Hand

- The hand (manus), a very important organ, is located at the distal end of the upper limb. Much of the importance of the hand depends on the pincer-like action of the thumb, which enables us to grasp objects between the tips of the thumb and index finger. The anterior (ventral) side of the hand is its palmar (volar) surface. The posterior aspect is the dorsal surface. In identifying the individual digits, the thumb (pollux) is digit 1, with the other numbers following sequentially from lateral to medial.

Skin

- The skin of the palm of the hand is thick and hairless. It is bound down to the underlying deep fascia by numerous fibrous bands. The skin shows many flexure creases at the sites of skin movement, which are not necessarily placed at the site of joints. Sweat glands are present in large numbers. The skin on the dorsum of the hand is thin, hairy, and freely mobile on the underlying tendons and bones.

Deep Fascia

- The deep fascia of the wrist and palm is thickened to form the flexor retinaculum (described previously) and the palmar aponeurosis.

Palmar Aponeurosis

- The palmar aponeurosis is triangular and occupies the central area of the palm
- The apex of the palmar aponeurosis is attached to the distal border of the flexor retinaculum and receives the insertion of the palmaris longus tendon.
- The base of the aponeurosis divides at the bases of the fingers into four slips.
- Each slip divides into two bands, one passing superficially to the skin and the other passing deeply to the root of the finger. Here, each deep band divides into two, which diverge around the flexor tendons and finally fuse with the fibrous flexor sheath and the deep transverse ligaments.

- The medial and lateral borders of the palmar aponeurosis are continuous with the thinner deep fascia covering the hypothenar and thenar muscles. From each of these borders, fibrous septa pass deeply into the palm and take part in the formation of the palmar fascial spaces (see below).
- The function of the palmar aponeurosis is to give firm attachment to the overlying skin and so improve the grip and to protect the underlying tendons.

Dupuytren Contracture

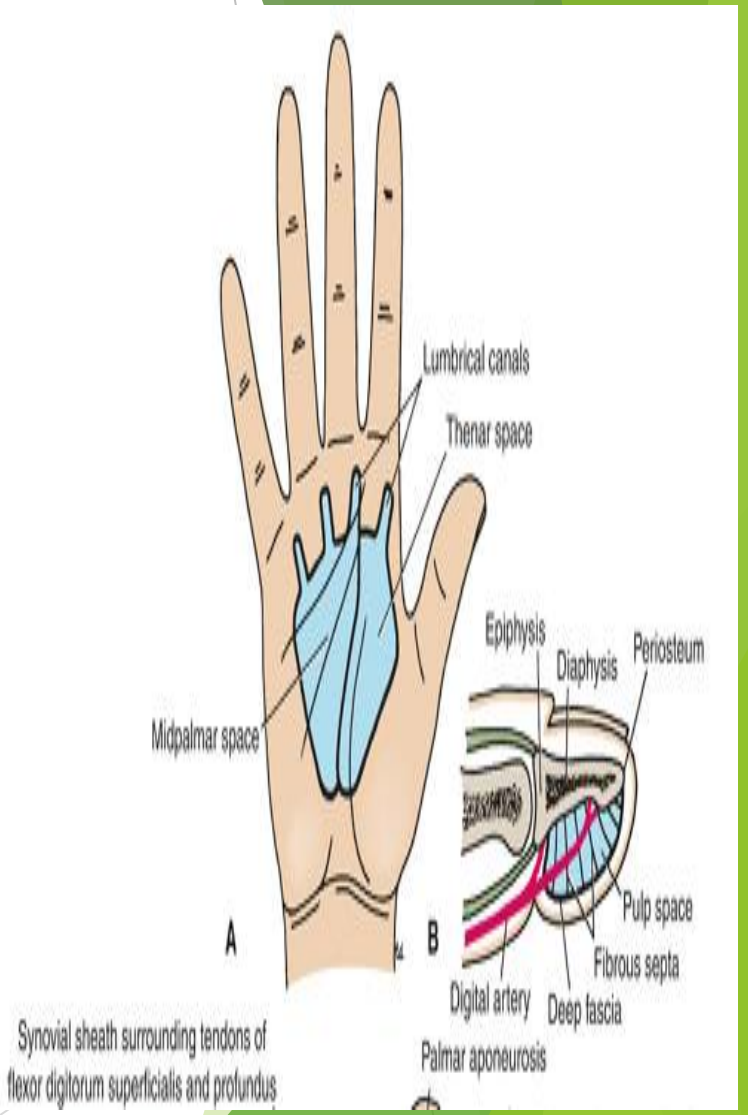
- Dupuytren contracture is a localized thickening and contracture of the palmar aponeurosis, which limits hand function and may eventually disable the hand.
- It commonly starts near the root of the ring finger and draws that finger into the palm, flexing it at the metacarpophalangeal joint. Later, the condition involves the little finger in the same manner.
- It commonly starts near the root of the ring finger and draws that finger into the palm, flexing it at the metacarpophalangeal joint. Later, the condition involves the little finger in the same manner.

Treatment

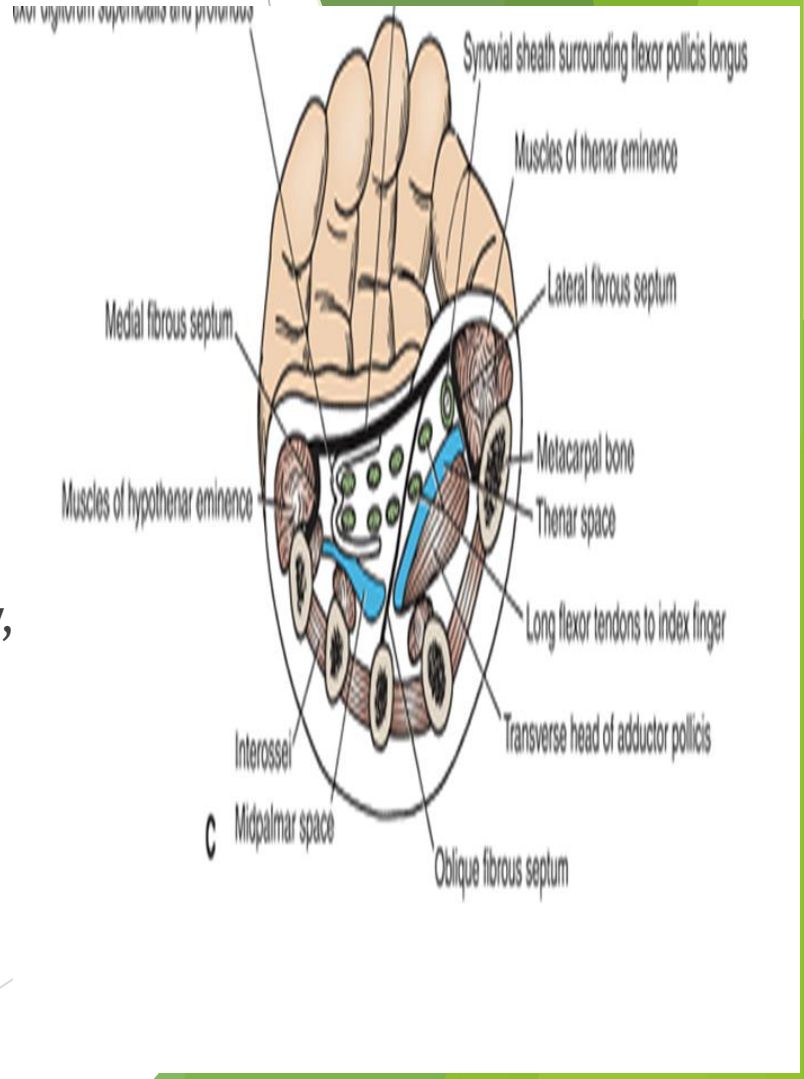
- Surgical division of the fibrous bands followed by physiotherapy to the hand is the usual form of treatment. The alternative treatment of injection of the enzyme collagenase into the contracted bands of fibrous tissue has been shown to significantly reduce the contractures and improve mobility.

Fascial Spaces of Palm

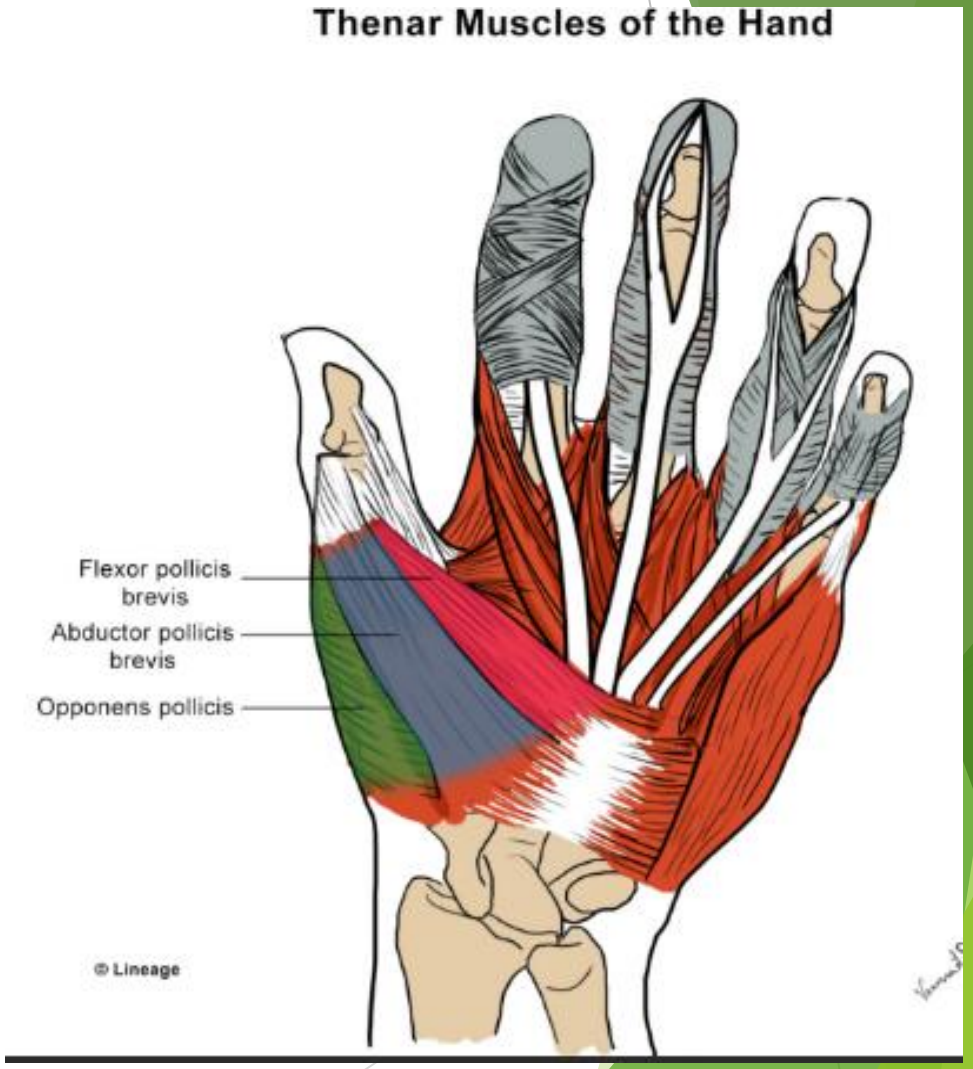
- Normally, the fascial spaces of the palm are potential spaces filled with loose connective tissue.
- Their boundaries are important clinically because they may limit the spread of infection in the palm.
- he triangular palmar aponeurosis fans out from the distal border of the flexor retinaculum .
- From its medial border , a fibrous septum passes backward and is attached to the anterior border of the fifth metacarpal bone



- The thenar space contains the first lumbrical muscle and lies deep to the long flexor tendons to the index finger and superficial to the adductor pollicis muscle
- The midpalmar space contains the second, third, and fourth lumbrical muscles and lies posterior to the long flexor tendons to the middle, ring, and little fingers. It lies superficial to the interosseous muscles and the third, fourth, and fifth metacarpal bones.
- The lumbrical canal is a potential space surrounding the tendon of each lumbrical muscle and is normally filled with connective tissue. Proximally, it is continuous with one of the palmar spaces.



- Medial to this septum is a fascial compartment containing the three hypothenar muscles. From the lateral border of the palmar aponeurosis, a second fibrous septum passes obliquely backward to the anterior border of the third metacarpal bone.



Osseofascial Compartments

- The muscles of the hand can be described as either extrinsic or intrinsic muscles.
- Extrinsic muscles are those that originate outside of the hand proper (in the forearm) and insert within the hand via long tendons.
- Intrinsic muscles (small muscles) of the hand are those that both originate and insert within the hand.
- Both the extrinsic and intrinsic muscles are organized in five osseofascial compartments within the hand.

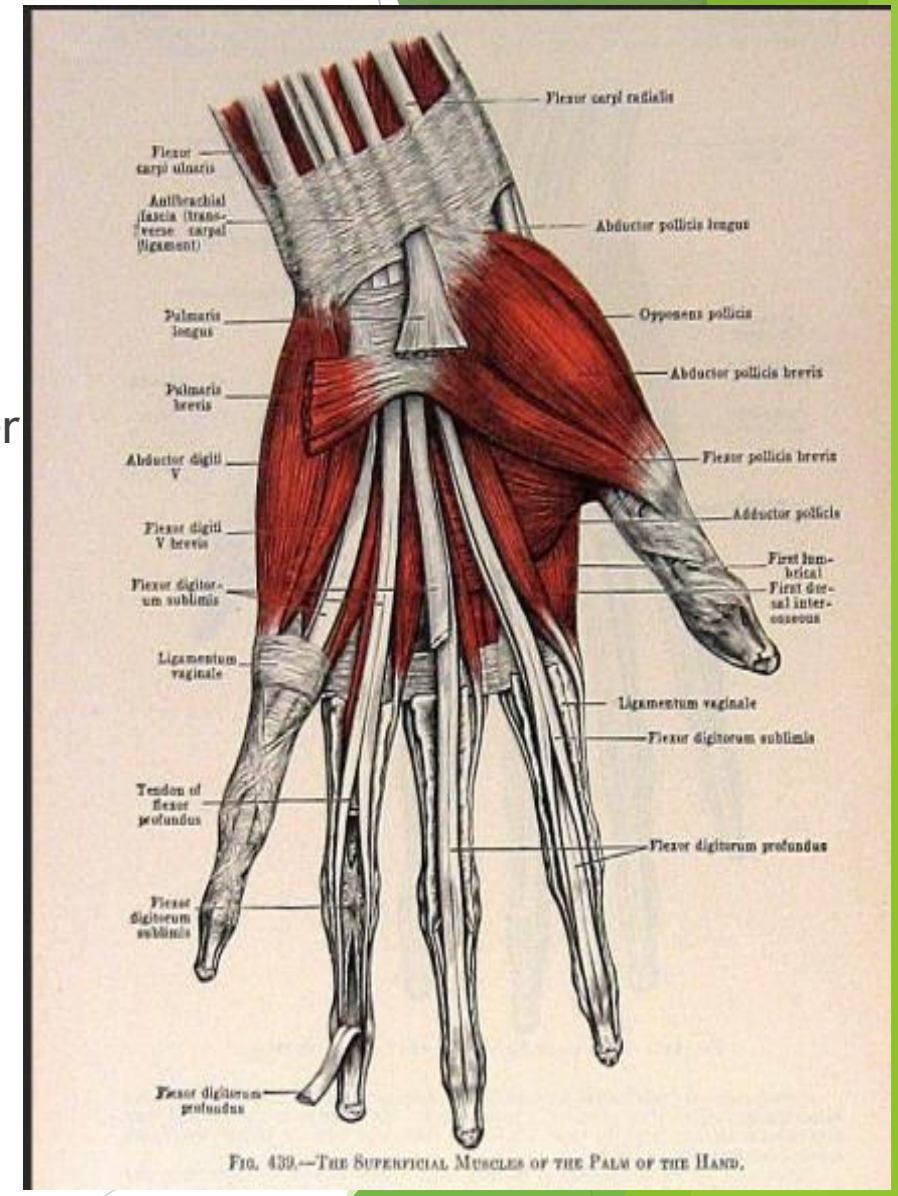


FIG. 439.—THE SUPERFICIAL MUSCLES OF THE PALM OF THE HAND.

Four compartments (thenar, hypothenar, central [mid palmar], and interosseous) are located in the palmar aspect of the hand.

One compartment (dorsal/extensor) is related to the dorsum of the hand.

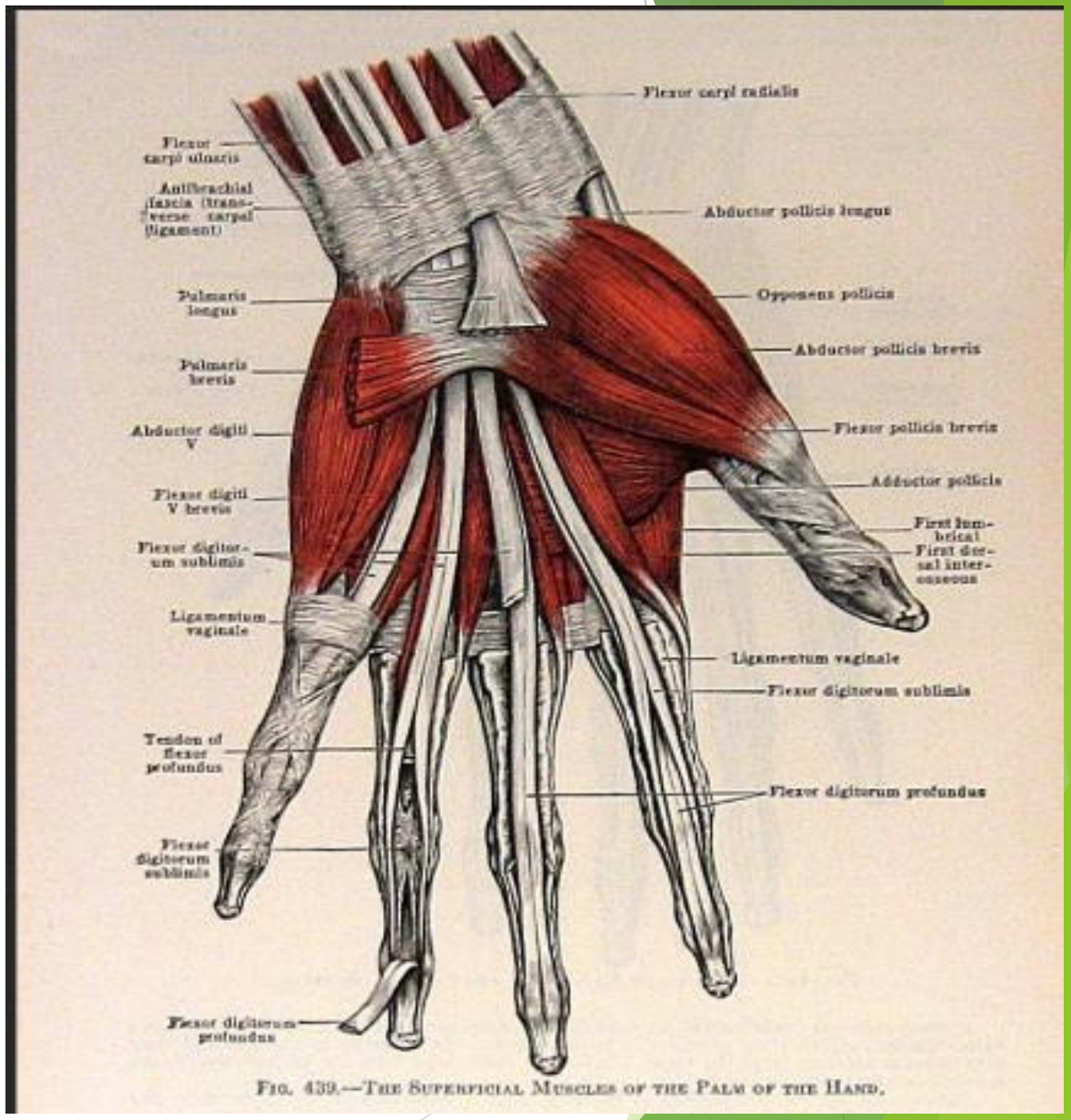
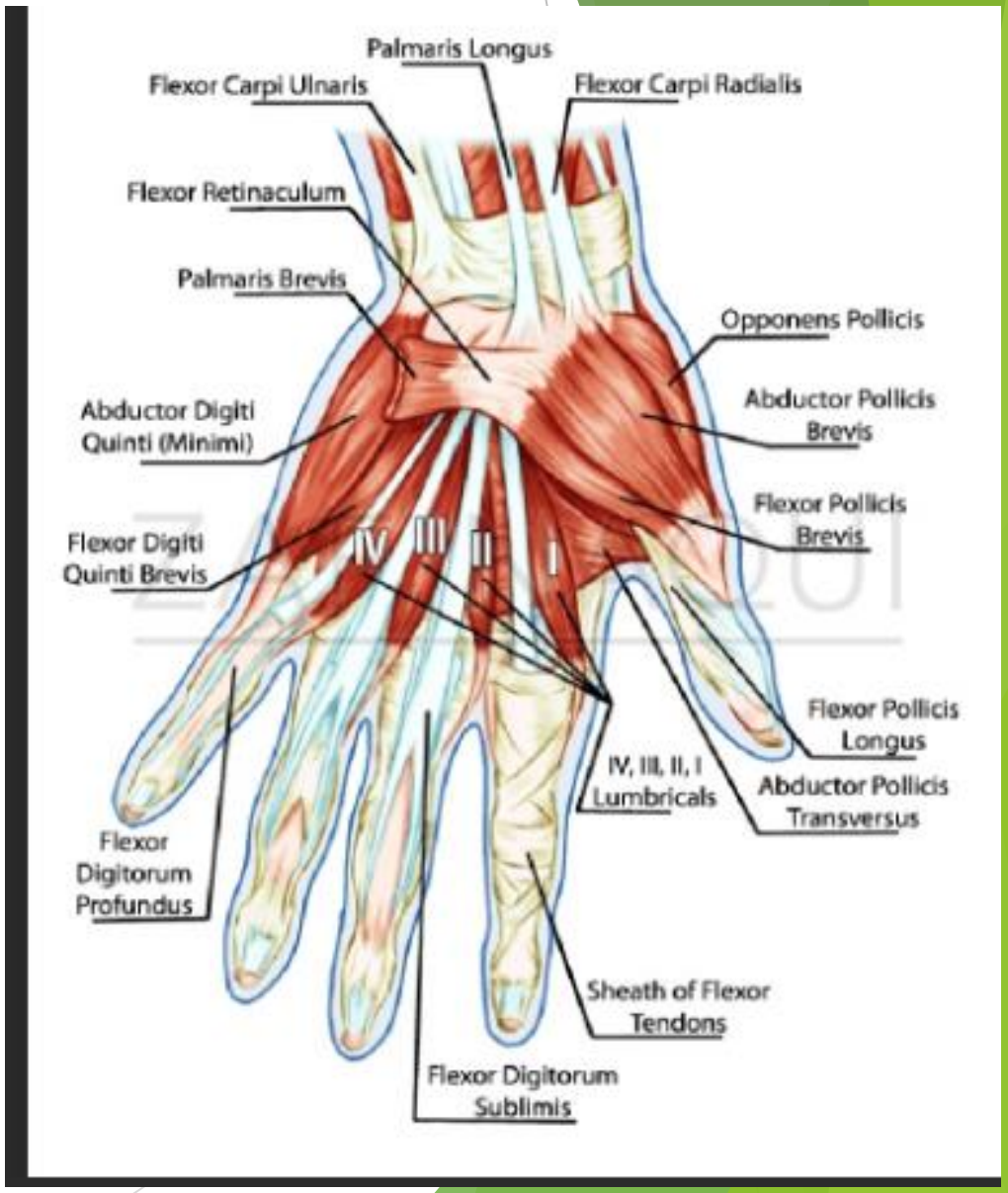


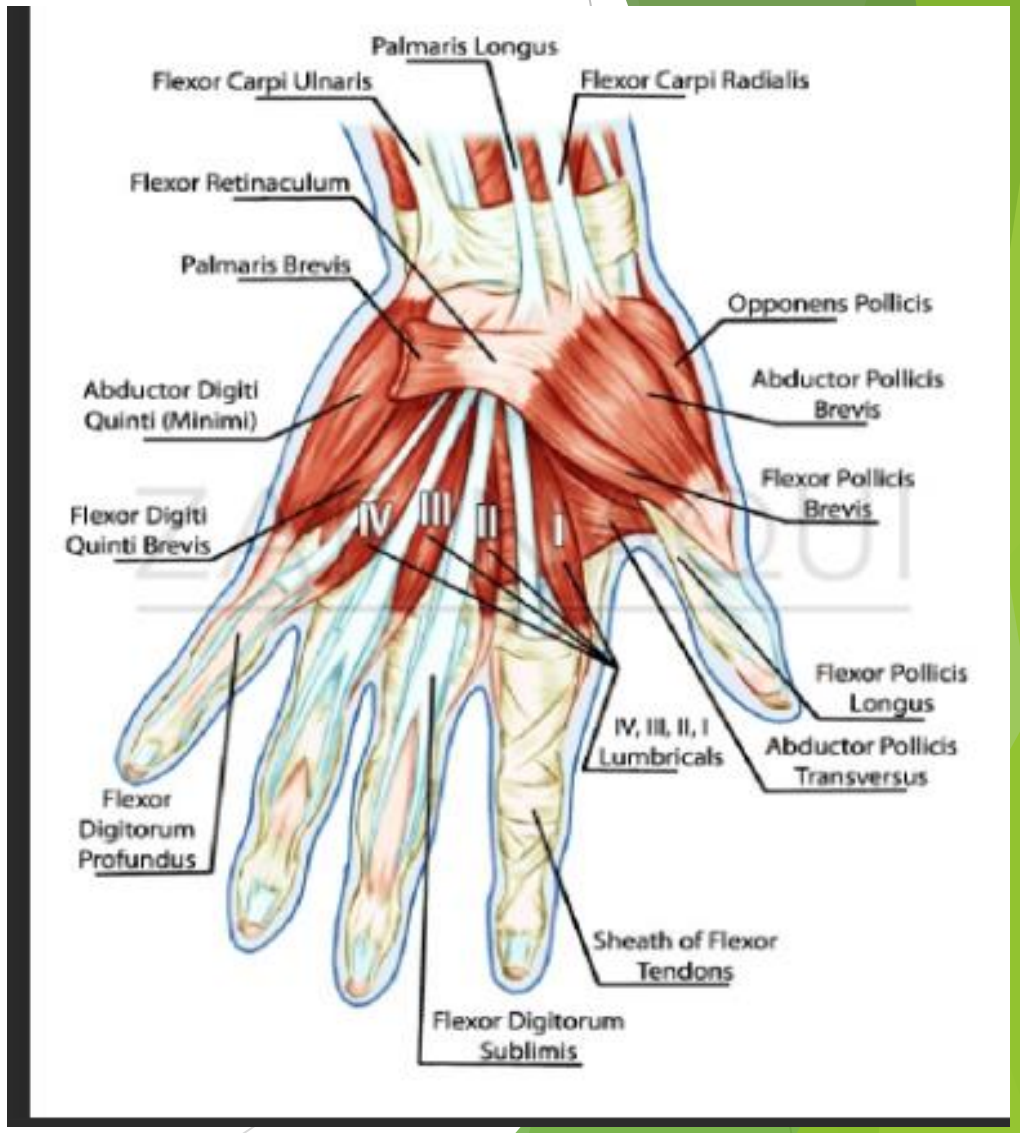
FIG. 439.—THE SUPERFICIAL MUSCLES OF THE PALM OF THE HAND.

Thumb and Little Finger Muscles

- The thenar compartment makes up the thenar eminence, which is the fleshy
- mound at the base of the thumb (digit 1). The hypothenar compartment forms
- the smaller hypothenar eminence at the base of the little finger (digit 5).
- Notice that each compartment contains three muscles named for the basic
- functions they share: flexion, abduction, and opposition.



- The four intrinsic (short) muscles of the thumb are the abductor pollicis
- brevis,
- the flexor pollicis brevis,
- the opponens pollicis, and the adductor pollicis
- Note that only the first three of these muscles form the thenar eminence.



Movement of the thumb

- The opponens pollicis muscle pulls the thumb medially and forward
- across the palm so that the palmar surface of the tip of the thumb may come
- into contact with the palmar surface of the tips of the other fingers in true
- opposition. It is a critical muscle in that it is the sole muscle of opposition
- that enables the thumb to form one claw in the pincer-like action used for
- picking up objects. This complex movement involves flexion of the
- carpometacarpal and metacarpophalangeal joints and a small amount of
- abduction and medial rotation of the metacarpal bone at the specialized first
- carpometacarpal joint.



Movements of the thumb

Movement of the thumb

- Abduction of the thumb may be described as a forward movement of the
- thumb in the anteroposterior plane. It takes place at the carpometacarpal joint
- and the metacarpophalangeal joint.



Movement of the thumb

- Adduction of the thumb can be described as a backward movement of the
- abducted thumb in the anteroposterior plane. It restores the thumb to its
- anatomic position, which is flush with the palm. The adductor pollicis is the
- muscle that, in association with the flexor pollicis longus and the opponens
- pollicis muscles, is largely responsible for the power of the pincers grip of the
- thumb. Adduction of the thumb occurs at the carpometacarpal and
- metacarpophalangeal joints.



Movements of the thumb

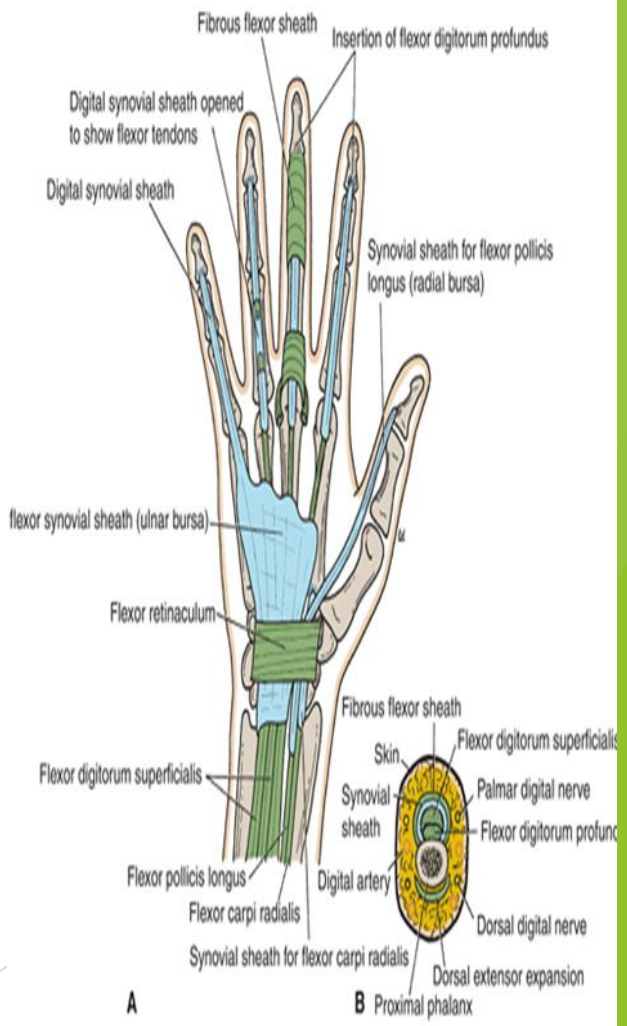
The muscles and majorOsseofascial Compartments of Hand & neurovascular structures of the hand

COMPARTMENT	MUSCLES	MOTOR NERVE(S)
Thenar	Flexor pollicis brevis Abductor pollicis brevis Opponens pollicis	Median nerve (recurrent branch)
Hypothenar	Flexor digiti quinti Abductor digiti quinti Opponens digiti quinti	Ulnar nerve (deep branch)
Central (midpalmar)	Tendons of long extrinsic digital flexors (flexor digitorum superficialis, flexor digitorum profundus, flexor pollicis longus) Lumbrical muscles	Median nerve Ulnar nerve (deep branch)
Interosseous	Adductor pollicis Palmar interossei Dorsal interossei	Ulnar nerve (deep branch)
Dorsal (extensor)	Tendons of long digital extensors	No intrinsic motor nerves

MUSCLE	ORIGIN	INSERTION	NERVE SUPPLY	NERVE ROOTS[a]	ACTION
Opponens pollicis	Flexor retinaculum	Shaft of metacarpal bone of thumb	Median nerve	**C8**; T1	Pulls thumb medially and forward across palm
Adductor pollicis	Oblique head; second and third metacarpal bones; transverse head; third metacarpal bone	Base of proximal phalanx of thumb	Deep branch of ulnar nerve	C8; **T1**	Adduction of thumb
Short Muscles of Little Finger					
Abductor digiti minimi	Pisiform bone	Base of proximal phalanx of little finger	Deep branch of ulnar nerve	C8; **T1**	Abducts little finger
Flexor digiti minimi	Flexor retinaculum	Base of proximal phalanx of little finger	Deep branch of ulnar nerve	C8; **T1**	Flexes little finger
Opponens digiti minimi	Flexor retinaculum	Medial border of the fifth metacarpal bone	Deep branch of ulnar nerve	C8; **T1**	Pulls fifth metacarpal forward as in cupping the palm

[a]The predominant nerve root supply is indicated by boldface type.

- In the hand, the tendons of the flexor digitorum superficialis and profundus muscles invaginate a common synovial sheath from the lateral side
- . The medial part of this common sheath extends distally without
- interruption on the tendons of the little finger
- The lateral
- part of the sheath stops abruptly on the middle of the palm, and the distal
- ends of the long flexor tendons of the index, the middle, and the ring fingers
- acquire digital synovial sheaths as they enter the fingers. The flexor pollicis
- longus tendon has its own synovial sheath that passes into the thumb. These

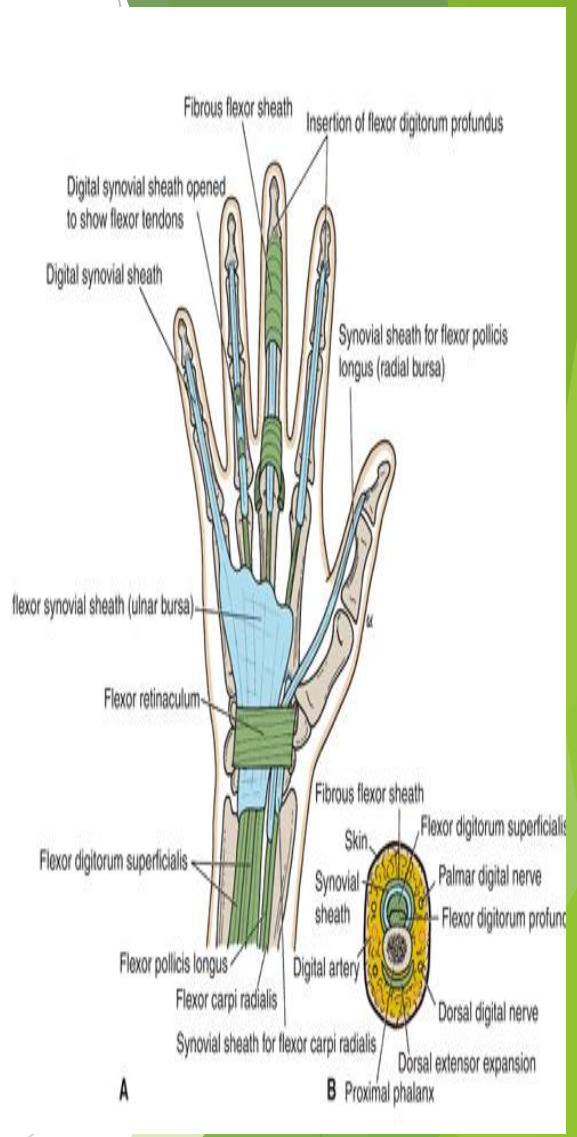


Synovial Flexor Sheaths

- . These sheaths allow the long tendons to move smoothly, with a minimum of friction, beneath the flexor retinaculum and the fibrous flexor sheaths.
- the radial bursa) communicates with the common synovial sheath of the superficialis and profundus tendons (sometimes referred to as the ulnar bursa) at the level of the wrist in about 50% of subjects.
- The vincula longa and brevia are small vascular folds of synovial membrane that connect the tendons to the anterior surface of the phalanges (Fig. 3.47C). They resemble a mesentery and convey blood vessels to the tendons.

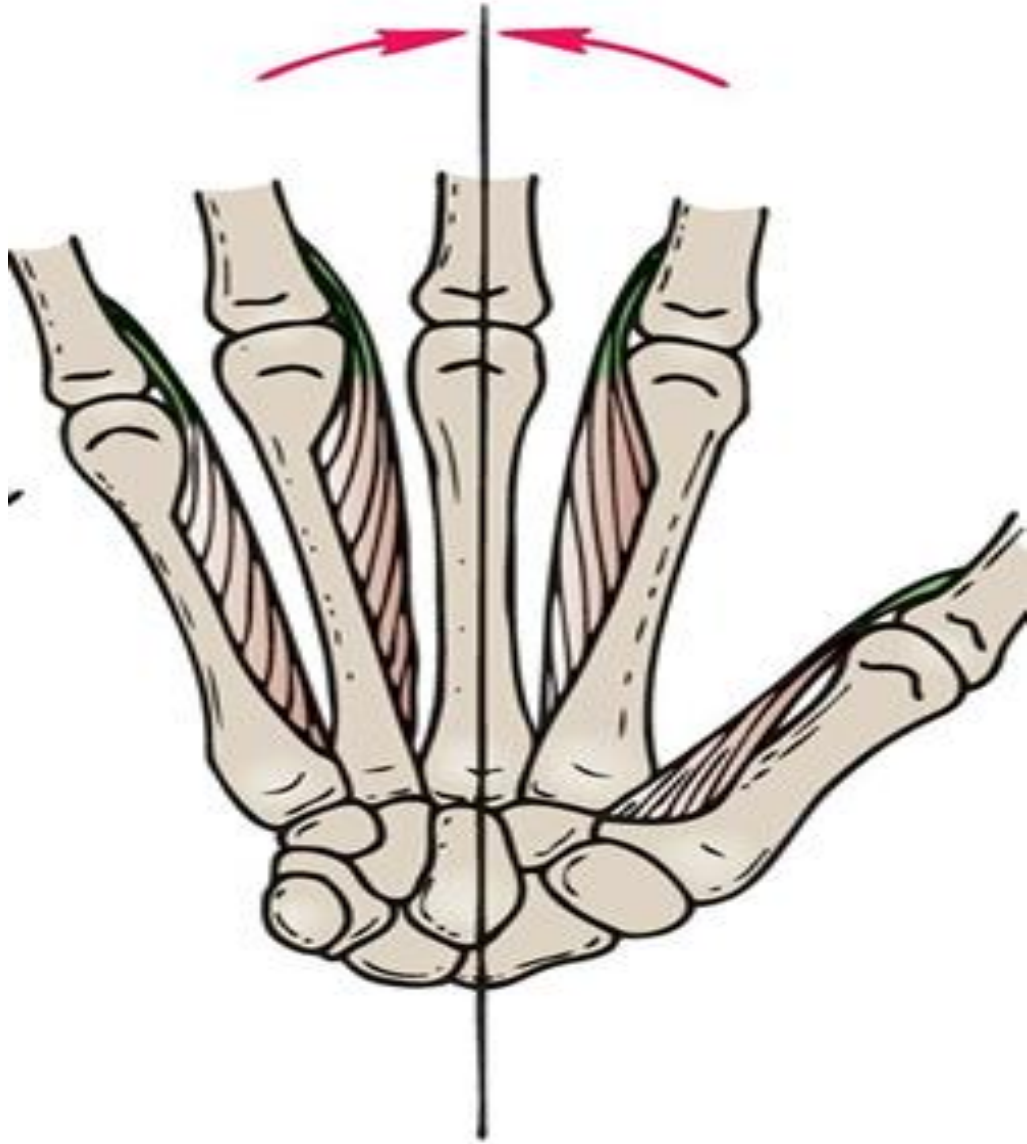
Fibrous Flexor Sheaths

- The anterior surface of each finger, from the head of the metacarpal to the base of the distal phalanx, is provided with a strong fibrous sheath that is attached to the sides of the phalanges
- The proximal end of the fibrous sheath is open, whereas the distal end of the sheath is closed and is attached to the base of the distal phalanx.
- The sheath and the bones form a blind tunnel, which contains the flexor tendons of the finger.
- In the thumb, the osseofibrous tunnel contains the tendon of the flexor pollicis longus. In the case of the four medial fingers, the tunnel is occupied by the tendons of the flexor digitorum superficialis and profundus
- .. The fibrous sheath is thick over the phalanges but thin and lax over



Lumbrical Muscles

- The four lumbrical muscles arise in the hand from the four tendons of the
- flexor digitorum profundus and insert into digits 2 through 5. However, each
- lumbrical is identified by number according to its position in the lateral to
- medial sequence of the muscles rather than according to the digit to which it
- attaches. Therefore, lumbrical 1 inserts into digit 2 and so forth. This offset of
- numbers sometimes can be confusing when describing the lumbricals and
- their individual actions. The lumbricals act to produce both flexion of the
- metacarpophalangeal joints and extension of the interphalangeal joints of
- digits 2 through 5

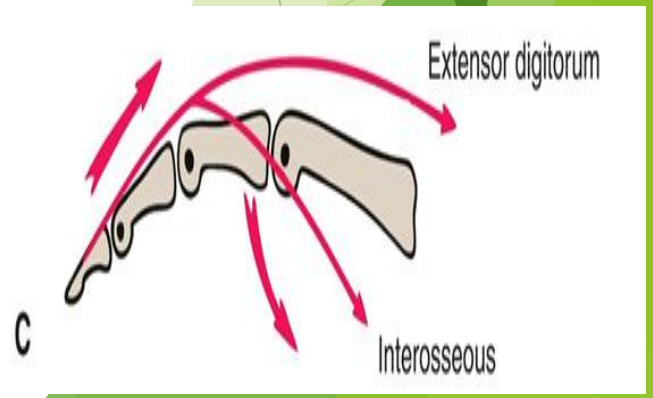


B Palmar interossei

Interosseous Muscles

- The eight interosseous muscles comprise four palmar interossei and four
- dorsal interossei. Some authors describe only three palmar interossei and
- state that the first palmar interosseous is a second head to the flexor brevis pollicis
- or that it is part of the adductor pollicis muscle. In any case, the
- interossei (along with the lumbricals) act to produce both flexion of the
- metacarpophalangeal joints and extension of the interphalangeal joints of
- digits 2 through 5 . Additionally, the
- interossei have significant actions in producing adduction and abduction of
- the digits. The palmar interossei adduct digits, whereas the dorsal interossei abduct digits





showing the relations of the long flexor tendons, lumbricals, interossei, and dorsal expansion

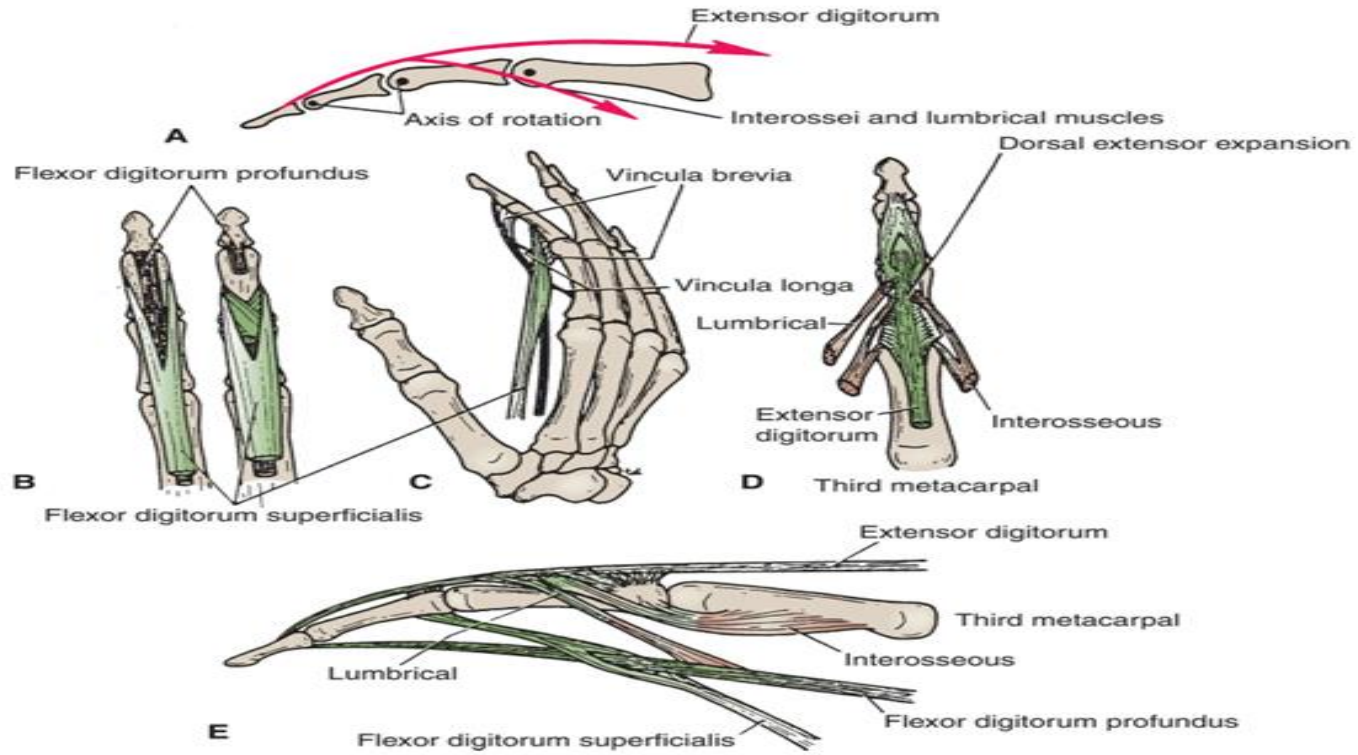
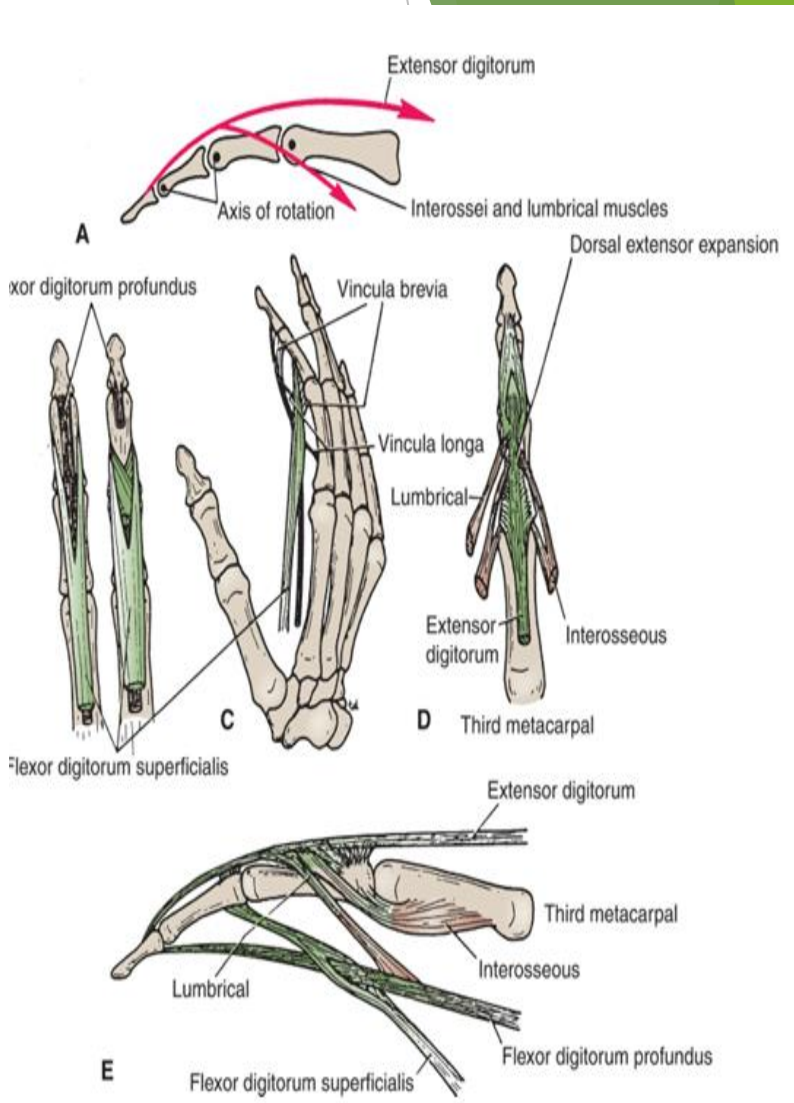


Figure 3.47 Insertions of long flexor and extensor tendons and lumbrical and interosseous muscles in the fingers. **A.** Lateral view showing the action of the lumbrical and interosseous muscles in flexing the metacarpophalangeal joints and extending the interphalangeal joints. **B.** Anterior view showing the arrangement of the tendons of the flexor digitorum superficialis and profundus muscles. **C.** Oblique view showing the vincula brevia and longa. **D.** Posterior view showing the relation of the lumbrical and interosseous muscles to the dorsal expansion. **E.** Lateral view

Long Flexor Tendon Insertion

- Each tendon of the flexor digitorum superficialis enters its appropriate fibrous
- flexor sheath and then divides into two halves opposite the proximal phalanx
- (see Figs. 3.44 and 3.47B). The half tendons pass around the profundus
- tendon and then reunite deep to the profundus tendon, where partial
- decussation of the fibers takes place (see Fig. 3.47B,E). The superficialis
- tendon, having united again, divides almost at once into two further slips,
- which are attached to the borders of the middle phalanx. The tendon of the
- flexor digitorum profundus passes through the division of the superficialis
- tendon and continues distally, to be inserted into the anterior surface of the



Long Extensor Tendon Insertion

- The four tendons of the extensor digitorum emerge from under the extensor
- retinaculum and fan out over the dorsum of the hand . The tendons are embedded in the deep fascia, and together, they form
- the roof of a subfascial space, which occupies the whole width of the dorsum
- of the hand. Strong oblique fibrous bands connect the tendons to the little,
- ring, and middle fingers, proximal to the heads of the metacarpal bones. The
- tendon to the index finger is joined on its medial side by the tendon of the
- extensor indicis, and the tendon to the little finger is joined on its medial side
- by the two tendons of the extensor digiti minimi

- On the posterior surface of each finger, the extensor tendon joins the fascial expansion called the extensor expansion . Near the proximal interphalangeal joint, the extensor expansion splits into three parts: a central part, which is inserted into the base of the middle phalanx, and two lateral parts, which converge to insert into the base of the distal phalanx

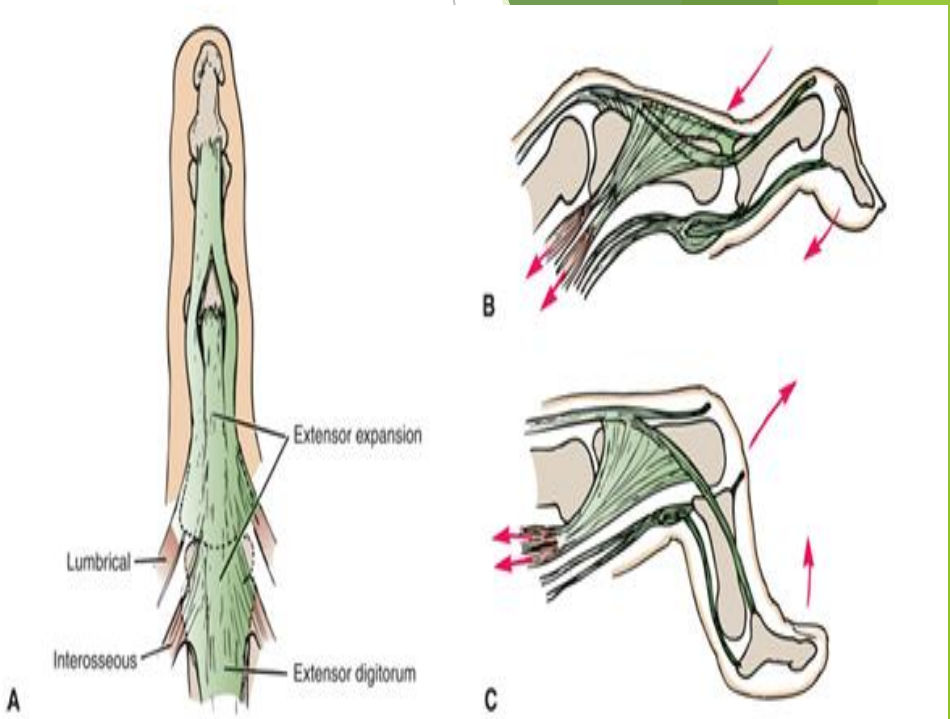
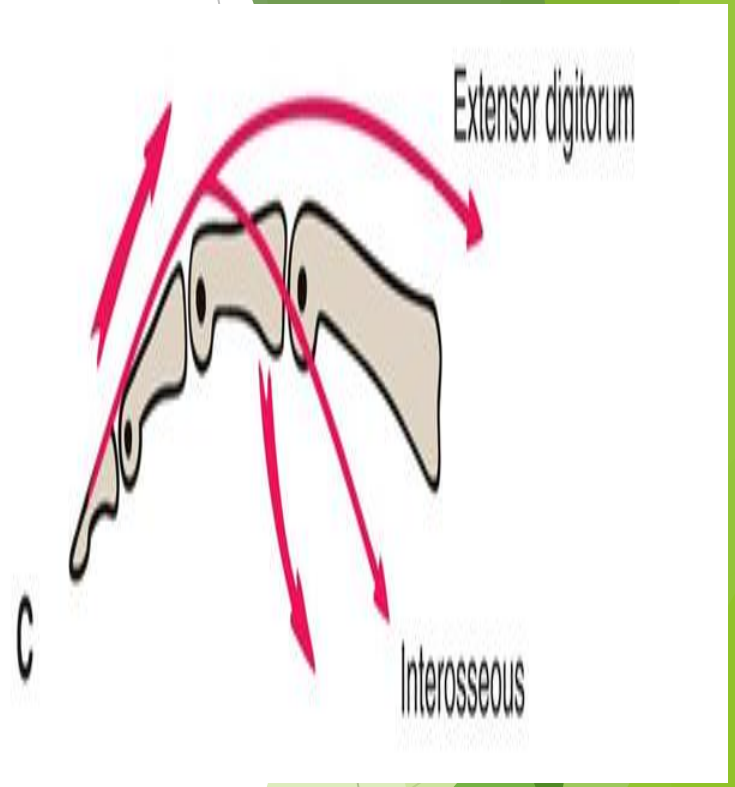


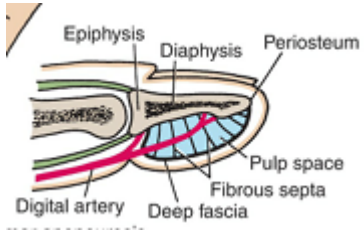
Figure 3.49 A. Posterior view of normal dorsal extensor expansion. The extensor expansion near the proximal interphalangeal joint splits into three parts: a central part, which is inserted into the base of the middle phalanx, and two lateral parts, which converge to be

- The dorsal extensor expansion receives the tendon of insertion of the corresponding interosseous muscle on each side and farther distally receives the tendon of the lumbrical muscle on the lateral side This arrangement, in which the tendons of the lumbricals and interossei emerge from the palmar aspect of the hand and cross the axes of rotation of the digits to attach onto the dorsal side of the digits, is the mechanism by which these muscles perform the seemingly contradictory actions of flexion of the metacarpophalangeal joints and extension of the interphalangeal joints .



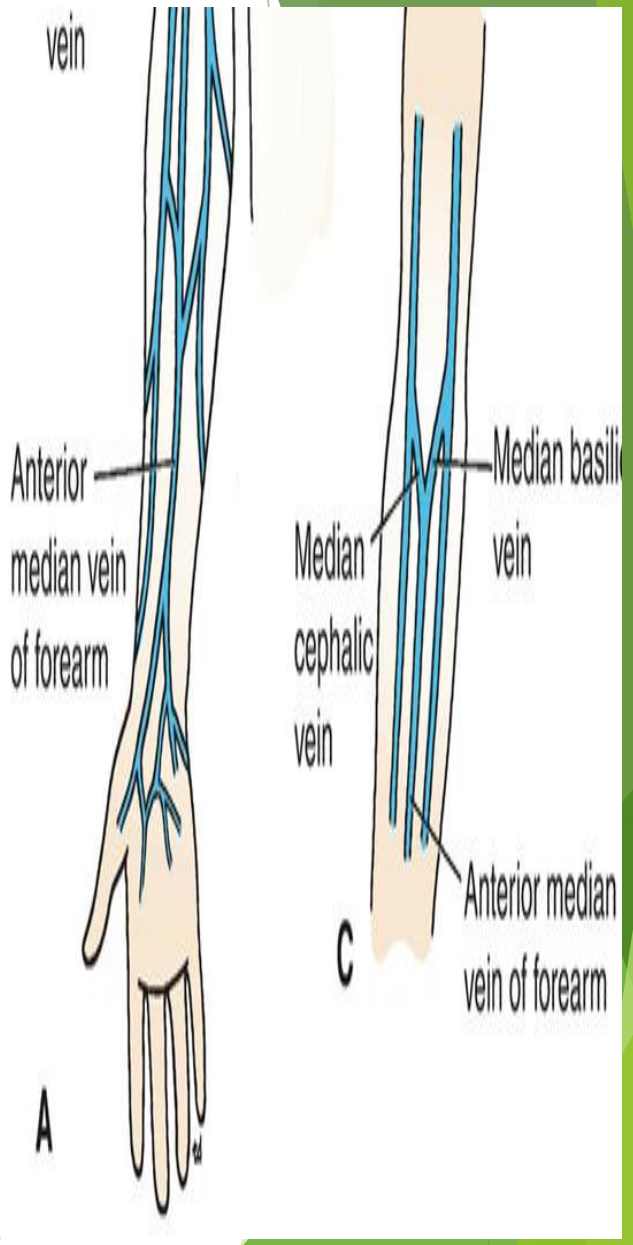
Finger Pulp Spaces

The deep fascia of the pulp of each finger fuses with the periosteum of the



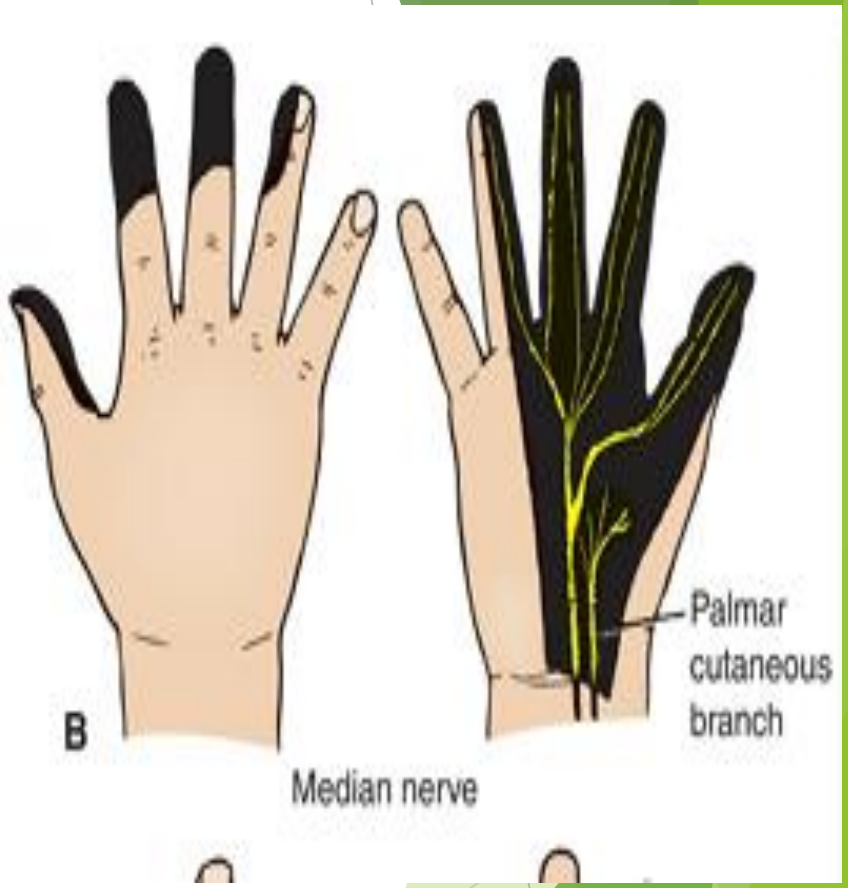
Veins

- The superficial venous network begins with the dorsal venous arch in the
- dorsum of the hand. This arch lies proximal to the metacarpophalangeal
- joints. The greater part of the blood from the whole hand drains into the arch,
- which receives digital veins and freely communicates with the deep veins of
- the palm through the interosseous spaces. The dorsal venous arch drains into
- the cephalic and basilic veins at its lateral and medial ends, respectively.



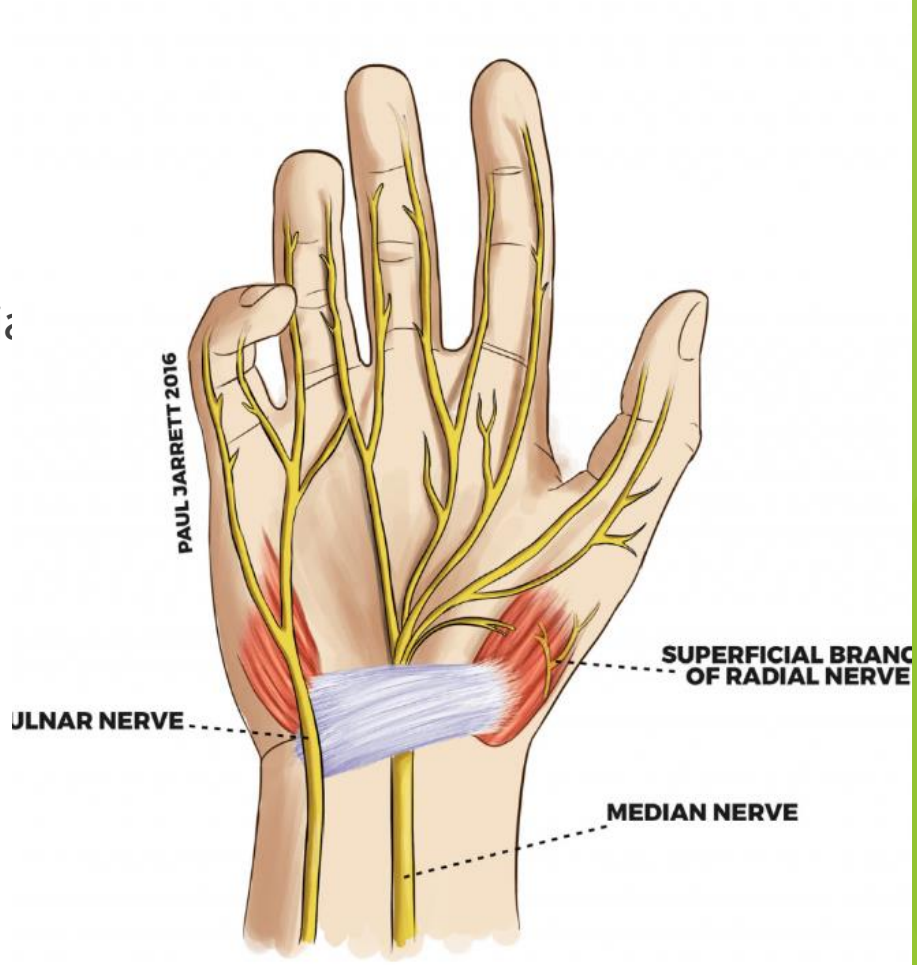
Hand Branches of median nerve

- The recurrent branch curves back around the distal border of the flexor retinaculum and lies about one fingerbreadth distal t the tubercle of the scaphoid. It supplies the muscles of the thenar compartment (abductor pollicis brevis, flexor pollicis brevis, and opponens pollicis) and the first lumbrical muscle
- The palmar digital branches supply the palmar aspect of the lateral three and a half fingers and the distal half of the dorsal aspect of each finger (see Figs. 3.41 and 3.54). One of these branches also supplies the second lumbrical muscle.



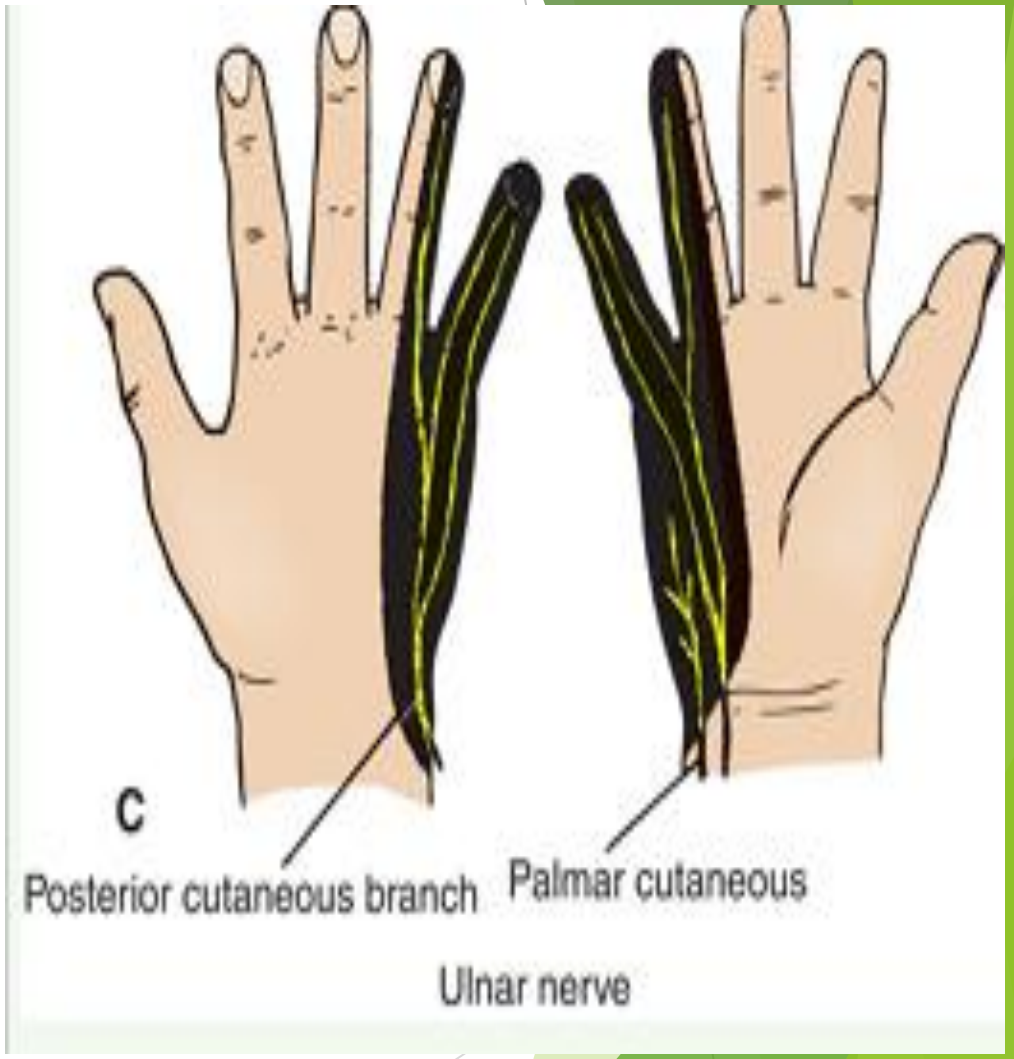
ulnar nerve branches in the hand

- Superficial Branch of Ulnar Nerve
- It descends into the palm, lying in the subcutaneous tissue between the pisiform bone and the hook of the hamate
- The nerve lies medial to the ulnar artery. Here, the nerve and artery may lie in a fibro-osseous tunnel (the tunnel of Guyon) created by fibrous tissue derived from the superficia part of the flexor retinaculum.



Branches

- A muscular branch supplies the palmaris brevis muscle.
- Palmar cutaneous branches (the common palmar digital and proper palmar digital nerves) supply the palmar aspect of the medial side of the little finger and the adjacent sides of the little and ring fingers.
- They also supply the distal half of the dorsal aspect of each finger.



Deep Branch of Ulnar Nerve

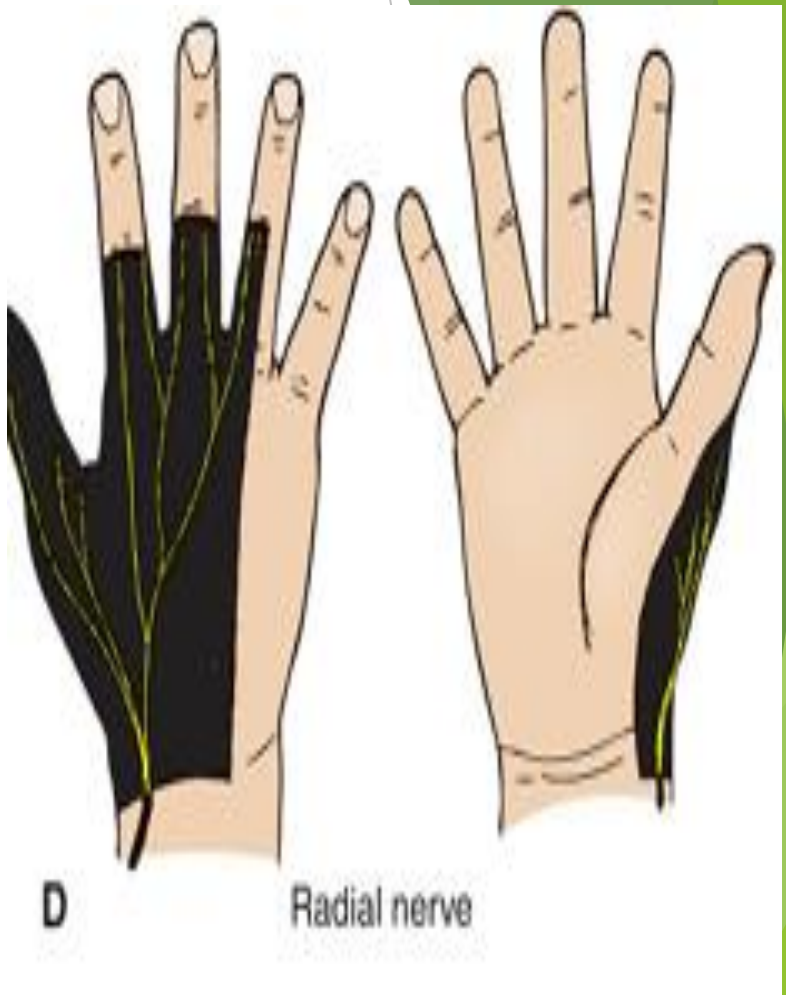
- The deep branch of the ulnar nerve is the primary motor nerve to the intrinsic muscles of the hand. It supplies all the intrinsic muscles except for the three muscles in the thenar compartment and the first two lumbricals, which are innervated by the median nerve.
- The deep branch curves deeply between the abductor digiti minimi and the flexor digiti minimi (see Figs. 3.44 and 3.45). It pierces the opponens digiti minimi, winds around the lower border of the hook of the hamate, and passes laterally within the concavity of the deep palmar arterial arch. The nerve lies deep to the long flexor tendons and superficial to the metacarpal bones and interosseous muscles

Branches

- Muscular branches supply the three muscles of the hypothenar eminence
- (abductor digiti minimi,
- flexor digiti minimi,
- and opponens digiti minimi),
- all the palmar and dorsal interossei, the third and fourth lumbrical muscles, and both heads of the adductor pollicis.

radial branches in the hand

- Superficial Branch of Radial Nerve
- The superficial branch of the radial nerve is a cutaneous nerve to the wrist and hand. It is the direct continuation of the radial nerve after its main stem has given off its deep branch in front of the lateral epicondyle of the humerus
- These terminal branches supply the lateral two thirds of the dorsum of the hand and the posterior surface over the proximal phalanges of the lateral three and a half fingers

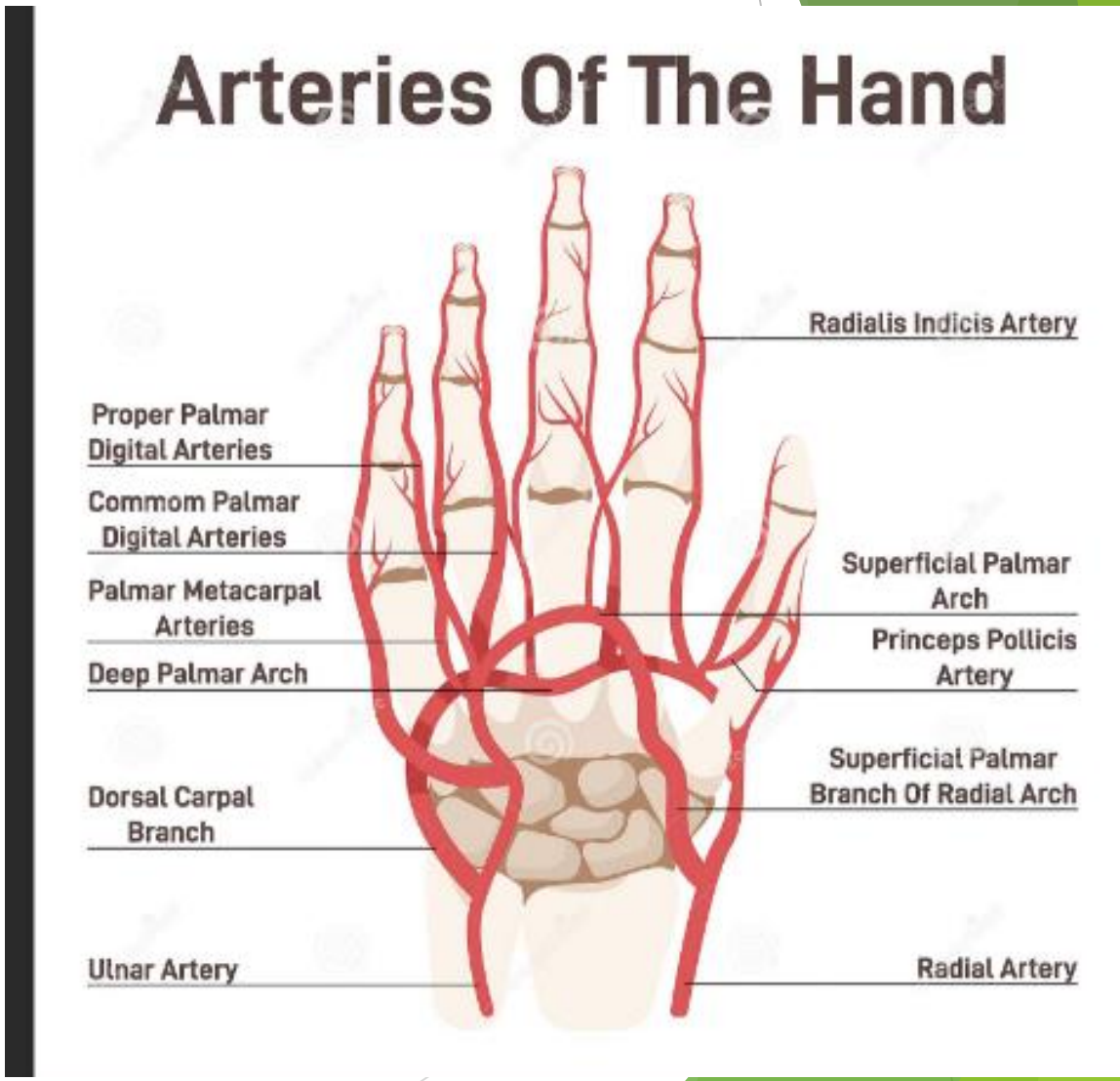


Ulnar Artery in Hand

- The ulnar artery enters the hand superficial to the flexor retinaculum on the lateral side of the ulnar nerve and the pisiform bone
- The artery gives off a deep palmar branch and then continues into the palm as the superficial palmar arch. On entering the palm, the superficial palmar arch curves laterally deep to the palmar aponeurosis and superficial to the long flexor tendons. The arch is completed on the lateral side by anastomosing with the superficial palmar branch of the radial artery.
- The curve of the arch lies across the palm, level with the distal border of the fully extended thumb

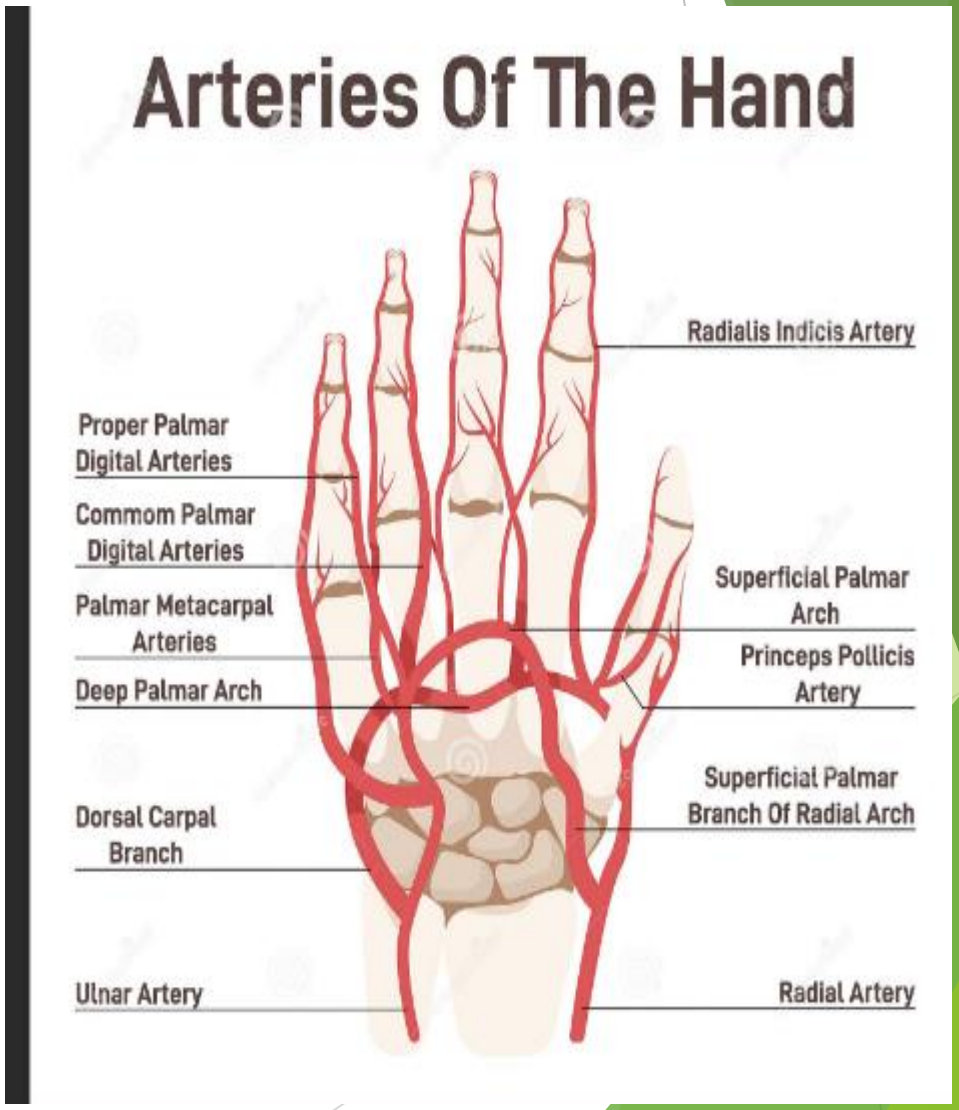
The superficial arch

- gives rise to three common palmar digital arteries
- Each common artery divides into two proper palmar digital arteries that supply adjacent sides of two digits.



The deep palmar branch

- of the ulnar artery arises superficial to the
- flexor retinaculum, passes deep between the abductor digiti minimi and the
- flexor digiti minimi, and joins the radial artery to complete the deep palmar
- arch



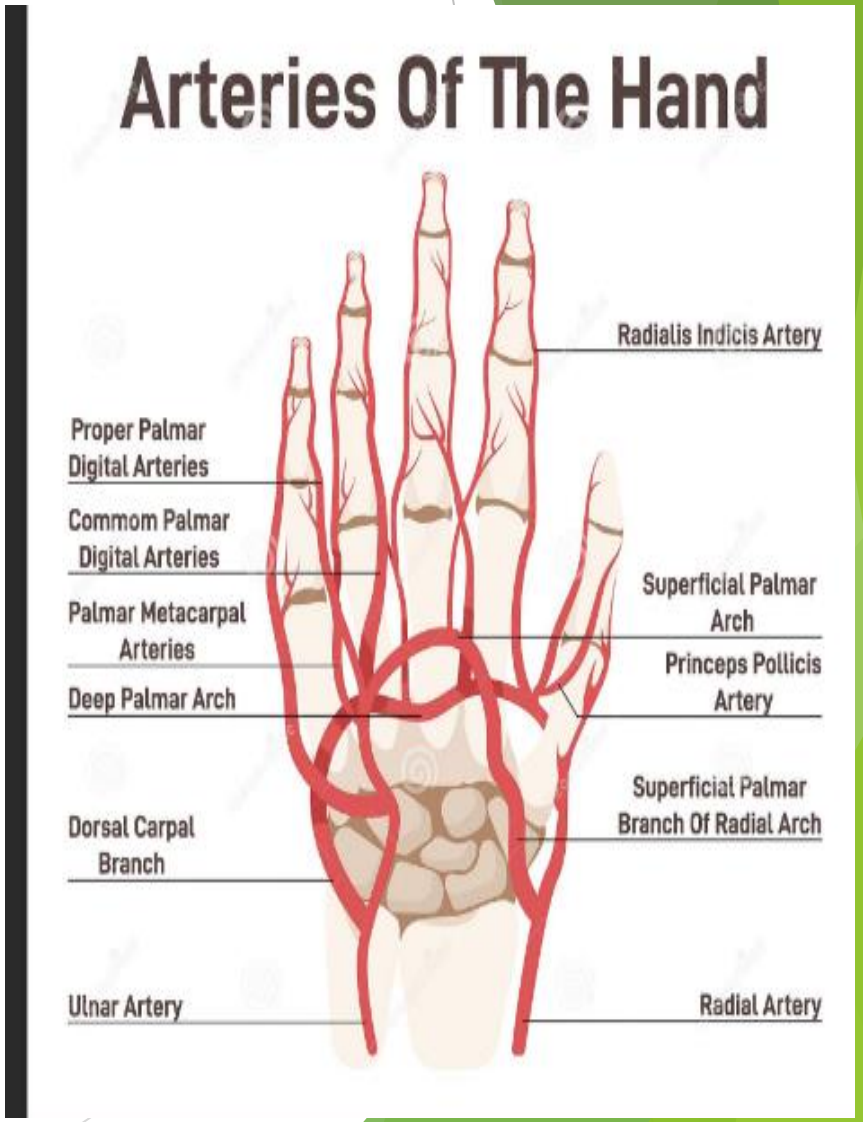
Radial Artery

- The artery enters the floor of the anatomic snuffbox, lying on the lateral ligament of the wrist joint and passing deep to the tendons of the abductor pollicis longus and extensor pollicis brevis muscles
- The vessel continues under the tendon of the extensor pollicis longus to reach the interval between the two heads of the first dorsal interosseous muscle. Here, the artery dives between the muscle heads to enter the deep aspect of the palm of the hand
- Upon entering the palm, the radial artery curves medially between the oblique and transverse heads of the adductor pollicis and continues as the deep palmar arch

Branches of radial artery in hand

- Upon entering the palm, the radial artery curves medially between the
- oblique and transverse heads of the adductor pollicis and continues as the
- deep palmar arch .
- The deep palmar arch curves
- medially deep to the long flexor tendons and superficial to the metacarpal
- bones and the interosseous muscles. The arch is completed on the medial side
- by the deep palmar branch of the ulnar artery. The curve of the arch lies at a
- level with the proximal border of the extended thumb.

- Immediately upon entering the palm, the radial artery gives off the arteria
- radialis indicis, which supplies the lateral side of the index finger, and the
- arteria princeps pollicis, which divides into two and supplies the lateral and
- medial sides of the thumb. The deep palmar arch sends branches proximally,
- which take part in anastomoses around the wrist joint, and distally, to join the
- digital branches of the superficial palmar arch.



- Before it dives to form the deep palmar arch, the radial artery gives rise
- to the dorsal carpal arch on the dorsum of the hand. Branches of the dorsal
- carpal arch take part in anastomoses around the wrist joint and also supply
- the digits

