Brachial plexus and nerves of hand

Apley System.

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brachial plexus

ضفيرة عصبية

- The brachial plexus is a network of nerve fibres that supplies the skin and musculature of the upper limb. It begins in the root of the neck, passes through the axilla, and runs through the entire upper extremity.

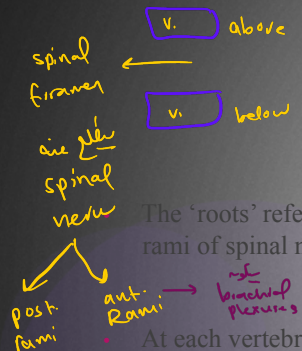
- The plexus is formed by the anterior rami (divisions) of cervical spinal nerves C5, C6, C7 and C8, and the first thoracic spinal nerve, T1. [C5 - T1]

لو تقطع سه C7

- The brachial plexus is divided into five parts; roots, trunks, divisions, cords and branches (a good mnemonic for this is Read That Damn Cadaver Book).

RTDCB

Roots



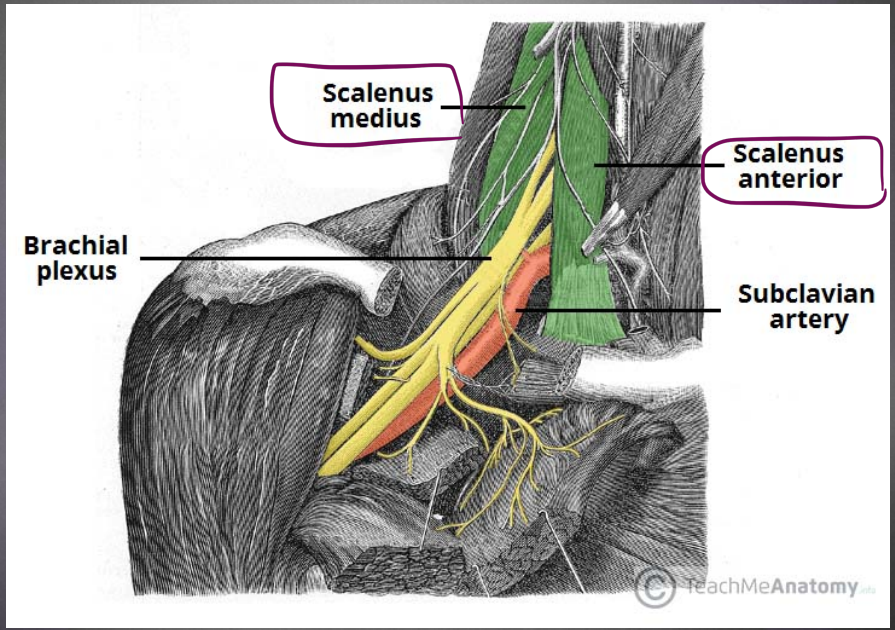
The 'roots' refer the anterior rami of the spinal nerves that comprise the brachial plexus. These are the anterior rami of spinal nerves C5, C6, C7, C8, and T1.

- At each vertebral level, paired spinal nerves arise. They leave the spinal cord via the intervertebral foramina of the vertebral column.

- Each spinal nerve then divides into an anterior and a posterior ramus. The roots of the brachial plexus are formed by the anterior rami of spinal nerves C5-T1 (the posterior divisions innervate the skin and musculature of the intrinsic back muscles).

- After their formation, these nerves pass between the anterior and medial scalene muscles to enter the base of the neck.

Roots بتطلع من Scalenus ant. Scalenus medius



وتنقل لـ base of neck وتكوّن trunks وتنقسم لـ Relation of subclavian artery.

Trunks

- At the base of the neck, the roots of the brachial plexus converge to form three trunks. These structures are named by their relative anatomical location:

- Superior trunk – a combination of C5 and C6 roots.
- Middle trunk – continuation of C7.
- Inferior trunk – combination of C8 and T1 roots.
- The trunks traverse laterally, crossing the posterior triangle of the neck.

Divisions

Trunk → ant. division → medial cord
ant. division → lateral cord.
→ post division.

- Each trunk divides into two branches within the posterior triangle of the neck. One division moves anteriorly (toward the front of the body) and the other posteriorly (towards the back of the body). Thus, they are known as the anterior and posterior divisions.

- We now have three anterior and three posterior nerve fibres. These divisions leave the posterior triangle and pass into the axilla. They recombine into the cords of the brachial plexus.

Cords

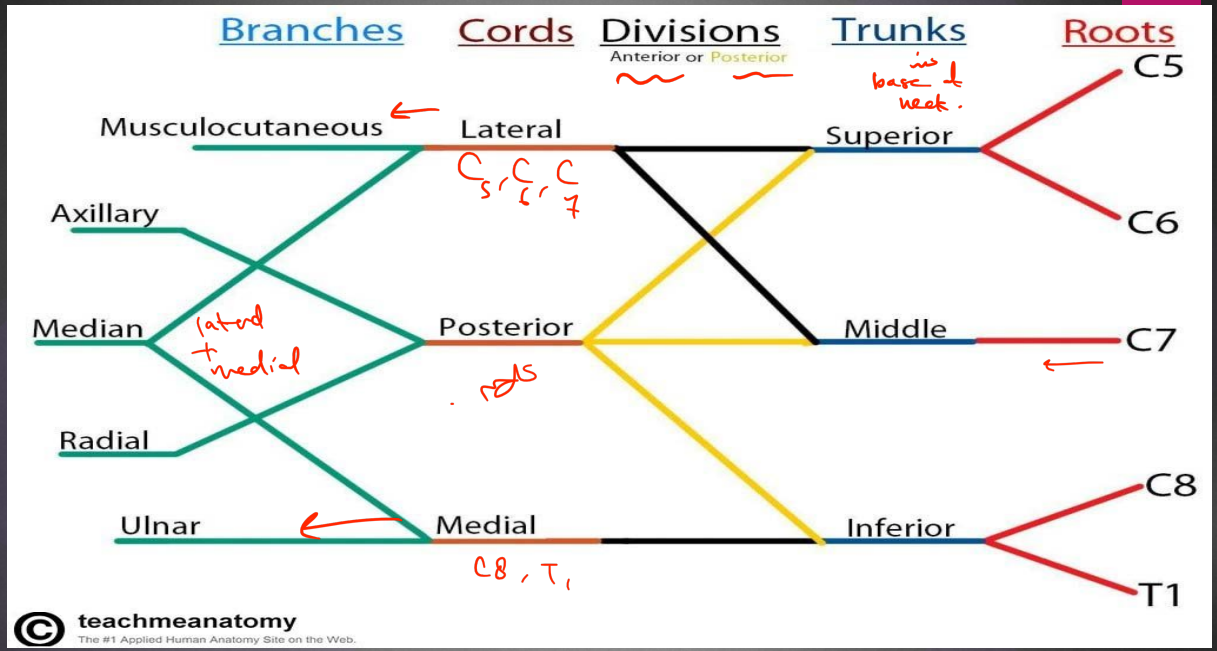
- Once the anterior and posterior divisions have entered the axilla, they combine together to form three cords, named by their position relative to the axillary artery.

- The lateral cord is formed by:
- The anterior division of the superior trunk
- The anterior division of the middle trunk

↑ post. to axillary artery.

- The posterior cord is formed by:
- The posterior division of the superior trunk
- The posterior division of the middle trunk
- The posterior division of the inferior trunk

- The medial cord is formed by:
- The anterior division of the inferior trunk.
- The cords give rise to the major branches of the brachial plexus.


Branches
Cords
Divisions
Anterior or Posterior
Trunks
Roots
Musculocutaneous
Axillary
Median
Radial
Ulnar
Lateral
Posterior
Medial
Superior
Middle
Inferior
C5
C6
C7
C8
T1
teachmeanatomy
The #1 Applied Human Anatomy Site on the Web.

Major Branches

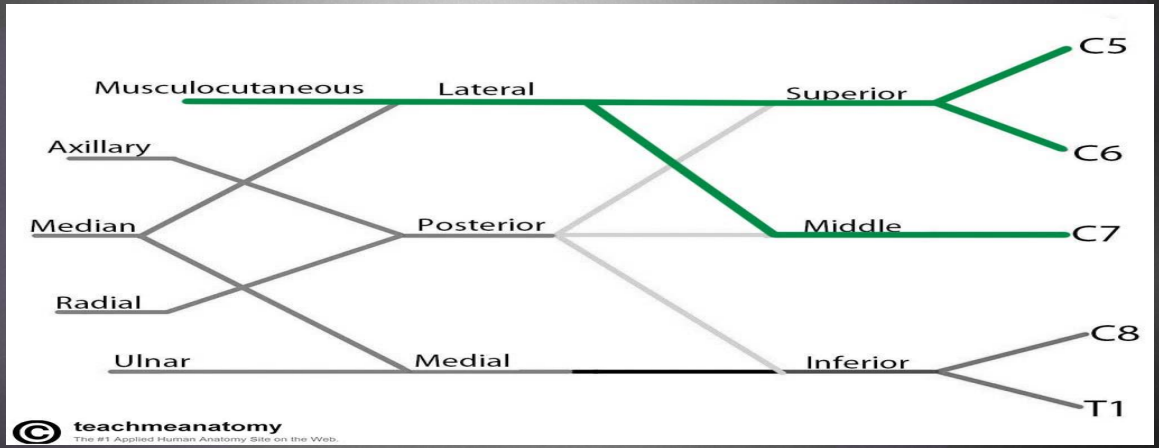
Radial, Ulnar, Median + Musculocutaneous + axillary

- In the axilla and the proximal aspect of the upper limb, the three cords give rise to five major branches. These nerves continue into the upper limb to provide innervation to the muscles and skin present. In this section, we shall concentrate on these five nerves.

Musculocutaneous Nerve

- Roots: C5, C6, C7.
- Motor Functions: Innervates the brachialis, biceps brachii and coracobrachialis muscles.
- Sensory Functions: Gives off the lateral cutaneous branch of the forearm, which innervates the lateral half of the anterior forearm, and a small lateral portion of the posterior forearm.

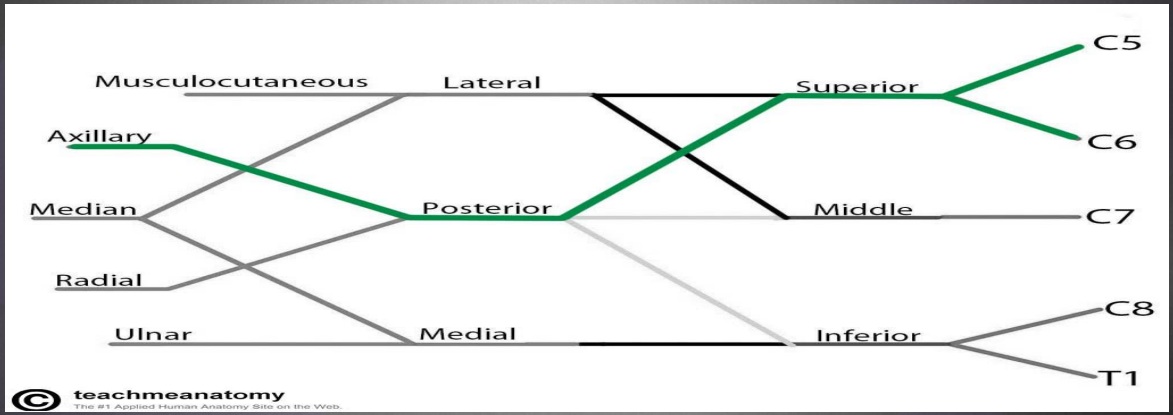
The derivation of the musculocutaneous nerve from the brachial plexus



Axillary Nerve

- Roots: C5 and C6.
- Motor Functions: Innervates the teres minor and deltoid muscles.
- Sensory Functions: Gives off the superior lateral cutaneous nerve of arm, which innervates the inferior region of the deltoid (“regimental badge area”).

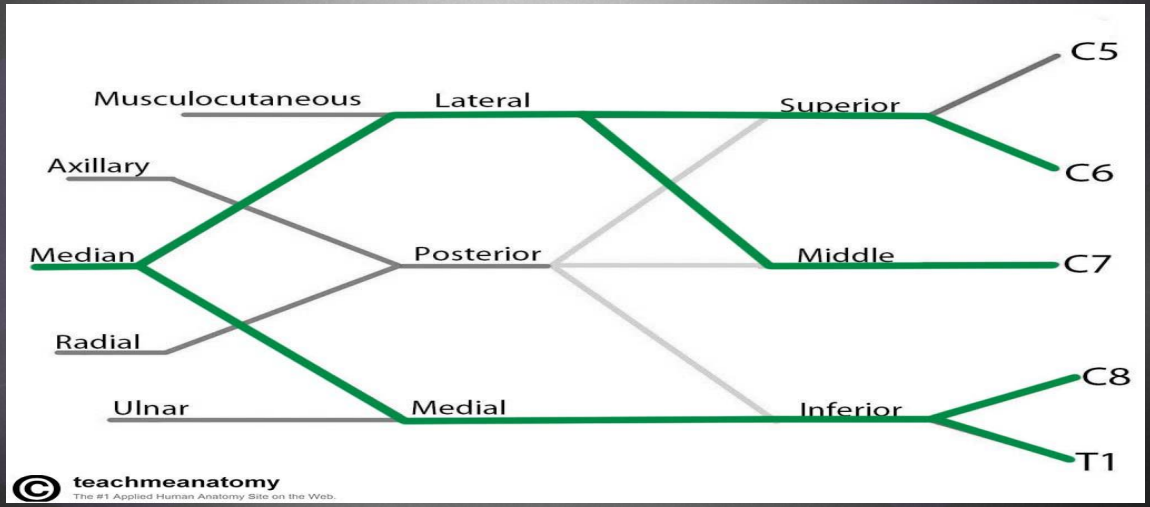
The derivation of the axillary nerve from the brachial plexus.



Median Nerve

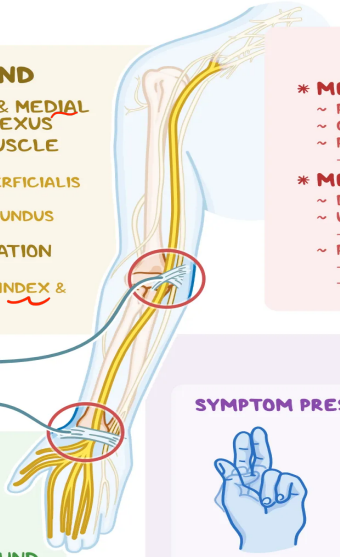
- Roots: C6 – T1. (Also contains fibres from C5 in some individuals).
- Motor Functions: Innervates most of the flexor muscles in the forearm, the thenar muscles, and the two lateral lumbricals associated with the index and middle fingers.
- Sensory Functions: Gives off the palmar cutaneous branch, which innervates the lateral part of the palm, and the digital cutaneous branch, which innervates the lateral three and a half fingers on the anterior (palmar) surface of the hand

The derivation of the median nerve from the brachial plexus



BACKGROUND

* ARISES from LATERAL & MEDIAL CORDS of BRACHIAL PLEXUS
* ANTERIOR FOREARM MUSCLE INNERVATION
  - ~ FLEXOR DIGITORUM SUPERFICIALIS
  - ~ PRONATOR QUADRATUS
  - ~ FLEXOR DIGITORUM PROFUNDUS (WITH ULNAR NERVE)
* HAND MUSCLE INNERVATION
  - ~ THENAR EMINENCE
  - ~ LUMBRICAL MUSCLES of INDEX & MIDDLE FINGERS



TREATMENT

* SPLINTING
* PHYSICAL THERAPY
* YOGA
* THERAPEUTIC ULTRASOUND
* ERGONOMIC ADJUSTMENTS
* SURGICAL DECOMPRESSION

PATHOPHYSIOLOGY

* **MEDIAN NERVE DAMAGE at ELBOW** (high) → thinner muscles, 3 fingers
  - ~ PROXIMAL INJURY
  - ~ CAUSED by FRACTURE of HUMERUS BONE
  - ~ PRESENTS with **"HAND OF BENEDICTION"**
    - NO FLEXION of 1ST & 3RD FINGER JOINTS ON 1ST & 2ND FINGERS
* **MEDIAN NERVE DAMAGE at WRIST**
  - ~ DISTAL INJURY
  - ~ USUALLY CAUSED by CARPAL TUNNEL SYNDROME (CTS)
    - PAIN, TINGLING & NUMBNESS
  - ~ PRESENTS with **APE HAND** if PROLONGED
    - WASTING of THENAR EMINENCE MUSCLES
    - INABILITY to MOVE THUMB

loss of thinner sensation + tip pointed index

Thinner muscle preserved + numbness in 3,5 fingers

DIAGNOSIS

SYMPTOM PRESENTATION

HAND of BENEDICTION

APE HAND

PHYSICAL EXAMINATION

PHALEN MANEUVER

- flexion of elbow (90°)
- flexion of wrist (90°)
- compression of ulnar wrist

TINEL SIGN

percussion over wrist → thinner → hypothinner

or prayer test

Managment :—

① Conservative .

- (bracing , at night " → عشان ما يحس numbness.
- physiotherapy
- drugs (- NSAIDs
  - Steroids)

To reduce congestion and pain

⇒ if doesn't work , give steroids injection

if failed > 3 months

do surgery

Release of transverse Carpal ligament

suturing بنعمل ايه

surgery بنعمل عملية

↳ high risk for nerve injury.

Radial Nerve

function | Extension of wrist and fingers

Roots: C5 – T1. post. division.

all extensor group + triceps. + snuff box.

- Motor Functions: Innervates the triceps brachii, and the muscles in the posterior compartment of the forearm (which are primarily, but not exclusively, extensors of the wrist and fingers).

for motor

in Radial groove + head divides in - Post. interosseous - Superficial radial nerve → sensation only for snuff box

sup. in ant. muscle group

- Sensory Functions: Innervates the posterior aspect of the arm and forearm, and the posterolateral aspect of the hand.

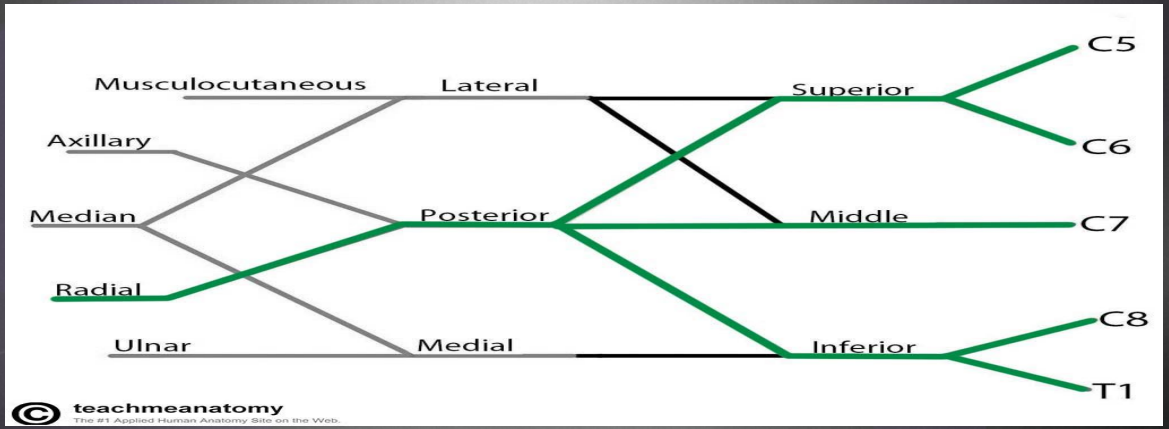
→ high Radial nerve injury

wrist + finger drop.

→ low Radial nerve injury

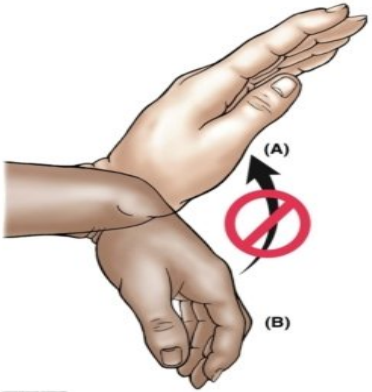
only finger drop (Radial deviation + extention)

The derivation of the radial nerve from the brachial plexus



Radial nerve injury

- Injury in the axilla
  - Wrist-drop
- Injury in the spiral groove
  - Wrist-drop
- Injury to the deep branch
  - No wrist-drop (finger drop)
  - Inability to extend the thumb and the metacarpophalangeal joints (test against resistance)
  - No loss of sensation
- Injury to the superficial branch
  - Limited anasthesia



Ulnar Nerve

- Roots: C8 and T1.
- Motor Functions: Innervates the muscles of the hand (apart from the thenar muscles and two lateral lumbricals), flexor carpi ulnaris and medial half of flexor digitorum profundus.
- Sensory Functions: Innervates the anterior and posterior surfaces of the medial one and half fingers, and associated palm area.

high level Ulnar nerve injury :-

Sensory claw hand

2 medical Lumbrical are affected

↓

half flexor digitorum profundus is affected

↓

flexor carpi ulnaris

↓

interossi + long extensor → paralyzed → claw

low level ulnar nerve injury :-

→ Ulnar pardox

↓

clawing يعني مش
of the hand

[نشيط]   زيه
flexor digitorum profundus still working

عكس
[كسول]   interossie
↓
paralysized

!عععع

Ulnar nerve → ماشي على Ulnar groove → وبيطلع me pronator teres —anti groove→ على lower 1/3 بعمله ع bifurcation → ant. aspect (volar) / → dorsal.

→ **high level** ulnar nerve injury → Both of them will be affected (loss of sensation)

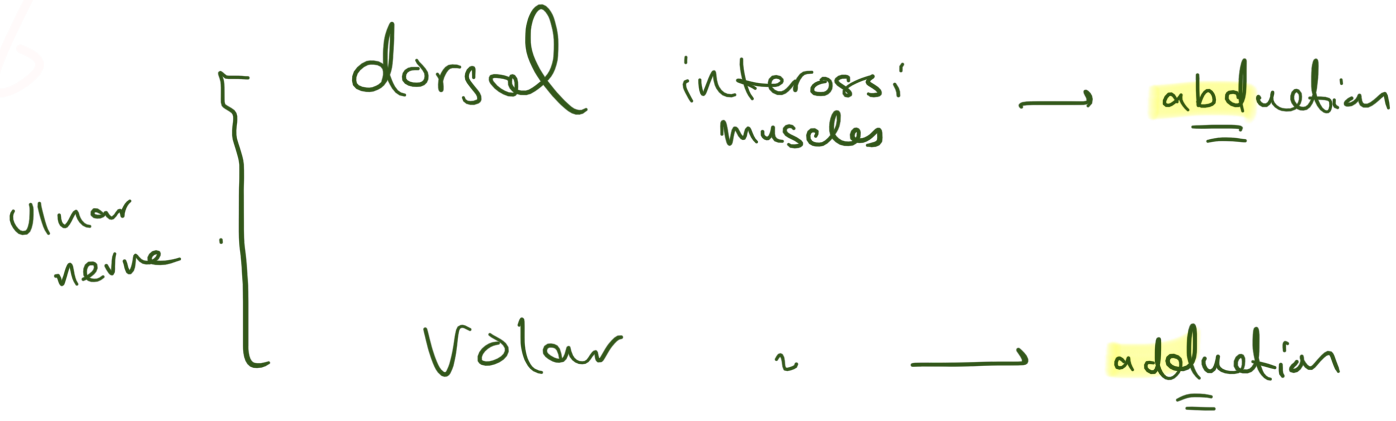
→ **low level** (level of the wrist)

↓

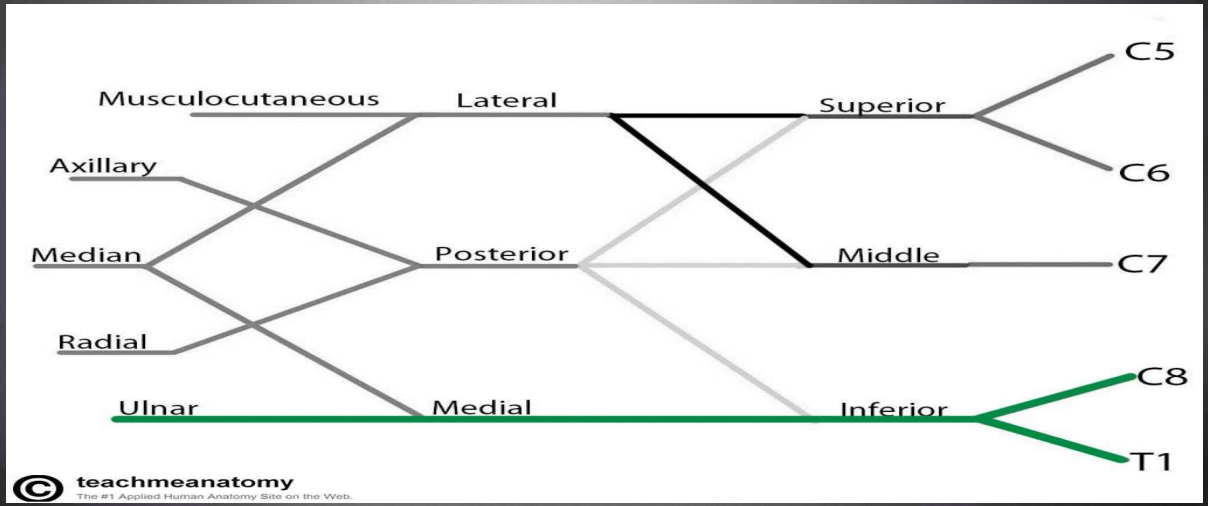
dorsal → working.

Volar → not working.

→ sensation preserved (طبعا) (hypothenar area.


dorsal
interossi muscles
abduction
Ulnar nerve
Volar
adduction

The derivation of the ulnar nerve from the brachial plexus



SYMPTOMS

* MUSCLE WEAKNESS
* DECREASED GRIP STRENGTH
* CLUMSINESS
* MUSCLE WASTING
* NUMBNESS, PAIN, and TINGLING (PARESTHESIA) in HAND

* CLAWING of the FOURTH and FIFTH FINGERS
* PERMANENT DISABILITY

PATHOPHYSIOLOGY

COMPRESSIVE NEUROPATHY ANYWHERE ALONG LENGTH of ULNAR NERVE

CAUSES

* **ULNAR NERVE ENTRAPMENT at the ELBOW**
  - CUBITAL TUNNEL SYNDROME
    - ELBOW INJURIES
    - BONE and JOINT DISEASE
    - REPEATED BENDING
    - EXCESSIVE LEANING
  - DIABETES
  - HEREDITARY NEUROPATHY with PRESSURE PALSIES (HNPP)
* **ULNAR NERVE ENTRAPMENT at the WRIST**
  - DIRECT TRAUMA
  - LACERATION
  - GANGLION CYSTS
  - ULNAR TUNNEL SYNDROME
  - DISTAL VASCULAR ANOMALIES
  - SOME JOINT CONDITIONS
  - CHRONIC and REPEATED EXTERNAL PRESSURE


Thank
you