

وَقُلْ رَبِّ زِدْنِي عِلْمًا



# PERIPHERAL NERVOUS SYSTEM



SUBJECT : Anatomy

LEC NO. : ||

DONE BY : Batool Alzubaidi + Hashem Ata

#كَلِينِيكَال\_إِلَا\_شَحْطَة



**PNS..**

**Lecture (11)**

# **Brachial Plexus**

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## Branches from the cords:

### 1-Branches from the lateral cord (C5,6,7):

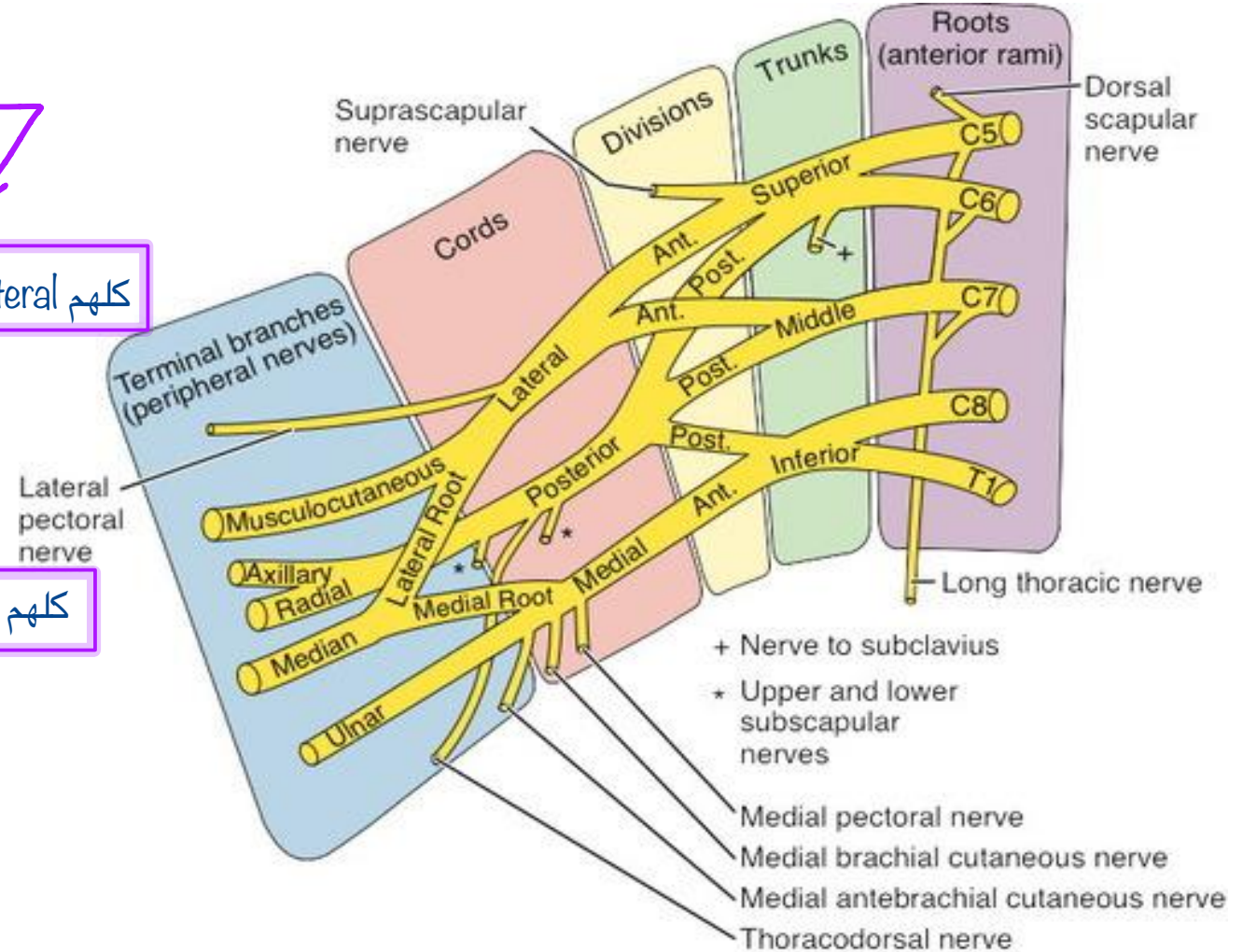
- a- Lateral pectoral nerve.
- b- Lateral root of median nerve.
- c- Musculo-cutaneous n.

كلهم lateral ما عدا musculocutaneuos

### 2- Branches from the medial cord (C8,T1):

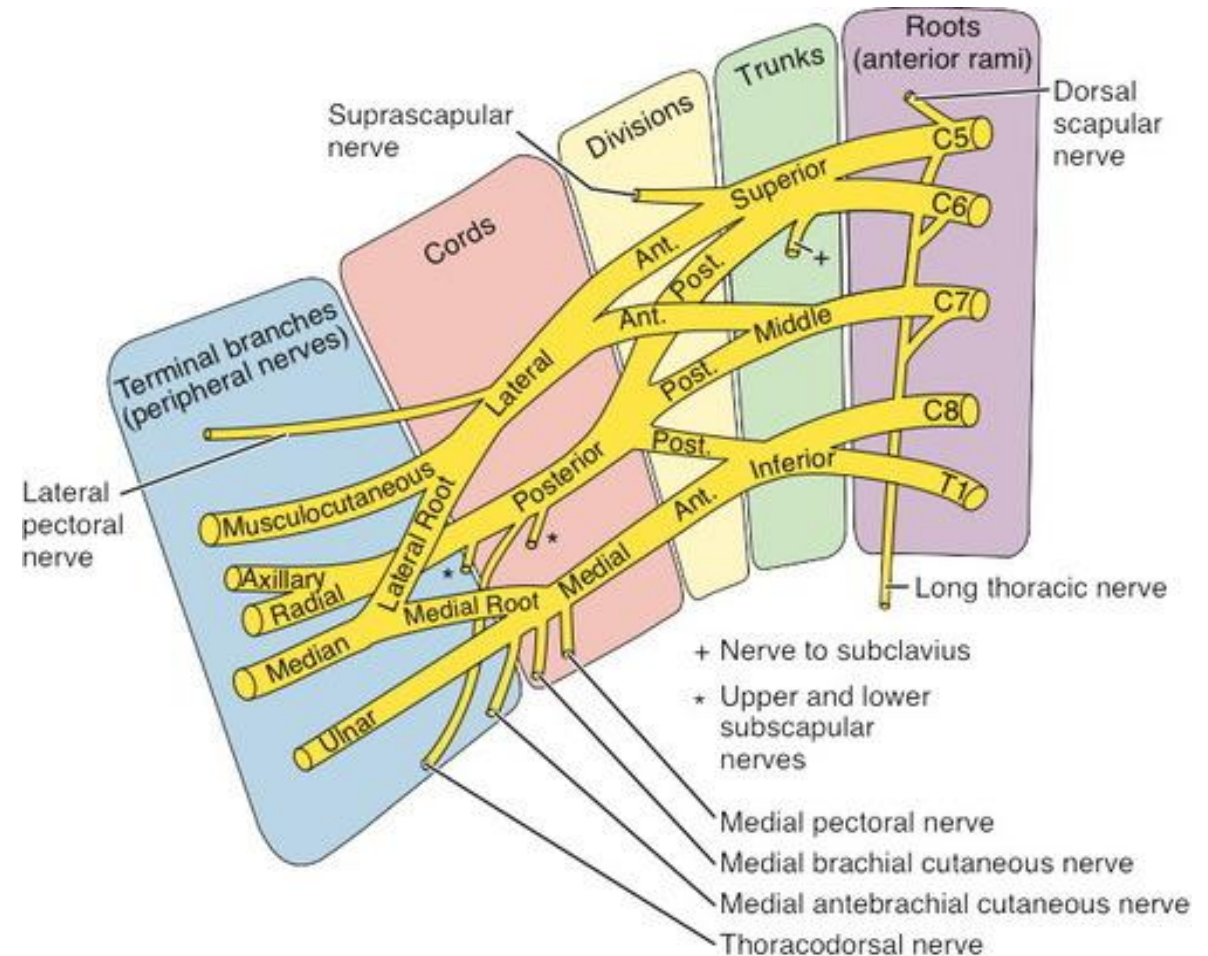
- a- Medial pectoral nerve.
- b- Medial root of median nerve.
- c- Ulnar nerve
- d- Medial cutaneous nerve of the arm.
- e- Medial cutaneous nerve of the forearm.

كلهم medial ما عدا ulnar



**3-Branches from the posterior cord**  
**(C5,6,7,8,T1):**

- a- Radial nerve (C5,6,7,8 ,T1).
- b- Axillary nerve (C5,6).
- c- Upper subscapular nerve (C5,6 ).
- d- Lower subscapular nerve (C5 ,6).
- e- Thoracodorsal nerve (nerve to latissimus dorsi) (C6,7 ,8).

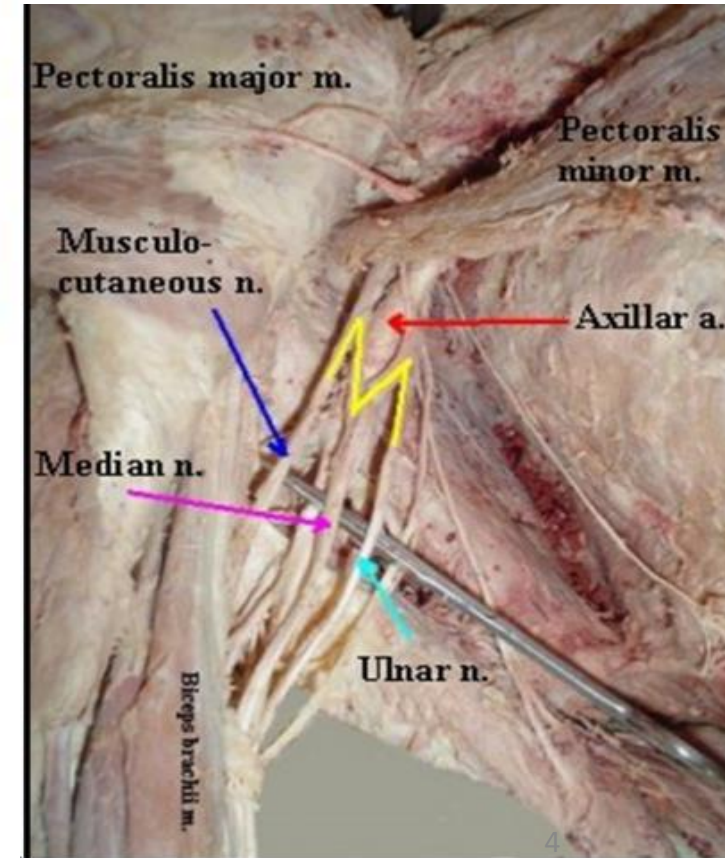
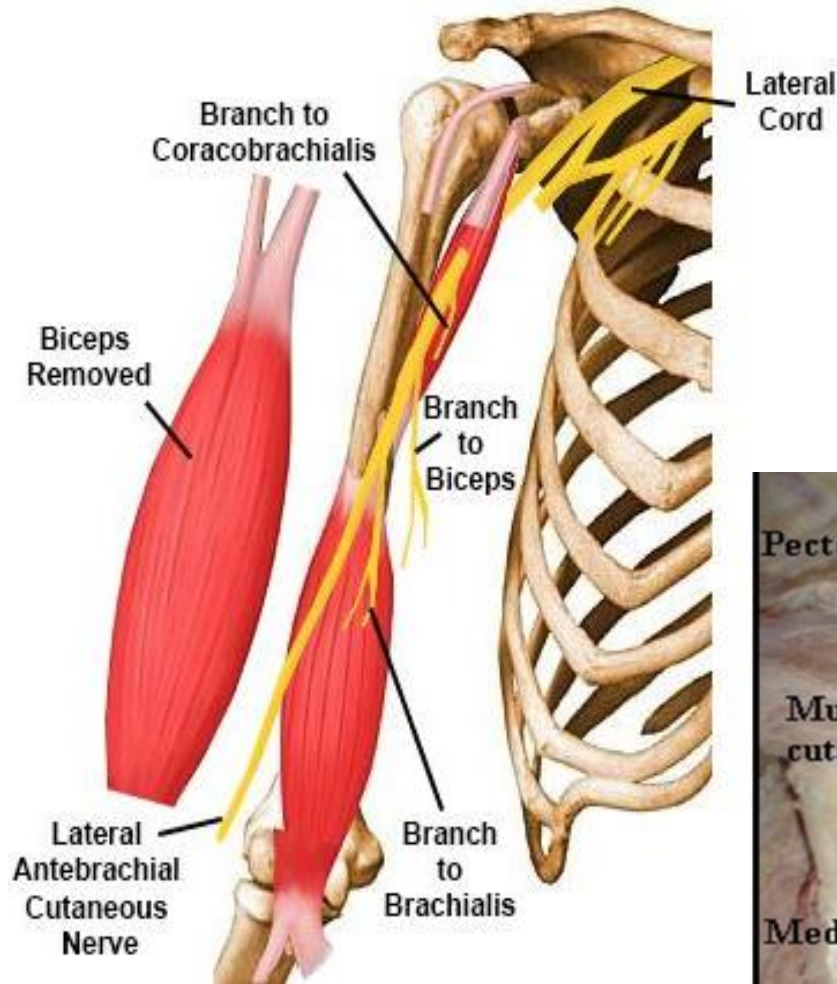


الفكرة انه بعض ال branches من ال cords of the  
brachial plexus بتكون branches صغيرة بتعمل supply  
لعضلة او تنتين زي ال lateral and medial pectoral  
nerves بعملوا supply لل pectoralis major and minor ،  
ال lower and upper subscapular nerves بعملوا  
supply لل subscapularis ، ال neeve to latissimus  
dorsi يعطي ال supply لهاي العضلة بس

و ممكن يكون ال branch ما يكون motor يعني ما يعمل  
supply لعضلات يعطي لل skin زي ال medial cutaneous  
nerve of arm or forearm .. و ممكن يكون branch كبير  
زي ال median, ulnar, axillary, musculocutaneous, radial  
هدول بكونوا mixed nerves motor and sensory fibers  
بكونوا يعملوا supply لمجموعة من العضلات مع ال skin

## Musculocutaneous nerve:

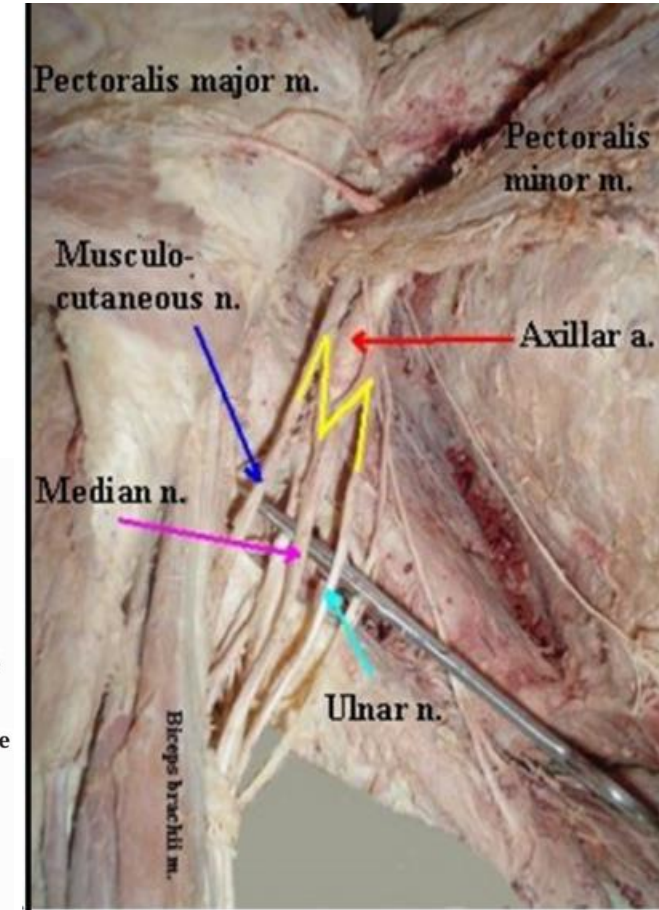
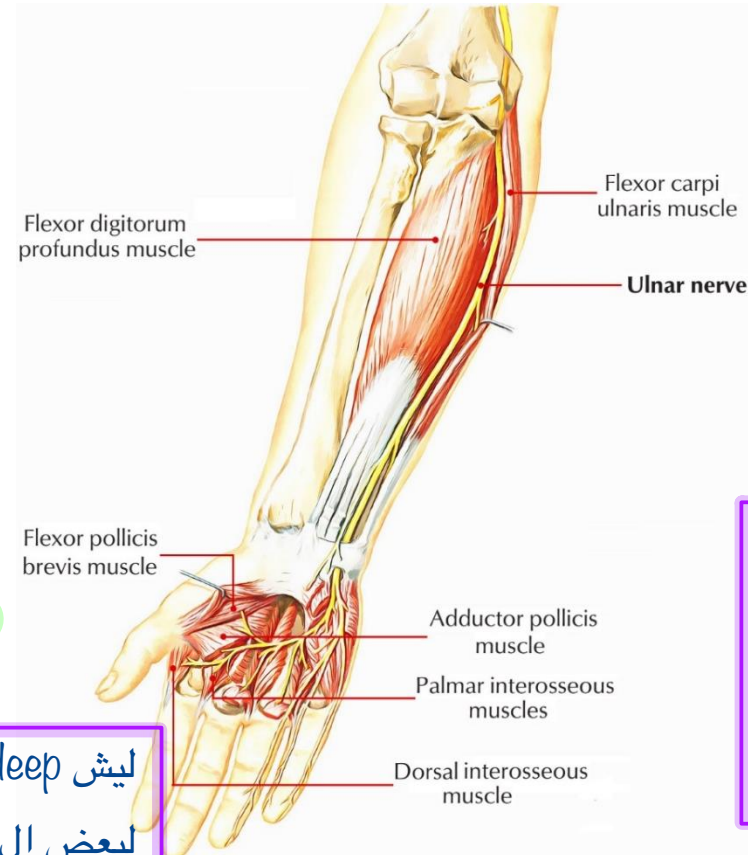
- It pierces coracobrachialis then runs between biceps and brachialis (supplying all these three muscles).
- lateral cutaneous nerve of the forearm is its terminal branch innervates the skin of the lateral aspect of the forearm.
- The musculocutaneous nerve is best tested by having the patient flex the arm against resistance.



لما بدك تختبر اي nerve انت ما بتفحص اذا هو paralysed او لا بدك تفحص كمان قوته يعني الحركة الي بعملها قوية ولا ضعيفة وهاي النقطة بتختبرها بانك تخليه يعمل الحركة with resistance و هيك بتكون استبعدت ال disability انه مش قادر يعمل الحركة و استبعدت انه يكون عنده weakness

## Ulnar nerve

- It lies **medial to the brachial artery**.
- Then pierces the medial intermuscular septum.
- It **passes behind the medial epicondyle** (where it can readily be rolled against the bone).
- It **enters the forearm**, descend beneath flexor carpi ulnaris then **lie superficially on its lateral side**.
- It **enters the palm of hand by crossing the flexor retinaculum superficially** to **break up into a superficial & deep terminal branches**.



بكون partially superficial to flexor  
retinaculum بس بمشي ب cacal اسمها  
guyon's canal (حكت اعرفوها) و ممكن  
ينحشر فيها و يصيرله compression

ليش superficial and deep لانه بكون مطلوب منه و هو بال palm شغلتين يعمل supply  
لبعض ال muscles of the hand و يعمل supply ل area of the skin of the hand

اول اشني بدك تحطه ببالك انه ما بتوزع نهائيا على ال  
distribution ال arm تاعه بال forearm and hand فقط

## Distribution of ulnar nerve:

### Muscular— to

- Flexor carpi ulnaris, Muscle and half in the forearm
- Medial half of flexor digitorum profundus,
- Hypothenar muscles, ال ٨ كلهم بعملهم supply
- Intrinsic muscle of hand (Interossei, 3<sup>rd</sup> & 4<sup>th</sup> lumbricals and the adductor pollicis).

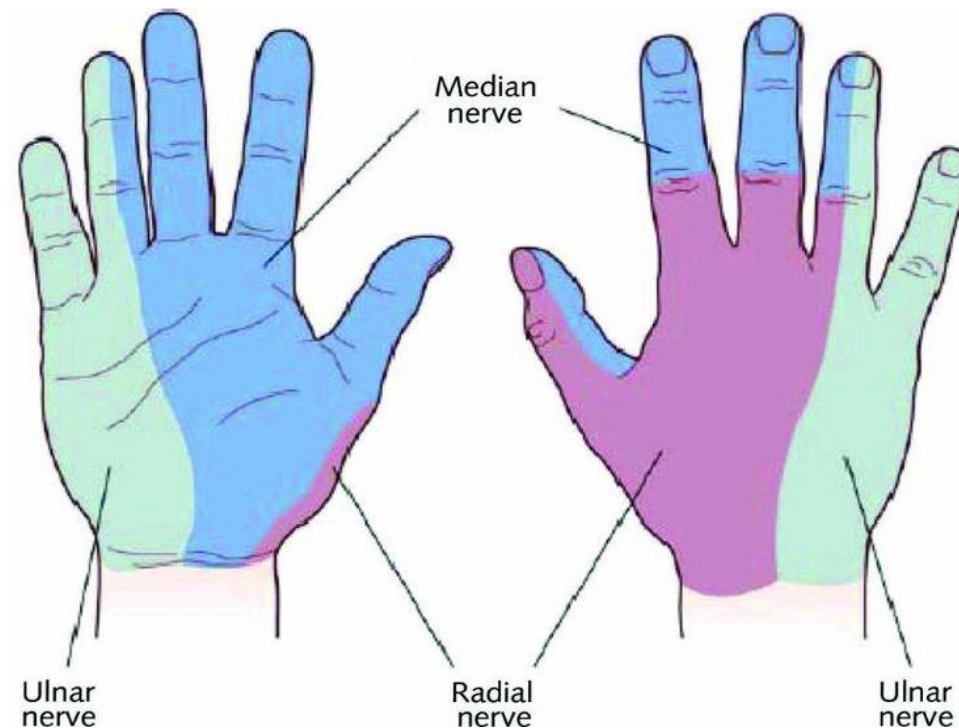
ما عدا : first and second lumbrical و ال muscles of thenar eminence

### Cutaneous— to

- Ulnar side of both aspects of the hand and both surfaces of the ulnar 1.5 fingers.

بعمل supply للجھتين ال palmer and dorsal ال medial side منهم تقريبا ال 1/3 medial

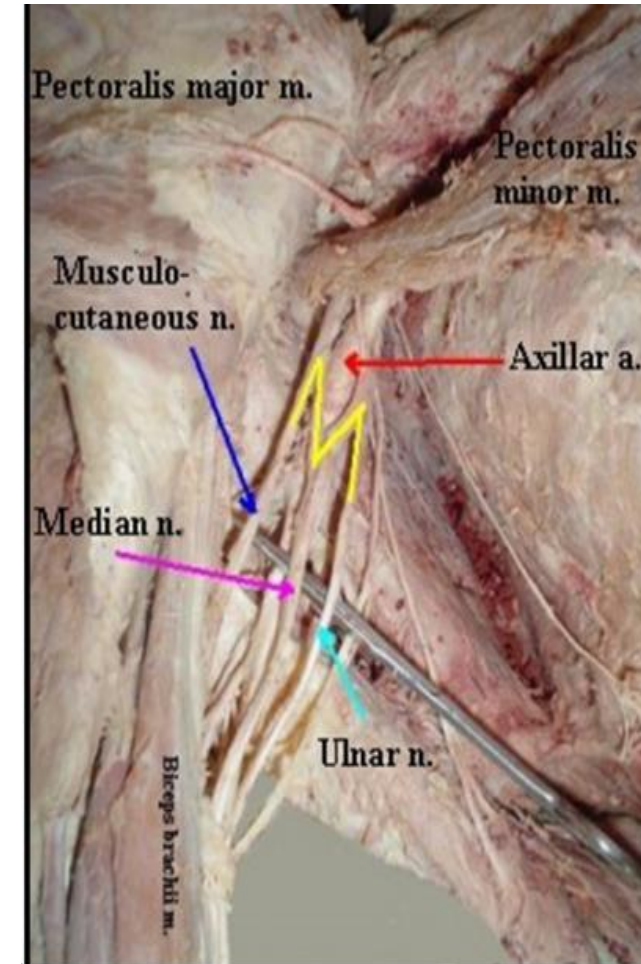
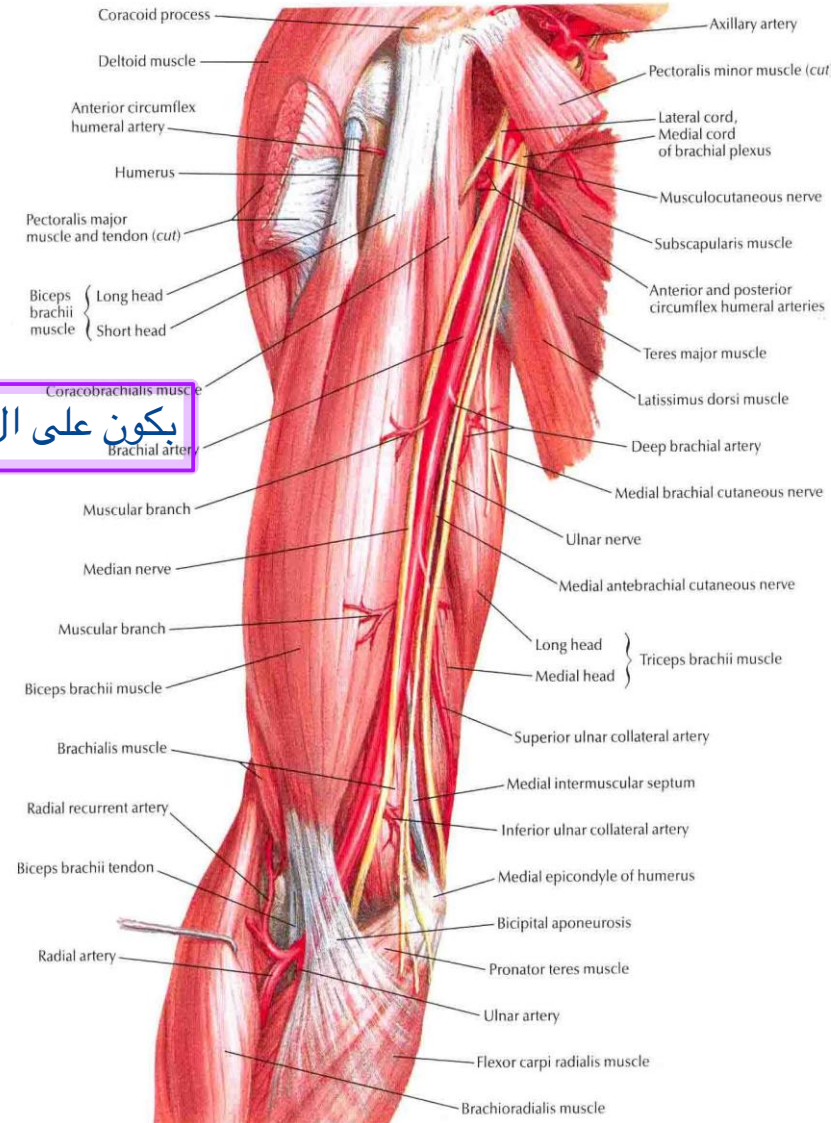
كيف يعني بعمل supply لنصها ؟ احنا عارفين انه الها ٤  
tendons للاربع اصابع فالجزء من العضلة الي ماخذ supply  
from the ulnar nerve بحرك ال little finger and ring finger





# Median nerve

- It arises by the junction of a branch from the medial and another from the lateral cord of the plexus.
- Descend in relation to the brachial artery. يكون على ال lateral بعدين بعمله cross بعدين بصيرله medial
- The nerve enters the forearm between the heads of pronator teres, may be compressed "Pronator teres syndrome."
- It enters the palmar aspect of hand as it passes deep to the flexor retinaculum. ↙ ↘



## Distribution of the median nerve:

### Muscular— to

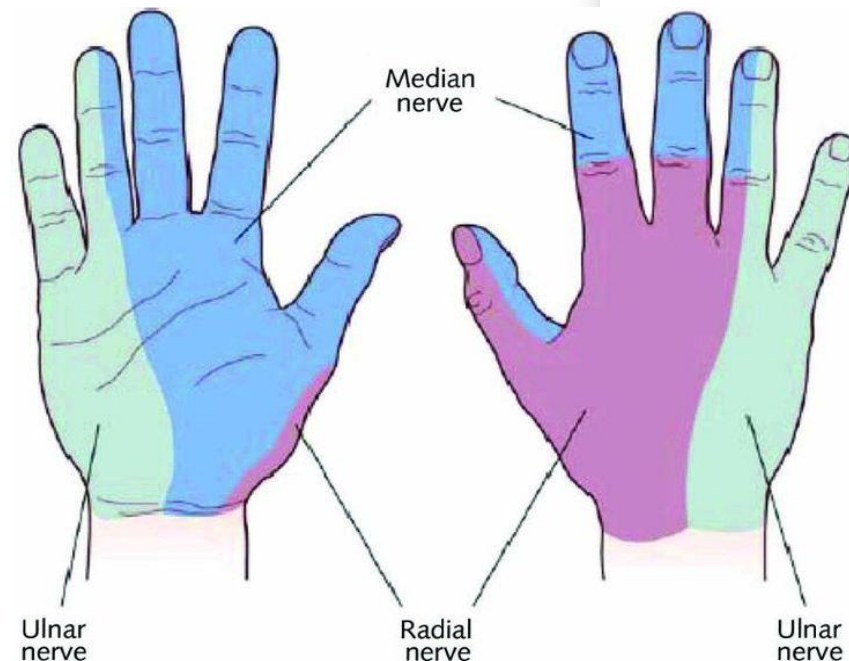
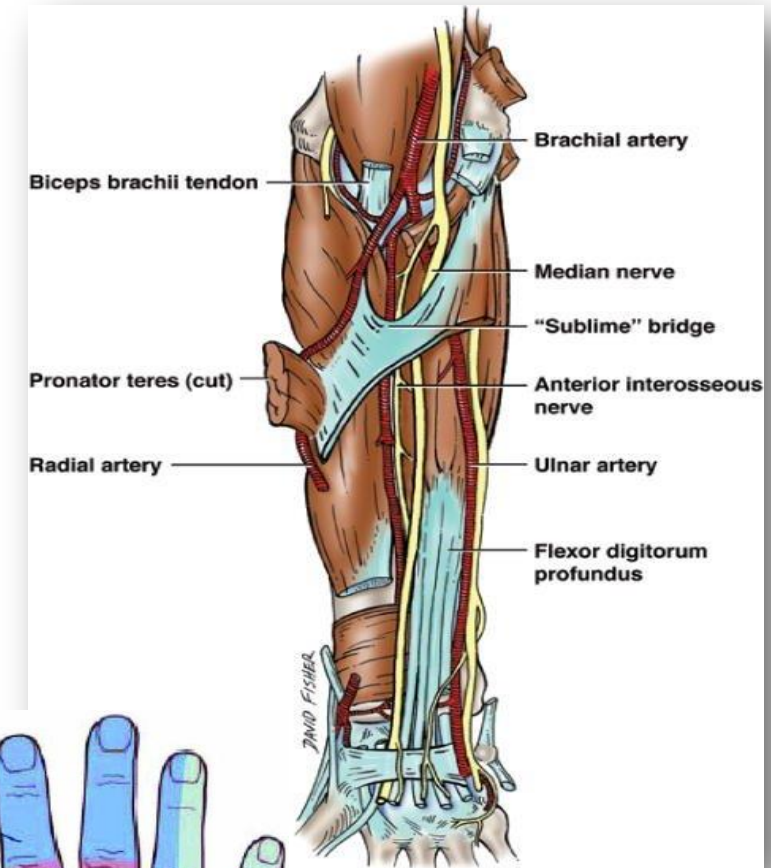
- All the muscles of the flexor aspects of the forearm, except?
- Anterior interosseous nerve is a branch of the median nerve, supplies the deep forearm flexors.
- Thenar eminence muscles & Lateral two lumbricals.

### Cutaneous— to

Lateral side (~2/3)

- Skin of the radial side of the palm and the palmar & dorsal aspect of the radial 3.5 digits.

اول اشي بدك تحطه ببالك انه ما بتوزع  
نهائياً على ال arm ال distribution تاعه  
بال forearm and hand فقط



## Axillary nerve

- Winds around the surgical neck of the humerus.

### Distribution:

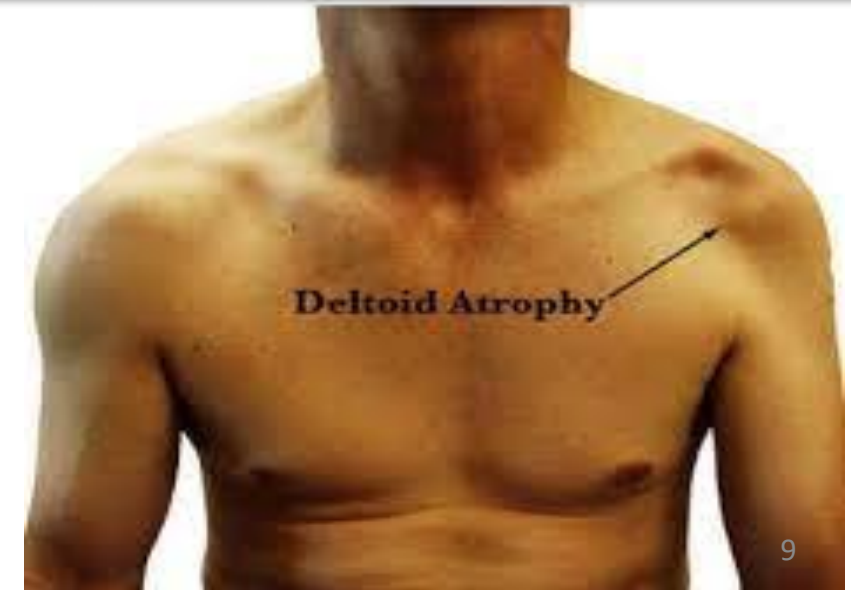
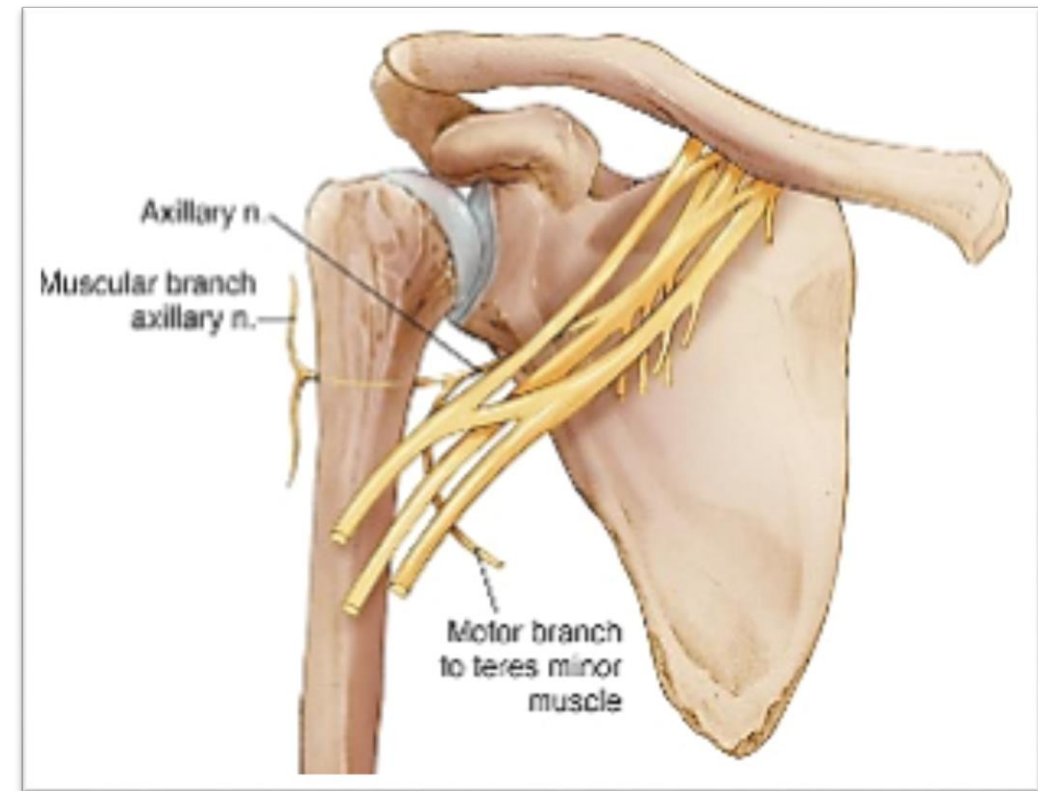
- Muscular—To deltoid and teres minor.
- Cutaneous—To area of skin over the deltoid.

### The axillary nerve may be injured;

- In fractures of the humeral neck or in dislocations of the shoulder.

الwasting بتقيسه انك تقارن الجهتين مع بعض


- Result in;** weakness of shoulder abduction, wasting of the deltoid (the rounded contour of the shoulder is lost and becomes flattened compared to the uninjured side). and sensory loss of skin over this muscle (lower part).
- Sensation over upper 1/2 of deltoid is normal as it is supplied by supraclavicular nerves C 3,4.

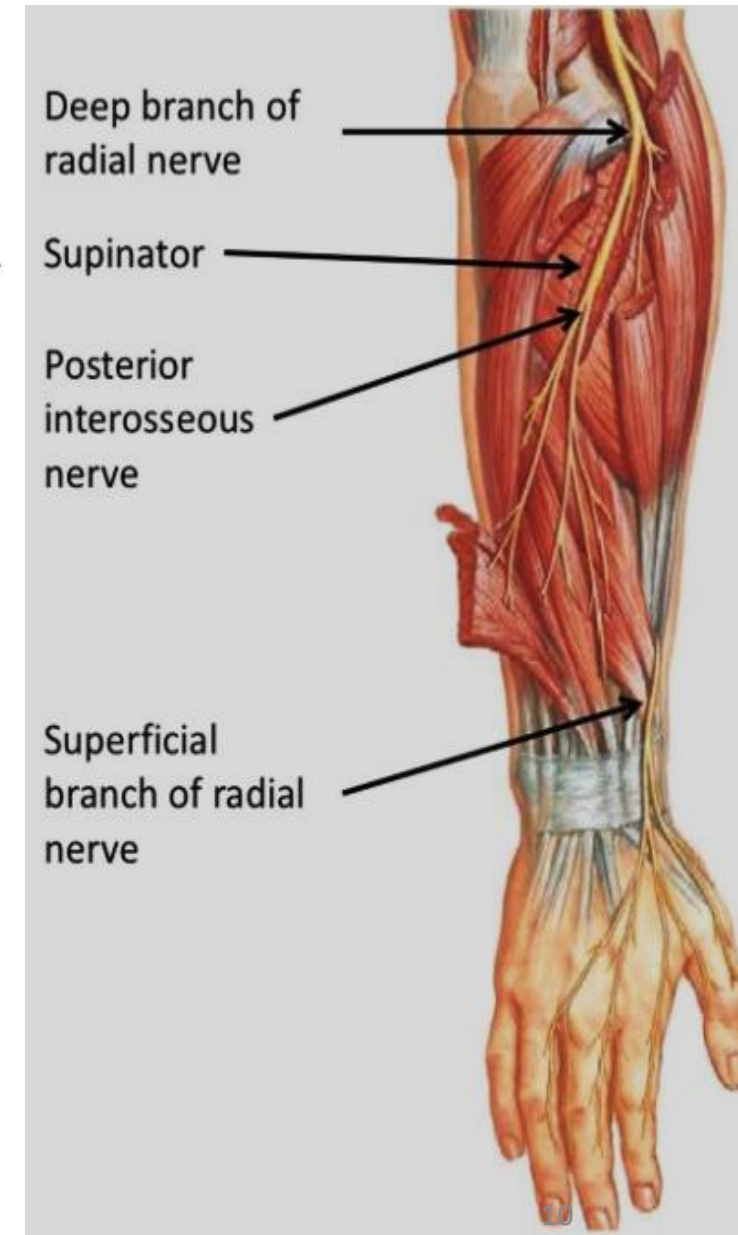
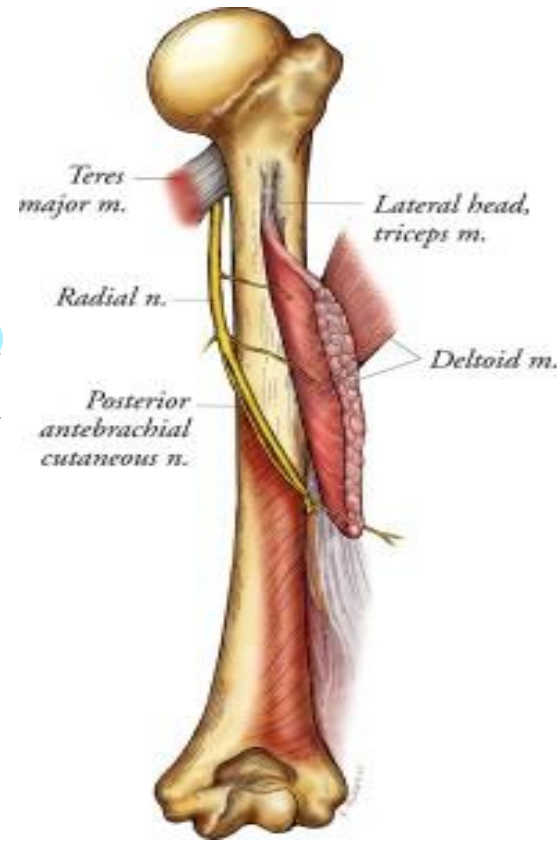


## Radial nerve

- It passes backwards to lie in the **spiral groove**.
- Then it pierces the lateral intermuscular septum to re-enter the anterior compartment of the arm between brachialis and brachioradialis.
- At the level of the lateral epicondyle it gives rise to posterior interosseous nerve.  

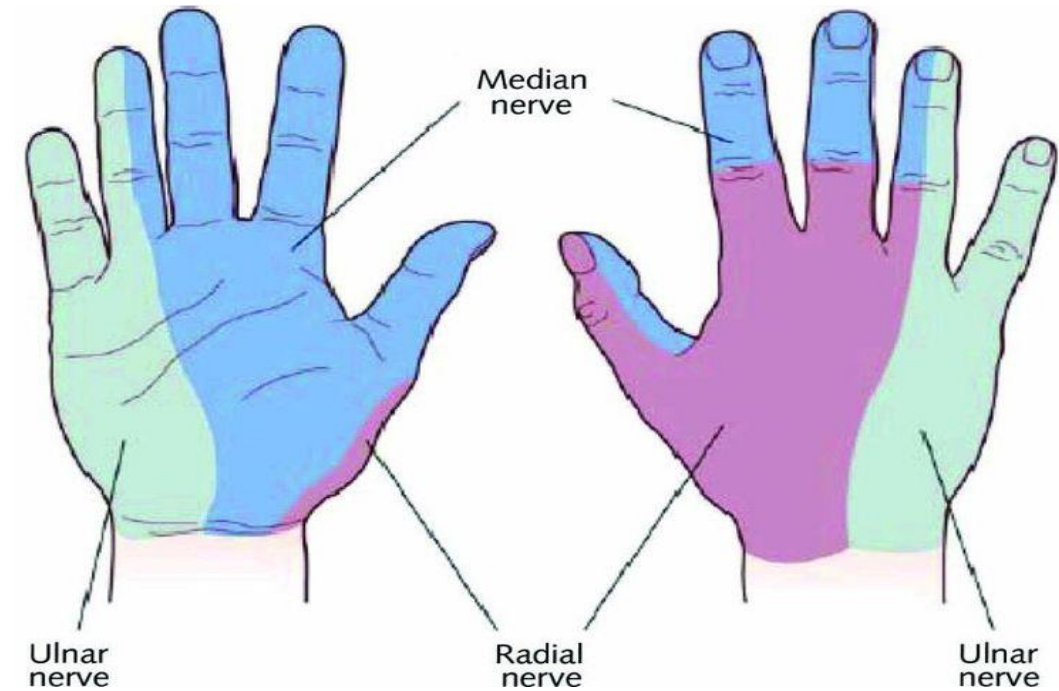
Deep branch of radial nerve


- The radial nerve itself continues as the superficial radial nerve, lying deep to brachioradialis.
- Above the wrist, it emerges posteriorly from beneath this muscle to end by dividing into cutaneous nerves.



## Distribution of the radial nerve:

- **Motor supply:** Extensor muscles of the upper limb by branches from the main trunk & posterior interosseous branch.
- **Sensory supply:** To skin of the back of the arm, forearm and radial side of the dorsum of the hand, dorsal aspects of the radial 3 & 1/2 digits.

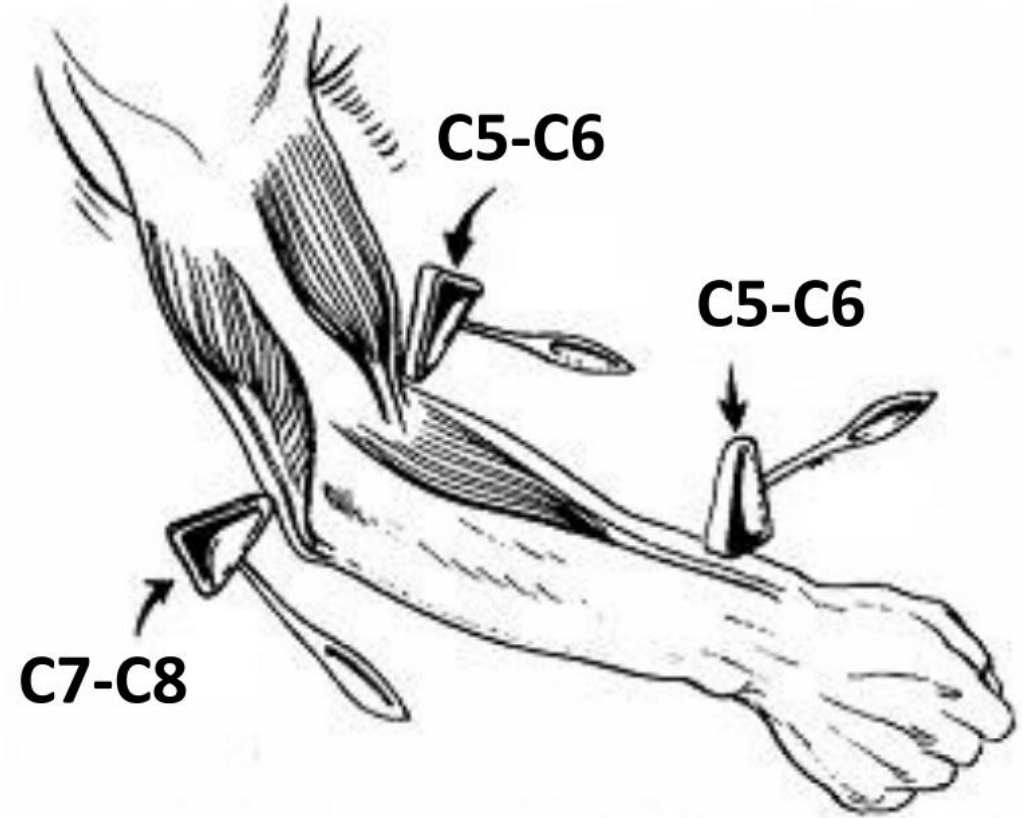


## Deep tendon reflexes

Biceps jerk C5-C6.

Brachioradialis C5-C6.

Triceps C7-C8.



هلا السلايدات الجاي للتسهيل عليكم انكم تحفظوا كل injury شو  
بتاثر فيها عضلات احفظوا الشكل تاها و جابوا على اساسه

# Brachial plexus injuries

## □ Lesion of upper trunk (C5, C6) .... Erb's paralysis

**Cause:** Birth injury.. excessive traction or tearing of roots C5 & C6.

In adults; violent falls on the side of the head and shoulder.

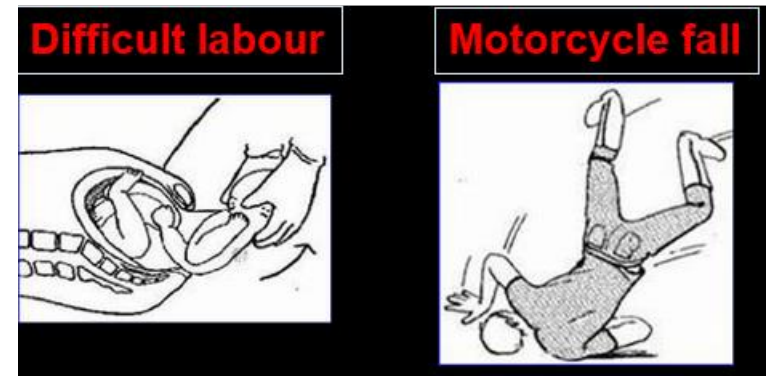
### Resulting in:

- **Motor consequence:** paralysis of muscles supplied by **C5, C6**
- **Paralysis of abductor muscles of arm** (supraspinatus & deltoid).
- **Paralysis of the lateral rotators** (infraspinatus & teres minor).
- **Paralysis of brachialis and biceps.**
- **Sensory consequence:** loss of sensation over the lower half of deltoid & latera side of forearm.

اعرف شكل الصورة و منها اعرف العضلات الي صار لها paralysis

### Deformity: Policeman tip position (Waiter's tip deformity);

- The limb hangs by the side with the forearm pronated and the palm facing backwards, Adduction, medial rotation of arm, extension of elbow.



□ Lesion of lower trunk (C8, T1)... Klumpke's paralysis

Causes:

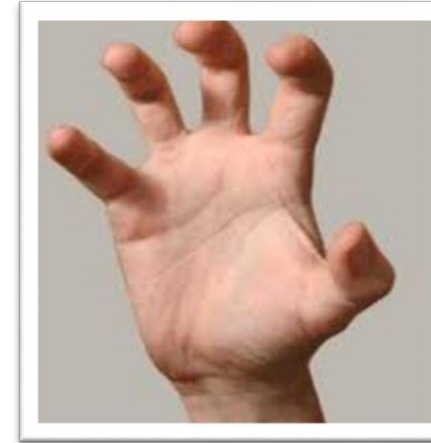
Birth injury - Fall on outstretched arm.

Resulting in:

- Motor affection: Paralysis of muscle supplied by **C8, T1**
- Principally, **Intrinsic muscles of the hand**
- **Flexors of the wrist and fingers** (in particular flexor carpi ulnaris and ulnar half of the flexor digitorum profundus)
- **Sensory affection: loss of sensation over medial side of forearm & hand**

Deformity:

- a clawed appearance of the hand (**Claw hand**). due to hyperextension of the metacarpophalangeal joints & flexion of the interphalangeal joints.





ليش saturday common بالغرب بال weekends عارفين انه عطلتهم سبت و احد ف هم يوم السبت المعظم بطلع  
يسهر يشرب ف بناموا زي الصورة لفترة طويلة بدون ما يحس على حاله و بعمل compression على ال radial nerve

## □ Radial nerve injury:

### Causes:

- Falling a sleep with arm over the back of chair (Saturday night palsy)
- Fractures of the humeral shaft.
- Posterior interosseous branch, may be injured in fractures or dislocations of the radial head.

### Resulting in:

**A-Injury in axilla;** paralyzes of extensor muscles.

- Elbow, wrist, finger drop,
- Patient unable to extend elbow, wrist and fingers.



### **B-Injury in spiral groove;**

- **Wrist& finger drop**
- Sensory loss: Dorsum of hand and dorsum of lateral 3 ½ finger.

بهاد ال groove يكون اعطى ال branches الي بتعمل supply لل triceps ف ال elbow سليم

### **C-Injury of post. interosseous nerve;**

- **Finger drop, no wrist drop** (extensor carpi radialis longus intact).
- No sensory loss (motor only).

بتاخذ من ال radial nerve نفسه مش من ال interosseous عشان هيك ما في wrist drop

### **D-Injury of superficial radial nerve;**

No motor affection

Sensory loss



The disability produced by a wrist drop is inability to grip firmly.

## □ Ulnar nerve injury:

### Causes:

- Fracture medial epicondyle- Cutting injury at the wrist.
- Compressed in Guyan's canal, the roof of which is formed by the palmar fascia & the floor being the flexor retinaculum.

### A-Injury of ulnar nerve at or above wrist

**Sensory loss:** palmar one third of the hand + one & a half fingers.

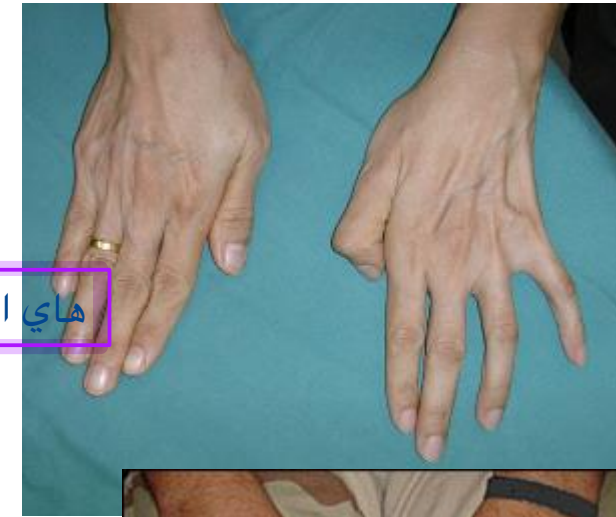
### Motor consequence:

- Paralysis of all interossei & medial 2 lumbricals.
- Paralysis of muscles of hypothenar eminence.
- Paralysis of adductor pollicis muscle.

## Resulting in

- **Wasting of the hypothenar muscles.**
- **Wasting of the interossei muscles-** Hollowing between the metacarpal bones.
- **Loss of adduction of thumb.**
- Patient is **unable to grip** piece of paper between his fingers due to paralysis of adductors and abductors of the fingers.

هاي الطريقة الي بتختبر فيها ال abduction and adduction لو ما في hollowing



## **B-Injury of ulnar nerve at the elbow:**

### Motor consequence:

- As the previous, but there is also paralysis of the **flexor carpi ulnaris** & medial ½ of FDP results in a **tendency to radial deviation** of the wrist.

**Sensory loss:** skin area supplied by ulnar nerve.

### Deformity of ulnar nerve injury:

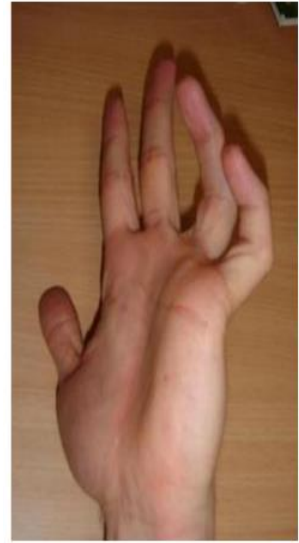
- **Claw hand.**
- **The clawing is slightly less intense in the 2nd and 3rd digits** because of their intact lumbricals (supplied by the median nerve).

هاد الفرق بين ال claw hand تاغت ال ulnar  
nerve injury و ال lower trunk injury



من علامات الإصابات

## Froment's sign



Ulnar nerve paradox!



High lesion → less clawing

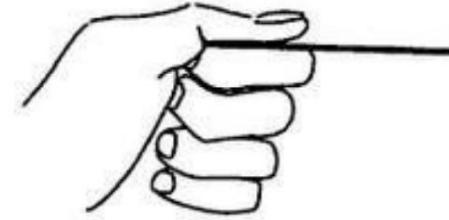
Lesion near elbow

Low lesion → more clawing

Lesion near wrist

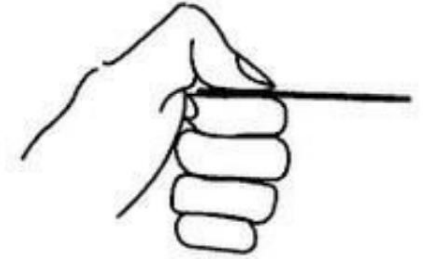
In high lesion; Flexor digitororum profundus to the 4th and 5th fingers is paralyzed so that the clawing of these two fingers is less intense than in case of its division at the wrist.

Normal



Intact ulnar nerve & normal adductor polices

Froment's positive



Injured ulnar nerve & paralyzed adductor polices

- Physical examination of the hand to test for palsy of the ulnar nerve.
- Can be elicited by asking the patient to hold a piece of paper between the thumb and index finger.
- In the affected hand, the adductor pollicis is weak and thumb adduction does not occur. Instead, the interphalangeal joint of the affected thumb flexes to hold the paper through contraction of the flexor pollicis longus.

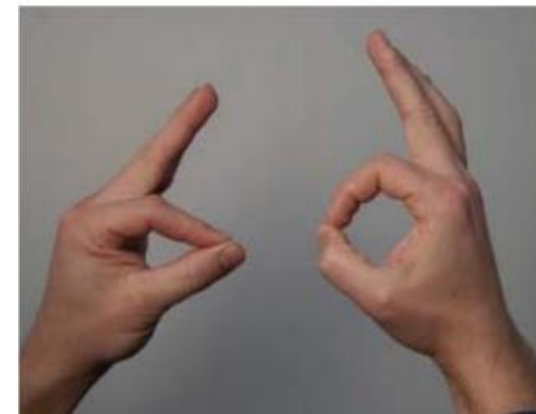
## Median nerve injury:

### Causes:

- Supracondylar fractures- penetrating injuries of the wrist.

### A- If the median nerve is injured at the elbow;

- Inability to pronate the forearm.
- Difficulty in proper wrist flexion& ulnar deviation.
- Thenar eminence is flattened.
- Opposition is not possible.
- **Paralysis of anterior interosseous nerve**, result in inability to flex the distal interphalangeal joints of the index and middle fingers and the interphalangeal joint of the thumb. This deficit would lead to the **collapsed “O.K. sign”**(pinch grip test) indicated in the photo. ➡
- **Deformity; ‘Ape hand’** Thumb is adducted& a loss of its opposable function.



## **B-If the is injured at the wrist;**

- Paralysis of the thenar muscles and the lateral two lumbricals.

**Deformity ... Ape hand deformity.**

### **Carpal tunnel syndrome:**

- Entrapment neuropathy caused by compression of the median nerve within the carpal tunnel.
- Roof of carpal tunnel: thick fibrous transverse carpal ligament.
- Floor of carpal tunnel: Carpal bones.
- **Symptoms:** paresthesia (pins & needles pain over the palmar aspect of lateral 3 & half fingers & lateral aspect of palm)
- Muscle weakness & wasting of thenar eminence (in severe and prolonged case).

## Long thoracic nerve injury

### Result in:

- **Paralysis of the serratus anterior** results in **posterior protrusion of the scapula** in a condition known as “**winged scapula**” **medial border and inferior angle of the scapula** are prominent.
- **Functions lost:** **Abduction above 90 degrees,**  
**Protraction.**







# Quiz

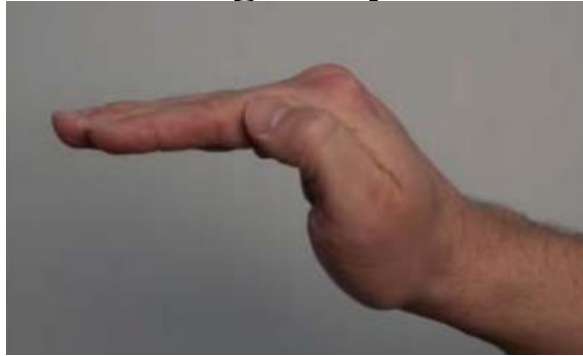
**A man is unable to hold typing paper between his index and middle fingers. Which of the following nerves was likely injured?**

- (A) Radial nerve
- (B) Median nerve.
- (C) Ulnar nerve
- (D) Musculocutaneous nerve
- (E) Axillary nerve

**Regarding the ulnar nerve, all are correct EXCEPT:**

- a. Is a branch of the medial cord of the brachial plexus.
- b. Carries fibers from C6, C7 and C8.
- c. Has no branches in the arm.
- d. It enters the hand superficial to the flexor retinaculum.
- e. Injury of the nerve causes claw hand.

A physician asks the patient to assume the Z-position (seen in photo) with his hand, which involves flexion of the metacarpophalangeal joints and extension of the interphalangeal joints of the fingers. Which of the following nerves is being tested in assuming this position?



- A. Deep branch of radial nerve.
- B. Superficial branch of radial nerve.
- C. Recurrent branch of median nerve.
- D. Deep branch of ulnar nerve.
- E. Superficial branch of ulnar nerve

“Pronator teres syndrome” is a condition in which one of the following nerves is excessively compressed where it passes between the two heads of the pronator teres muscle. Which of the following nerves is entrapped?

- A. Deep branch of radial nerve
- B. Median Nerve
- C. Deep branch of ulnar nerve
- D. Superficial branch of ulnar nerve
- E. Musculocutaneous nerve