CQ HAND + UPPER LIMB
SPECIALIST ORTHOPAEDIC SURGEON

EVIDENCE SUMMARY

Distal Scaphoid Excision

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, whereas they are located at the distal ends of the other metacarpals [3].
- The fixed elements of the hand skeleton include the middle metacarpals, which are united to the carpus by intrinsic interlocking encasement [9].
- The index metacarpal is the most firmly fixed [9].
- The ring metacarpal has about 10 degrees of mobility in flexion and extension [9].
- The fifth metacarpal has a range of flexion–extension of approximately 20 degrees [9].

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- The second to fifth metacarpals are bound together by the deep transverse intermetacarpal ligament, also known as the interglenoid ligament [9].

MUSCULATURE

- Extrinsic muscles have their origin outside of the hand and insertion on the hand or carpus, whereas 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 second extensor compartment contains the extensor carpi radialis longus and the extensor carpi radialis brevis [2].
- The third compartment contains the extensor pollicis longus, which turns abruptly radialward about Lister tubercle [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 extensor carpi ulnaris tendon runs through the sixth compartment and inserts at the base of the little finger metacarpal [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].
- The sagittal band fibers insert onto the volar proximal phalanx and onto the lateral borders of the volar plate [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 originates from the proximal ulna and the interosseous membrane [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].
- 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 [13].
- The flexor pollicis longus originates from a radial head on the proximal radius and interosseous membrane, and an accessory head on the coronoid process of the ulna and medial epicondyle of the humerus [13].

- The flexor pollicis longus inserts into the proximal base of the thumb distal phalanx [13].
- There are seven interosseous muscles, four dorsal and three volar [6].
- The dorsal interossei are abductors and lie to the radial side of the index and middle fingers and the ulnar side of the middle and ring fingers [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: a superficial head and a deep head [6].
- The superficial head of the dorsal interosseous muscles abducts and weakly flexes the proximal phalanx [6].
- The deep head of the dorsal interosseous muscles flexes and weakly abducts the proximal phalanx while extending the middle and distal phalanges [6].
- The volar interossei have only one muscle head and none of them insert onto the proximal phalanx [6].
- The abductor digiti quinti and flexor digiti quinti brevis are similar in structure and function to the superficial and deep heads of the dorsal interossei, respectively [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].

SOFT TISSUE & VASCULAR ANATOMY

- The superficial palmar fascia lies in a coronal plane beneath the palmar subcutaneous tissue [16].
- The palmaris longus tendon, when present, terminates in continuity with the fibers of the proximal corner of the superficial palmar fascia [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, and those palmar to the neurovascular bundle are called Grayson ligament [16].
- The “princeps pollicis” artery is the terminal branch of the radial artery that crosses the first intermetacarpal space and runs along the ulnar side of the first metacarpal bone [10].
- The princeps pollicis artery emerges onto the subcutaneous palmar tissue at the level of the cutaneous flexion crease of the metacarpophalangeal joint [10].
- The princeps pollicis artery divides into two terminal rami, the collateral palmar arteries of the thumb, which run along the digital tunnel symmetrically [10].
- An arcade located deep in the flexor tendon joins together the two palmar arteries at the level of the distal metaphysis of the first phalanx [10].
- The dorsal arteries of the thumb originate from the terminal branches of the radial artery at the level of the anatomical snuff-box [10].

- The posterior area of the thumb is vascularized by two arteries which originate from the palmar arteries at the level of the first metacarpal [10].
- 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 [13].
- The fibroosseous tunnel of the digital flexor sheath consists of annular pulleys that provide mechanical stability and cruciate pulleys that provide flexibility [13].
- The A2 and A4 pulleys are the most essential in maintaining the mechanical advantage of the flexor tendons [13].
- The tenosynovium lining the fibroosseous tunnel supplies nutrition and lubrication to the poorly vascularized flexor tendons [13].
- Within the flexor tendon sheath, tendon vascularity is supplied via the vincula system: the vinculum longus and brevis [13].

FUNCTIONAL ANATOMY & MECHANICS

- The hand is both an organ designed to obtain information and an organ of execution [4].
- The hand functions efficiently only if the proximal joints of the limb are stable and yet mobile [4].
- The open hand, with fingers extended and in contact, forms a balanced graceful oval in its longitudinal axis [4].
- The posterior or dorsal aspect of the hand is convex, and the anterior, palmar or volar aspect is concave [4].
- The digits converge in closing (flexion and adduction) and diverge in opening (extension and abduction) [4].
- When the fingers are extended and separated, the tips of the fingers lie on the circumference of a circle whose center is the head of the third metacarpal [4].
- The hand consists of 19 bones, 17 articulations, and 19 muscles situated entirely within the hand [4].
- The metacarpal arch is endowed with adaptability because of the mobility of the peripheral metacarpals [9].
- The heads of the second and third metacarpals are fixed [9].
- The longitudinal arches are composed of a fixed carpometacarpal portion and a mobile digital portion [9].
- The metacarpophalangeal articulations are the keystones of the longitudinal arches [9].
- The volar plates prevent hyperextension at the metacarpophalangeal joints [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].
- Most structures in the hand glide in relation to neighboring structures [14].
- The dorsal integument must be supple, elastic, and malleable to allow metacarpophalangeal joint flexion [14].

- In unrestricted areas with a straight tendon trajectory, tendons are surrounded by paratenon and areolar connective tissue [14].
- In narrow crowded areas, the gliding mechanism is assured by the synovial sheath surrounded by fibrous sheaths that keep the tendon close to the skeleton [14].
- The synovial sheaths at specific sites assume the role of a pulley when the tendon changes direction [14].
- The gliding mechanism represented by synovial sheaths is much more developed on the palmar aspect than the dorsal aspect [14].
- There are three digitopalmar synovial sheaths for the flexor tendons of the index finger, long finger, and ring finger [14].
- On the dorsal aspect, extensor synovial tendon sheaths are present only at the level of the wrist [14].
- The position of each articulation depends on the equilibrium of forces acting at that level, which is subject to the position of the immediately proximal articulation [14].
- The wrist influences the position of the metacarpophalangeal joint, which affects the position of the proximal interphalangeal joint, which in turn affects the distal interphalangeal joint [14].
- Single articular movements around a fixed perpendicular axis simply do not exist in the hand [14].
- Almost all movements in the hand are around oblique and variable axes, resulting in combined movements [14].
- The dorsal skin is thin and lined by a horny layer that is only 0.02 mm thick [15].
- The dorsal skin possesses a normal pilosebaceous system, unlike the palm [15].
- Flexion of the fingers produces a significant lengthening of the dorsal skin [15].
- In the middle finger, the distance between the wrist and the ungual fold shows an average increase of 3 cm as the finger goes from extension to full flexion [15].
- Flexion at the metacarpophalangeal joint alone requires an average skin lengthening of 1.25 cm [15].
- The dorsal and palmar areas of skin are independent because of a system of adhesions that anchors their common boundary to the underlying plane [15].
- In the proximal part of the first phalanx, skin fixation occurs in the plane of the commissural crest in the form of small fibrils arranged in a fan shape [15].
- Opposite the middle and distal phalanges, the adhesion band lies just posterior to the palmar collateral neurovascular bundle on the lateral side [15].
- The axes of flexion are arranged so that flexion of all the metacarpophalangeal and proximal interphalangeal joints causes the fingers to converge toward the scaphoid [17].

Investigations

- Clinical evaluation of the injured or dysfunctional 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].
- The skeleton is divided into five rays, each ray making up a polyarticulated chain comprising the metacarpals and phalanges [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 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].
- 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].
- 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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