CQ HAND + UPPER LIMB
SPECIALIST ORTHOPAEDIC SURGEON

EVIDENCE SUMMARY

Mucous Cyst Excision (with Local Flap)

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 open hand with fingers extended and in contact forms a balanced graceful oval in its longitudinal axis [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 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 hinges for finger flexion and extension are located at the thenar crease and 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 MECHANICS

- The dorsum of the hand contains a cutaneous unit extending 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 fine tight skin of the dorsal aspect of the middle phalanx forms a distinct cutaneous unit [3].
- The dorsal integument of the distal phalanx is distinct due to the presence of the nail bed and its matrix [3].

CQ HAND + UPPER LIMB
Dr Kieran Hirpara — Specialist Orthopaedic Surgeon
Suite 2, Level 1, Mater Private Hospital Rockhampton, 31 Ward Street, The Range, QLD 4700
Phone 07 4863 6556 · office@cqupperlimb.com.au · cqupperlimb.com.au

- 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 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 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].
- 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 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].

INTRINSIC MUSCULATURE

- 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 and no volar interossei 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 of the dorsal interosseous muscles 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 superficial head of the dorsal interosseous muscles 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 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].
- At the level of the middle of the proximal phalanx, transverse fibers arch dorsally from each lateral band to join over the dorsum of the finger, flexing the proximal phalanx [4].
- Oblique fibers, or 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].
- The three volar interossei arise from adjacent surfaces of contiguous metacarpal shafts [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 arises from the fifth metacarpal and inserts onto the ulnar lateral tubercle at the base of the proximal phalanx of the little finger [4].
- The flexor digiti quinti brevis arises from the fifth metacarpal and forms the ulnar lateral band [4].
- The opponens digiti quinti lies deepest among the hypothenar muscles and 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, which it flexes and supinates [4].

VASCULAR ANATOMY

- The arteries of the thumb vary in both size and number, making surgical reconstruction delicate [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, a terminal branch of the radial 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 metacarpophalangeal joint level, the princeps pollicis artery divides into two terminal rami, 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 that are 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].
- Only 15% of anatomical dissections of the thumb palmar arteries fall into the classical “typical” category [8].
- In the first segment of the thumb (between the opposition crease and metacarpophalangeal flexion crease), arteries of surgical interest on the volar surface are rare [8].
- In the first segment of the thumb, the artery is located deeply and is more easily accessible from the dorsal surface [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].
- In cases where the palmar ulnar collateral artery is absent in the second segment, the dorsal artery takes its place by means of a branch through the subtendinous arcade [8].
- In the third segment of the thumb (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 supply [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 AND INCISIONS

- Distal palmar incisions are transverse, while proximal palm incisions tend to be more longitudinal with the distal end curving radially to parallel the closest major skin crease [9].
- An incision of any desired length can be made across the palm provided that the underlying digital nerves and other vital structures are protected [9].
- After skin and underlying fat are incised, the fat is dissected from the palmar fascia and carried with the skin flaps [9].
- It may be desirable to preserve small vessels perforating the palmar fascia if wide undermining of the skin flaps is necessary [9].
- Most vital structures in the palm are deep to the palmar fascia [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 [9].
- Incisions in the more proximal palm should parallel the thenar crease [9].
- When extended proximal to the wrist, 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, which should be exposed and protected if its exact location is in doubt [9].
- Care should be taken to avoid injury to the palmar cutaneous branches of the median and ulnar nerves [9].
- There is no single longitudinal incision in the proximal palm that completely avoids the palmar cutaneous branches of the median and ulnar nerves [9].
- Midlateral incisions described for the fingers are suitable for the thumb, with the radial side being more accessible [9].
- A radial midlateral thumb incision can be extended by curving its proximal end at the midmetacarpal area to create a flap on the palmar surface of the thumb [9].
- Care should be taken to avoid the dorsal branch of the superficial radial nerve to the radial side of the thumb during radial midlateral incisions [9].
- The volar zigzag finger incision does not require mobilizing either neurovascular bundle and directly exposes the volar surface of the flexor tendon sheath [9].

CQ HAND + UPPER LIMB
Dr Kieran Hirpara — Specialist Orthopaedic Surgeon
Suite 2, Level 1, Mater Private Hospital Rockhampton, 31 Ward Street, The Range, QLD 4700
Phone 07 4863 6556 · office@cqupperlimb.com.au · cqupperlimb.com.au

- On a contracted skin surface, the volar zigzag finger incision tends to straighten out and result in a more linear scar than is desirable [9].
- The volar midoblique incision crosses the flexion creases obliquely in the midline of the finger between the neurovascular bundles [9].

SKIN COVERAGE DIMENSIONS

- The necessary skin to cover the thumb distal to the metacarpophalangeal joint is about 9 cm wide and 8 cm long [6].
- Skin loss of the thumb and first metacarpal is 13 cm wide and 12 cm long [6].
- The skin cover of both the palmar and dorsal surfaces of the hand is 12 cm by 10 cm [6].
- The skin covering each finger is 7 cm by 10 cm on both the palmar and dorsal aspects [6].
- Skin grafting or flaps for both sides of the hand and digits requires a skin of 20 cm by 20 cm [6].
- Skin grafting or flaps for one aspect of the forearm from wrist to elbow requires skin of 30 cm by 15 cm [6].
- Skin grafting or flaps for both aspects of the forearm requires skin of 30 cm by 30 cm [6].

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].
- The potential of MRI as a staging tool based on cellularity measurement has not been investigated yet on a large scale [11].

CQ HAND + UPPER LIMB
Dr Kieran Hirpara — Specialist Orthopaedic Surgeon
Suite 2, Level 1, Mater Private Hospital Rockhampton, 31 Ward Street, The Range, QLD 4700
Phone 07 4863 6556 · office@cqupperlimb.com.au · cqupperlimb.com.au

References

[1] Orthopaedic Knowledge Update 13 Ebook Without Multimedia. Anatomy, Evaluation, Clinical Examination, and Imaging > Evaluation and Clinical Examination: Current Concepts.

[2] Exam Of The Hand Wrist 2Ed. INTRODUCTION.

[3] Exam Of The Hand Wrist 2Ed. Functional cutaneous units.

[4] Green S Operative Hand Surgery. Interosseous and Hypothenar Muscles.

[6] Exam Of The Hand Wrist 2Ed. Planning skin cover of the hand and forearm.

[8] Exam Of The Hand Wrist 2Ed. Techniques of investigation of the arterial supply by J P Melki > Vascularization of the thumb > Palmar aspect.

[9] Campbell S Operative Orthopaedics 4 Volume Set. RESULTS OF SUTURE OF THE SCIATIC NERVE > PALMAR INCISIONS.

[11] Dupuytren S Disease And Related Hyperproliferative Disorders. 54. The Future of Dupuytren's Research and Treatment > 54.4 Mechanical Measurements and Procedures > 54.4.4 Imaging.

CQ HAND + UPPER LIMB
Dr Kieran Hirpara — Specialist Orthopaedic Surgeon
Suite 2, Level 1, Mater Private Hospital Rockhampton, 31 Ward Street, The Range, QLD 4700
Phone 07 4863 6556 · office@cqupperlimb.com.au · cqupperlimb.com.au