

Full length research paper

Morphological study of cutaneous ligaments

Anjali S. Sabnis

K.J. Somaiya Medical College and Hospital, Sion, Mumbai -400022, Maharashtra, India.

Accepted 04 February, 2013

The cutaneous ligaments of phalanges of palm and foot are fine and sender fibrous strips running from tendon sheath to skin over phalanges. Different opinions regarding cutaneous ligaments have created interest to find out the structure of them. By keeping aim in the mind to study ligaments in relation to attachment, thickness, length and histological structure, a study was conducted on 80 digits of 8 cadavers. These ligaments are running in relation to ventral and dorsal aspect of the digital nerve from tendon sheath to the skin. Attachment of the ligaments to the skin is suggestive of stabilization of skin during movements. The morphological data of cutaneous ligaments will be helpful in surgical implication of Duputren's Contracture, replantation and revascularization of the digit. Thus clinical significance of cutaneous ligaments has attracted vascular surgeons in microsurgery of hand.

Key words: Cutaneous ligaments, Cleland's ligament, Grayson's ligaments, Duputren's contracture.

INTRODUCTION

The anatomy and function of fingers has created interest amongst surgeons and anatomist for a long time. It forms strong foundation for understanding normal function of finger and for identifying the cause of disease. The cutaneous ligaments of the fingers are fine, small but important structures, running from tendon sheath to skin. These are present dorsal (Cleland's ligaments) and ventral (Grayson's Ligaments) to the digital nerves. Cleland had first described these ligaments seen dorsal to digital nerves which prevent the skin bagging to the sides of joints in flexion (Cleland 1878). Grayson mentioned that in addition to these ligaments there is also fibrous septum ventral to digital nerves (Grayson 1941). As these ligaments are attached to skin, they hold the skin in place during the movements of fingers and also support the neurovascular bundle.

Hans Martin described that Cleland's ligaments divide the subcutaneous space into palmar and dorsal compartments of the fingers which is clinically significant with respect to spread of inflammation and tumor (Hans Martin et al 2004). We aimed to study morphological and histological structure of cutaneous ligaments. The precise knowledge regarding these ligaments will be useful for surgeons during the surgical implication of Duputren's contracture, replantation and revascularization of the

digit.

MATERIALS AND METHODS

64 fingers, 16 thumbs and 80 toes of 6 male and 2 female embalmed cadavers ranging from 60 to 80 years, from department of Anatomy of K.J. Somaiya Medical College were dissected by taking midline incision on palmar and dorsal aspect of finger and toe. The skin was separated from underlying tissue. The tendon sheath was identified and the ligaments running from it to the skin were observed and studied in relation to digital nerves. Their extent, thickness structure was studied by taking measurements.

Results

1. Dorsal cutaneous ligaments were seen running dorsal to digital nerves from phalanges to skin while palmar cutaneous ligaments were seen running ventral to digital nerve from tendon sheath to the skin.
2. Dorsal ligaments were thick, broad and obliquely arranged while palmar ligaments were thin and straight.
3. Dorsal ligaments were present on all over the digit while palmar ligaments were prominently seen at skin over proximal interphalangeal joint and on proximal phalanx.
4. Cutaneous ligaments of toes were prominently seen on dorsal aspect.

*Corresponding author. Email: dranjus2003@yahoo.com
Tel: 9820493036

Table 1. Mean length of cutaneous ligaments of palm.

Location	Cleland's Ligaments	Grayson's Ligaments
Thumb	4 cm	3 cm
Index finger	5 cm	3.2 cm
Middle finger	5 cm	4 cm
Ring finger	4 cm	3 cm
Little finger	4 cm	2.8 cm

Table 2. Mean length of cutaneous ligaments of foot.

Location	Dorsal aspect	Plantar aspect
Great toe	6.2 mm	5.8 mm
2 nd toe	5.8 mm	5 mm
3 rd toe	5.2 mm	4.7 mm
4 th toe	5 mm	4.3 mm
5 th toe	4.6 mm	3.8 mm

Plate 1. Dorsal cutaneous ligament.

Dorsal
cutaneous
ligament

DISCUSSION

Presence of important and clinically significant cutaneous ligaments were first mentioned by J Weitbrecht in 1742 (Weitbrecht J), less literature is available related to them with varied opinions. Then Cleland described dorsal cutaneous ligaments as fibrous septum dorsal to digital nerves. Grayson opined that in addition to these structures there is also a fibrous septum volar to the digital nerves. This septum forms a series of retinacula which might be termed as superficial or volar retinacula (Grayson 1941). Milford disagreed with the septal concept of these ligaments & described these fibers were forming a cone like structure before inserting into skin (Milford 1968). We found that thick and dense dorsal cutaneous

ligaments which were running obliquely from phalanges to the skin on all over the phalanx. According to Muzaffer Sindel some ligaments were of V shaped (Muzaffer Sindel 2011) and we also found the same (plate 1). Palmar cutaneous ligaments were thin and running straight from tendon sheath to the skin (plate 2). They were prominently seen on proximal phalanx and proximal interphalangeal joint. The distance between the attachments was measured by using vernier caliper (Table 1). The mean thickness of the ligaments is 1.2 mm on dorsal aspect and 0.8 mm on palmar aspect. Grayson explained that these fibers were most prominent in the middle section of proximal phalanx and over the entire length of middle phalanx as far as the distal interphalangeal joint (Grayson 1941). According to Knott C

Plate 2. Palmar cutaneous ligaments.

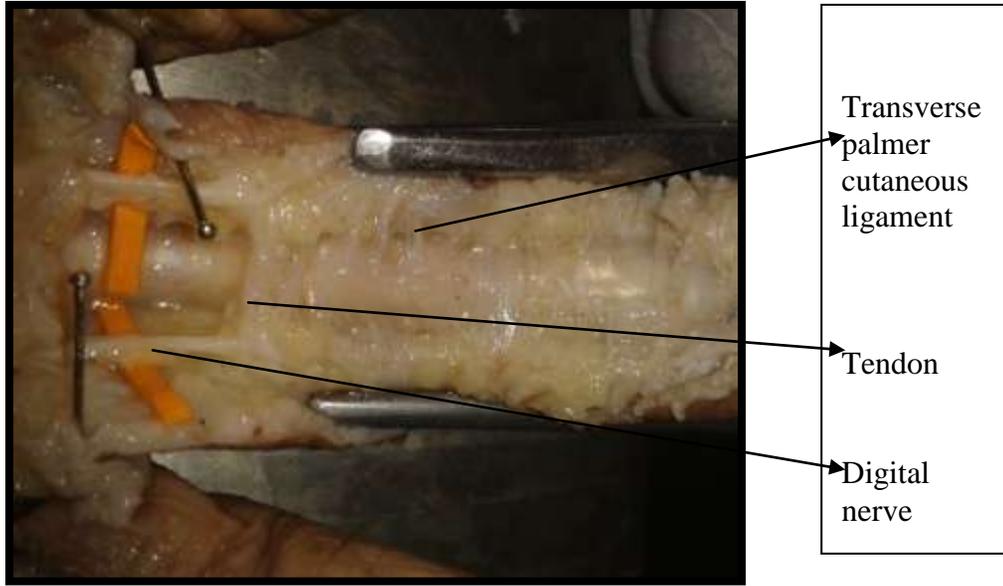


Plate 3. Cutaneous ligaments on dorsal aspect of 2nd toe

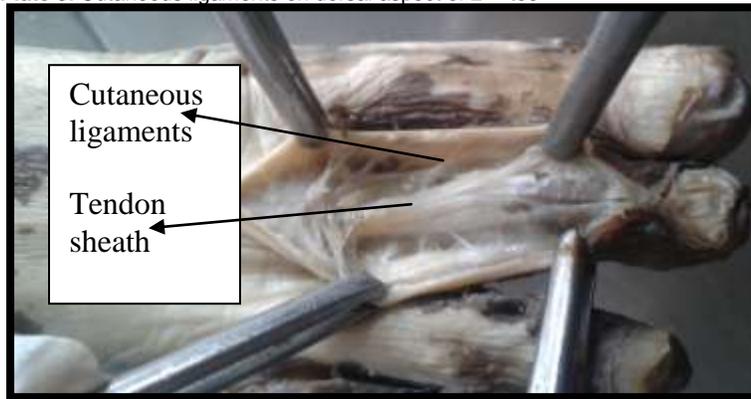
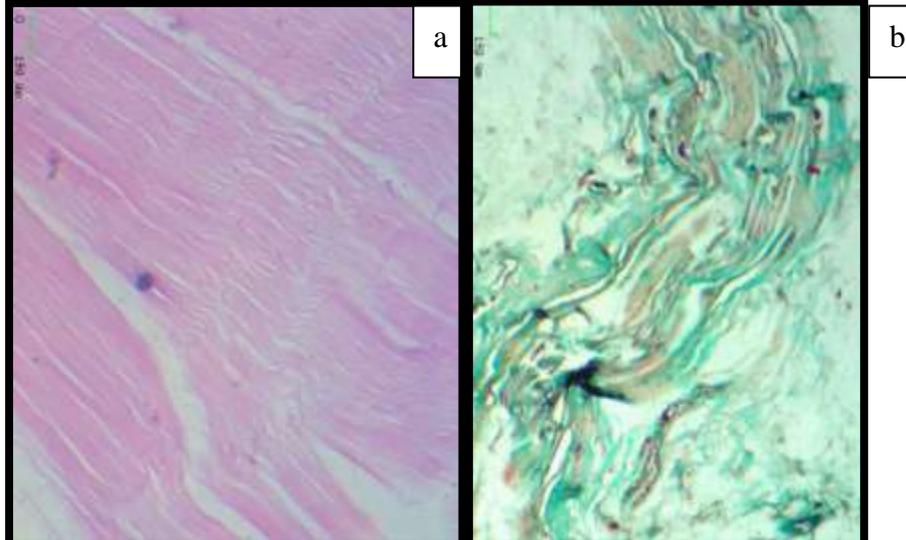


Plate 4. Histological structure of ligaments with H& E stain (a) & Masson Trichome Stain (b).



they were either perpendicular or oblique to the skin and forms interlaced network of fibers superficial to the flexor tendon sheath (Knott C1986). According to Daroussous N both ligaments were running from periosteum of phalanges as well as from fibrous part of digital sheath to the skin (Daroussous N 1991). de Ary Pires B opined that these were running from phalanges to dermis of finger (de Ary Pires B 2007). Chrysopoulo revealed that dorsal ligaments fanned out before insertion and palmar ligaments did not fan out (Chrysopoulo 2002). Mester found collagen fibers in the Grayson's ligaments (Mester 2006)

Histological study of ligaments was done with H & E stain and Masson Trichrome stain. Bundles of collagen fibers suggestive of presence of ligaments were seen under H and E stain which was confirmed with Masson Trichrome Stain (plate 4).

The cutaneous ligaments were seen in foot also. They were more prominent proximally on dorsal aspect than plantar aspect (plate 3) running from extensor tendons to the skin. They were thinner and shorter as compared to cutaneous ligaments of fingers of hand. The mean thickness of ligaments was 0.5 mm and length was 6 mm & 3.2 mm on dorsal aspect & plantar aspect respectively (Table 2). According to Cleland they are less distinctly seen at the distal joint of the toes (Cleland 1878). Very less literature regarding cutaneous ligaments in foot is available. They might be playing important role of holding skin in place during the movements of toes.

Dupuytren's contracture (DC) or palmar fibromatosis is an inherited proliferative connective tissue disorder in which pathologic nodules and cords are developed in the palmar & digital fascia (James W 1985). Precise anatomy of palmar and digital fascia is very important for hand surgeons to understand the pathology of DC. Pretendinous band is midline distal extension of the longitudinal fibers of PL tendon while spiral band is lateral continuation of pretendinous band in the digits. Lateral digital septum arises from superficial fascia and it is intimately adherent to skin. It is attached to tendon sheath over middle phalanx through fibers of Grayson's Ligaments. Formation of central, spiral and lateral cords can be seen when infiltration of myofibroblasts are seen in pretendinous, spiral bands and lateral digital septum respectively (James W 1985). Fascial continuity explains the involvement of cutaneous ligaments in DC. According to MC Farlane Grayson's ligaments are frequently involved and Cleland's ligaments are less frequently involved (MC Farlane 1974) in DC. Barton DC opined that cutaneous ligaments are involved to varying degree (Barton 1984). Hans Martin revealed that in cutaneous syndactyly, the Cleland's ligaments of adjacent fingers interlaces and form perpendicular septa in the area of adhesion (Hans Martin 2004).

The morphological data related to these ligaments will be helpful for the surgeons during microsurgery of the hand and foot.

ACKNOWLEDGEMENT

I would like to thank Dr. Lalit Mehta & Dr. Ashok Bendre for continuous support and encouragement.

I thank Dr. Sabnis, Dr. Smita, Dr. Kalpana for assisting me in special stain and photography.

REFERENCES

- Barton NJ (1984). Dupuytren's Disease arising from adductor digiti minimi. *J Hand Surg.* 9: 265-270
- Chrysopoulo MT (2002). Cleland's ligaments: an anatomic study. *Plast Reconstr Surg.* 109 (2): 573-5
- Cleland JJ (1878). *Anat. Phys.* 12:526, PIXVII
- Daroussos N (1991). The ligaments of the fingers, Anatomical study of the Cleland's ligaments. *Acta Anat (Basel)* 141(1): 90-2
- de-Ary-Pires B ((2007). Cleland's and Grayson's Ligaments of the hand: a morphological investigation. *Clinical Anatomy.* 20 (1): 68-76
- Farlane MC (1974). Patterns of diseased fascia in the fingers in Dupuytren's Contracture. *Plas Reconstru Surg.* 54: 31-54
- Grayson J (1941). Cutaneous ligaments of the digits. *J. Anat.* 75(pt2):164-165
- Hans-Martin (2004). *Surgical Anatomy of Hand, Cutaneous ligaments* New York, Thieme, Stuttgart
- James W (1985). The isolated digital cord in Dupuytren's contracture: Anatomy and clinical, significance. *J. Hand Surg.* 10 A (1):118-124
- Knott C, H M Schmidt (1986). Die bindegewebigen verstarckungseinrichtungender digitalen. *Sehnenscheiden an der menschlichen, hand. Gegenbaurs morph, Jahrb,* 132: 1-28
- Mester S (2006). Biomechanics of the membranous flexor tendon sheath: the role of Grayson's ligaments. *Plast Reconstr Surg.* 117 (2) : 497-506
- Milford LW (1968). Retaining Ligaments of the digits of the hand: Gross and microscopic study. Philadelphia :WB Saunders, 598-599,
- Muzaffer Sindel (2011). Cleland's and Grayson's ligaments: an anatomic study. *Fizyoterapi Rehabilitasyon.* 22(3): 245-248
- Weitbrecht J *Syndesmologia sive historia ligamentorum corporis humani, quam secundum observations anatomicas concinnant, et figures ac objecta recentia adumbration Sillustravit. Petropoli e x typographia Academiae Scientiarum, Anno MDCC XLII*

