CQ HAND + UPPER LIMB
SPECIALIST ORTHOPAEDIC SURGEON

EVIDENCE SUMMARY

Glomus Tumour

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 ray making up a polyarticulated chain comprising the 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 is added a third—pronation and supination from the forearm [3].
- The wrist has three axes of movement, permitting the hand to be positioned in any spatial configuration and allowing it to be placed as needed for grasping [3].
- The radial ray or first ray is the shortest and is made up of only three bones—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 clearly 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, and 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, whereas they 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, which corresponds to the metacarpophalangeal articulations, 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, whereas intrinsic muscles have both origin and insertion within the hand [2].
- Extrinsic muscles are either flexors or extensors, and intrinsic muscles contribute to both digital flexion and extension [2].
- The extrinsic extensors run through six different fibroosseous retinacular compartments at the wrist level [2].
- The first (most radial) compartment contains the abductor pollicis longus and the extensor pollicis brevis [2].
- The abductor pollicis longus has multiple slips that insert 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, providing balanced wrist dorsiflexion [2].
- The third compartment contains the extensor pollicis longus, which runs longitudinally down the forearm through the third compartment and turns abruptly radialward about Lister tubercle [2].
- The extensor pollicis longus provides forceful extension of the thumb interphalangeal joint [2].
- The oblique course of the extensor pollicis longus tendon provides a substantial adduction component to the pull of the extensor pollicis longus [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 that are composed of tendinous slips from the extrinsic and intrinsic tendons [2].
- The extensor indicis proprius inserts on the index finger ulnar to the extensor digitorum communis [2].
- The extensor digitorum communis inserts on the index, middle, ring, and, in some cases, little fingers [2].
- The extensor digiti quinti tendon inserts on the little finger ulnar to the extensor digitorum communis insertion [2].

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- 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 extensor indicis proprius tendon may be recognized at the wrist level as possessing the most distal muscle belly of any of the digital extensor tendons [2].
- The digital extensor tendons are stabilized over the mid-line of the metacarpophalangeal joint by their attachment to sagittal band fibers [2].
- The sagittal band fibers insert onto the volar proximal phalanx and onto the lateral borders of the volar plate [2].
- The sagittal band fibers form a sling that allows proximal extrinsic extensor tension to be transmitted to the proximal phalanx, permitting metacarpophalangeal joint extension without a tendinous insertion onto the proximal phalanx [2].
- By holding the extrinsic extensor tendon balanced over the prominence of the metacarpal head, the sagittal bands normally keep the extrinsic extensor as far as possible away from the center of rotation of the metacarpophalangeal joint, thereby 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, flexing 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].
- Because the anatomic axis of the hand coincides with the axis of the third metacarpal, 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 muscle arises most dorsally from the shaft of the contiguous metacarpals and is inserted deeply by a medial tendon onto the lateral tubercle of the base of the proximal phalanx [6].

- The superficial head abducts and weakly flexes the proximal phalanx [6].
- The superficial head has no direct effect on the middle or distal phalanges [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].
- At the level of the middle of the proximal phalanx, transverse fibers arch dorsally from each lateral band to join each other over the dorsum of the finger, flexing the proximal phalanx [6].
- More distally, oblique fibers (spiral fibers) from the lateral bands sweep over the distal third of the proximal phalanx to insert onto the lateral tubercles at the base of the middle phalanx [6].
- The oblique fibers extend the middle phalanx (PIP joint) [6].
- More distally, 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].
- The three volar interossei arise from adjacent surfaces of contiguous metacarpal shafts [6].
- Unlike the dorsal interossei, 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].
- As with the lateral bands of the dorsal interossei, transverse fibers arch over the dorsum of the proximal phalanx and join those of the opposite lateral band to flex the proximal phalanx [6].
- All lateral bands are joined by the lateral slips of the extensor tendon to form a conjoined lateral band and finally a terminal tendon that extends to the distal phalanx [6].
- Of the hypothenar muscles, the abductor digiti quinti and flexor digiti quinti brevis are similar in both structure and function to the superficial and deep heads of the dorsal interossei, respectively, and arise from the fifth metacarpal [6].
- The abductor 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].
- A third muscle, the opponens digiti quinti, lies deepest [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, which it flexes and supinates [6].

- The extrinsic flexors of the finger consist of the flexor digitorum profundus and the flexor digitorum superficialis [13].
- The flexor digitorum profundus originates from the proximal ulna and the interosseous membrane [13].
- In the forearm, the flexor digitorum profundus divides into two muscle groups: the most radial component supplying the index finger and the ulnar component supplying the middle, ring, and little fingers [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, these two bursae communicate, allowing a so-called 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 profundus provides digital flexion at both the proximal and distal interphalangeal joints [13].
- The flexor digitorum superficialis has two heads: The radial head originates from the proximal shaft of the radius, and the humeral ulnar head originates from the medial humeral epicondyle and coronoid process of the ulna [13].
- Each digit has a corresponding independent superficialis muscle [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 then 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 tendon then 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: The radial head takes origin from the proximal radius and interosseous membrane, and an accessory head originates from the coronoid process of the ulna and from the 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 and 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].

TENDON SHEATHS AND PULLEYS

- As the flexor tendons pass distal to the metacarpal neck, they enter the fibroosseous tunnel, or digital flexor sheath [13].
- The fibroosseous tunnel extends distally to the proximal aspect of the distal phalanx [13].
- The tendinous sheath consists of annular pulleys, which provide mechanical stability, and cruciate pulleys, which provide flexibility [13].
- The first, third, and fifth annular pulleys (A1, A3, and A5) are located over the metacarpophalangeal, proximal interphalangeal, and distal interphalangeal joints, respectively [13].
- The second and fourth pulleys (A2 and A4) are situated over the middle portion of the proximal and middle phalanges [13].
- The A2 and A4 pulleys are the most essential in maintaining the mechanical advantage of the flexor tendons [13].
- The tenosynovium that lines the fibroosseous tunnel supplies both nutrition and lubrication to the poorly vascularized flexor tendons [13].
- Proximal to the sheath, the tendons are well vascularized by the peritenon [13].
- Within the sheath, tendon vascularity is supplied via the vincula system: the vinculum longus and brevis [13].

SOFT TISSUE AND FASCIA

- The superficial palmar fascia lies in a coronal plane beneath the palmar subcutaneous tissue [16].
- It covers a triangular area of the central palm, 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].
- Confluent proximally, the central bands separate and diverge just distal to the transverse retinacular ligament, each following the underlying ray [16].

- At the distal palmar cre

Investigations

- Clinical evaluation of the hand and wrist requires combining patient history with a careful physical examination to pinpoint or 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].
- 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].
- Doppler imaging is a promising improvement over handheld Doppler assessment but higher resolution imaging technology is needed [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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