CQ HAND + UPPER LIMB
SPECIALIST ORTHOPAEDIC SURGEON

EVIDENCE SUMMARY

STT Arthritis

Anatomy & Pathophysiology

OSSEOUS SKELETON

- The skeleton of the hand and wrist consists of 27 bones, of which 19 are long bones [3].
- The skeleton is divided into five rays, each comprising a polyarticulated chain of metacarpals and phalanges [3].
- The base of each metacarpal articulates with the distal row of the carpus [3].
- The carpus articulates with the skeleton of the forearm through its proximal row [3].
- The radioulnocarpal articulation has two axes of movement, to which a third axis of pronation and supination from the forearm is added [3].
- The wrist has three axes of movement, permitting the hand to be positioned in any spatial configuration [3].
- The radial ray (first ray) is the shortest, made up of a metacarpal and two phalanges [3].
- The first ray continues the external column of the carpus formed by the scaphoid and trapezium [3].
- The trapezium is angled out in front of the carpal plane so that the first metacarpal makes an angle of about 45 degrees with the second metacarpal in the sagittal plane [3].
- The thumb metacarpal is the shortest, while the index metacarpal is by far the longest [3].
- The proximal and middle phalanges of the long and ring fingers are longer than those of the index finger [3].
- The epiphyseal plates are located at the proximal ends of the phalanges and the first metacarpal [3].
- The epiphyseal plates are located at the distal ends of the other metacarpals [3].
- The hand presents a longitudinal and transverse concavity, giving it the shape of a cup with a palmar concavity when the thumb is placed next to the index finger [3].
- The transverse axis of the palm corresponds to the metacarpophalangeal articulations and is not perpendicular to the longitudinal axis [3].
- The transverse axis forms an acute angle of approximately 75 degrees with the longitudinal axis [3].

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MUSCULATURE

- Extrinsic muscles have their origin outside of the hand and their insertion on the hand or carpus [2].
- Intrinsic muscles have both origin and insertion within the hand [2].
- The extrinsic extensors run through six different fibroosseous retinacular compartments at the wrist level [2].
- The first extensor compartment contains the abductor pollicis longus and the extensor pollicis brevis [2].
- The abductor pollicis longus inserts at the base of the thumb metacarpal and radially abducts the thumb [2].
- The extensor pollicis brevis inserts on the dorsum of the proximal aspect of the proximal phalanx of the thumb and actively extends the metacarpophalangeal joint of the thumb [2].
- The second extensor compartment contains the extensor carpi radialis longus and the extensor carpi radialis brevis [2].
- The extensor carpi radialis longus inserts on the index metacarpal, dorsiflexes and radially deviates the wrist [2].
- The extensor carpi radialis brevis inserts into the base of the middle metacarpal and provides balanced wrist dorsiflexion [2].
- The third compartment contains the extensor pollicis longus, which turns abruptly radialward about Lister tubercle [2].
- The extensor pollicis longus inserts on the distal phalanx and provides forceful extension of the thumb interphalangeal joint [2].
- The fourth extensor compartment contains the extensor indicis proprius lying deep to the four tendons of the extensor digitorum communis [2].
- The fifth compartment contains the extensor digiti quinti [2].
- The principal bony insertion of the extrinsic digital extensors is on the dorsal proximal aspect of the middle phalanx [2].
- Metacarpophalangeal joint extension is provided by extrinsic extensor force transmitted through the sagittal bands [2].
- Distal interphalangeal joint extension is achieved through the conjoined lateral bands composed of tendinous slips from the extrinsic and intrinsic tendons [2].
- The extensor carpi ulnaris tendon runs through the sixth compartment and inserts at the base of the little finger metacarpal [2].
- The extensor carpi ulnaris provides wrist extension and ulnar deviation [2].
- The extensor digitorum communis tendons of the middle, ring, and little fingers are tethered together by juncturae tendinum over the dorsum of the hand proximal to the metacarpophalangeal joint [2].
- The digital extensor tendons are stabilized over the mid-line of the metacarpophalangeal joint by their attachment to sagittal band fibers [2].

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- The sagittal band fibers insert onto the volar proximal phalanx and onto the lateral borders of the volar plate [2].
- The sagittal bands keep the extrinsic extensor as far as possible away from the center of rotation of the metacarpophalangeal joint, giving it the greatest mechanical efficiency [2].
- With rupture or attenuation of the sagittal band fibers, the extrinsic extensor tendon can sublux to the ulnar side of the metacarpal head causing ulnar deviation of the finger [2].
- The extrinsic finger flexors are the flexor digitorum profundus and the flexor digitorum superficialis [2].
- The flexor digitorum profundus inserts on the proximal volar aspect of the distal phalanx [2].
- The flexor digitorum profundus flexes the distal interphalangeal joint as well as the proximal interphalangeal and metacarpophalangeal joints [2].
- The flexor digitorum superficialis acts as a flexor of the proximal interphalangeal and metacarpophalangeal joints [2].
- There are seven interosseous muscles, four dorsal and three volar [6].
- The dorsal interossei are abductors [6].
- The dorsal interossei lie to the radial side of the index and middle fingers and the ulnar side of the middle and ring fingers [6].
- The little finger is abducted by the abductor digiti quinti [6].
- The volar interossei are adductors and lie to the ulnar side of the index finger and the radial side of the ring and little fingers [6].
- The middle finger has two dorsal interossei (abductors) and no volar interossei (adductors) because the central axis of the hand lies within it [6].
- Each dorsal interosseous muscle, with the exception of the third, has two muscle heads [6].
- The superficial head of the dorsal interosseous muscles abducts and weakly flexes the proximal phalanx [6].
- The deep head of each dorsal interosseous muscle forms a lateral tendon, or lateral band, at the level of the MP joint [6].
- The deep head flexes and weakly abducts the proximal phalanx while extending the middle and distal phalanges [6].
- Transverse fibers arch dorsally from each lateral band to join each other over the dorsum of the finger, flexing the proximal phalanx [6].
- Oblique fibers (spiral fibers) from the lateral bands insert onto the lateral tubercles at the base of the middle phalanx and extend the middle phalanx (PIP joint) [6].
- The lateral bands are joined by the lateral slips of the extensor tendon to form the conjoined lateral band [6].
- The two conjoined lateral bands to each finger unite at the distal third of the middle phalanx to form the terminal tendon [6].
- The terminal tendon inserts at the base of the distal phalanx to extend it [6].

- The flexor digiti quinti brevis is structurally and functionally similar to the deep head of the dorsal interossei, forming the ulnar lateral band of the little finger [6].
- Each volar interosseous muscle has only one muscle head and none of them insert onto the proximal phalanx [6].
- The volar interossei form the ulnar lateral band of the index finger and the radial lateral band of the ring and little fingers [6].
- The abductor digiti quinti inserts onto the ulnar lateral tubercle at the base of the proximal phalanx of the little finger [6].
- The flexor digiti quinti forms the ulnar lateral band [6].
- The opponens digiti quinti arises from the pisohamate ligament and the hook of the hamate and inserts onto the ulnar side of the diaphysis of the fifth metacarpal [6].
- The opponens digiti quinti flexes and supinates the fifth metacarpal [6].
- The flexor digitorum profundus originates from the proximal ulna and the interosseous membrane [13].
- The flexor digitorum profundus and the flexor pollicis longus muscles form the deep compartment of the volar forearm [13].
- As the flexor digitorum profundus and flexor pollicis longus tendons travel through the carpal tunnel, they occupy the floor of the carpal tunnel [13].
- The tenosynovial sheath of the flexor pollicis longus is continuous with the radial bursa [13].
- The tenosynovial sheath to the little finger is continuous with the ulnar digital bursa [13].
- In some patients, the radial and ulnar bursae communicate, allowing a horseshoe abscess to spread between the thumb and little finger if infection occurs in the flexor tendon sheath of either one of these digits [13].
- The lumbricals originate from the radial side of the index, middle, ring, and little fingers in the palm [13].
- The profundus tendon passes through the bifurcation of the flexor digitorum superficialis before inserting into the proximal palmar base of the distal phalanx [13].
- The innervation of the flexor digitorum profundus of the index and middle fingers is through the anterior interosseous branch of the median nerve [13].
- The profundus of the ring and little fingers is innervated by the ulnar nerve [13].
- The flexor digitorum superficialis has two heads: a radial head originating from the proximal shaft of the radius, and a humeral ulnar head originating from the medial humeral epicondyle and coronoid process of the ulna [13].
- As the superficialis tendons pass through the carpal tunnel, the tendons of the middle and ring fingers are more superficial and central than those of the index and little fingers [13].
- In the proximal aspect of the finger, the flexor digitorum superficialis tendon bifurcates around the flexor digitorum profundus at the beginning of the A2 pulley [13].
- The flexor digitorum superficialis tendon slips reunite distally at the Camper chiasm, with approximately half of the fibers staying on the ipsilateral side and half crossing to the contralateral side of the finger [13].

- The flexor digitorum superficialis inserts via radial and ulnar slips into the proximal metaphysis of the middle phalanx [13].
- The entire flexor digitorum superficialis muscle receives innervation from the median nerve [13].
- The primary function of the superficialis is digital flexion at the proximal interphalangeal joint [13].
- The flexor pollicis longus originates from two heads: a radial head from the proximal radius and interosseous membrane, and an accessory head from the coronoid process of the ulna and medial epicondyle of the humerus [13].
- In the palm, the flexor pollicis longus tendon transverses between the abductor pollicis brevis and the flexor pollicis brevis [13].
- The flexor pollicis longus inserts into the proximal base of the thumb distal phalanx [13].
- The flexor pollicis longus is innervated by the anterior interosseous branch of the median nerve [13].
- The flexor pollicis longus flexes both the interphalangeal and metacarpophalangeal joints of the thumb [13].

LIGAMENTS AND FASCIA

- The second to fifth metacarpals are all bound together by various fibrous structures, the most distal of which is the deep transverse intermetacarpal ligament [9].
- The deep transverse intermetacarpal ligament is better named the interglenoid ligament because it ties together the anterior "glenoid ligaments" of the metacarpophalangeal articulations, known as the "volar plates" [9].
- The volar plates are interconnected by the transverse interglenoid ligament [9].
- The stability of the metacarpophalangeal joints is essential to the support of the longitudinal arch as well as of the transverse metacarpal arch [9].
- The superficial palmar fascia lies in a coronal plane beneath the palmar subcutaneous tissue [16].
- The superficial palmar fascia covers a triangular area of the central palm, with the proximal corner facing directly proximal [16].
- The palmaris longus tendon, when present, terminates in continuity with the fibers of this proximal corner [16].
- From this common point, four central bands of fascia extend distally toward each of the fingers [16].
- There is no central band for the thumb [16].
- At the distal palmar crease level, the central bands are bridged transversely by the superficial transverse palmar ligament [16].
- Fibers from the central bands pass above, below, and through the superficial transverse palmar ligament [16].
- Superficial fibers of the central bands stay superficial and merge with vertical retinacular fibers at the dermis's undersurface in the distal palm in areas between skin flexion creases [16].

- Intermediate fibers split transversely into two sections, which extend toward the lateral border of the digit base [16].
- These intermediate fibers are the spiral band that tracks around the neurovascular bundle [16].
- Proximally, the spiral band is central and superficial to the neurovascular bundle; distally, it is lateral and deep beneath it [16].
- Spiral neurovascular bundles develop when spiral bands shorten [16].
- Deep fibers continue dorsally to merge with sagittal interosseous fascia fibers and pierce the transverse deep intermetacarpal ligament to merge with fibers of the sagittal bands of the extensor mechanism [16].
- The digital neurovascular structures are surrounded by a diffuse network of thin transverse oblique fibers [16].
- Fibers dorsal to the neurovascular bundle are collectively called Cleland ligament [16].
- Fibers palmar to the neurovascular bundle are called Grayson ligament [16].
- Undisturbed, these "ligaments" are a mesh of nonparallel individual fibers [16].
- The appearance of a ligament is a dissection artifact from releasing skin attachments [16].
- These fibers have a common origin in continuity with the fingers' retinacular ligaments, the floor of the flexor tendon sheath, and retinacular fibers attaching the palmar digital skin to deeper structures [16].
- On the small finger's ulnar border, lateral fascial attachments are in continuity with the abductor digiti minimi fascia and tendon [16].
- A subdermal fascial layer borders the periphery of the web spaces from roughly the radial thumb sesamoid to the ulnar side of the small finger's proximal flexion crease [16].
- These border fibers form the distal first web space ligament between thumb and index in continuity with the natatory ligament that spans the remaining web spaces [16].
- Fibers from the natatory ligament extend distally at each finger's lateral base in continuity with Grayson ligament fibers and the lateral digit dermis [16].

VASCULAR ANATOMY

- The "princeps pollicis" artery, the terminal branch of the radial artery, crosses the first intermetacarpal space [10].
- The "princeps pollicis" artery runs along the ulnar side of the first metacarpal bone and along the volar surface of the adductor muscle [10].
- The "princeps pollicis" artery emerges onto the subcutaneous palmar tissue at the level of the cutaneous flexion crease of the metacarpophalangeal joint [10].
- At the metacarpophalangeal joint level, the "princeps pollicis" divides into two terminal rami, namely the collateral palmar arteries of the thumb [10].
- The collateral palmar arteries run along the digital tunnel symmetrically and are of equal caliber [10].
- The collateral palmar arteries head distally to finally unite in the pulp arcade [10].

- During their transit in the digital tunnel, the collateral palmar arteries break off into numerous collateral branches, either cutaneous, articular or osseous [10].
- An arcade located deep in the flexor tendon joins together the two arteries at the level of the distal metaphysis of the first phalanx [10].
- From this arcade, vessels originate which enter the “vincula” and irrigate the flexor tendon [10].
- In anatomical studies, only 15% of dissections fall into the classical category of palmar artery layout [10].
- In

Clinical Presentation

- Inflammatory arthritis is a collection of different diseases that cause inflammation in the joints [20].
- The diagnosis of inflammatory arthritis requires a complete review of the disease process profile [20].
- There are no simple clinical tests that can be used to diagnose inflammatory arthritis diseases [20].
- The rheumatologic history and physical examination play a critical role in the diagnosis and treatment of inflammatory arthritis [20].
- The location of the problems is an important disease feature for diagnosing inflammatory arthritis [20].
- The symmetry of presentation is an important disease feature for diagnosing inflammatory arthritis [20].
- Rheumatoid arthritis has a predilection for the wrists and the proximal joints of the hands and feet [20].
- Psoriatic arthritis involves the distal interphalangeal joint of the hands [20].
- The physical findings with rheumatoid arthritis tend to be symmetrical [20].
- Other inflammatory arthritis conditions do not tend to present with symmetrical physical findings [20].
- The onset of the disease is an important feature for diagnosing inflammatory arthritis [20].
- The chronology of the disease is an important feature for diagnosing inflammatory arthritis [20].
- The onset of rheumatoid arthritis tends to present in a subacute manner [20].
- Septic arthritis has a rapid onset in several hours [20].
- Age can aid in the diagnosis of inflammatory arthritis [20].
- Gender can aid in the diagnosis of inflammatory arthritis [20].
- Precipitating factors can aid in the diagnosis of inflammatory arthritis [20].

Investigations

- Clinical evaluation of the hand and wrist requires combining patient history with a careful physical examination to narrow the scope of possible pathologic processes [1].
- Diagnostic tests such as imaging and serum laboratory studies are useful in determining pathology but can be expensive, time-consuming, and often nonspecific [1].

- A careful physical examination is essential to direct care and future testing if indicated [1].
- The radioulnocarpal articulation has two axes of movement, to which a third axis—pronation and supination from the forearm—is added [3].
- The transverse axis of the palm forms an acute angle of approximately 75 degrees with the longitudinal axis [3].
- An 8-MHz Doppler tone assessment may be used to identify superficially displaced neurovascular bundles when Dupuytren cords lie beneath soft fleshy prominences [19].
- False-negatives are possible with 8-MHz Doppler tone assessment for identifying neurovascular bundles [19].
- MR assessment of Dupuytren's disease is hindered by the resolution of current equipment, orientation issues due to multiplanar deformities of the fingers, and lack of intraoperative availability [19].
- MRI is probably most useful in identifying additional pathology such as flexor tendon bowstringing [19].
- MRI may be helpful in providing a quantitative noninvasive measure of cellularity of affected areas, which is an index of biologic activity [19].

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