CQ HAND + UPPER LIMB
SPECIALIST ORTHOPAEDIC SURGEON

EVIDENCE SUMMARY

Drainage of a Felon

Anatomy & Pathophysiology

GENERAL HAND ARCHITECTURE

- The hand is composed of 19 bones, 17 articulations, and 19 muscles situated entirely within the hand [2].
- The hand contains approximately the same number of tendons activated by forearm muscles as it has intrinsic muscles [2].
- The hand functions as an organ designed to obtain information and an organ of execution [2].
- The dorsal aspect of the hand is convex, while the anterior, palmar, or volar aspect is concave [2].
- The distal half of the hand is separated into five digits which flex toward the palm [2].
- The thumb has a more proximal and lateral position than the four fingers, allowing movement inward and outward from the palm [2].
- The web space of the thumb is the largest and deepest of the digital web spaces [2].

CUTANEOUS ANATOMY

- The dorsal cutaneous unit extends from the wrist to the proximal interphalangeal joints of the fingers and the interphalangeal joint of the thumb [3].
- The dorsal covering of the interphalangeal articulations forms a unique cutaneous unit characterized by considerable excess of skin when digits are in extension [3].
- The dorsal integument of the distal phalanx is distinct due to the presence of the nail bed with its matrix [3].
- The palm forms a cutaneous unit extending from the distal transverse crease of the wrist up to the transverse crease at the base of the digits [3].
- The palmar integument is subdivided into two separate zones by the oppositional crease of the thumb [3].
- The skin of the radial portion of the palm covers the thenar eminence and is relatively well vascularized and mobile [3].
- The skin of the ulnar and distal portion of the palm covers the hypothenar eminence and has poor mobility [3].

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- The central triangular part of the palm has fixed, poorly vascularized skin that covers almost directly the superficial palmar aponeurosis [3].
- The integument of the palmar face of the digits is subdivided into phalangeal units separated by digital flexion folds [3].
- When a digit is completely flexed, the integument of adjacent phalanges comes into contact in the zones of the flexion creases, establishing areas of cutaneous contact in the form of a diamond [3].
- The sides of the diamond-shaped cutaneous contact zones do not undergo variations in length during flexion and extension movements [3].
- Incisions made along the lines of the diamond-shaped cutaneous contact zones present a minimal chance of retraction [3].
- The dorsal slope of the web spaces has a gradual incline and its supple skin is not adherent to the subjacent region [3].
- The palmar surface of the web spaces is flat and precipitously interrupted, with skin densely adherent to the commissural skeleton [3].
- The commissural skeleton of the web spaces is formed by the interdigital palmar (natatory) ligament between the fingers and by the distal transverse ligament at the level of the thumb web [3].

MUSCULAR ANATOMY

- There are seven interosseous muscles in the hand, consisting of four dorsal and three volar muscles [4].
- 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 [4].
- The little finger is abducted by the abductor digiti quinti [4].
- 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 [4].
- The middle finger has two dorsal interossei (abductors) and no volar interossei (adductors) because the central axis of the hand lies within it [4].
- Each dorsal interosseous muscle, with the exception of the third, has two muscle heads [4].
- The superficial head of the dorsal interosseous muscles 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 [4].
- The superficial head of the dorsal interosseous muscles abducts and weakly flexes the proximal phalanx [4].
- The deep head of each dorsal interosseous muscle forms a lateral tendon, or lateral band, at the level of the metacarpophalangeal joint [4].
- The deep head of the dorsal interosseous muscles flexes and weakly abducts the proximal phalanx while extending the middle and distal phalanges [4].
- Transverse fibers arch dorsally from each lateral band to join each other over the dorsum of the finger, flexing the proximal phalanx [4].

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- 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 [4].
- The oblique fibers extend the middle phalanx at the proximal interphalangeal joint [4].
- The lateral bands are joined by the lateral slips of the extensor tendon to form the conjoined lateral band [4].
- The two conjoined lateral bands to each finger unite at the distal third of the middle phalanx to form the terminal tendon [4].
- The terminal tendon inserts at the base of the distal phalanx to extend it [4].
- 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 [4].
- Each volar interosseous muscle has only one muscle head and none of them insert onto the proximal phalanx [4].
- The volar interossei form the ulnar lateral band of the index finger and the radial lateral band of the ring and little fingers [4].
- The abductor digiti quinti and flexor digiti quinti brevis arise from the fifth metacarpal [4].
- The abductor digiti quinti inserts onto the ulnar lateral tubercle at the base of the proximal phalanx of the little finger [4].
- The flexor digiti quinti forms the ulnar lateral band [4].
- 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 [4].
- The opponens digiti quinti flexes and supinates the fifth metacarpal [4].

VASCULAR ANATOMY

- The “princeps pollicis” artery is the terminal branch of the radial artery and crosses the first intermetacarpal space [8].
- The “princeps pollicis” artery runs along the ulnar side of the first metacarpal bone and along the volar surface of the adductor muscle [8].
- The “princeps pollicis” artery emerges onto the subcutaneous palmar tissue at the level of the cutaneous flexion crease of the metacarpophalangeal joint [8].
- At the metacarpophalangeal joint level, the “princeps pollicis” artery divides into two terminal rami, namely the collateral palmar arteries of the thumb [8].
- The collateral palmar arteries of the thumb run along the digital tunnel symmetrically and are of equal caliber [8].
- The collateral palmar arteries head distally to finally unite in the pulp arcade [8].
- During their transit in the digital tunnel, the collateral palmar arteries break off into numerous collateral branches, either cutaneous, articular, or osseous [8].

- An arcade located deep in the flexor tendon joins together the two arteries at the level of the distal metaphysis of the first phalanx [8].
- Vessels originating from the subtendinous arcade enter the “vincula” and irrigate the flexor tendon [8].
- In anatomical studies, only 15% of dissections fall into the category of the classical layout of palmar arteries of the thumb [8].
- In the second segment of the thumb, the two arteries run alongside the flexor tendon and behind the collateral nerves [8].
- In the second segment of the thumb, the main artery is the ulnar collateral artery [8].
- The subtendinous anastomosis situated at the level of the neck of the first phalanx acts as a “moderator” between the two arteries [8].
- In cases where the palmar ulnar collateral artery is absent, the dorsal artery takes its place by means of a branch through the subtendinous arcade [8].
- In the pulp segment, the two arteries are of similar size and run through the thick fatty subcutaneous padding [8].
- In the pulp segment, the arteries cross over and convert into the ends of the digital nerves at the level of the median axis [8].
- The posterior area of the thumb is vascularized by two arteries which originate from the palmar arteries at the level of the first metacarpal [8].
- These dorsal arteries run laterally along the metacarpophalangeal joint and continue obliquely from volar to dorsal [8].
- At the level of the neck of the first phalanx, an anastomosis can be found which originates from the palmar arteries [8].
- The ulnar dorso-collateral artery generally stems from the “princeps pollicis” onto the medial border of the neck of the first metacarpal [8].

SURGICAL ANATOMY CONSIDERATIONS

- Distal palmar incisions are transverse, while proximal palmar incisions tend to be more longitudinal with the distal end curving radially [9].
- Proximal palmar incisions should parallel the thenar crease [9].
- When extended proximal to the wrist, palmar incisions should not cross the flexor wrist creases at a right angle [9].
- The most important structure in the thenar area is the recurrent branch (motor) of the median nerve [9].
- Anatomic studies have shown that there is no single longitudinal incision in the proximal palm that completely avoids the palmar cutaneous branches of the median and ulnar nerves [9].
- In the distal palm, structures lying between the metacarpal heads are not protected by the palmar fascia [9].
- The superficial volar neurovascular arch should be protected when deeper exposure is required in the palm [9].

- Midlateral incisions described for the fingers are also suitable for the thumb [9].
- The radial side of the thumb is more accessible for midlateral incisions [9].
- Care should be taken to avoid the dorsal branch of the superficial radial nerve to the radial side of the thumb during midlateral incisions [9].

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].
- An 8-MHz Doppler tone assessment may be used to identify superficially displaced neurovascular bundles when Dupuytren cords lie beneath soft fleshy prominences [11].
- False-negatives are possible with 8-MHz Doppler tone assessment for identifying neurovascular bundles [11].
- Doppler imaging is a promising improvement for visualizing palmar structures, but higher resolution imaging technology is needed [11].
- 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 [11].
- MRI is probably most useful in identifying additional pathology such as flexor tendon bowstringing [11].
- MRI may be helpful in providing a quantitative noninvasive measure of cellularity of affected areas, which is an index of biologic activity [11].

References

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