ULNAR NERVE ANATOMY

Learning Objectives

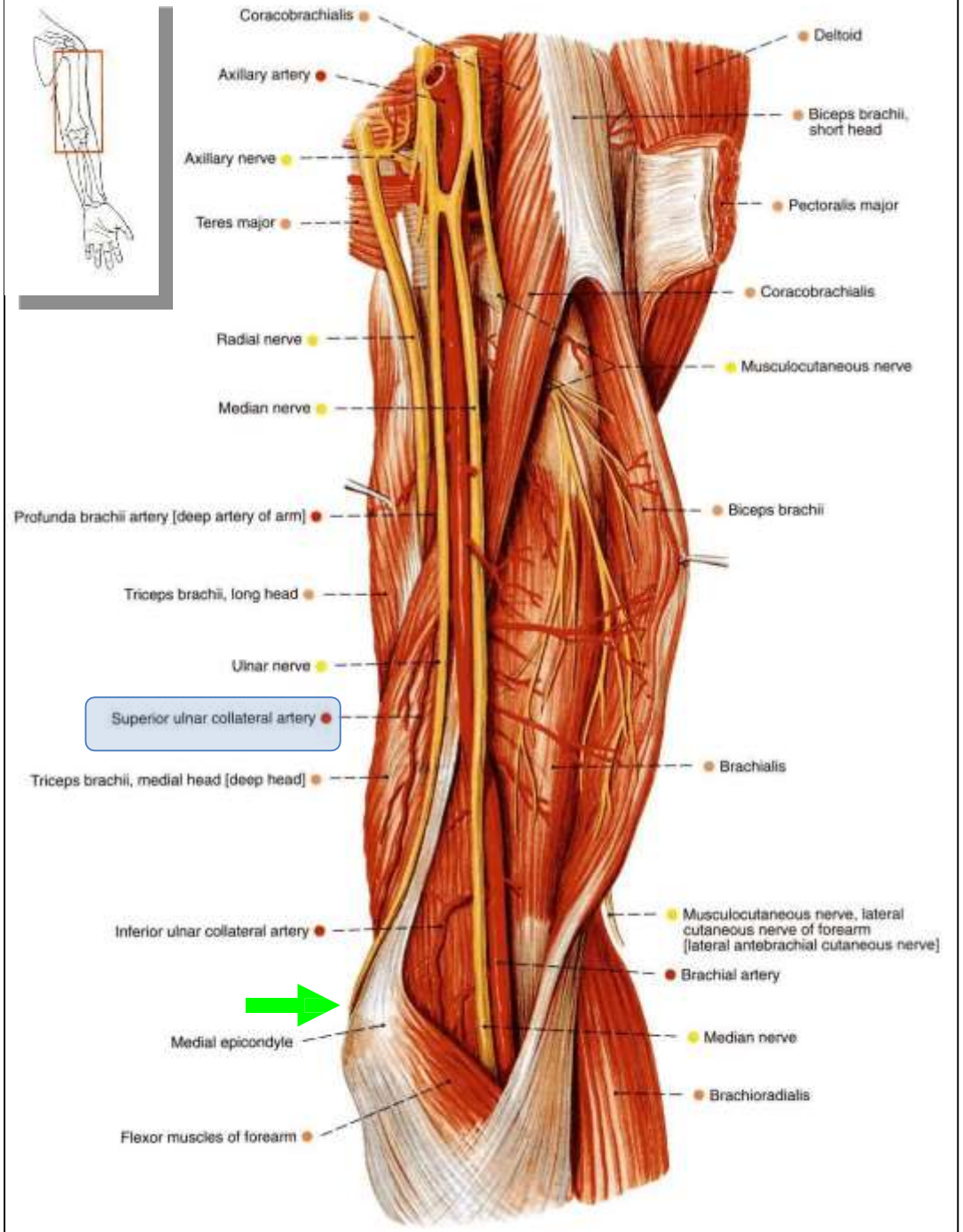
1. Ulnar nerve formation , root value and important relations

2. Motor and sensory supply

3. Important sites of injuries/entrapment of nerve

4. Effects of injury of ulnar nerve

5. How to clinically test ulnar nerve injury



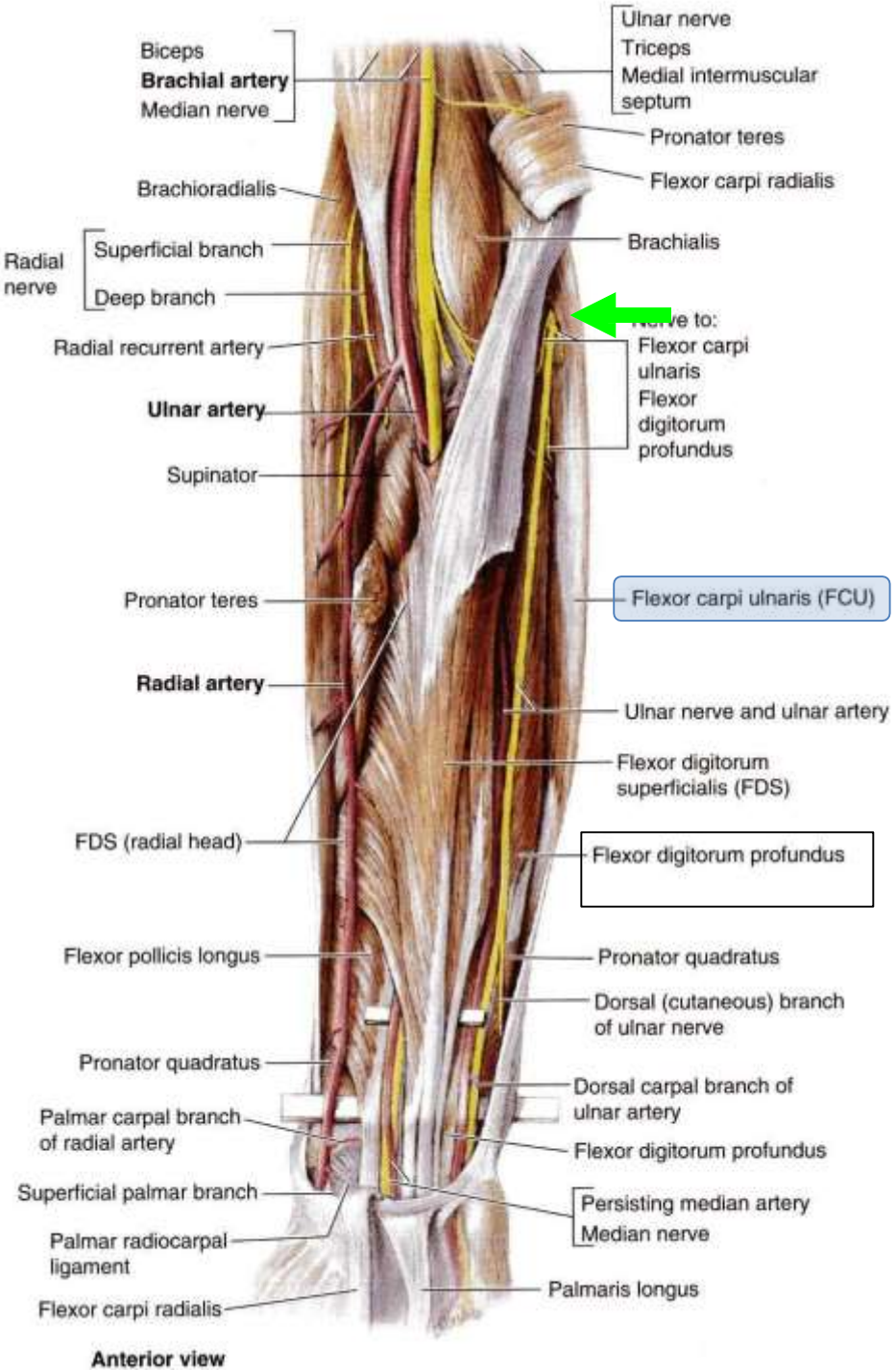
Ulnar nerve C8T1

Origin : medial cord of brachial plexus , runs *medial to brachial artery*- middle of arm.

At **coracobrachialis insertion**, - ***pierces medial intermuscular septum***, is accompanied by superior ulnar collateral artery –and *enter posterior compartment of arm.*

At elbow - *posterior to medial epicondyle.*

No *branches* in arm.



Ulnar nerve in forearm

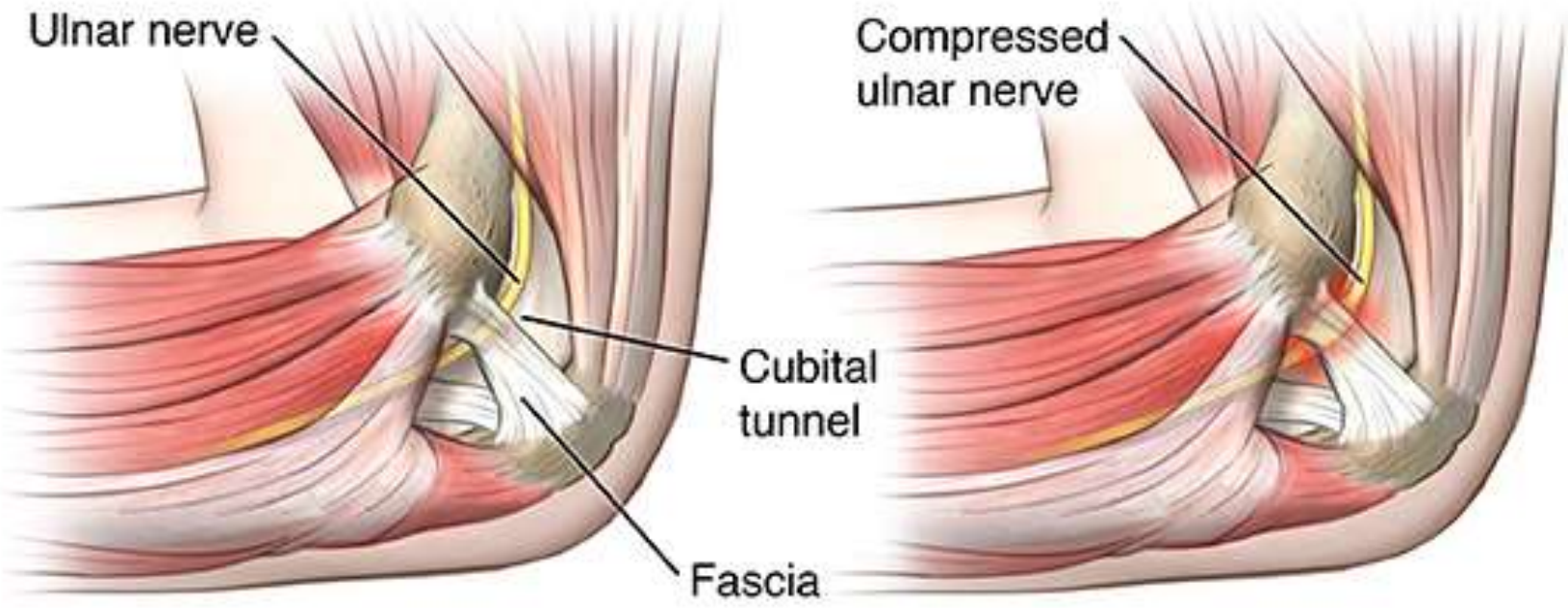
- It continues downward to enter in forearm
- b/w two heads of **flexor carpi ulnaris.**
  Passes through <u>CUBITAL TUNNEL</u>
- It runs down forearm **between FCU and FDP.**
- In lower half of forearm it lies **medial to ulnar artery.**

Cubital Tunnel

Cubital tunnel is a space of dorsal medial elbow which allows passage of the ulnar nerve around the elbow.

It is bordered
Medially - medial epicondyle of the humerus,
laterally -olecranon process of the ulna and tendinous arch joining the humeral and ulnar heads of the flexor carpi ulnaris.

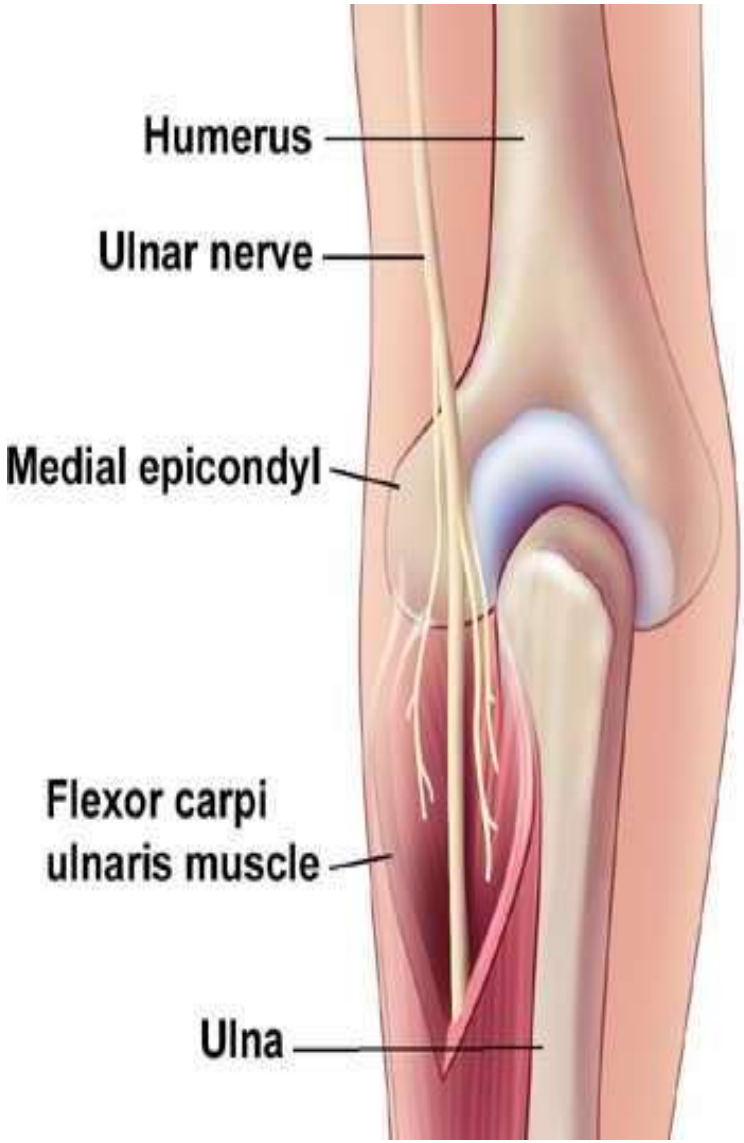
Cubital Tunnel



Side view of elbow

Normal cubital tunnel

Ulnar nerve compressed in the cubital tunnel


Humerus
Ulnar nerve
Medial epicondyl
Flexor carpi
ulnaris muscle
Ulna


Ulnar
nerve
Cubital
tunnel
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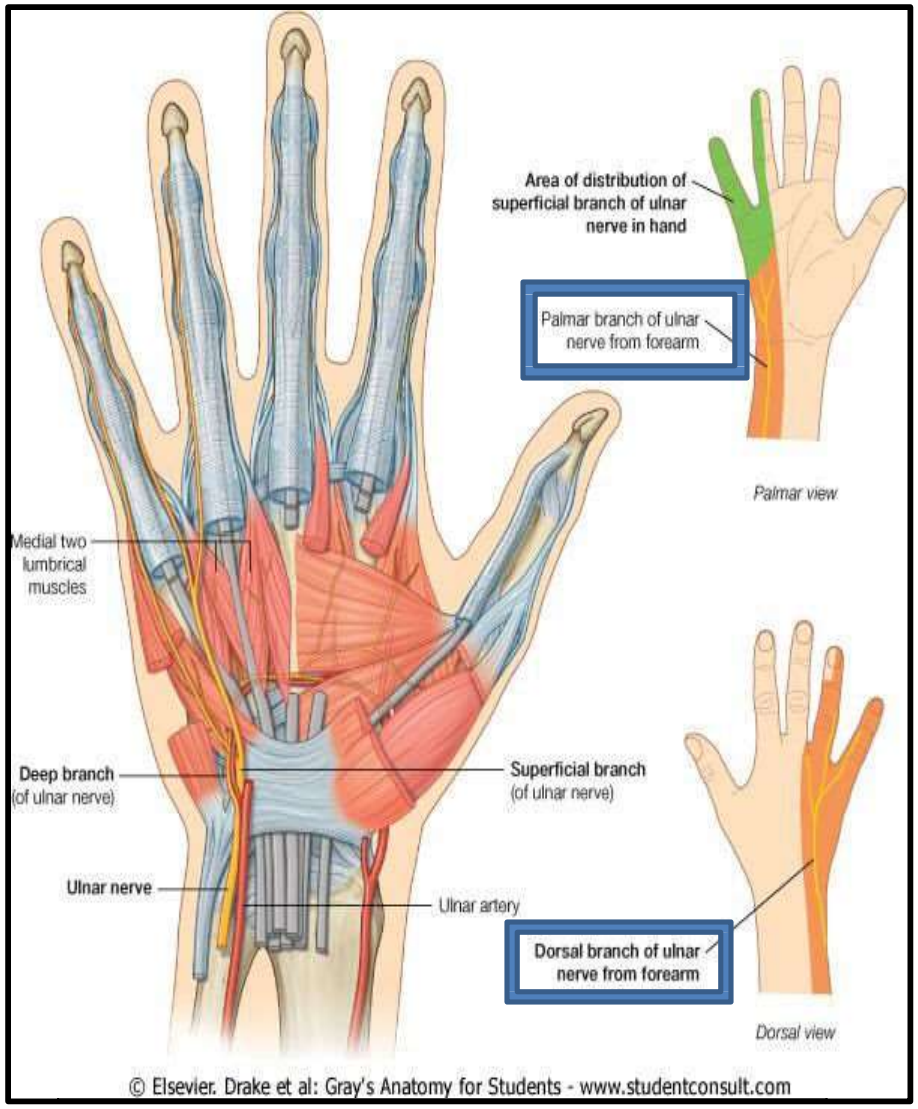
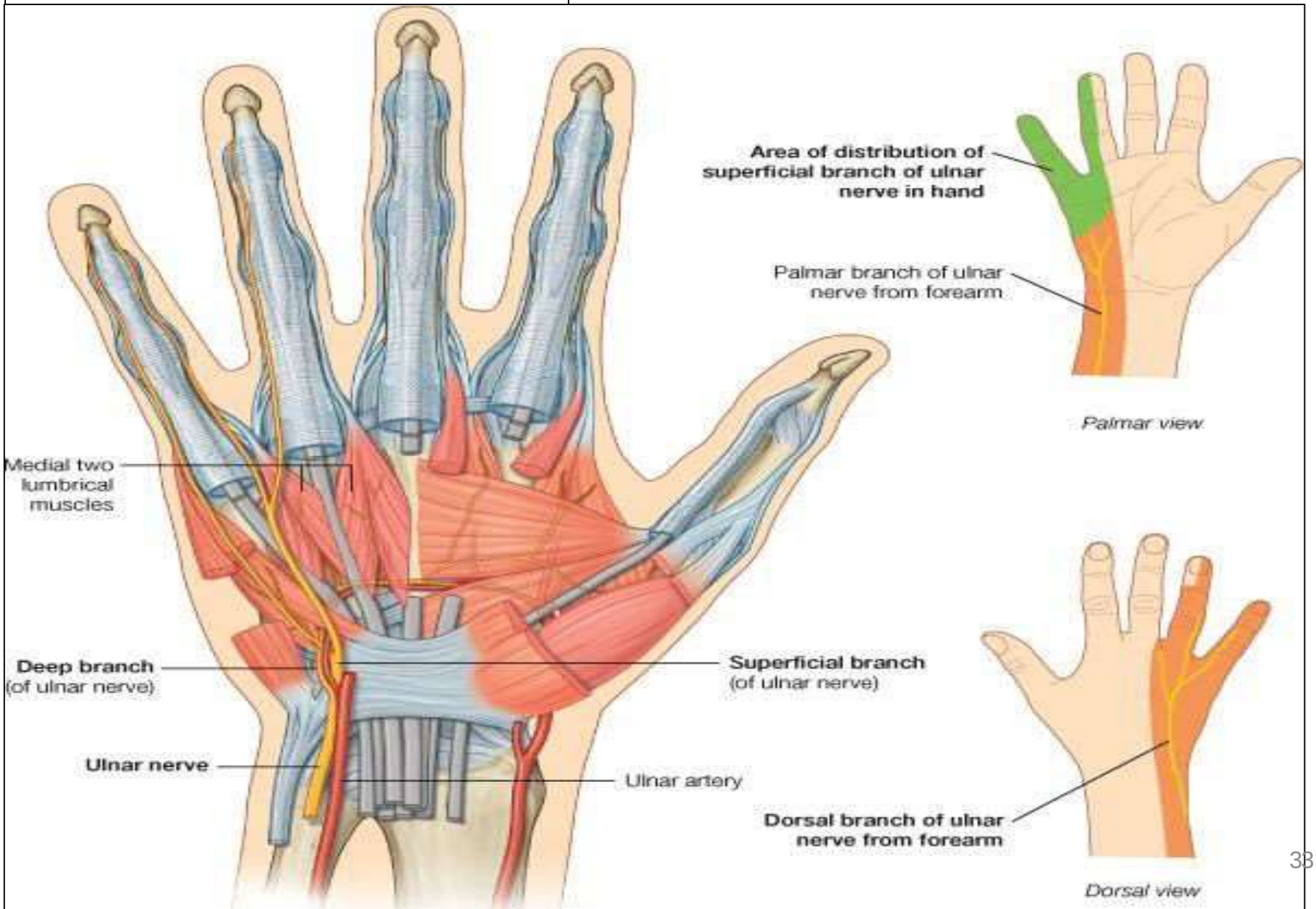
Ulnar nerve in Forearm



- Flexor carpi ulnaris.
- Medial ½of FDP
- **Articular:** elbow joint.
- **Dorsal or posterior cutaneous branch:**
- Dorsal surface - **medial 1/3rd** of **hand 1½ fingers.**
- **Palmar cutaneous branch :** to supply skin of palm of hand and medial **1½ fingers.**

Ulnar nerve in Hand



Ulnar nerve in Hand

After it travels down the ulna, ulnar nerve enters the palm of the hand.

At the wrist, the ulnar nerve and artery lie in a canal formed by the pisiform bone medially and the hook of hamate laterally (Guyon's canal).

- In this region the nerve divides into two branches.
- The Superficial sensory Branch
- The Deep Motor Branch

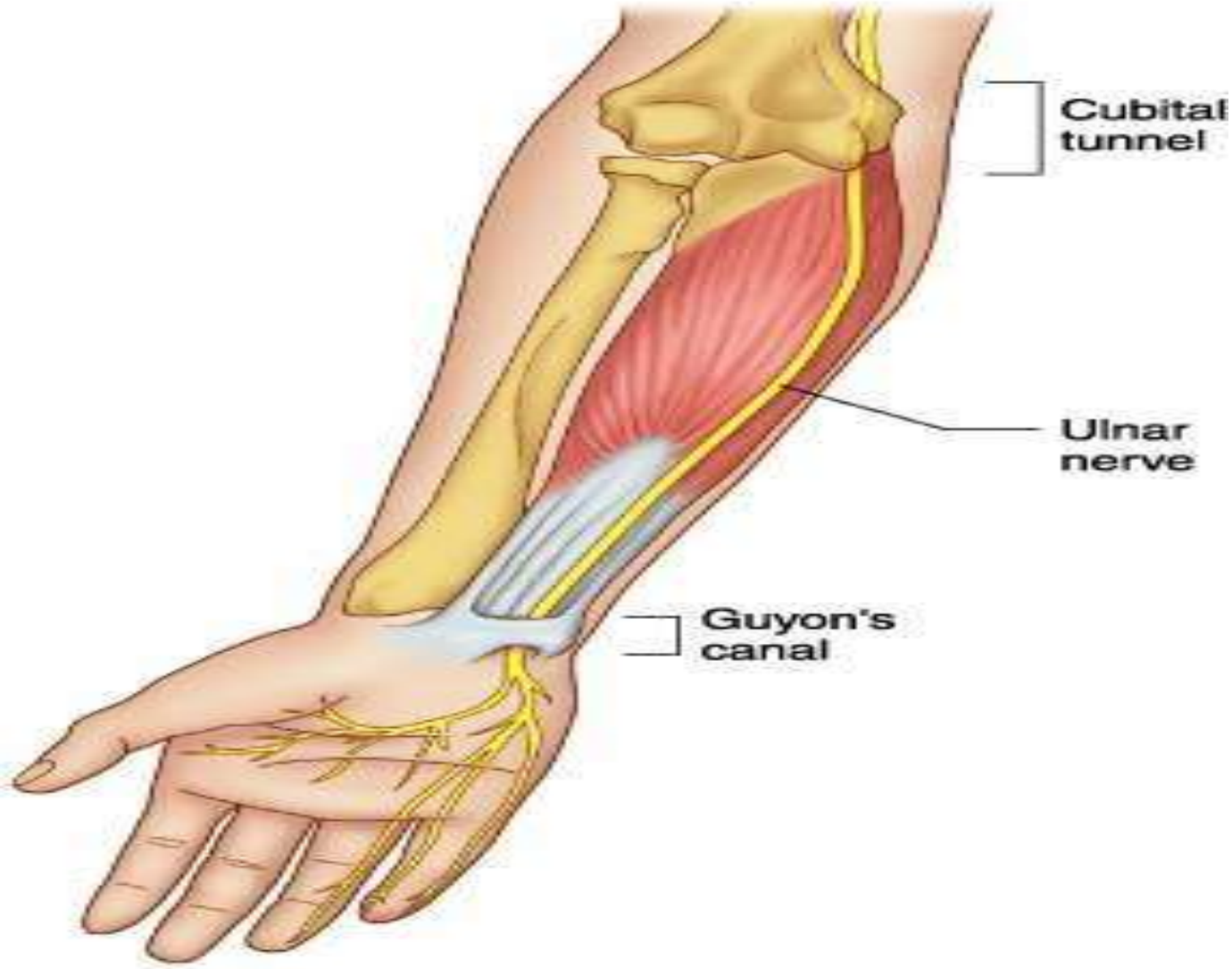
Ulnar nerve in Hand

The superficial branch is generally considered a sensory branch which supplies to distal palm, fifth and half of the fourth digit.

- It also supplies palmaris brevis, a thin muscle beneath the skin which cannot be studied electromyographically.

The deep branch gives off motor innervation to the hand muscles.

WRIST TO (MEDIAL) HAND

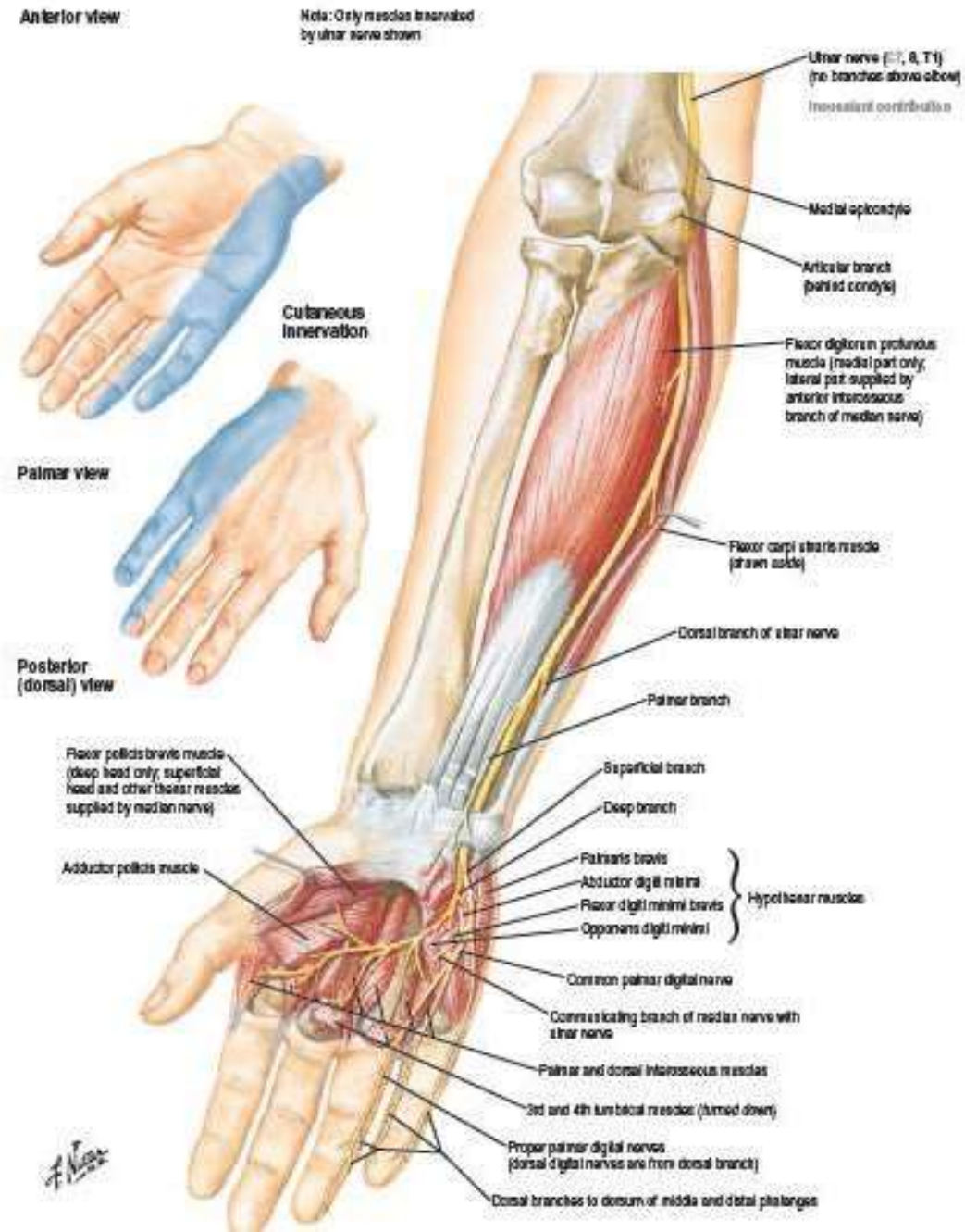


Ulnar nerve in Hand

Deep branch:

- Runs b/w abductor digiti minimi & flexor digiti minimi.
- pierces opponens digiti minimi.
- Then passes laterally within concavity of **deep palmar arch.**
- lies deep to flexor tendons.
- **It supplies 14 muscles :**
- **Three hypothenar muscles**.
- ***Adductor pollicis.***
- **All dorsal & palmar interossei.**
- **Medial 2 lumbricals.**

Ulnar Nerve


Anterior view
Note: Only muscles innervated by ulnar nerve shown
Ulnar nerve (C7, 8, T1) (no branches above elbow)
Innervation contribution
Medial epicondyle
Articular branch (behind condyle)
Cutaneous innervation
Flexor digitorum profundus muscle (medial part only; lateral part supplied by anterior interosseous branch of median nerve)
Palmar view
Flexor carpi ulnaris muscle (drawn aside)
Dorsal branch of ulnar nerve
Posterior (dorsal) view
Palmar branch
Flexor pollicis brevis muscle (deep head only; superficial head and other thenar muscles supplied by median nerve)
Superficial branch
Deep branch
Palmaris brevis
Abductor digiti minimi
Flexor digiti minimi brevis
Opponens digiti minimi
Hypothenar muscles
Adductor pollicis muscle
Common palmar digital nerve
Communicating branch of median nerve with ulnar nerve
Palmar and dorsal interosseous muscles
3rd and 4th lumbrical muscles (turned down)
Proper palmar digital nerves (dorsal digital nerves are from dorsal branch)
Dorsal branches to dorsum of middle and distal phalanges

- BRANCHES:

Muscular

FCU, FDP (medial half), palmaris brevis, hypothenar muscles, medial 2 lumbricals, all palmar & dorsal interossei , thumb intrinsics medial to FPL {adductor pollicis , flexor pollicis brevis (deep head)}

Cutaneous

- palmar cutaneous supply to hypothenar eminence
- Dorsal cutaneous supply dorsum of hand (medial part), dorsum of little finger , part of dorsum of ring finger.

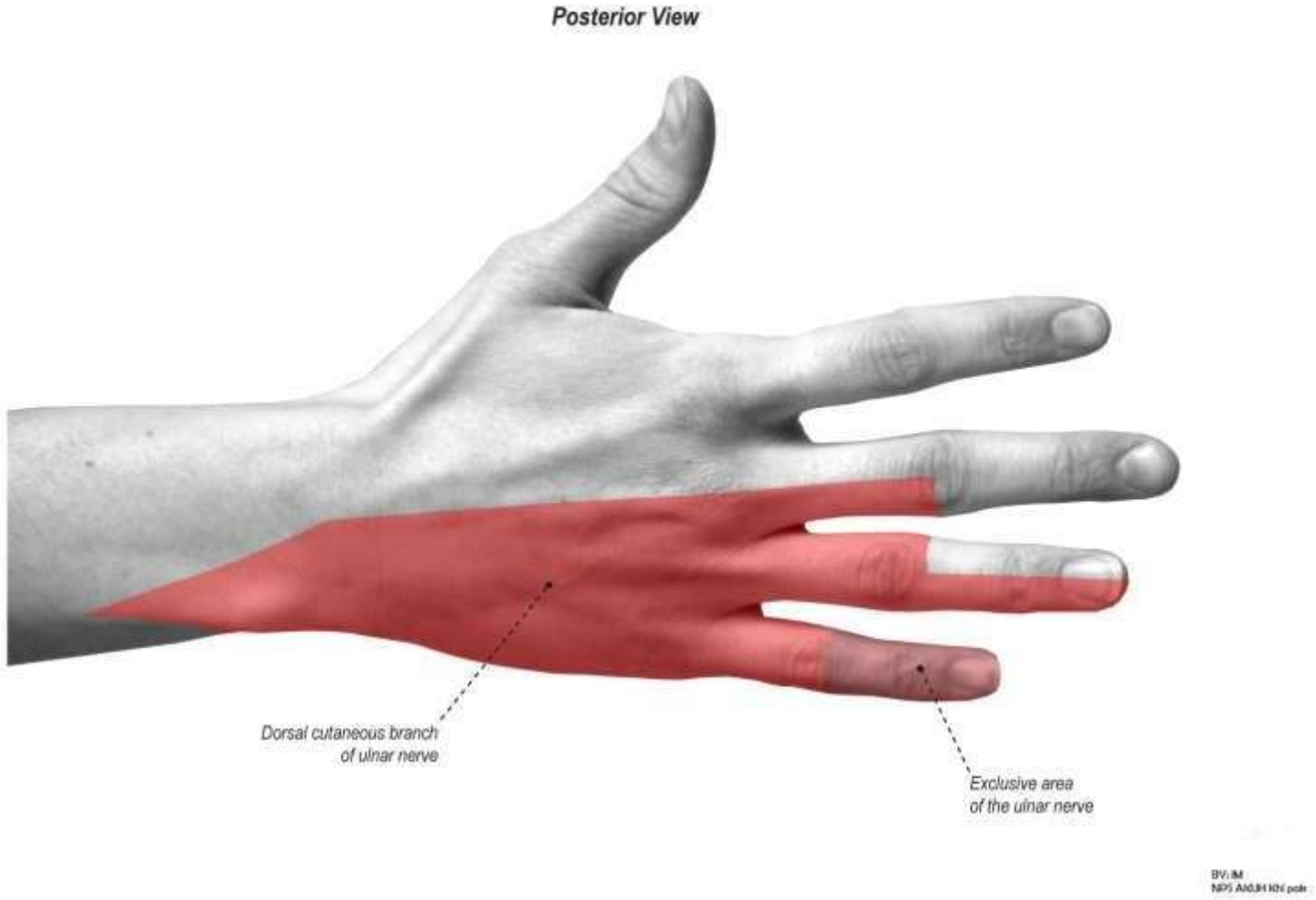
Digital

- forms the main sensory branches to the ring and little finger

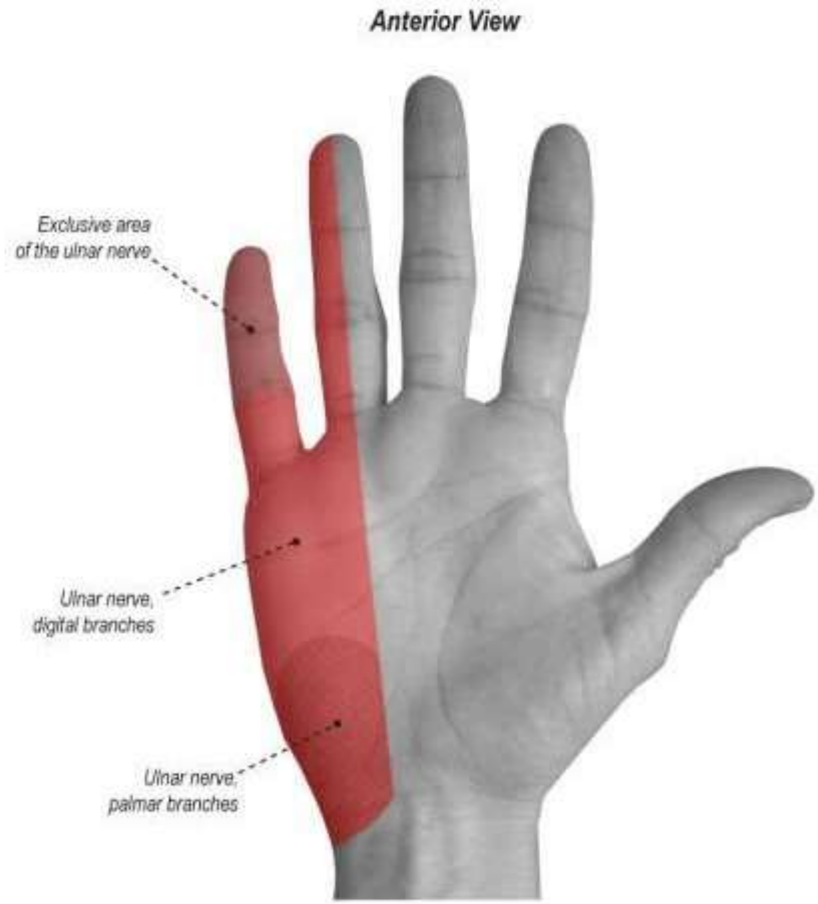
Vascular & Articular

No branches above elbow

DORSAL CUTANEOUS BRANCH



PALMAR CUTANEOUS BRANCH



Guyon Canal or Tunnel

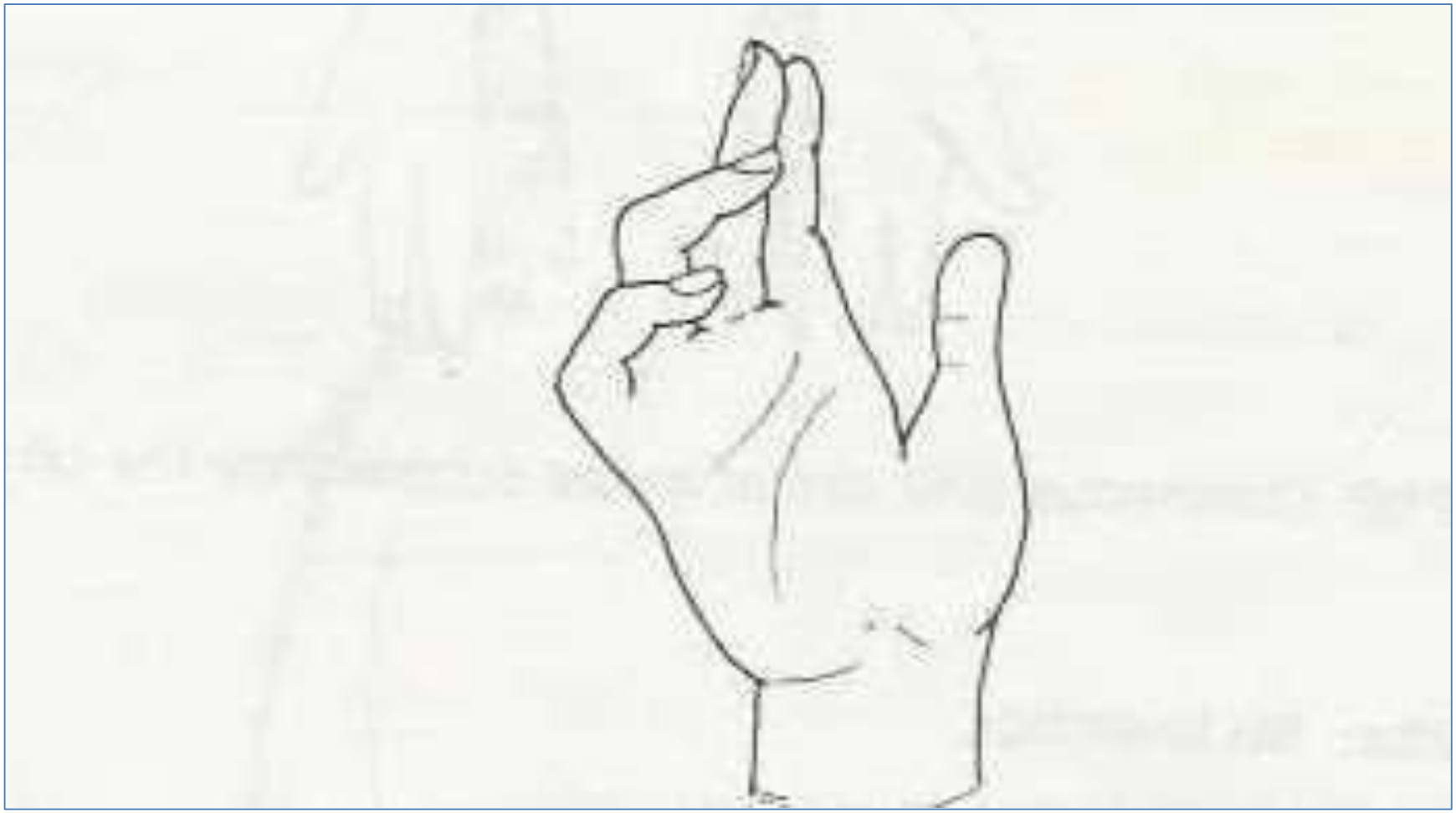
Semi-rigid longitudinal canal in the wrist that allows passage of the ulnar artery and ulnar nerve into the hand.

Roof of the canal -superficial palmar carpal ligament, deeper flexor retinaculum and hypothenar muscles comprise the floor.
The space is medially bounded by the pisiform and pisohamate ligament more proximally, and laterally bounded by the hook of the hamate more distally.It is approximately 4 cm long, beginning proximally at the transverse carpal ligament and ending at the aponeurotic arch of the hypothenar muscles.


Guyon's
Canal
Zone 3
Sensory branch
Zone 2
Motor branch
Zone 1
Ulnar nerve
Pisiform
Hamate

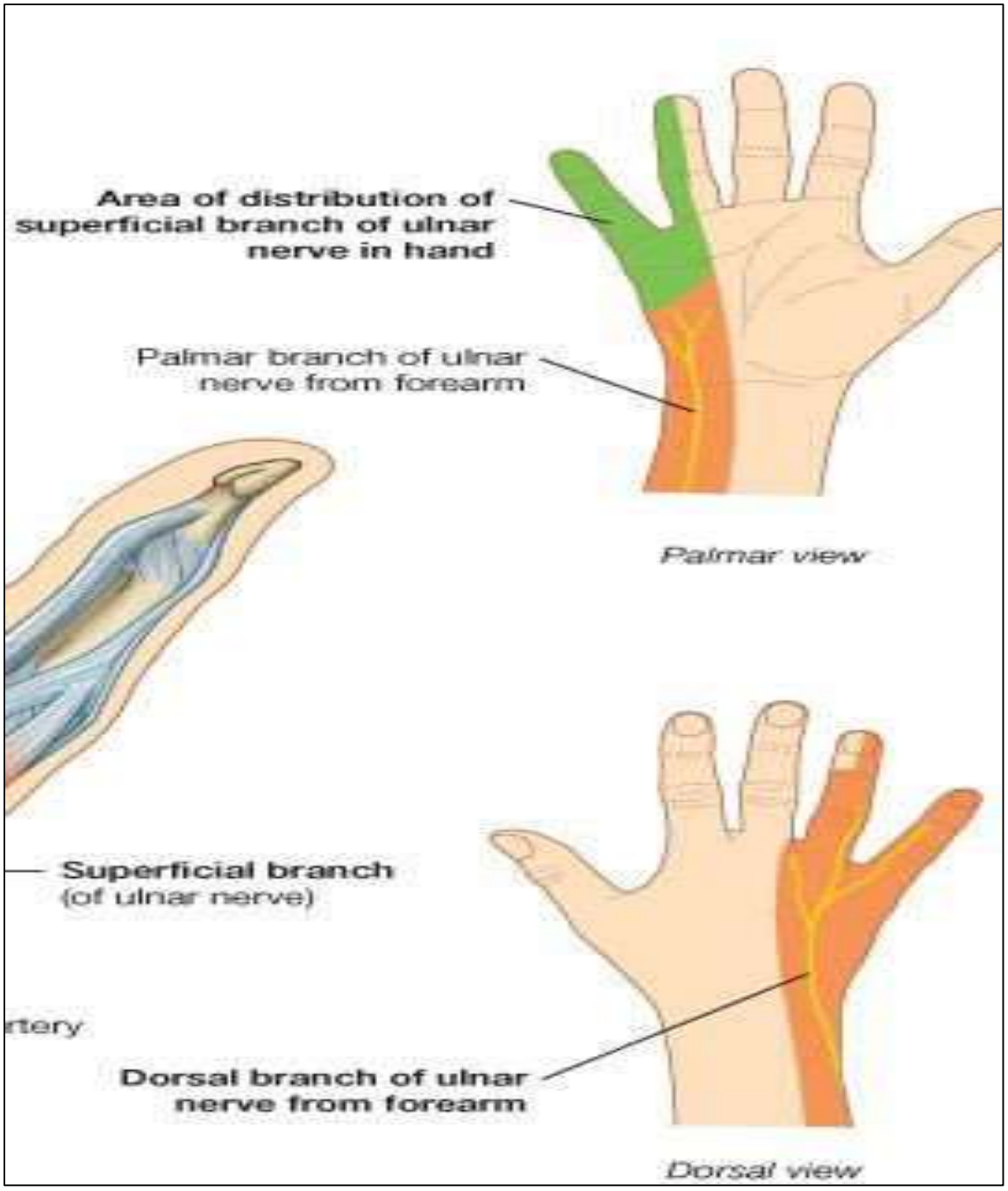
- Martin-Gruber anastomosis: a median-ulnar communication.
  - the crossing of fibers from the median to the ulnar nerve usually occurs 3 to 10 cm distal to the medial humeral epicondyle.
  - median fibers ultimately innervate the intrinsic hand muscles.
  - The overall incidence of Martin-Gruber anastomoses is approximately 17%.

Lesion of ulnar nerve above elbow - atrophy of hypothenar muscles



Lesion of ulnar nerve above elbow

- Weakness of flexion at wrist → paralysis of FCU
- Loss of flexion of terminal phalanges of ring & little fingers → paralysis of medial ½ of FDP
- Paralysis of all interossei & medial 2 lumbricals (3rd & 4th).
- Characteristic deformity is - partial claw hand.
- Atrophy of hypothenar muscles.
- Fingers - hyperextended at metacarpophalangeal joints & flexed at interphalangeal joints - ring & little finger.
- Loss of adduction of hand & thumb due to paralysis of flexor carpi ulnaris & adductor pollicis.



Lesion of ulnar nerve above elbow - Loss of cutaneous sensations on front & dorsum of medial 1/3 of hand+ medial 1 ½fingers.

Lesion of ulnar nerve above wrist

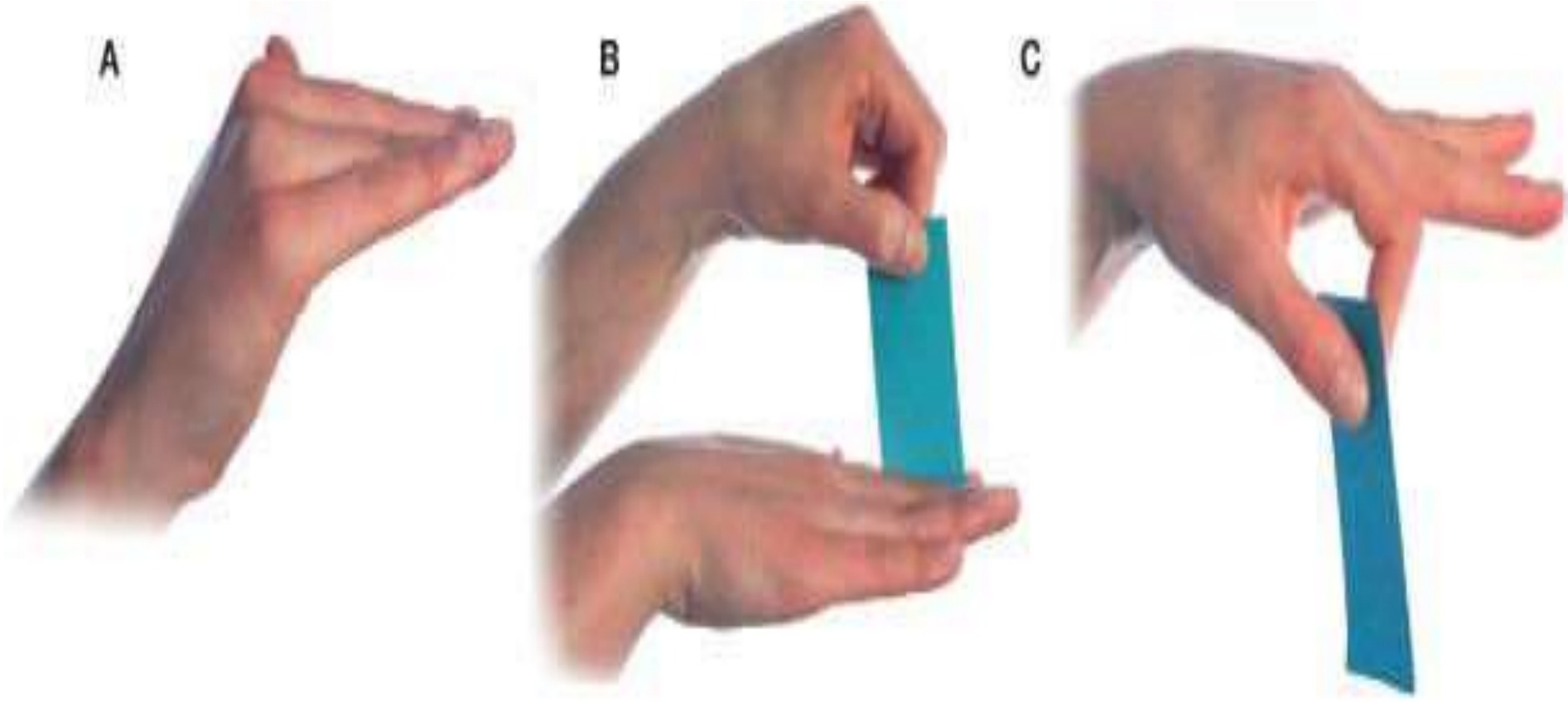
- **It leads to paralysis of intrinsic muscles of hand as described above.**
- **deformity 'claw hand'**
- **Loss of cutaneous sensations of medial 1 ½ fingers.**

Test for Palmar interossei for adduction of fingers.

Test for adductor & opponens pollicis.

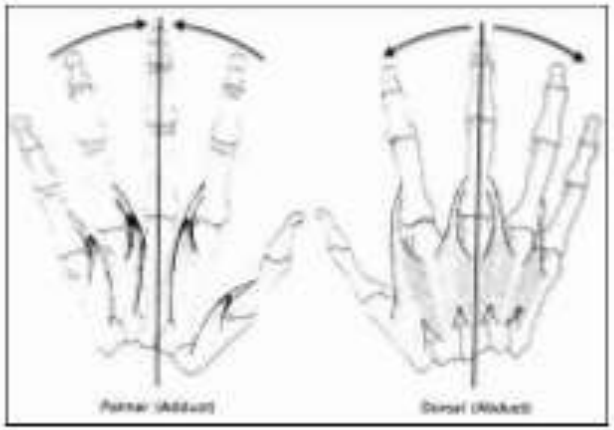
Test for Palmar interossei for adduction of fingers.

Test for adductor & opponens pollicis.



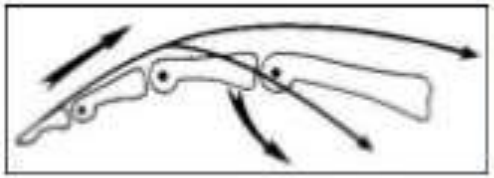
Ulnar nerve

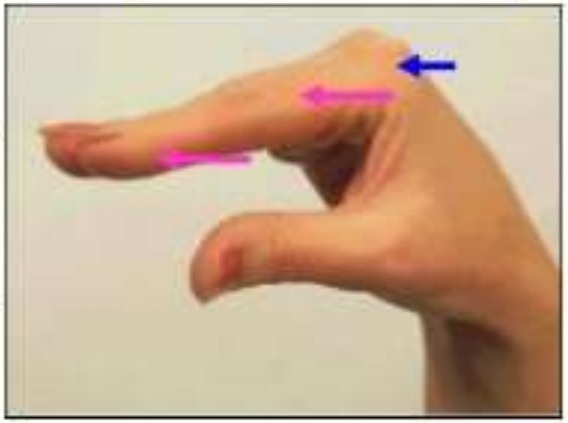
- **Action of interossei**
- Palmar ADduct – Dorsal Abduct (PAD & DAB)
- **Testing**:
  - Palmar interossei: adducting the fingers against a piece of paper
  - Dorsal interossei: Resisted abduction of fingers.
- **Action of interossei and lumbricals:**
  - Flexion of metacarpo-phalangeal joints and Extension of inter-phalangeal joints.
  - Act through the extensor expansion.



Testing palmar interossei

Testing dorsal interossei





Ulnar Nerve Injuries

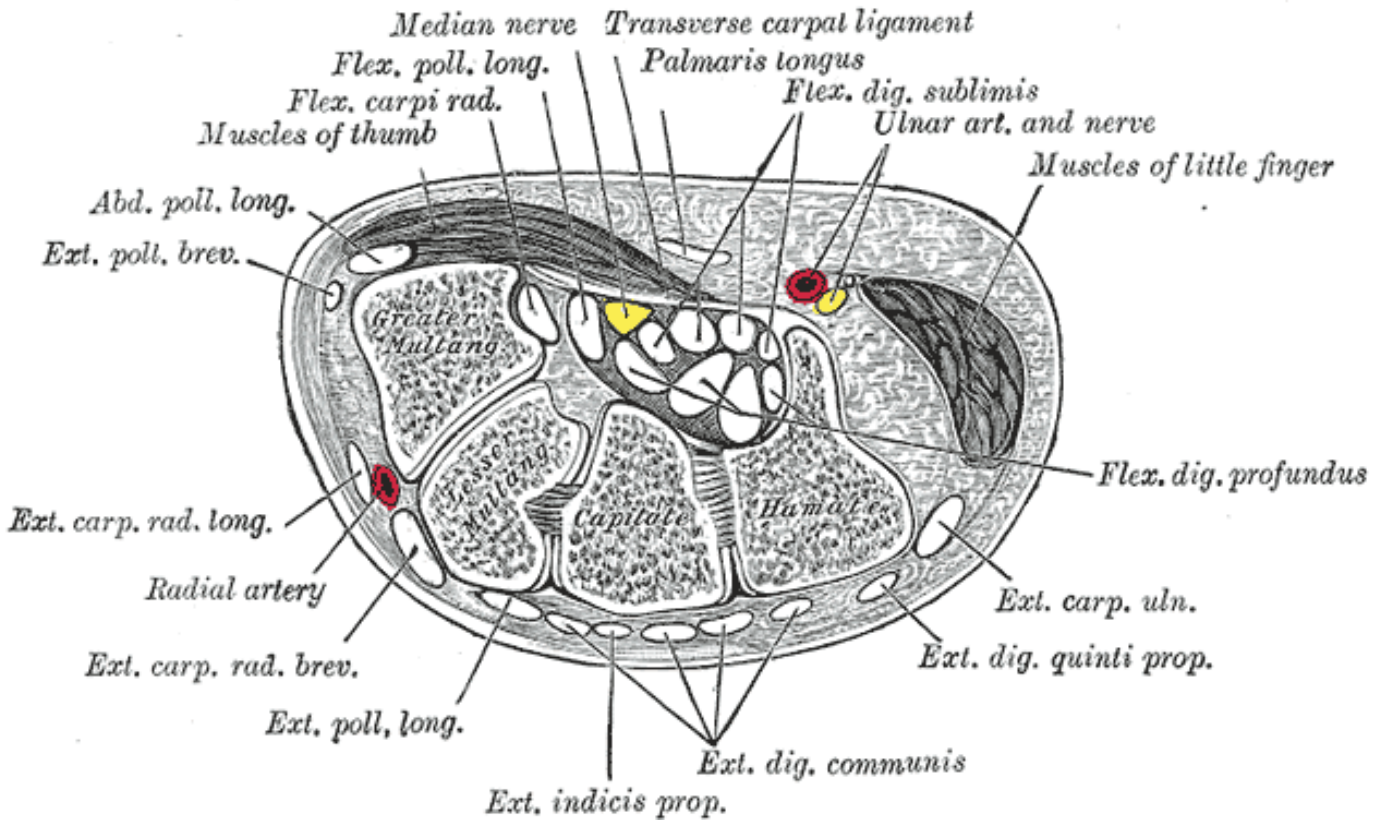
most commonly injured @

At elbow

where it lies behind the medial epicondyle usually associated with fracture

At wrist

where culum.



Injuries to the Ulnar Nerve at the Elbow

CUBITAL TUNNEL SYNDROME (2ND most common)

Motor

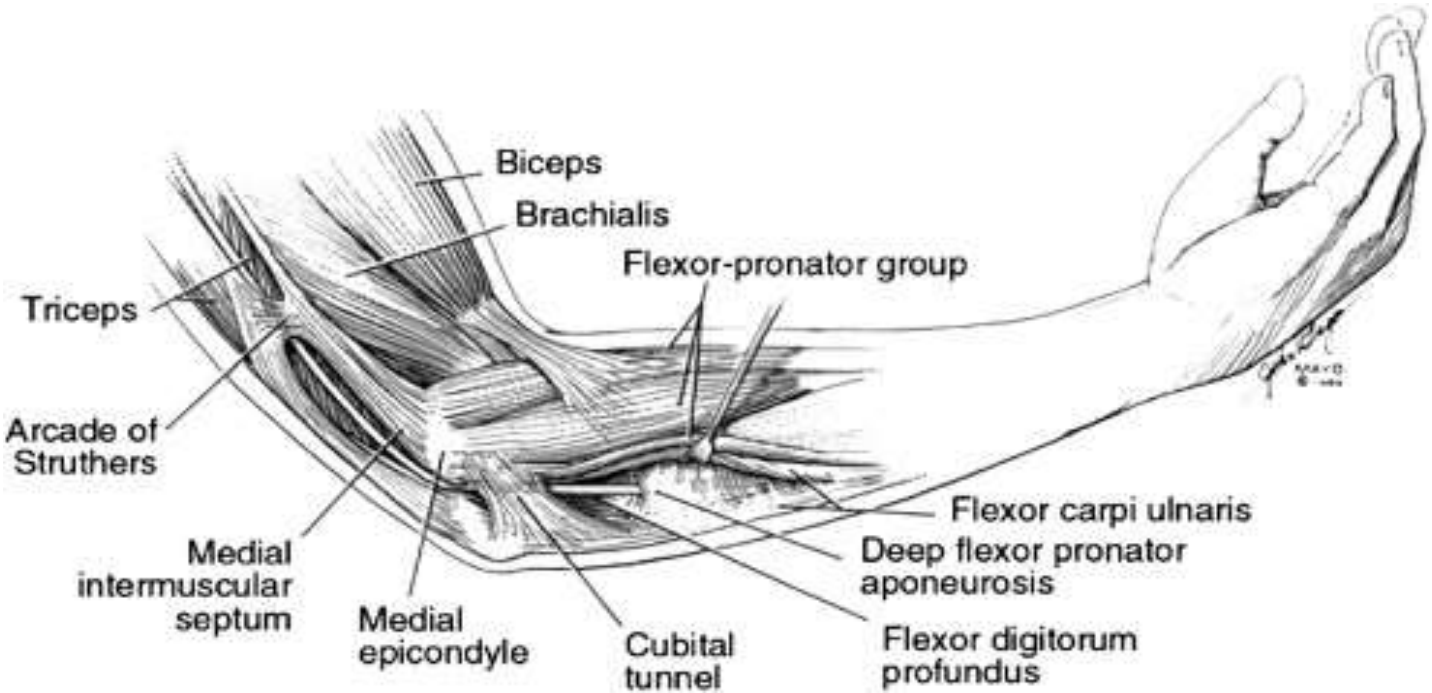
Flexor carpi ulnaris & medial half of flexor digitorum profundus
ring & little fingers

No flexion of the terminal phalanges of the ring & little fingers

Flexion of wrist = abduction paralysis of flexor carpi ulnaris

medial border of the front of the forearm flattned/wasted

All the small muscles of the hand paralyzed EXCEPT ?



Injuries to the Ulnar Nerve @ the Elbow

Motor

Extensor digitorum can abduct the fingers to a small extent when metacarpophalangeal joints are hyperextended

Impossible to **adduct the thumb** adductor pollicis paralyzed

Froment's sign

Grip a piece of paper between the thumb and index fingers

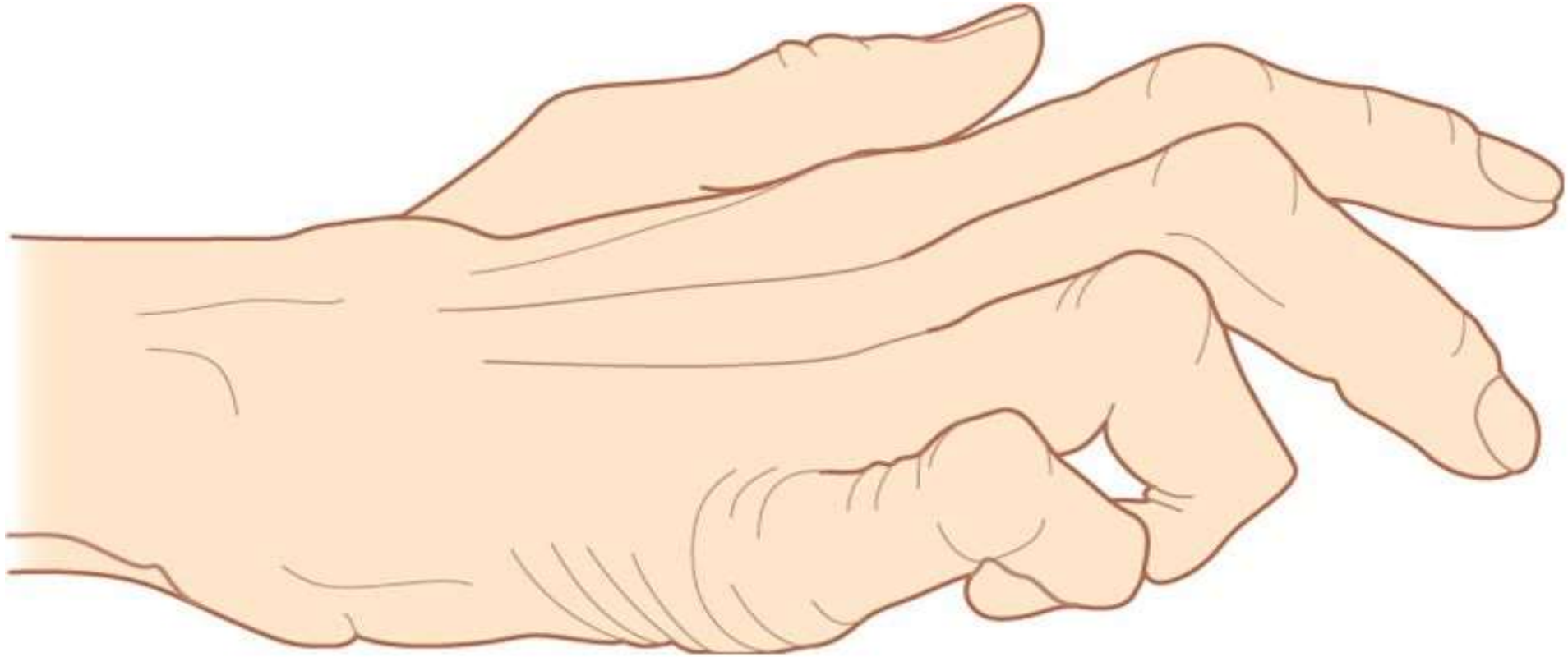
Froment sign: The patient is asked to hold the paper between the thumb and index finger. (*A*) With the intact ulnar nerve, the patient is able to make use of the adductor pollicis. (*B*) When the ulnar nerve is deficient, the patient compensates for the denervated adductor by using the flexor pollicis longus (median nerve innervated).

Injuries to the Ulnar Nerve @ the Elbow

Motor

2 medial lumbricals & interossei Hyperextended metacarpophalangeal joints
Flexed interphalangeal joints
fourth & fifth fingers

"claw" deformity main en griffe



Injuries to the Ulnar Nerve @ the Elbow

Motor

Flattening of hypothenar eminence

Loss of the convex curve to the medial border of the hand

Hollowing between metacarpal bones @ dorsum of the hand

wasting of dorsal interossei

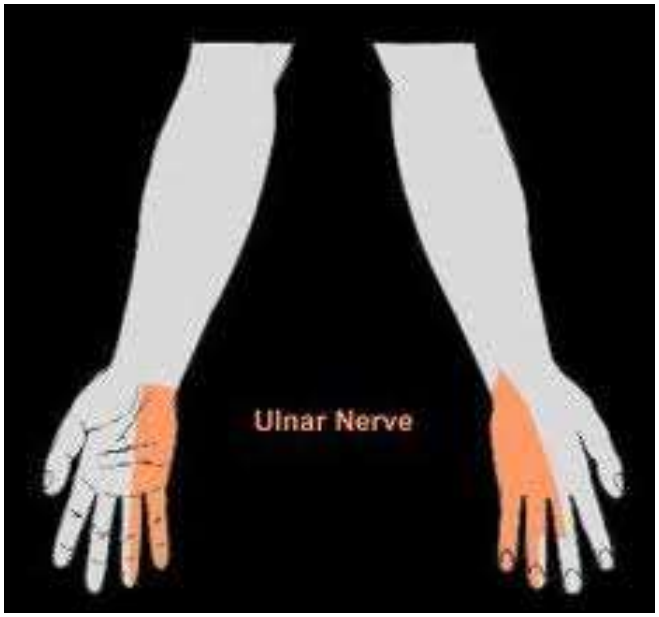
Injuries to the Ulnar Nerve @ the Elbow

Sensory

Loss of skin sensation

anterior & posterior surfaces of medial 1/3 of the hand

medial 1 ½ fingers



Vasomotor Changes

warmer and drier skin area

arteriolar dilatation and absence of sweating /loss of sympathetic control

Injuries to the Ulnar Nerve @ the Wrist

Motor

Small hand muscles paralyzed, wasted – EXCEPT 3 thenar @ first 2 lumbricals

Claw hand

More obvious

Flexor digitorum profundus intact

Marked flexion of the terminal phalanges

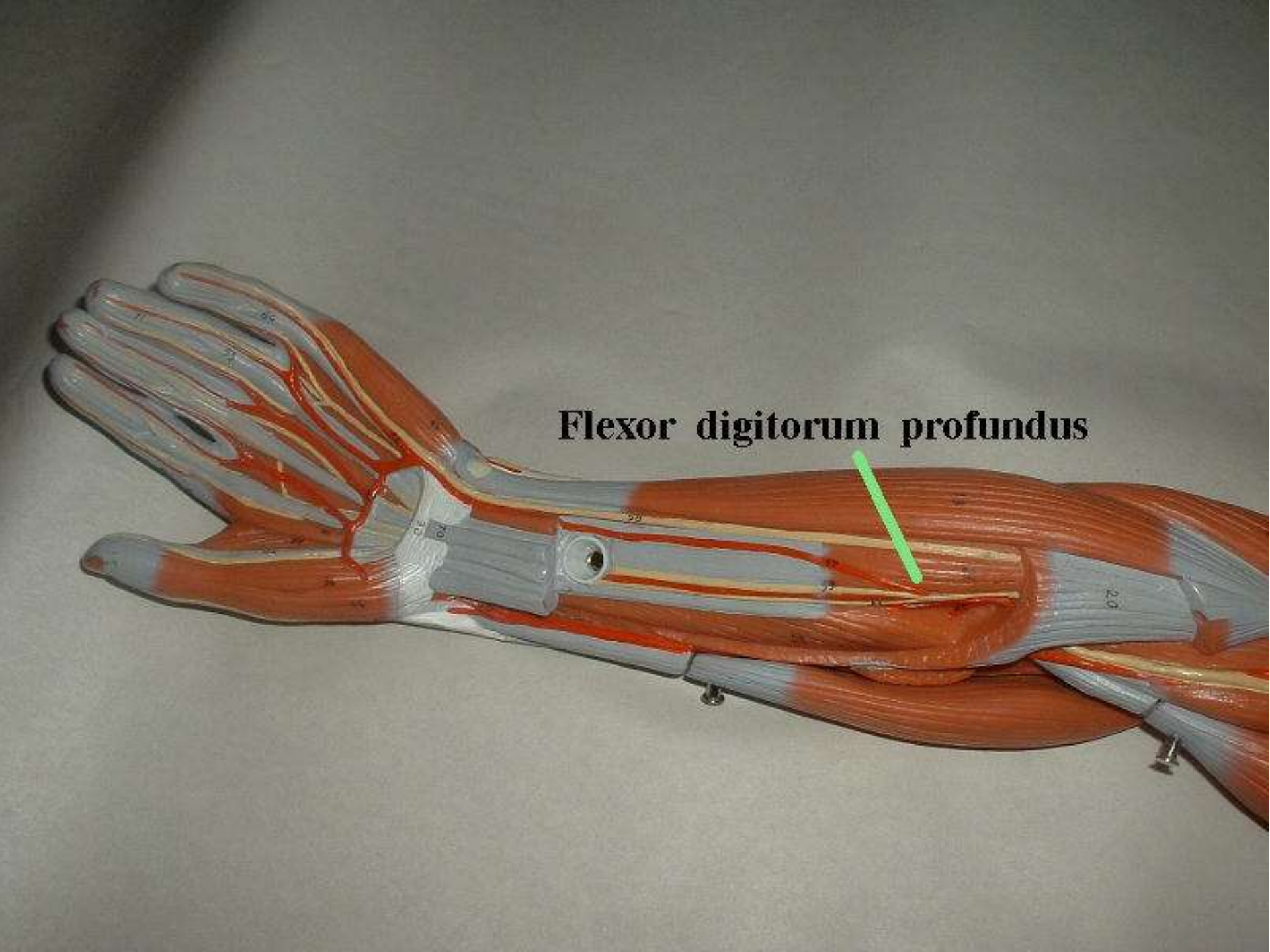
Ulnar paradox

Higher lesion

Less obvious claw deformity

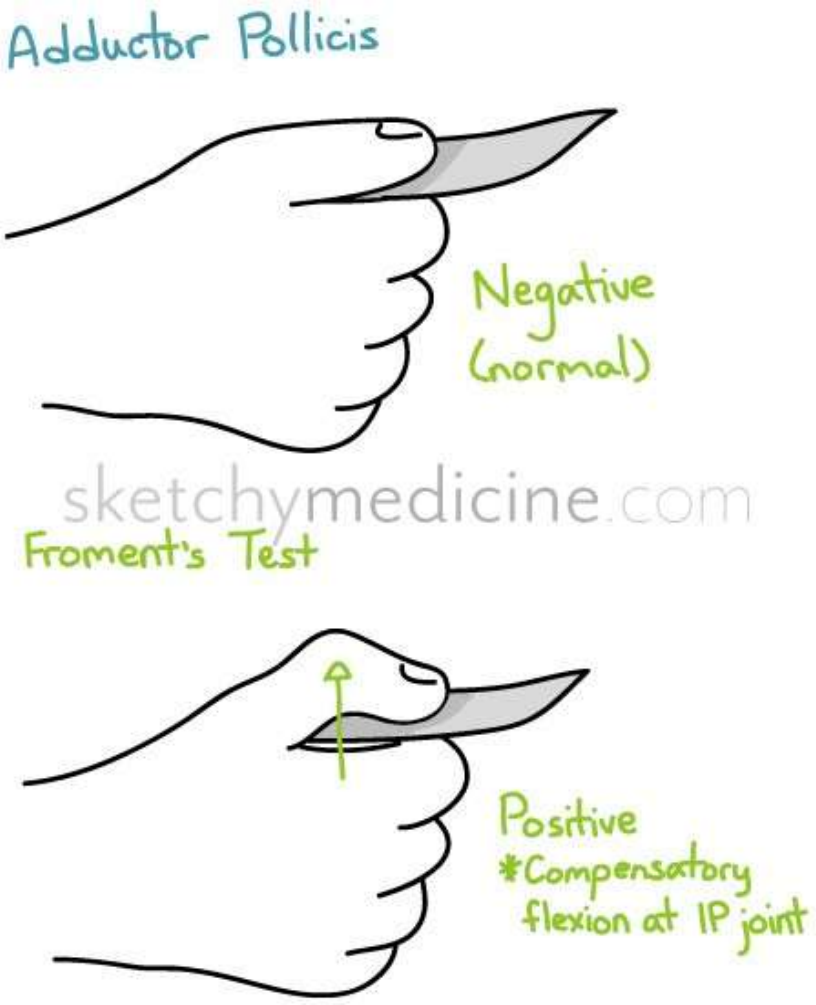
More proximal injury

Less claw


Flexor digitorum profundus

Froment's sign

To perform the test, a patient is asked to hold an object, usually a flat object such as a piece of paper, between their thumb and index finger (pinch grip). The examiner then attempts to pull the object out of the subject's hands.[2]



Froment's sign : hyperflexion of IP jt of thumb while attempting a lateral pinch(indicates paralysis of adductor pollicis, 1st DI , with replacement of pinch function by FPL)

Ulnar paradoxus

In proximal ulnar lesion (closer to the elbow), the Flexor Digitorum Profundus may also be denervated. As a result, flexion of the Interphalangeal joints is weakened, which reduces the claw-like appearance of the hand.

In distal lesion, at or below wrist
Condition of claw hand is worse because as FDP is spared ,there is active flexion of interphalangeal joint of medial two digits.This is called the **“ulnar paradox”** because one would normally expect a more debilitating injury to result in a more deformed appearance.

Some Facts

- At the back of medial epicondyle, ulnar nerve is lodged in a groove.
- Pressure on nerve at this site produce “ funny bone ,symptoms with tingling along hypothenar eminence and little finger

THANK
YOU