Anatomy of the palmar branch of the ulnar nerve: application to ulnar and median nerve decompressive surgery

Laboratory investigation

R. SHANE TUBBS, M.S., P.A.-C., Ph.D.,1 JASON M. ROGERS, M.D.,1 MARIOS LOUKAS, M.D., Ph.D.,2 AYHAN COİMERT, M.D.,3 MOHAMMADALI M. SHOJA, M.D.,4 AND AARON A. COHEN-GADOL, M.D., M.Sc.4

1Pediatric Neurosurgery, Children’s Hospital, Birmingham, Alabama; 2Department of Anatomical Sciences, St. George’s University, Grenada, West Indies; 3Department of Anatomy, Ankara University, Faculty of Medicine, Ankara, Turkey; 4Clarian Neuroscience Institute, Indianapolis Neurosurgical Group and Indiana University Department of Neurosurgery, Indianapolis, Indiana

Object. The palmar cutaneous branch of the ulnar nerve (PCUN) has received little attention in the literature, and to the authors’ knowledge, has received no attention in the neurosurgical literature. The present study was performed to help the surgeon minimize postoperative complications of nerve decompression at the wrist.

Methods. Forty cadaveric upper limbs underwent dissection of the ulnar nerve in the forearm, at the wrist, and in the palm. The PCUN was investigated and when identified, measurements were made and relationships documented between this cutaneous branch and the ulnar artery. The length and width of the PCUN were measured, as was the distance from the medial epicondyle of the humerus to the origin of the PCUN from the ulnar nerve.

Results. A PCUN was found on 90% of sides. The origin of the PCUN from the ulnar nerve was found to lay a mean of 14.3 cm distal to the medial epicondyle. The mean length and width of this branch were 13 and 0.08 cm, respectively. In the forearm, the PCUN traveled lateral to the ulnar artery on 75% of sides and on the medial side of this vessel on the remaining sides. The PCUN perforated the fascia of the anterior forearm just proximal to the distal wrist crease. In the palm, the PCUN traveled superficial to the superficial palmar arch on all but 5 sides, where it traveled deep to this vascular structure’s distal extent. On 2 sides each, the PCUN communicated with the superficial and deep ulnar nerves. On 2 sides, the PCUN communicated with the palmar cutaneous branch of the median nerve. The majority of the terminal fibers of the PCUN were found on the ulnar side of a hypothetical line drawn longitudinally through the fourth digit and supplied an area roughly 3 × 3 cm over the proximal medial palm.

Conclusions. The authors hope that the present data may be useful to the surgeon during decompressive procedures at the wrist, such as carpal tunnel and the Guyon canal. Based on this study, skin incisions of the palm made longitudinally along a line through the middle of the fourth digit would minimize injury to the PCUN.

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Key Words • anatomy • hand • ulnar nerve • cadaver • decompressive surgery • palmar branch
nerve provides innervation to the medial hand and digits via various branches. The dorsal cutaneous branch of the ulnar nerve branches in the distal forearm and extends posteriorly, where it provides cutaneous innervation for the medial dorsal hand and ulnar one and one-half digits.\textsuperscript{4} The superficial terminal branch (palmar digital) of the ulnar nerve innervates the skin over the hypothenar eminence and palmar one and one-half digits, including the distal dorsal surface of these digits and their associated nail beds.\textsuperscript{1} Infrequently mentioned in anatomy texts is the PCUN, which innervates the skin of the medial palm (Fig. 1).

Doyle and Botte\textsuperscript{4} stated that the PCUN is not consistent, and when present, arises at variable levels from the ulnar nerve in the distal forearm, usually at the junction of the middle and distal thirds of the forearm. These authors also stated that the PCUN may occasionally innervate the palmaris brevis muscle, although this muscle is usually believed to be innervated by the superficial terminal branch of the ulnar nerve. Clinically, preservation

![Schematic drawing illustrating the right PCUN and its superficial cutaneous innervation of the proximal palm. The upper right image depicts the regional areas of skin supplied by the palmar branches of the ulnar and median nerves.](image)

**Fig. 1.** Schematic drawing illustrating the right PCUN and its superficial cutaneous innervation of the proximal palm. The upper right image depicts the regional areas of skin supplied by the palmar branches of the ulnar and median nerves.
Palmar branch of the ulnar nerve

of sensation overlying the hypothenar eminence with intrinsic hand weakness of muscles innervated by the ulnar nerve may imply compression of the ulnar nerve at the Guyon canal.

Because painful postsurgical neuromas can be disabling, knowledge of all cutaneous branches at the wrist are important to the surgeon who decompresses the median or ulnar nerves at this location. The aim of the present study was to investigate the anatomy of the PCUN, including surgical landmarks, so that complications of nerve decompression at the wrist (such as carpal tunnel and the Guyon canal) may be minimized.

Methods

Twenty adult formalin-fixed cadavers (40 sides) underwent dissection of the ulnar nerve in the forearm, at the wrist, and in the palm. Thirteen specimens were male and 7 were female. Ages of the cadavers at death ranged from 56 to 97 years (mean 75 years). With the cadaver in the supine position, careful removal of the skin of the anterior upper limb was performed using a scalpel. Next, particular attention was given to uncovering the ulnar nerve from the elbow to the wrist. From a proximal to distal direction, the ulnar nerve was dissected and all branches identified and traced to their termination. The PCUN was investigated and when identified, measurements were made and relationships documented between this cutaneous branch and the UA. The length and width of the PCUNs were measured, as was the distance from the medial epicondyle of the humerus to their origin from the ulnar nerve. All measurements were made with a ruler and calipers. Statistical analysis was performed between the left and right sides and between the sexes using Student t-tests, with a p value < 0.05 considered statistically significant.

Results

A PCUN was identified on 36 (90%) of 40 sides (absent on 3 left sides and 1 right side). On the 4 sides where a PCUN was not identified, the palmar branch of the median nerve appeared to have a more ulnar distribution. The origin of the PCUN from the ulnar nerve was found to lay a mean of 14.3 cm distal to the medial epicondyle of the humerus (range 8.2–19.3 cm; Fig. 2). The length of this branch was 13 cm on average (range 7.5–19.4 cm). The width of the PCUN ranged from 0.05 to 0.1 cm (mean 0.08 cm). As it coursed distally, this nerve traveled lateral to the UA on 27 sides (75%) and on the medial side of this vessel on 9 sides (25%; Fig. 2). The PCUN was usually found to perforate the fascia of the anterior forearm just proximal to the distal wrist crease, pierce the palmar carpal ligament, and then supply the palmar skin. The majority of the terminal fibers of the PCUN were found on the ulnar side of a line drawn longitudinally through the middle of the fourth digit, and supplied an area roughly 3 × 3 cm over the proximal medial palm (Figs. 1 and 3). At the level of the wrist, the PCUN was always found to lie medial to the tendon of the palmaris longus muscle and lateral to the tendon of the flexor carpi ulnaris at the pisiform. We did not identify fibers of the PCUN that innervated the dorsal side of the hand. In the palm, the PCUN traveled superficial to the superficial palmar arch on all but 5 sides, where it traveled deep to this vascular structure’s distal extent. On 2 sides each, the PCUN communicated with the superficial and deep ulnar nerves (Fig. 4). On 2 sides (5.5%), the PCUN communicated with the palmar cutaneous branch of the median nerve. No specimen was noted to have prior surgical scars in the areas dissected. The PCUN was not found to have any muscular branches. No statistical differences were identified between sexes or sides.

Discussion

Although little is written about the PCUN, we identified this branch in 90% of upper limbs, and in none of these did it innervate the dorsal surface of the hand. April,1 in brief, has stated that the PCUN arises in the forearm and innervates the ulnar side of both the dorsum and palm of the hand. Engber and Gmeiner5 found 2 variants of the PCUN. One variant arose as a branch of the dorsal branch of the ulnar nerve and the second variant fell short of the skin creases of the wrist. We did not identify the PCUN as a branch of the dorsal cutaneous branch of the ulnar nerve.
nerve in any specimen. However, we did observe that the PCUN usually traveled over the Guyon canal, as most fibers were found medial to the pisiform bone. Ozcanli et al. found the PCUN in 67% of specimens.

Martin et al. reported finding the PCUN in only 4 of 25 specimens and confused these data by also discussing their findings of the nerve of Henle in 10 specimens. The nerve of Henle has historically been considered a variation of sympathetic fibers arising from the ulnar nerve and traveling with the UA from the forearm into the hand. McCabe and Kleinert found such a nerve in only approximately half of their dissections. Based on our observations, a separate nerve conveying only sympathetic fibers to the hand is not likely, given that the median nerve has been found to convey the majority of sympathetic fibers to the hand. Moreover, and based on our findings, a nerve of Henle does not exist as it has been described by some authors. This nerve branch is simply the PCUN that has an intimate relationship with the UA along its course in the anterior forearm. Our study did not find any limb where both a so-called nerve of Henle and PCUN existed together. Martin et al. found the nerve of Henle was “transected or endangered by the incision for carpal tunnel release,” specifically with longitudinal incisions in the axis of the ring finger.

We identified some specimens with interconnections between the PCUN and the deep and superficial branches of the ulnar nerve and with the palmar cutaneous branch of the median nerve (Fig. 4). Connections between the sensory nerves of the palm provided by the ulnar and median nerves are referred to as Berrettini communications. Lack of such a connection of the hand may explain why some patients describe sensory loss following transection of the palmar cutaneous branch of the median nerve during carpal tunnel decompression. The palmar cutaneous branch of the median nerve normally serves the radial side of the palm up to a hypothetical line drawn vertically along the palm from the radial side of the fourth digit. Talesnik concluded that transection of the flexor retinaculum should be located to the “ulnar side of the axis of the ring finger ray.” Given our results, such an incision would most likely transect the PCUN. Although a skin incision along the radial side of such a line is least likely to transect a major nerve branch to the skin, smaller branches will inevitably be cut. Based on our study, skin incisions of the palm made longitudinally along a line through the middle of the fourth digit would minimize injury to the PCUN, and based on the literature, this approach would also minimize injury to the palmar cutaneous branch of the median nerve. More generally, Born and Mahoney concluded that the PCUN may be responsible for painful incisions following carpal tunnel release. These authors identified a PCUN in 42% of dissected limbs and found that 12.5% of these nerves had branches in the vicinity of a typical carpal tunnel release incision. Ozcanli et al. found that the mean distal extent of the PCUN from the distal wrist crease was 4.2 mm. Lastly, given that we identified an intimate relationship of the PCUN with the UA, manipulation of this vessel with various procedures may result in sensory loss over the medial palm.

Conclusions

Injury to the cutaneous nerves of the wrist following decompressive procedures can result not only in sensory loss in this region, but also in potentially painful neuromas. Based on our study, the primary branches of the PCUN can be avoided with skin incisions made longitudinally in the palm along a hypothetical line through the middle of the fourth digit. In terms of origin and position of this nerve in relation to the UA, some variation may exist, but based on the present study, we believe that the PCUN will be found in the majority of specimens. Our hope is that the present study will aid the neurosurgeon in avoiding such complications as noted above.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author contributions to the study and manuscript preparation include the following. Conception and design: RS Tubbs, AA Cohen-Gadol. Acquisition of data: RS Tubbs, JM Rogers, M Loukas. Analysis and interpretation of data: RS Tubbs, M Loukas, A Cömert, MM Shoja, AA Cohen-Gadol. Drafting the article: RS Tubbs, AA Cohen-Gadol. Critically revising the article: RS Tubbs, M Loukas, A Cömert, MM Shoja, AA Cohen-Gadol. Reviewed final version of the manuscript and approved it for submission: RS Tubbs, JM Rogers, M Loukas, A Cömert, MM Shoja, AA Cohen-Gadol. Statistical analysis: RS Tubbs. Administrative/technical/material support: RS Tubbs. Study supervision: RS Tubbs.

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