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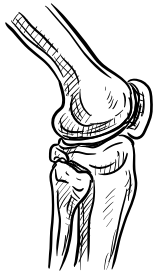

ANATOMY

FINAL | Lecture #4

Forearm: Flexors

وَإِن تَتَوَلَّوْا يَسْتَبْدِلْ قَوْمًا غَيْرَكُمْ ثُمَّ لَا يَكُونُوا أَمْثَالَكُم

اللهم استعملنا ولا تستبدلنا

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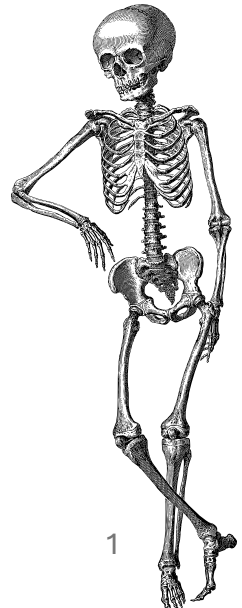

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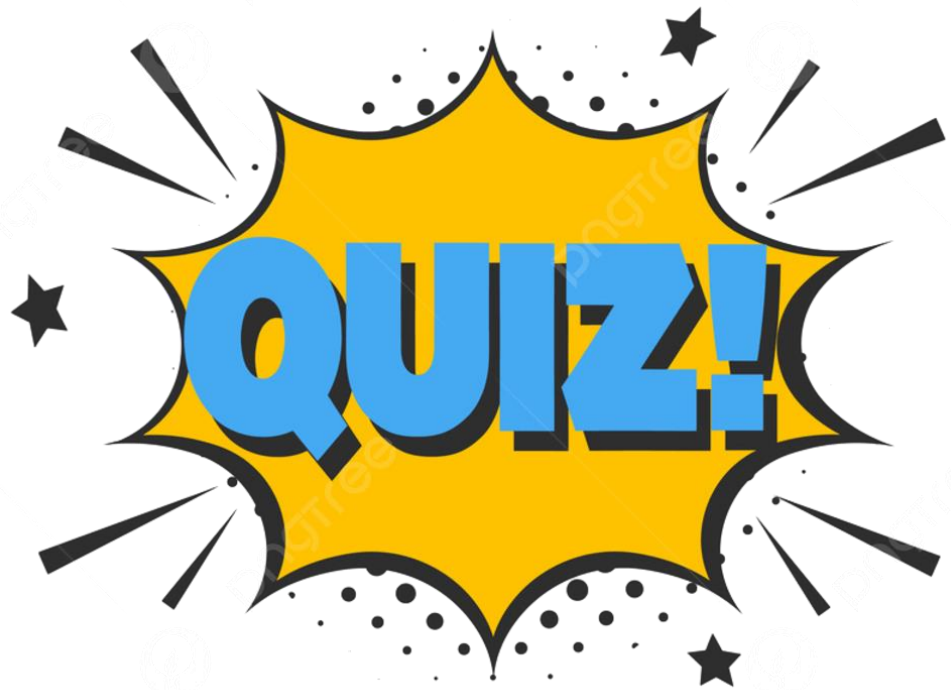
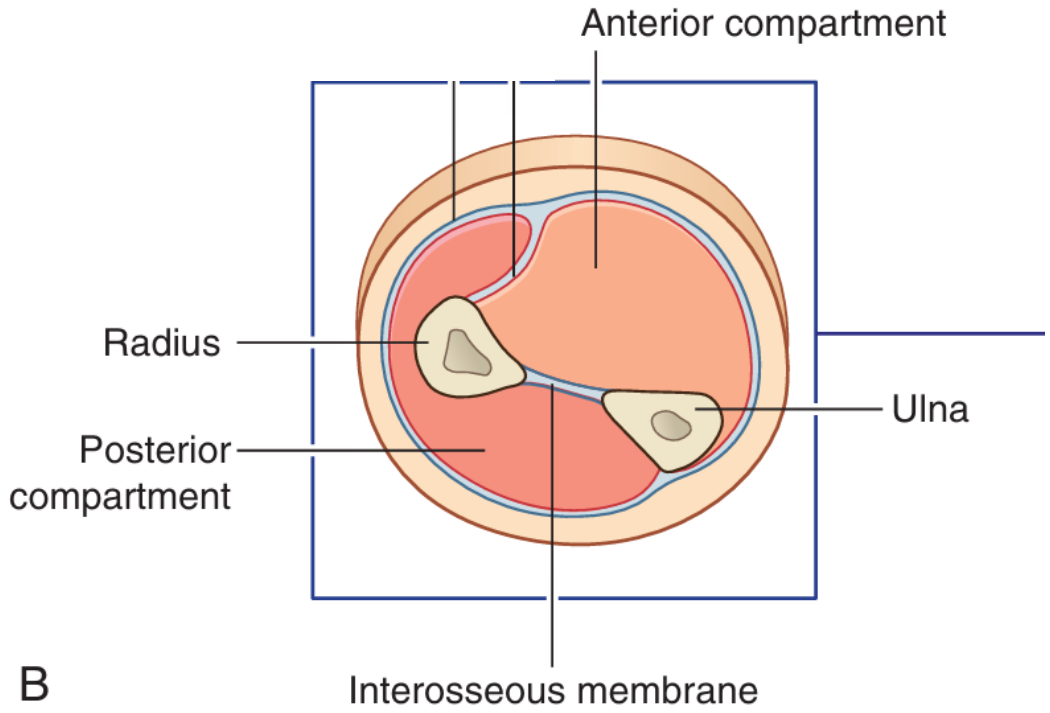

QUIZ!

The Forearm

Extends between the elbow joint and the wrist joint

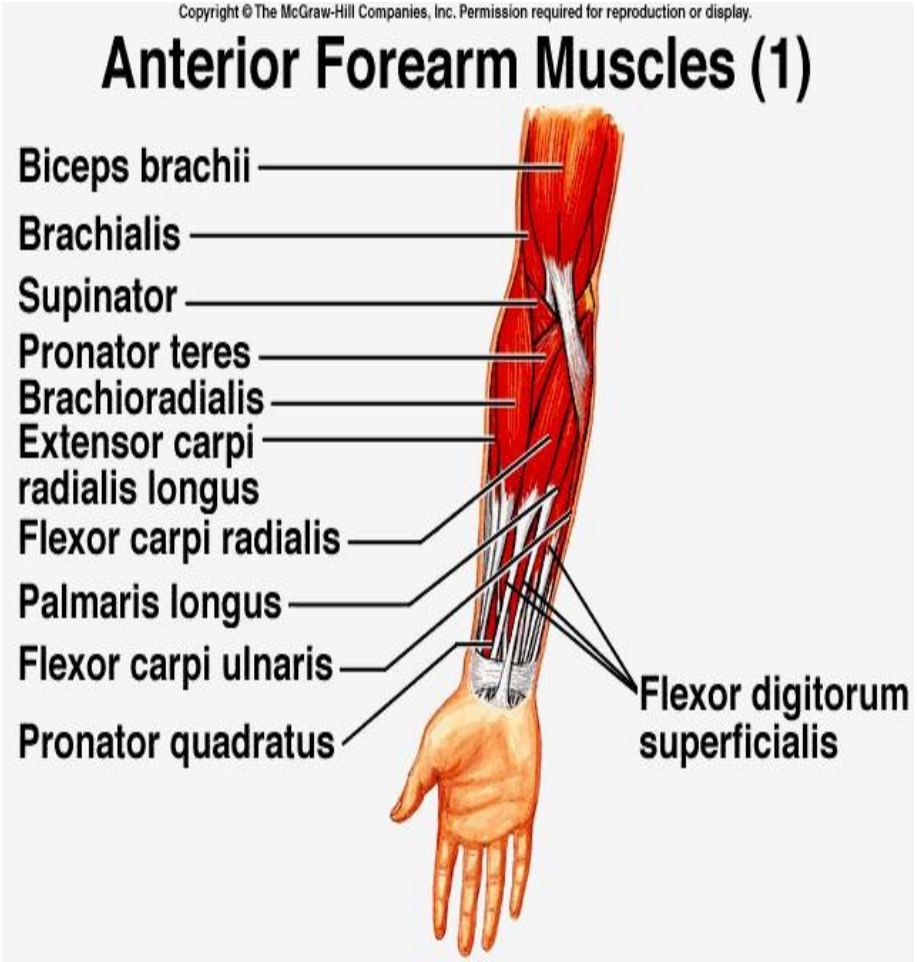
- The forearm contains two bones: the **Radius (laterally) and the Ulna (medially),** connected by the interosseous membrane.
- These three structures divide the forearm into anterior and posterior compartments.



The doctor informs that any nerve supplying a muscle (written in **bold**) is called the root value nerve of that muscle

Contents of the Anterior Fascial Compartment of the Forearm

- Muscles: A superficial group, consisting of the pronator teres, the flexor carpi radialis, the palmaris longus, and the flexor carpi ulnaris
- an intermediate group consisting of the flexor digitorum superficialis
- and a deep group consisting of the flexor pollicis longus, the flexor digitorum profundus, and the pronator quadratus
- Blood supply to the muscles: Ulnar and radial arteries
- Nerve supply to the muscles: All the muscles are supplied by the median nerve and its branches
- except the flexor carpi ulnaris and the medial part of the flexor digitorum profundus, which are supplied by the ulnar nerve



Contents of the Anterior Fascial Compartment of the Forearm

The anterior compartment is divided into three muscle groups:

1. **Superficial Group (Flexors)**
    1. Pronator teres
    2. Flexor carpi radialis
    3. Flexor carpi ulnaris
    4. Palmaris longus
2. **Middle (Intermediate) Group**
    1. Flexor digitorum superficialis
3. **Deep Group**
    1. Flexor pollicis longus (pollicis = thumb): flexes the thumb.
    2. Flexor digitorum profundus (profundus = deep): flexes 4 digits
    3. Pronator quadratus

Rules

Muscles called **radialis** perform abduction + flexion
Muscles called **ulnaris** perform adduction + flexion
Each Tendon passes in front of a joint flexes it
Nerves passing a joint innervate it

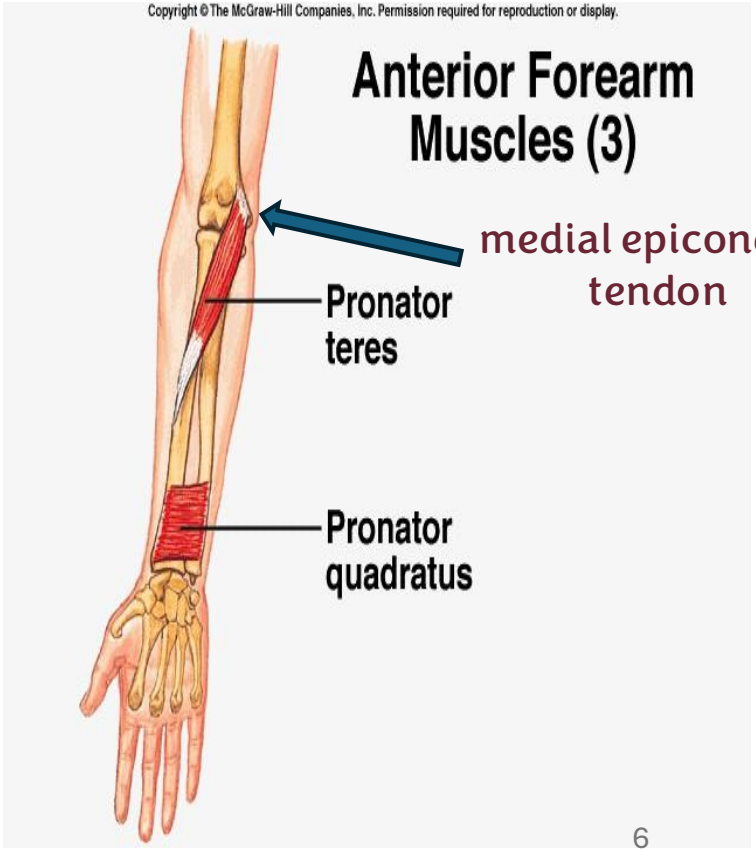
Superficial group

- the superficial group of muscles possesses a common tendon of origin, which is attached to the medial epicondyle of the humerus.
- The medial epicondyle serves as the **common tendon origin** for the flexor muscles of the forearm.

1. Pronator Teres

pronator teres video

- **Origin:**
  Humeral head: Medial epicondyle of humerus
  Ulnar head: Medial border of coronoid process of ulna.
- **Insertion:** middle Lateral aspect of shaft of radius
- **Nerve Supply:** Median nerve C6, **7**
  - Median nerve passes between the 2 heads
  - Median nerve origin from medial and lateral cord roots
- **Action:** Pronation and flexion of forearm



2. Flexor carpi radialis

flexor carpi radialis video

- Flexor carpi radialis
- Origin : Medial epicondyle of humerus
- Insertion: Bases of second and/**or** third metacarpal bones
- Nerve supply: Median nerveC6, **7**
- Action: Flexes and abducts hand at wrist joint

Sometimes this muscle is absent, not everyone has it.

3. Palmaris longus

palmaris longus video

- **Origin** : Medial epicondyle of humerus (Common tendon)
- **Insertion**: Flexor retinaculum (Deep fascia anterior to the wrist joint) and palmar aponeurosis (fibrous sheath on the palm of the hand)
- **Nerve supply**: Median nerveC7, 8
- **Action**: Flexes hand

This muscle is very important in surgery because its tendon can be used for tendon reconstruction. For example, the thumb is crucial for hand function. If the flexor pollicis longus tendon is ruptured, surgeons can replace it with the palmaris longus tendon.

4. Flexor Carpi Ulnaris

Flexor Carpi Ulnaris video

- **Origin** :

1. Humeral head (Medial epicondyle of humerus)
2. Ulnar head Medial aspect of olecranon process and posterior border of ulna

- **Insertion**: Pisiform bone, hook of the hamate, **base at fifth metacarpal bone**

- **Nerve supply**: Ulnar nerveC8; T1
  - Ulnar nerve is a branch of Medial cord of brachial plexus

- **Action**: Flexes and adducts hand at wrist joint

Flexor Digitorum Superficialis

Flexor Digitorum Superficialis video

Intermediate group Muscle of the anterior compartment of forearm

- Origin :

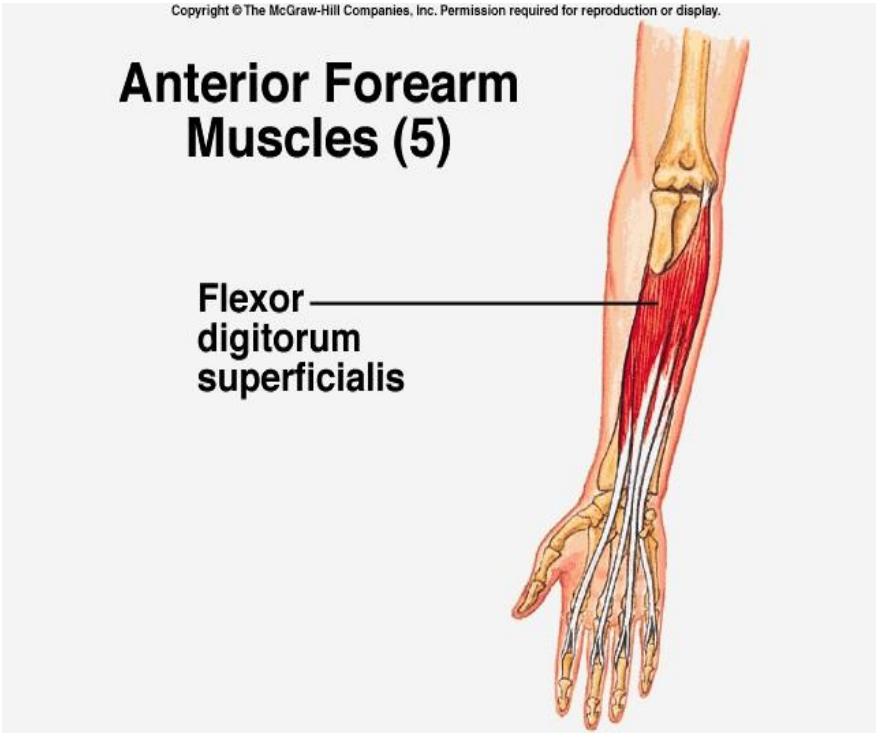
Common tendon

1. Humeroulnar head Medial epicondyle of humerus
2. medial border of coronoid process of ulna
3. Radial head Oblique line on anterior surface of shaft of radius

- Insertion: Middle phalanx of medial **four** fingers;

- Nerve supply: Median nerveC7, **8;** T1

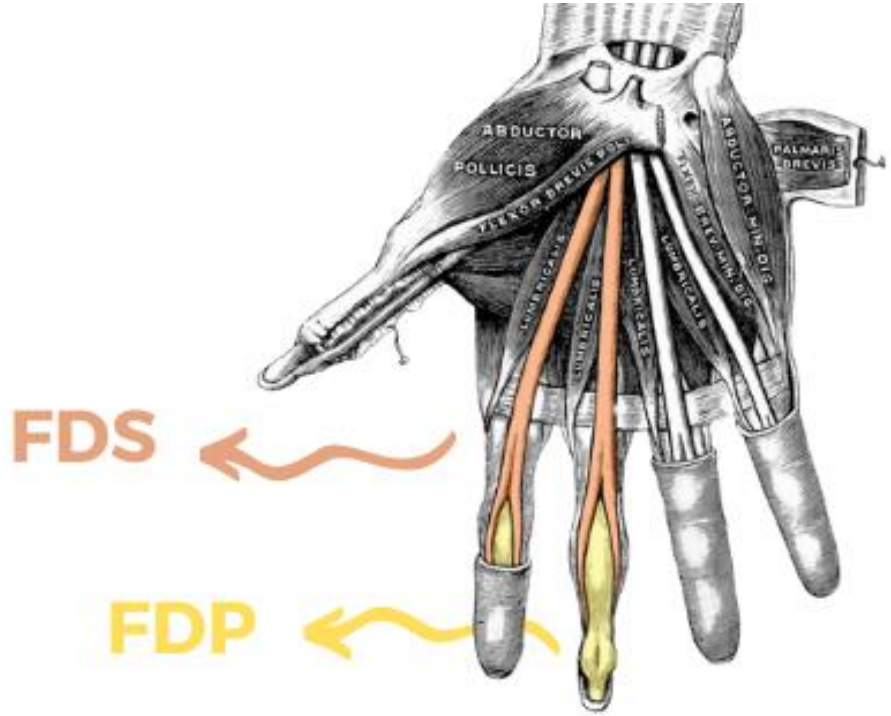
- Action: Flexes middle phalanx of fingers and assists in flexing proximal phalanx and hand



Recall the rule (Each Tendon passes in front of a joint flexes it).
As a result, Flexor Digitorum Superficialis Flexes 4 digits, metacarpophalangeal joints and wrist joint.

Flexor Digitorum Superficialis Insertion

- Insertion is constituted from 2 slips, to the side of the phalanx to ensure long profundus tendon to pass between them, which ends at the base of distal phalanx.



(FDP) → flexor digitorum profundus tendon
(FDS) → Flexor Digitorum Superficialis tendon

Deep group

1. Flexor pollicis longus

Flexor pollicis video

- Origin : Anterior surface of shaft of radius
- Insertion: Distal phalanx of thumb
- Nerve supply: Anterior interosseous branch of median nerve **C8;** T1
  - Follows the anterior surface of interosseous membrane.
  - supply deep muscles, pollicis longus and the lateral side of digitorum (index and middle fingers).
- Action: Flexes distal phalanx of thumb

2. Flexor digitorum profundus

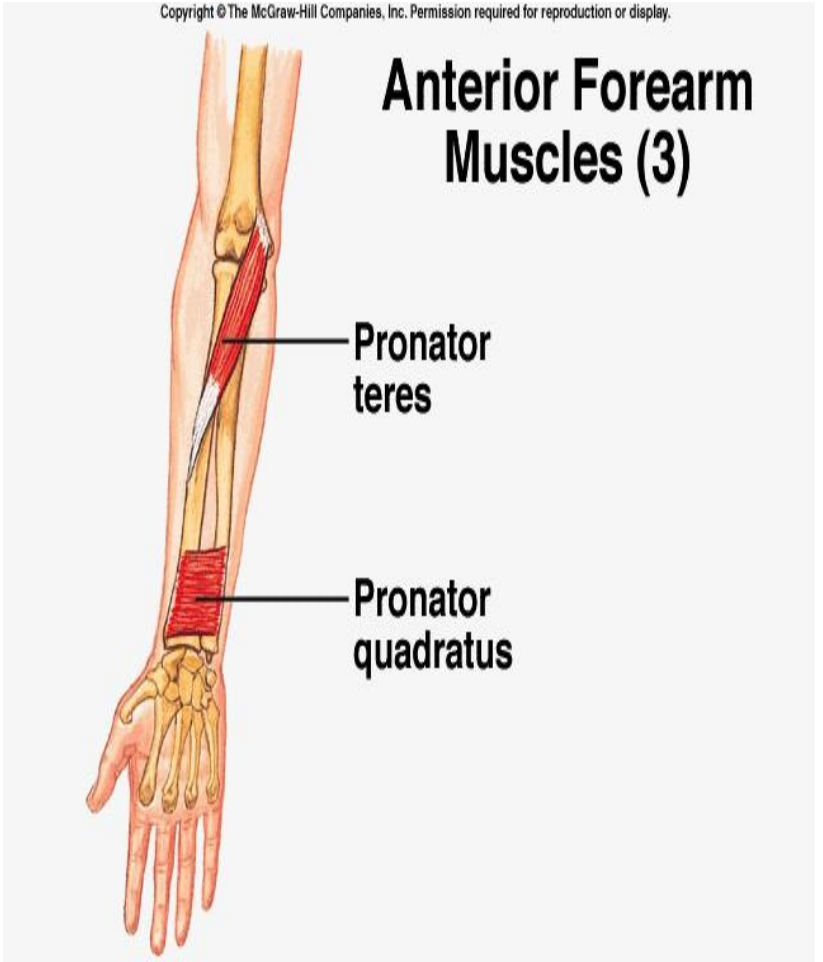
Flexor digitorum video

- Origin : Anteromedial surface of shaft of ulna **And part of interosseous membrane**
- Insertion: **Base of** Distal phalanges of medial four fingers, **Passes through the insertion of superficialis muscle.**
- Nerve supply: Ulnar (medial half, **ring and little fingers**) and median (lateral half, **index and middle fingers**) nerves **C8;** T1
- Action: Flexes distal phalanx of fingers; then assists in flexion of middle and proximal phalanges and wrist **Flexes the four digits.**

3. Pronator quadratus

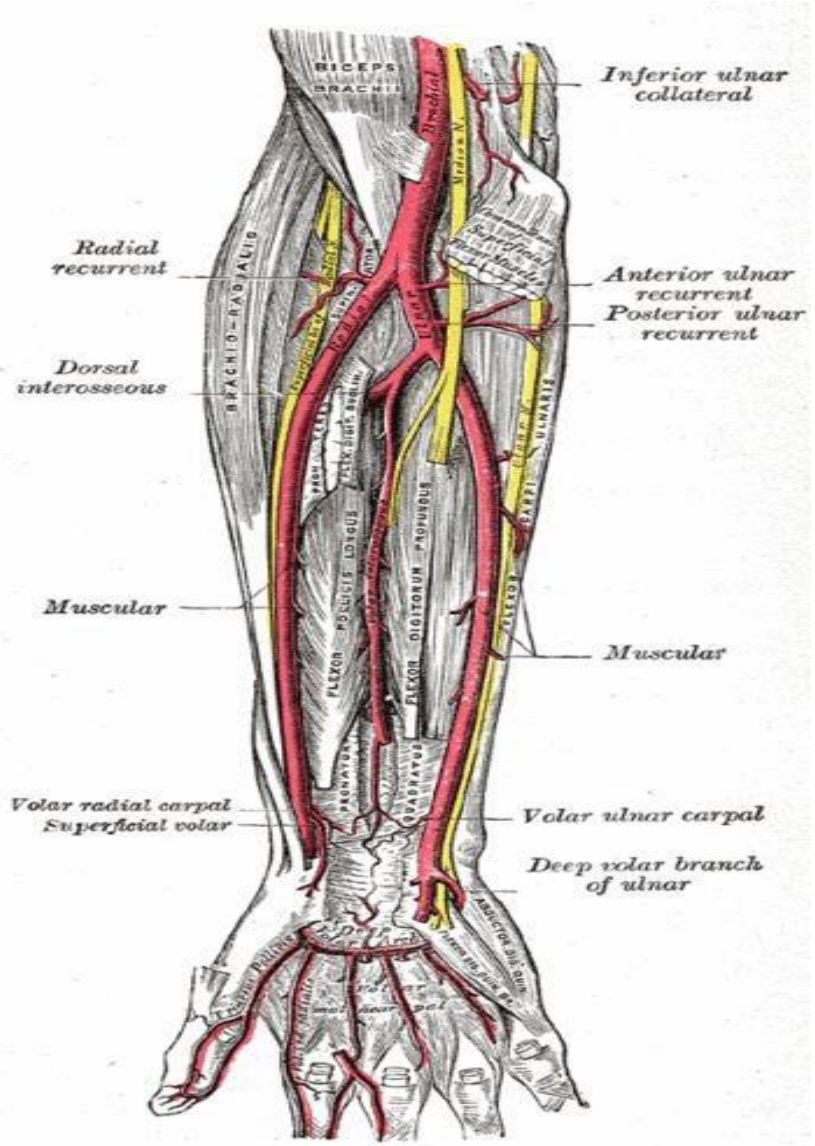
Pronator quadratus video

- Quadrate shape (square).
- Origin : Anterior surface of shaft of ulna
- Insertion: Anterior surface of shaft of radius
- Nerve supply: Anterior interosseous branch of median nerve **C8;** T1. Therefore, it is supplied by medial cord more than lateral cord.
- Action: Pronates forearm

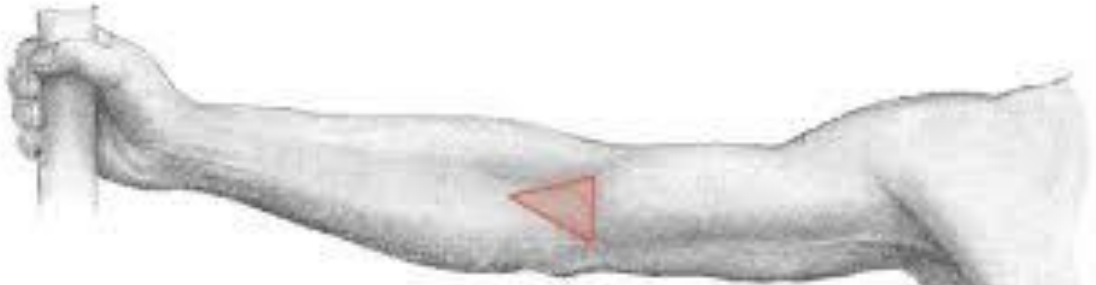


Ulnar artery

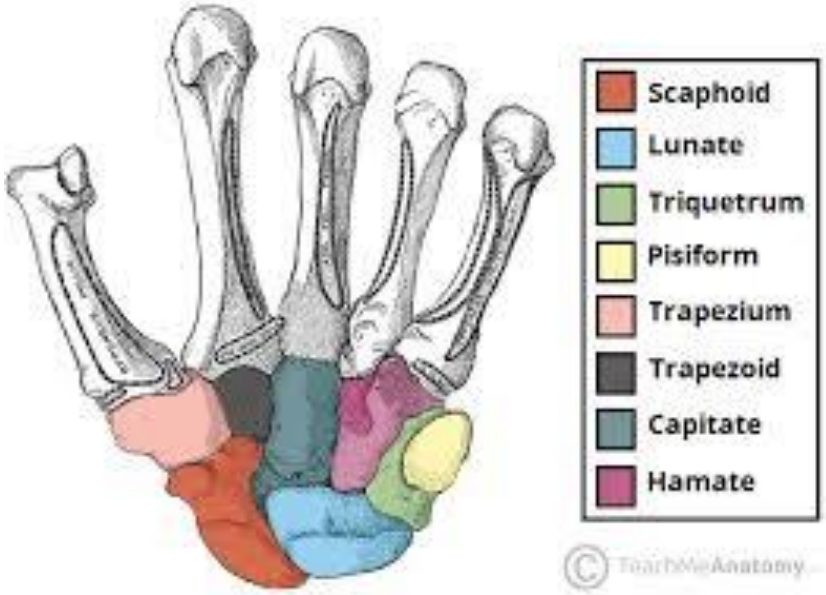
- The ulnar artery is the larger of the two terminal branches of the brachial artery
- It begins in the cubital fossa at the level of the neck of the radius
- descends through the anterior compartment of the forearm and enters the palm in front of the flexor retinaculum in company with the ulnar nerve
- It ends by forming the superficial palmar arch, often anastomosing with the superficial palmar branch of the radial artery



❖ Next slide preparation



Cubital fossa



flexor retinaculum:
is a fibrous connective tissue band that forms the anterior roof of the carpal tunnel

Ulnar artery

1. At the Cubital Fossa

- Brachial artery → bifurcates into **radial & ulnar arteries** at radial neck level.

2. Ulnar Artery Path

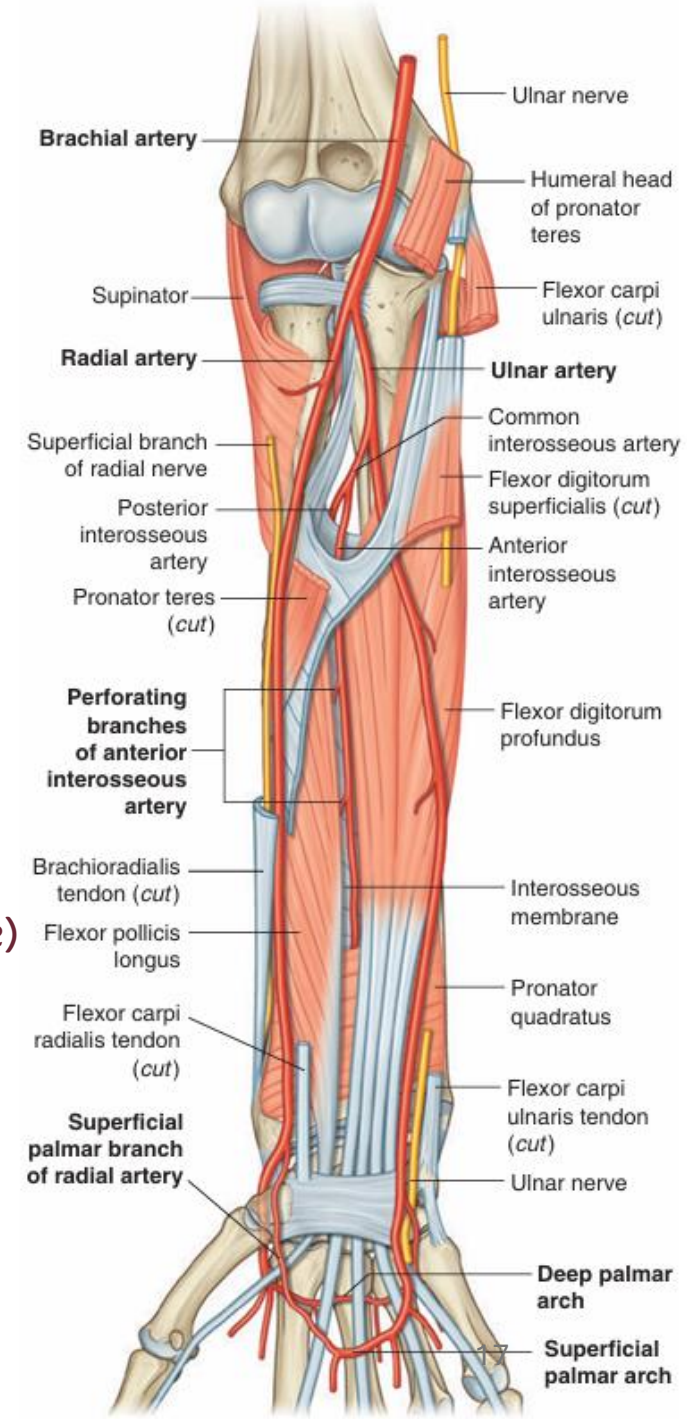
- Descends downward toward Ulna, when reaches carpals bone (pisiform) it goes along with the ulnar nerve superficial to flexor retinaculum.
- Forms **superficial palmar arch** (anastomoses with radial branch).

3. Branches

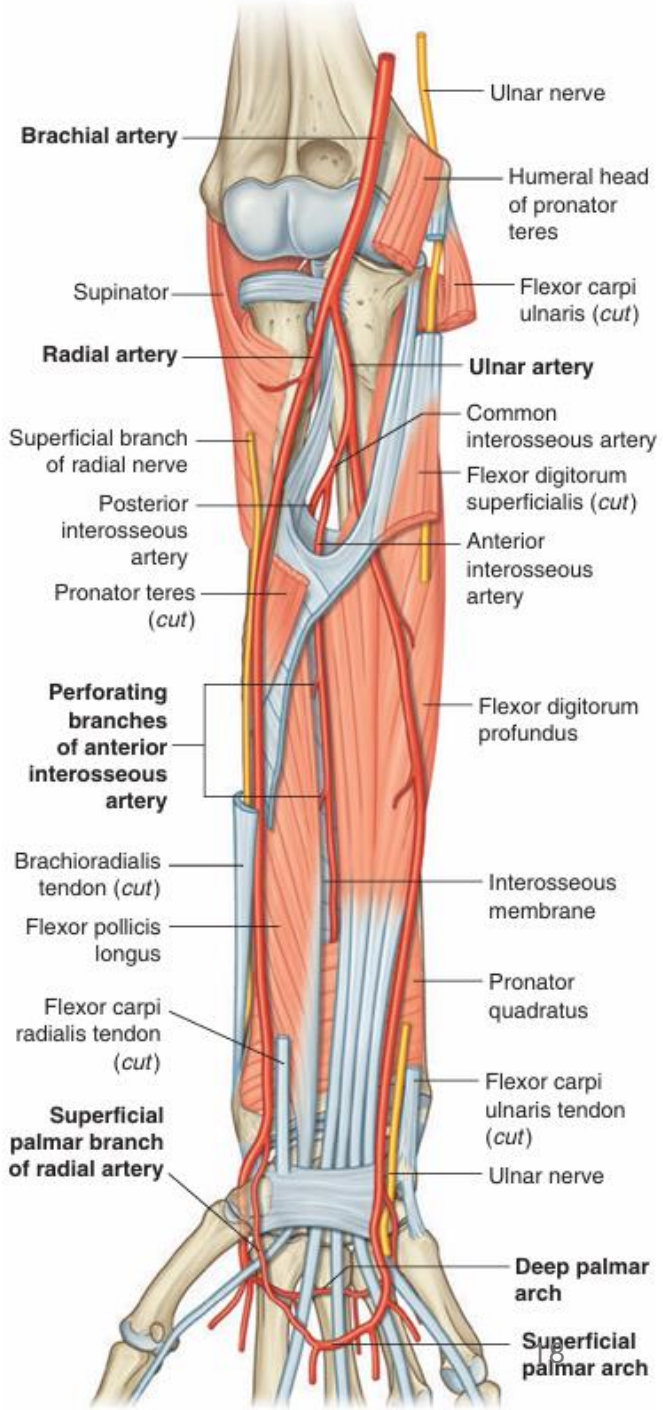
- **Common interosseous artery** → splits into: (related to interosseous membrane)
  - Anterior interosseous (ant. compartment).
  - Posterior interosseous (pierces membrane → post. compartment).

4. Neurovascular Relations

- Ulnar nerve is medial to the ulnar artery, also radial nerve is lateral to radial artery, so nerves are more deviated to the sides than center (compared to arteries).



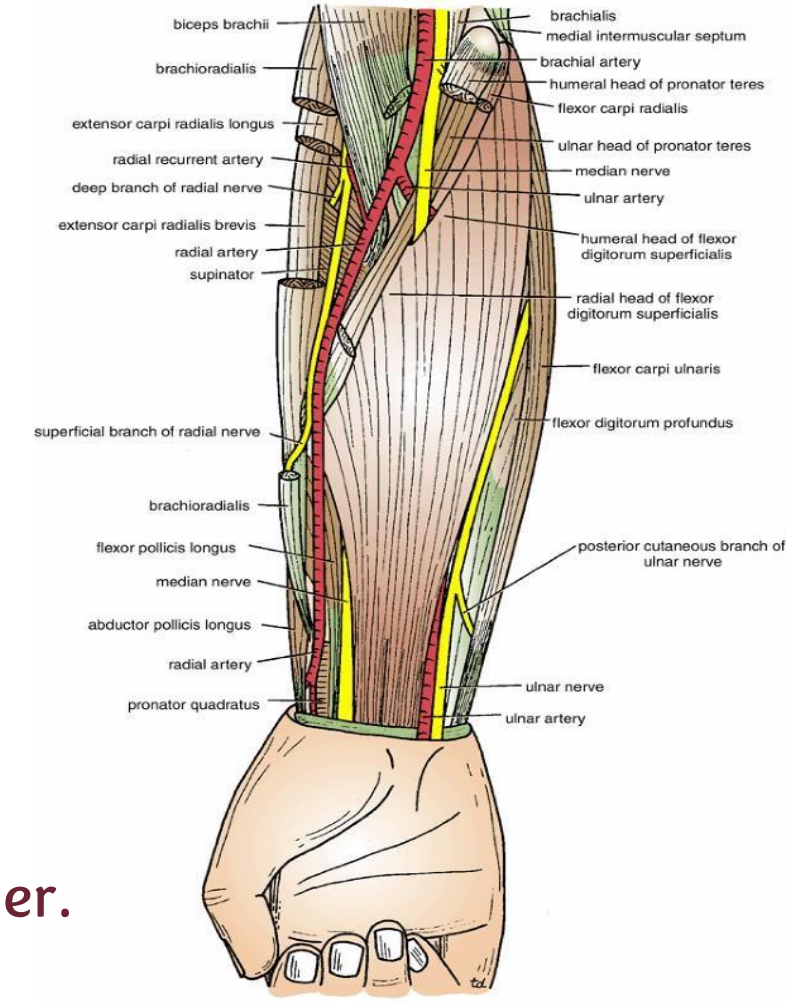
- the ulnar artery lies deep to most of the flexor muscles
- Below, it becomes superficial and lies between the tendons of the flexor carpi ulnaris and the tendons of the flexor digitorum superficialis
- In front of the flexor retinaculum, it lies just lateral to the pisiform bone and is covered only by skin and fascia (site for taking ulnar pulse).



Branches

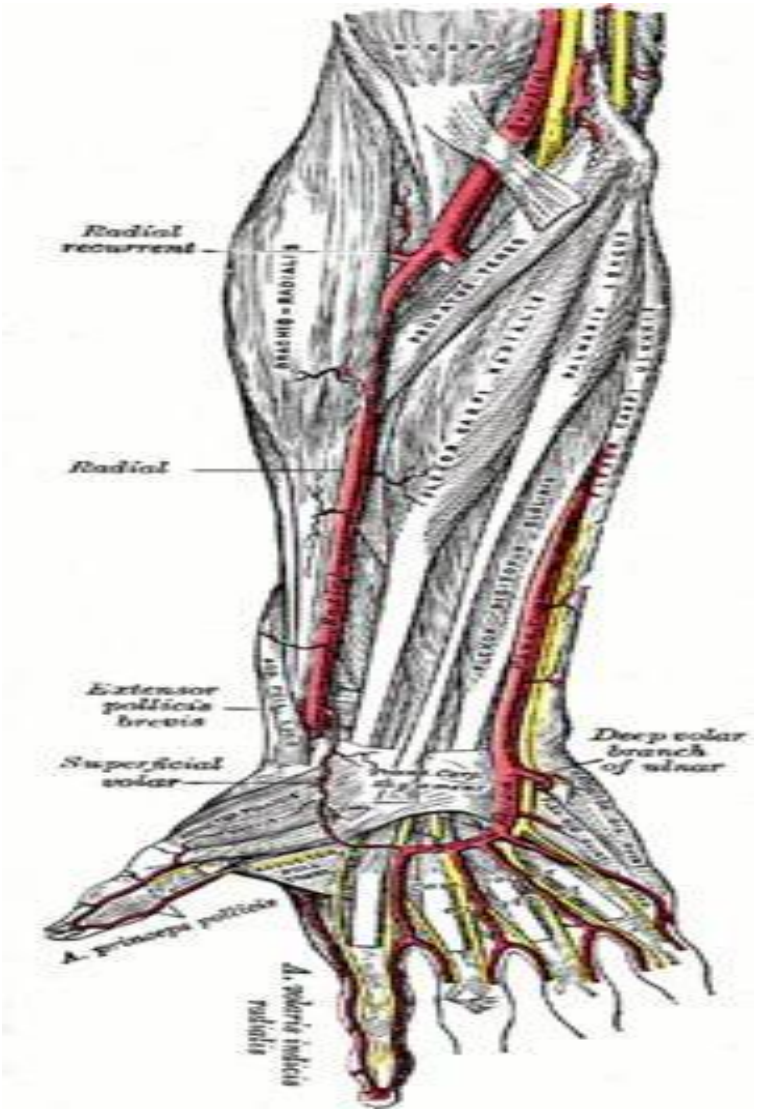
- Muscular branches to neighboring muscles
- Recurrent branches that take part in the arterial anastomosis around the elbow joint
- Branches that take part in the arterial anastomosis around the wrist joint
- The common interosseous artery, which arises from the upper part of the ulnar artery and after a brief course divides into the anterior and posterior interosseous arteries

And then given superficial palmar arch which is important in digital arteries, each finger has branch on medial side and branch on lateral side and both are joint on the tip of the finger.



Radial Artery

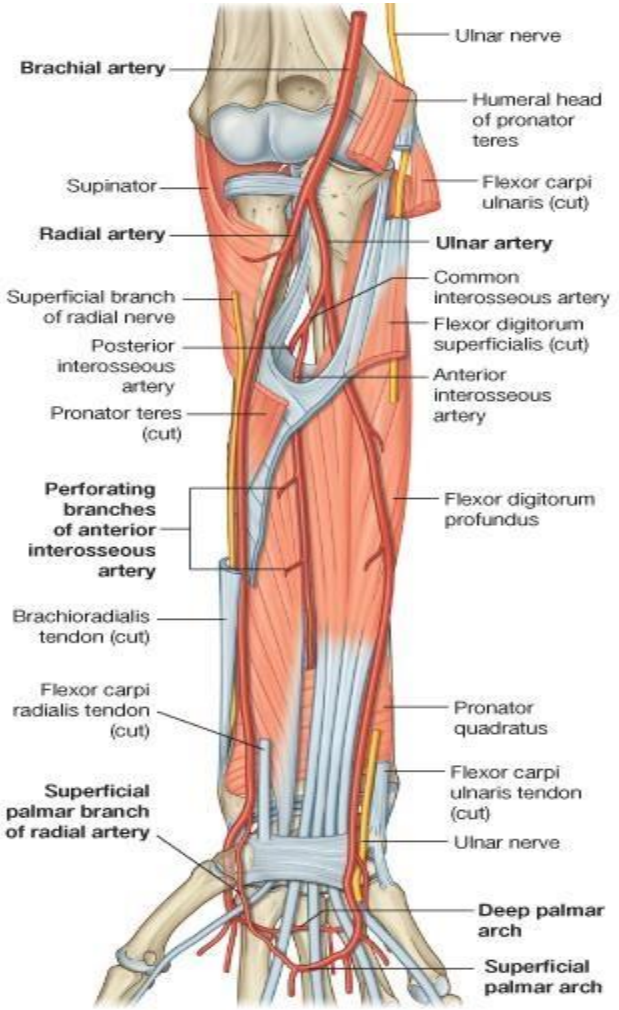
- Gives muscular, joint and palm branches.
- The radial artery is the smaller of the terminal branches of the brachial artery
- It begins in the cubital fossa at the level of the neck of the radius
- It passes downward and laterally, beneath the brachioradialis muscle and resting on the deep muscles of the forearm
- In the middle third of its course, the superficial branch of the radial nerve lies on its lateral side.



Radial Artery Notes

- Radial artery pulse is sensed in the lower 7cm of the radius (using 3 fingers).
- Radial is better sensed than ulnar because ulnar is above muscles (soft base), while radial is on the radial bone (tough base).
- Then, radial artery reaches floor of snuff box to the deep palmar arch.
- Deep palmar is more proximal than the superficial.
- Deep palmar arch is constituted from radial artery and branch from ulnar (deep branch of ulnar artery.

- In the distal part of the forearm, the radial artery lies on the anterior surface of the radius and is covered only by skin and fascia
- Here, the artery has the tendon of brachioradialis on its lateral side and the tendon of flexor carpi radialis on its medial side (site for taking the radial pulse).
- The radial artery leaves the forearm by winding around the lateral aspect of the wrist to reach the posterior surface of the hand



Branches in the Forearm

- Muscular branches to neighboring muscles
- Recurrent branch, which takes part in the arterial anastomosis around the elbow joint
- Superficial palmar branch, which arises just above the wrist enters the palm of the hand, and frequently joins the ulnar artery to form the superficial palmar arch

Some videos help with artery pulse detection

radial artery pulse video

Ulnar artery pulse video

Radial artery	Ulnar artery
Smaller in diameter	Larger in diameter
Better sensed pulse	Weak sensed pulse (due to depth)
Muscular, recurrent, superficial palmar branch, **mainly** forms the deep palmar arch	Common interosseous (→ ant./post. interosseous), recurrent, muscular, **mainly** forms the superficial palmar arch
Both the **radial** and **ulnar arteries** branch from the **brachial artery** in the **cubital fossa**, near the **radial head**	

Both the radial and ulnar arteries participate in forming both arches, but the ulnar artery mainly forms the superficial arch, while the radial artery mainly forms the deep arch.

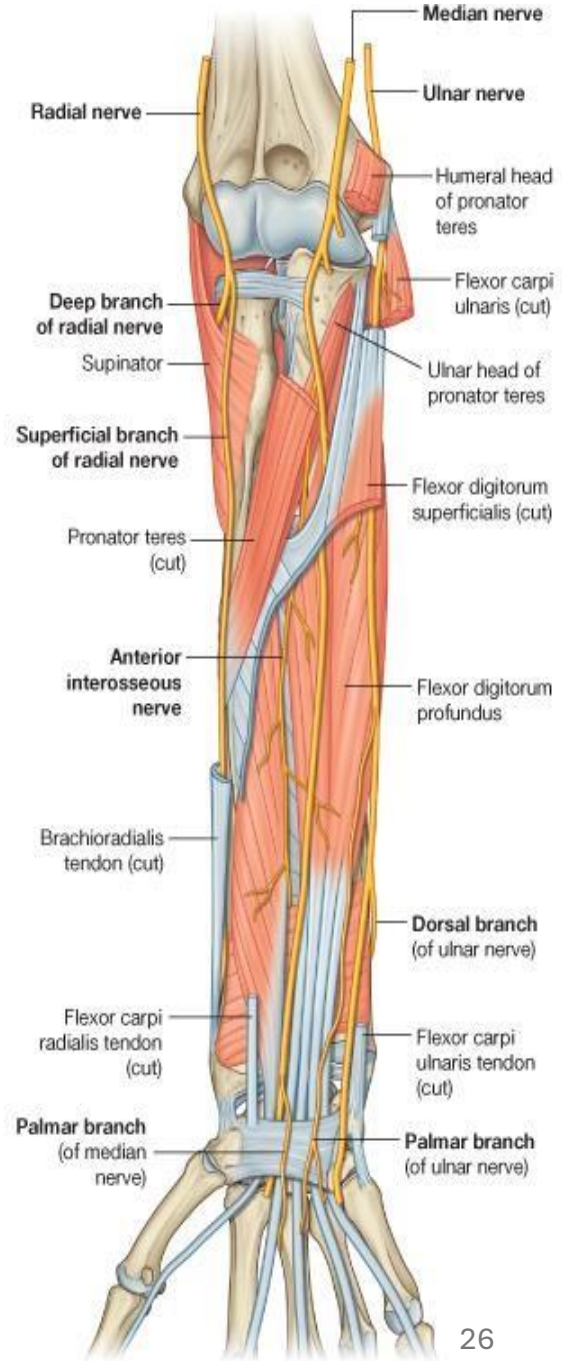
Median Nerve

- The median nerve arises from both the medial and lateral cords of the brachial plexus as roots.
- The median nerve leaves the cubital fossa by passing between the two heads of the pronator teres.
- It continues downward behind the flexor digitorum superficialis and rests posteriorly on the flexor digitorum profundus.
- At the wrist, the median nerve emerges from the lateral border of the flexor digitorum superficialis muscle and lies behind the tendon of the palmaris longus. Sometimes, surgeons may confuse the median nerve with the palmaris longus tendon, leading to accidental cutting of the median nerve instead of the tendon.
- Then passes through the carpal tunnel (a groove located on the anterior aspect of the carpal bones at the wrist joint) and terminates in the hand.
- It enters the palm by passing behind the flexor retinaculum.

Branches

1. Muscular branches in the cubital fossa to the pronator teres, the flexor carpi radialis, the palmaris longus, and the flexor digitorum superficialis.

2. Articular branches to the elbow joint. A general principle in anatomy is that any Nerves passing near a joint innervate it (as in elbow, wrist)
3. Anterior interosseous nerve, branch from the median nerve and innervates deep muscles, including:
    1. Flexor pollicis longus
    2. The lateral half of the flexor digitorum profundus
    3. Pronator quadratus
4. Palmar cutaneous branch, arises before the flexor retinaculum and supplies sensory innervation to the lateral two-thirds of the palm. This arises in the lower part of the forearm and is distributed to the skin over the lateral part of the palm.



See next slide

- If the median nerve is injured, the following effects occur:

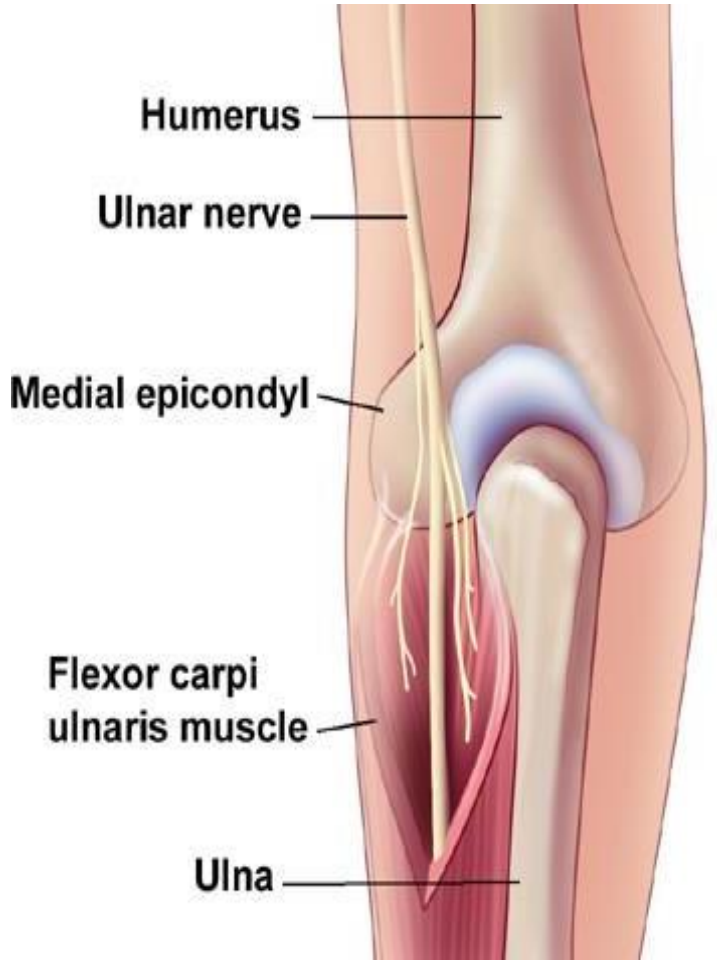
1. Ape Hand (يد القرد):
   - Loss of flexion and abduction at the wrist joint, resulting in extension and adduction due to unopposed action of the ulnar nerve.
   - Loss of thumb abduction.
2. Loss of Sensation: Loss of sensation in the lateral two-thirds of the palm.

Ulnar Nerve

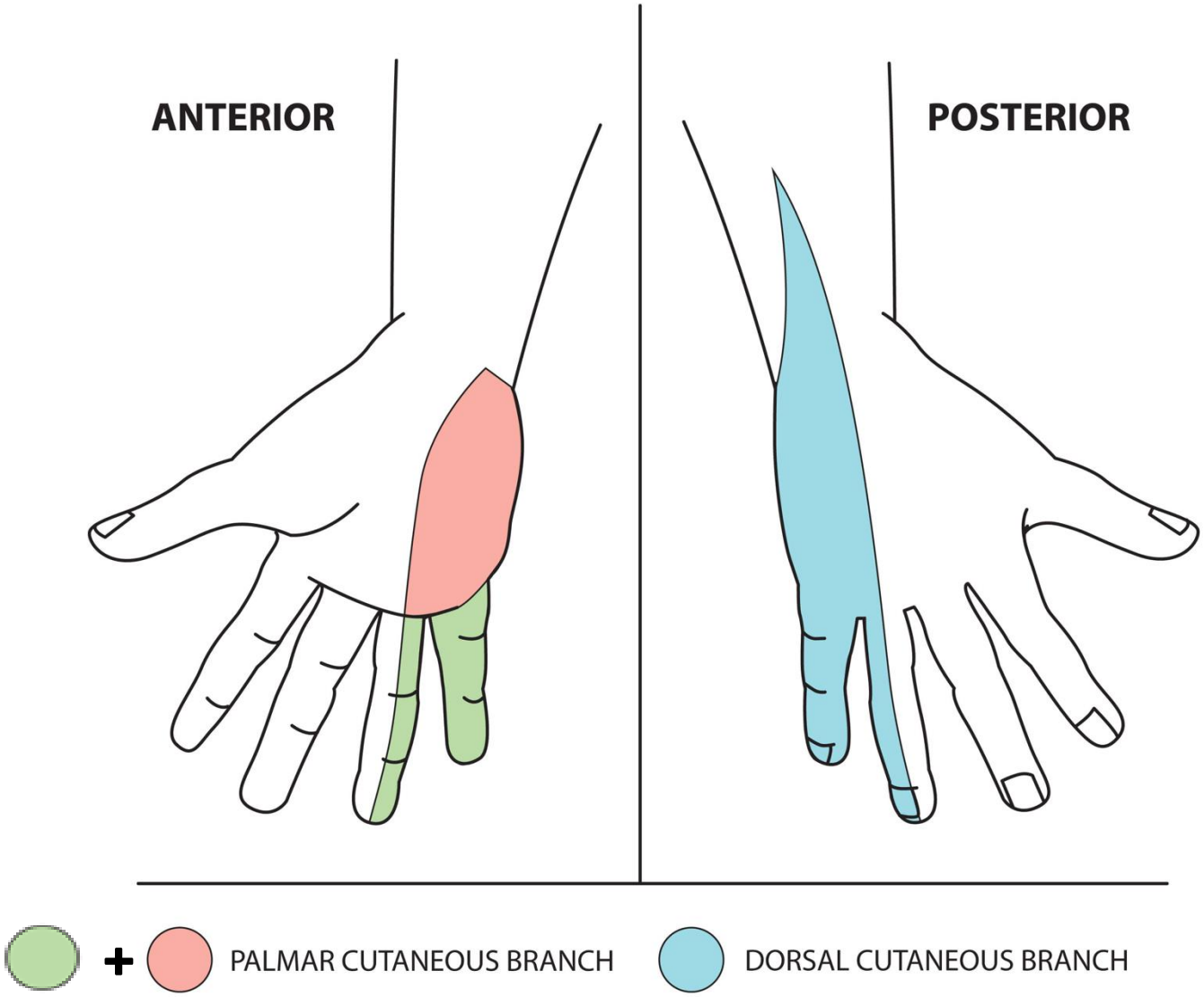
The ulnar nerve is a branch of the medial cord of the brachial plexus. It does not give any branches in the arm.

- passes from behind the medial epicondyle of the humerus, crosses the medial ligament of the elbow joint, and enters the front of the forearm by passing between the two heads of the flexor carpi ulnaris.

- runs down the forearm between the flexor carpi ulnaris and the flexor digitorum profundus muscles. In the distal two thirds of the forearm, the ulnar artery lies on the lateral side of the ulnar nerve.
- At the wrist, the ulnar nerve becomes superficial and lies between the tendons of the flexor carpi ulnaris and flexor digitorum superficialis muscles.
- The ulnar nerve enters the palm of the hand by passing in front of the flexor retinaculum **and gives off two branches, dorsal and palmar (see slide 30),** and lateral to the pisiform bone; here it has the ulnar artery lateral to it



Ulnar Nerve Supply To Skin



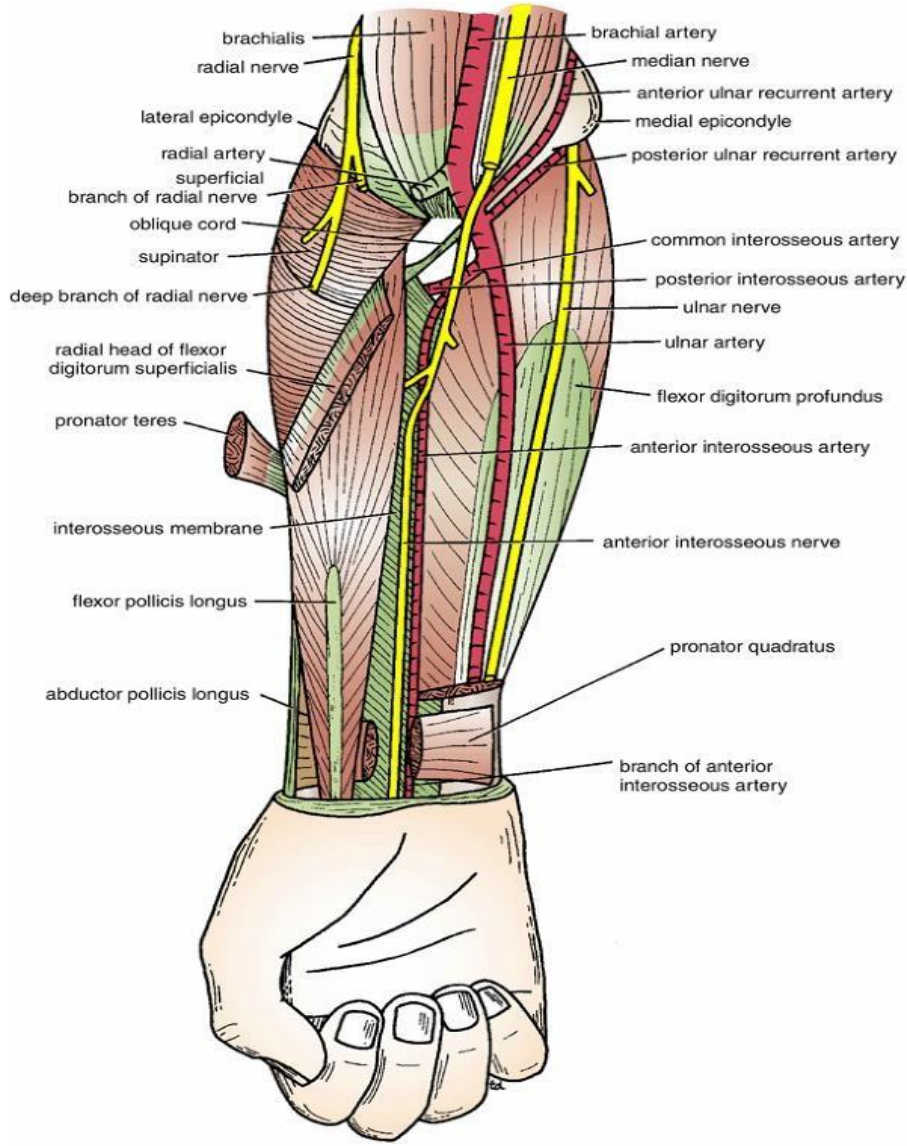
Branches

1. Muscular branches to the flexor carpi ulnaris and to the medial half of the flexor digitorum profundus. **(one and half muscle)**

2. Articular branches to the elbow joint.

3. The palmar cutaneous branch **to the medial third of the palm** is a small branch that arises in the middle of the forearm.

4. The dorsal posterior cutaneous branch is distributed on the posterior surface of the hand and **one and half fingers.**



Flexor Retinaculum

- The flexor retinaculum and palmer aponeurosis is a thickening of deep fascia (fibrous CT) **that holds the long flexor tendons in position at the wrist**
- It stretches across the front of the wrist and converts into an osteofascial tunnel, the carpal tunnel.
- for the passage of the median nerve and the flexor tendons of the thumb and fingers.
- It is attached medially to the pisiform bone and the hook of the hamate and laterally to the tubercle of the scaphoid and the trapezium bones
- The upper border of the retinaculum corresponds to the distal transverse skin crease in front of the wrist and is continuous with the deep fascia of the forearm. The lower border is attached to the palmar aponeurosis

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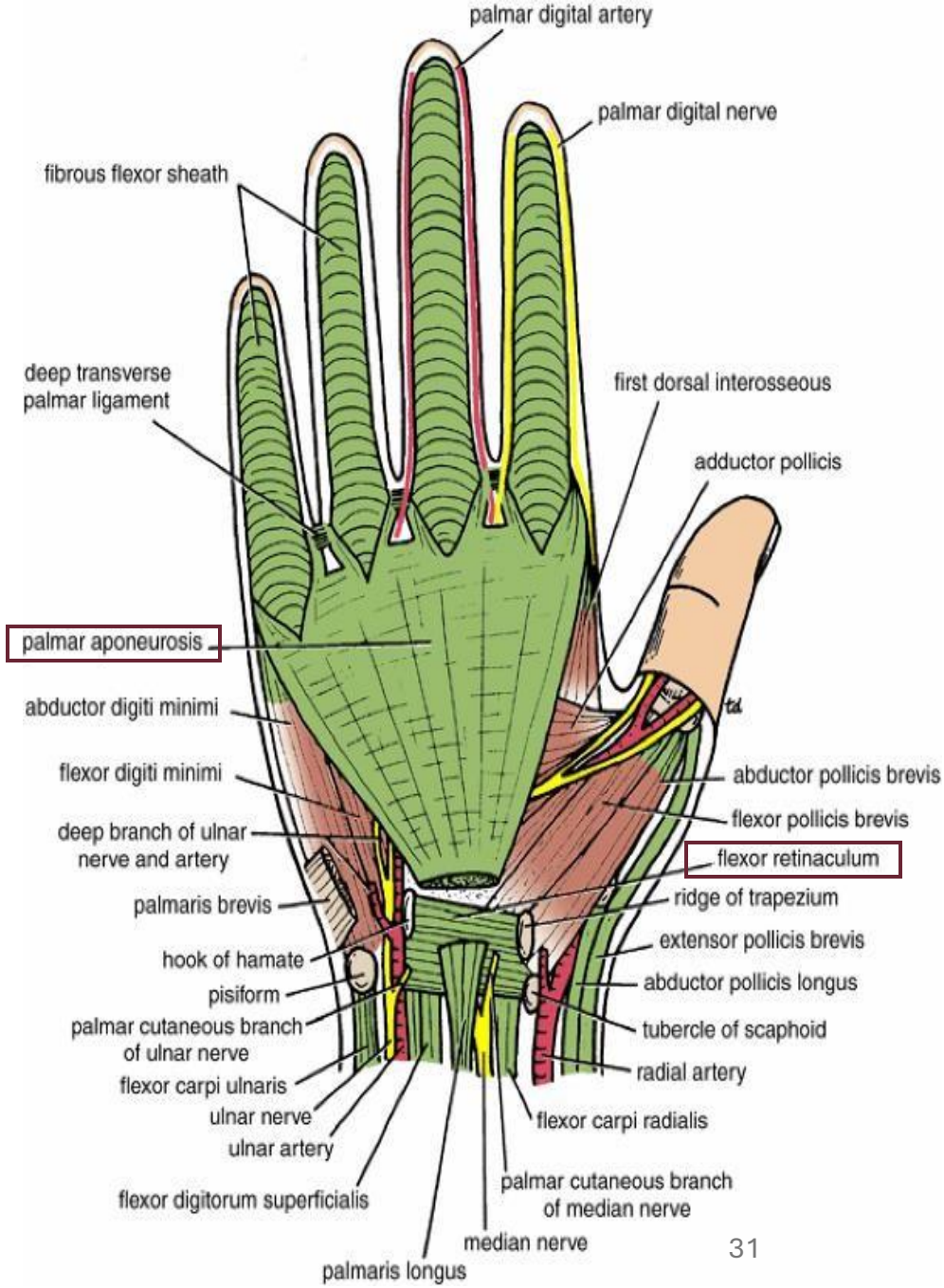


➢Structures that pass superficial to the flexor retinaculum include six structures: (3 palmar and 3 ulnar)

❖ Ulnar structures:

- Ulnar nerve
- Ulnar artery + vain

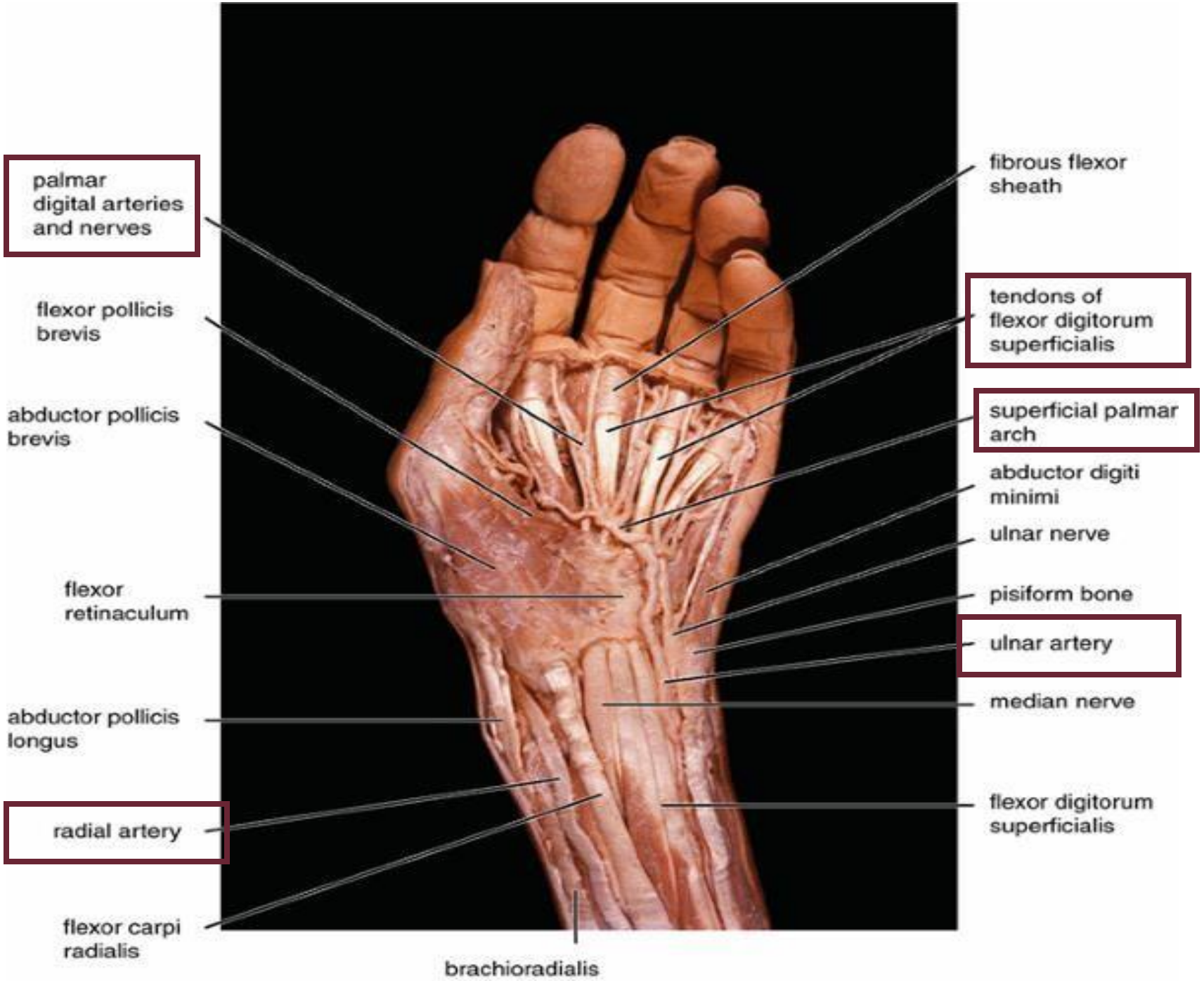
❖ Palmar structures:

- Palmar branch of the ulnar nerve
- Palmar branch of the median nerve
- Palmaris longus tendon

➢ Structures passing deep to the flexor retinaculum include:

- Tendons of the flexor carpi ulnaris and flexor digitorum superficialis.
- Four tendons of the flexor digitorum profundus.
- Tendon of the flexor pollicis longus and the flexor carpi radialis on the lateral side.

The tendons of the flexor digitorum superficialis are enclosed by a fibrous synovial sheath.



For any feedback, scan the code or click on it.

Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1	17 Fourth point	also lateral nerve is lateral to radial artery	also radial nerve is lateral to radial artery
	21 2nd point	while ulnar is on the radial bone	while radial is on the radial bone
	24		**The table has undergone comprehensive editing**
V1 → V2	13 The red text under O and I was swapped	• Origin : Anteromedial surface of shaft of ulna Passes through the insertion of superficialis muscle. • Insertion: **Base of** Distal phalanges of medial four fingers And part of interosseous membrane.	• Origin : Anteromedial surface of shaft of ulna And part of interosseous membrane • Insertion: **Base of** Distal phalanges of medial four fingers, Passes through the insertion of superficialis muscle.

رسالة من الفريق العلمي:

اللهم أعنا على ذكرك وشكرك وحسن عبادتك