or came to meet in a torturing Physics lecture. Whether you've changed your companions several times in one semester and a half, or still are discovering and putting names on faces, six years are bound to tell the longest and most delightful chapter of your life's journey. Rejoice the unity of us all; conveying a noble message, devoted to a noble cause. We will never linger to be those strange faces you came across one day. And so when it's time to leave those beeping and annoying doors you just can't put it all aside, and say: hey, but they were just people I met on the way.

All the best from me,

Shatha Kayed.