

Drainage of an Acute Paronychia

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 the forearm muscles as it has intrinsic muscles [2].
- The open hand forms a balanced graceful oval in its longitudinal axis when fingers are extended and in contact [2].
- The proximal carpometacarpal half of the hand is flattened and presents two faces with unique anatomical and functional significance [2].
- The posterior or 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 that flex toward the palm [2].
- The digits converge in closing by flexing and adducting, and diverge in opening by extending and abducting [2].
- The thumb has a more proximal and lateral position than the other digits, allowing movement inward and outward from the palm [2].
- The four fingers are the distal extension of the carpometacarpal part of the hand [2].
- The hinges for finger movement are located at the thenar crease and at the transverse distal palmar crease, not at the bases of the digits [2].
- When fingers are extended and separated, their tips lie on the circumference of a circle whose center is the head of the third metacarpal [2].

CUTANEOUS UNITS AND SKIN

- The dorsal covering of the interphalangeal articulations of the digits forms a unique cutaneous unit characterized by a considerable excess of skin when the 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, which constitutes the oblique axis of the hand [3].
- The skin of the radial portion of the palm covers the thenar eminence and the external part of the palm and is relatively well vascularized and mobile [3].
- The skin of the ulnar and distal portion covers the hypothenar eminence, where the skin has poor mobility [3].
- The central triangular part of the palm has fixed and 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 movements of flexion and extension [3].
- Incisions made along the lines of the diamond-shaped cutaneous contact zones present a minimal chance of retraction [3].
- The web spaces are formed from the union of two nonsymmetrical cutaneous surfaces [3].
- The dorsal slope of the web space has a gradual incline and its supple skin is not adherent to the subjacent region [3].
- The palmar surface of the web space is flat and precipitously interrupted, with skin densely adherent to the commissural skeleton [3].
- The commissural skeleton 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 [4].
- The anatomic axis of the hand coincides with the axis of the third metacarpal [4].
- The dorsal interossei 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 [4].
- The volar interossei 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 [4].
- The superficial head is inserted deeply by a medial tendon onto the lateral tubercle of the base of the proximal phalanx [4].
- The superficial head abducts and weakly flexes the proximal phalanx [4].
- The superficial head has no direct effect on the middle or distal phalanges [4].
- The deep head of each dorsal interosseous muscle forms a lateral tendon, or lateral band, at the level of the MP joint [4].
- The deep head flexes and weakly abducts the proximal phalanx while extending the middle and distal phalanges [4].
- 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 [4].
- These transverse fibers flex the proximal phalanx [4].
- 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 PIP 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 [4].
- The flexor digiti quinti brevis forms the ulnar lateral band of the little finger [4].
- Each volar interosseous muscle has only one muscle head [4].
- None of the volar interossei 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 lies deepest among the hypothenar muscles [4].

- The opponens digiti quinti arises from the pisohamate ligament and the hook of the hamate [4].
- The opponens digiti quinti 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 arteries of the thumb vary in both size and number [8].
- The palmar aspect of the thumb can be schematized into three segments defined by the metacarpophalangeal and interphalangeal flexion creases [8].
- In the classical layout, the “princeps pollicis” artery is the terminal branch of the radial artery [8].
- The “princeps pollicis” artery 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 level of the metacarpophalangeal joint crease, 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 this arcade enter the “vincula” and irrigate the flexor tendon [8].
- Only 15% of anatomical dissections fall into the category of the classical description of the palmar arteries of the thumb [8].
- In the first segment of the thumb (between the opposition crease and the metacarpophalangeal flexion crease), it is rare to find arteries of surgical interest on the volar surface [8].
- The artery in the first segment is located deeply and is more easily accessible from the dorsal surface [8].
- In the second segment, the two arteries run alongside the flexor tendon and behind the collateral nerves [8].
- In the second segment, 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 in the second segment [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 third segment (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 for the dorsal aspect [8].
- The dorsal arteries are joined by three arcades: one inconstant arcade located under the extensor tendon at the level of the neck of the first phalanx, the arcade of the nail matrix, and the arcade of the nailbed [8].
- The ulnar dorso-collateral artery generally stems from the “princeps pollicis” onto the medial border of the neck of the first metacarpal [8].

SKELETAL AND LIGAMENTOUS ARCHITECTURE

- The metacarpal arch is endowed with a great deal of adaptability because of the mobility of the peripheral metacarpals [7].
- The peripheral metacarpals form the sides of the cup or the palmar gutter and can deepen the concavity as they approach each other [7].
- The thumb metacarpal is independent and articulates with the trapezium [7].
- The middle metacarpals are united to the carpus by the intrinsic interlocking encasement of the bones themselves [7].
- The index metacarpal is the most firmly fixed [7].
- The ring metacarpal is a transitional element to the fifth metacarpal and has about 10 degrees of mobility in flexion and extension [7].
- The fifth metacarpal is semi-independent and articulates with the hamate [7].
- The fifth metacarpal is restrained on its radial side by its articulation with the base of the fourth metacarpal [7].
- The fifth metacarpal has a range of flexion–extension of approximately 20 degrees [7].
- The second to fifth metacarpals are all bound together by various fibrous structures [7].
- The most distal fibrous structure binding the second to fifth metacarpals is the deep transverse intermetacarpal ligament [7].
- The deep transverse intermetacarpal ligament is better named the interglenoid ligament [7].
- The interglenoid ligament ties together the anterior “glenoid ligaments” of the metacarpophalangeal articulations, known as the “volar plates” [7].
- The longitudinal arches are composed of a fixed portion, the carpometacarpal, and a mobile portion, the digits [7].
- For every ray there is a longitudinal arch [7].

- The kestones of the longitudinal arches are the metacarpophalangeal articulations [7].
- The thick anterior glenoid capsules, the volar plates, prevent hyperextension at the metacarpophalangeal joints [7].
- The volar plates are interconnected by the transverse interglenoid ligament [7].
- The stability of the metacarpophalangeal joints is essential to the support of the longitudinal arch as well as of the transverse metacarpal arch [7].
- The five rays of the hand differ in mobility and independence [7].
- Mobility and independence are considerable for the thumb, much less for the fifth ray, and even less for the others [7].
- The index ray has a certain degree of independence at the phalangeal level, owing to the arrangement of its flexor and extensor muscles [7].

Investigations

- A careful physical examination is essential to direct care and future testing if indicated [1].
- Diagnostic tests such as imaging and serum laboratory studies can be expensive, time consuming, and often nonspecific [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 [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].

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