Original Article

Relationship between the Dorsal Cutaneous Branch of the Ulnar Nerve and the Fifth Metacarpal Bone: An Anatomical Study

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Background: Operative fixation has become increasingly more common for treatment of hand fractures. The dorsal cutaneous branch of the ulnar nerve (DCBUN) is a distal sensory branch of the ulnar nerve. Iatrogenic injuries during surgery were reported in previous study. Although many authors have described the DCBUN anatomy at the wrist, our review of the literature did not reveal any reports that define the relationship between DCBUN and the fifth metacarpal bone.

Objective: To investigate the anatomical relationship between the DCBUN and the fifth metacarpal bone.

Materials and Methods: Thirty-one fresh cadavers were dissected. The number and distribution of DCBUN branches relative to the ulnar styloid and imaginary point of the fifth metacarpal bone were recorded.

Results: In 29 specimens, the DCBUN had 2 branches while the rest had 3 branches. The mean distance from the origin of DCBUN to the ulnar-most base of the bone in dorsal view (point A) was 7.41 cm. The mean distance from the DCBUN branching point to point A was 2.83 cm. The most ulnar branch of DCBUN innervated to subcutaneous border along the most ulnar and palmar side of the bone. The mean proportion of the length between point G, where the most radial branch crosses over the most radial side of the bone and the radial-most base of the bone in dorsal view (point B) (GB), and the length of the most radial side of the bone between base (point B) and head (point D) (BD) was 0.15 (range: 0.0 to 0.45).

Conclusion: The results of the present study suggest the safe area for making a skin incision to be at the mid-axial ulnar side of the fifth metacarpal bone to prevent ulnar branch injury. A dorsal skin incision over the proximal half of the fifth metacarpal bone may injure the radial branch.

Keywords: Ulnar nerve, Dorsal cutaneous branch of the ulnar nerve, Fifth metacarpal bone, Ulnar styloid, DCBUN

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Fracture of the fifth metacarpal bone is one of the most common fractures of the upper extremities[1-3]. Operative fixation has become increasingly more common for treatment of hand fractures[1,4].

The dorsal cutaneous branch of the ulnar nerve (DCBUN) is a distal sensory branch of the ulnar nerve[5]. Its role is to supply sensation to the dorsal and ulnar aspect of the hand, ring finger, and small finger. Injury to the DCBUN may result from traumatic injury or iatrogenic cause. The iatrogenic causes that were reported in previous studies related to direct open approach to ulna or the fifth metacarpal bone, percutaneous pinning, ulnar lengthening or shortening procedure, and wrist arthroscopic procedure[6,11,12]. DCBUN lesions can result in numbness, dysaesthesia, and pain[7]. Another potential complication is the formation of painful neuroma[8]. It has been suggested that the surgeon must dissect and identify the nerve to avoid injury[9]. Although many authors have described the anatomy of the DCBUN at the wrist, our review of the literature did not reveal any reports that define the relationship between the DCBUN and the fifth metacarpal bone[5,7,10,13,14]. The aim of this anatomical study was to investigate the relationship between the DCBUN and the fifth metacarpal bone.

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Materials and Methods

Thirty-one upper limbs from twenty-one adult fresh cadavers were dissected in the anatomy laboratory at the Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand after receiving approval from the Siriraj Institutional Review Board (SIRB) to do so. The study sample was calculated to be thirty-one specimens. Side and gender of cadavers were recorded. All cadaveric dissections were performed by a senior orthopedic resident.

Cadavers were positioned, as follows: shoulder abduction 0°, full elbow extension, full forearm pronation, and neutral wrist position. Direct surgical approach to ulna was performed as described by Hoppenfeld and de Boer[6]

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with extension to the ulnar side of the fifth metacarpal bone. The ulnar nerve was identified and traced distally to the origin of the DCBUN. The DCBUN was dissected distally by dividing the skin overlying its course, with subsequent identification of individual branches distally to their termination under the surface of the skin. The end points, and the number and distribution of DCBUN branches were recorded. The imaginary points used to describe the fifth metacarpal bone are shown in Figure 1. The distances from the DCBUN and its branches to the ulnar styloid and the imaginary points of the fifth metacarpal bone were measured using a Vernier caliper.

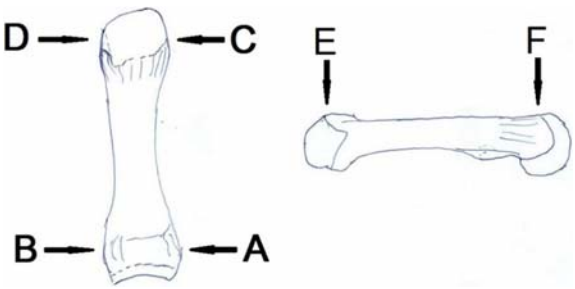
Statistical analysis

The present study was descriptive study in nature. All variables of measurement were reported as mean and standard deviation and median and range. Statistical analysis were perform using SPSS version 18.0 (SPSS Inc., Chicago, IL).

Results

The dissection was performed on fourteen right and seventeen left limbs from twenty-one fresh cadavers. Five were male and sixteen were female. The DCBUN presented in all specimens. In twenty-nine specimens, the DCBUN had two branches, while the remaining two specimens had three branches (Figure 2).

The mean distance from the origin of the DCBUN to point A was 7.41±1.07 cm (range: 5.6 to 9.6) (Figure 3). The mean distance from the DCBUN branching point to point A was proximally 2.83±0.73 cm (range: 1.5 to 4.1).



Point A: ulnar-most base of the fifth metacarpal bone in dorsal view.
Point B: radial-most base of the fifth metacarpal bone in dorsal view.
Point C: ulnar-most head of the fifth metacarpal bone in dorsal view.
Point D: radial-most head of the fifth metacarpal bone in dorsal view.
Point E: proximal and superior-most base of the fifth metacarpal bone in medial view.
Point F: distal and superior-most head of the fifth metacarpal bone in medial view.

Figure 1. Demonstration of the fifth metacarpal bone of right hand in dorsal view and medial view.

The mean distance from the DCBUN branching point to the ulnar styloid was 0.68±0.66 cm (range: 0.5 to 2.0). The mean distance from the origin of the DCBUN to the ulnar styloid process was 5.36±1.08 cm (range: 3.6 to 7.5) (Table 1).

The most ulnar branch of the DCBUN innervates the subcutaneous border along the most ulnar and palmar side of the fifth metacarpal bone (Figure 4). The most radial branch of the DCBUN innervates the subcutaneous border at the radial and dorsal side of the fifth metacarpal bone. There were two specimens in which the radial branch did not cross the imaginary line between point A and point B. The mean distance from point G where the most radial branch crosses over the most radial side of the bone to point B was 0.78±0.6 cm (range: 0.0 to 2.5) (Figure 5). The mean proportion of the length between point G, where the most radial branch crosses over the most radial side of the fifth metacarpal bone and point B (GB), and the length of the most radial side of the bone between point B and point D (BD) was 0.15±0.1 (range: 0.0 to 0.45).

Discussion

The present study showed the anatomical location of DCBUN terminal branches in the distal part of the wrist area. The fifth metacarpal bone and ulnar styloid were used as points of reference. The average distance between the origin of DCBUN/DCBUN branching point and ulnar styloid is comparable to the results of previous studies[5,10,13,14]. Dissection within 4 cm proximal to point A of the fifth metacarpal bone may cause injury to the DCBUN branching point.

The present study also showed that the most ulnar branch of DCBUN innervates the subcutaneous border along the most ulnar and palmar side of the fifth metacarpal bone.

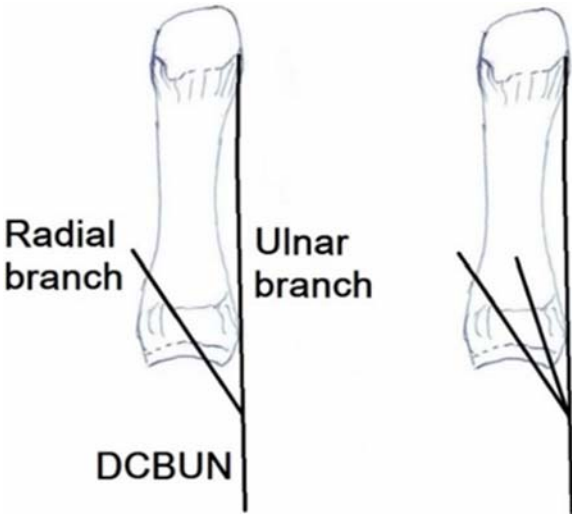


Figure 2. Demonstration of two and three terminal branches of the dorsal cutaneous branch of the ulnar nerve (DCBUN) in dorsal view.

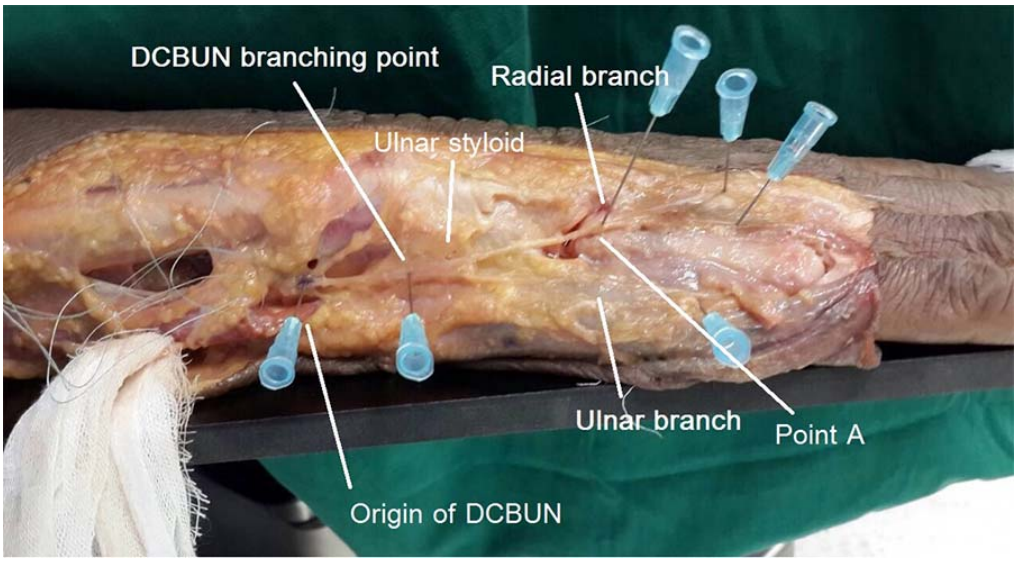


Figure 3. Demonstration of DCBUN and branches in medial view of right hand in cadaveric dissection.

Table 1. Distance measurements according to anatomical point of interest

Measurement	Range	Mean ± SD
Origin of DCBUN to ulnar-most base of the fifth metacarpal bone in dorsal view (point A) (cm)	5.60 to 9.60	7.41±1.07
Origin of DCBUN to ulnar styloid (cm)	3.60 to 7.50	5.36±1.08
DCBUN branching point to ulnar styloid (cm)	0.50 to 2.00	0.68±0.66
DCBUN branching point to ulnar-most base of the fifth metacarpal bone in dorsal view (point A) (cm)	1.50 to 4.10	2.83±0.73
Proportion of the length between point G, where the most radial branch crosses over the most radial side of the fifth metacarpal bone to point B (GB), and the length of - the most radial side of the bone between point B and point D (BD) in dorsal view	0 to 0.45	0.15±0.10

DCBUN = dorsal cutaneous branch of the ulnar nerve

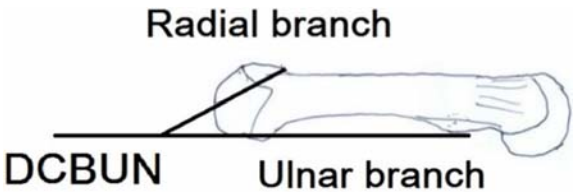


Figure 4. Demonstration of DCBUN and branches in medial view.

This suggests that skin incision at the mid-axial ulnar side of the fifth metacarpal bone may prevent ulnar branch injury.

The radial branch of all specimens ran over the radial side cortex of the fifth metacarpal bone within the proximal half of the bone. There were 2 specimens that had 3 branches in which the middle branch ran to the ulnar side parallel to the ulnar branch. This finding suggests that dorsal skin incision over the proximal half of the 5th metacarpal bone might injure the radial branch.

Conclusion

The anatomy of the DCBUN and its branches in fresh cadavers was found to be consistently relative to the fifth metacarpal bone. The results of this study suggest the safe area for making a skin incision to be at the mid-axial ulnar side of the fifth metacarpal bone to prevent ulnar branch injury. A dorsal skin incision over the proximal half of the fifth metacarpal bone may injure the radial branch.

What is already known on this topic?

The DCBUN can be injured during surgery at and near the fifth metacarpal bone.

What this study adds?

Our results suggest the safe area for making a skin incision to be at the mid-axial ulnar side of the fifth metacarpal bone to prevent ulnar branch injury. A dorsal skin incision

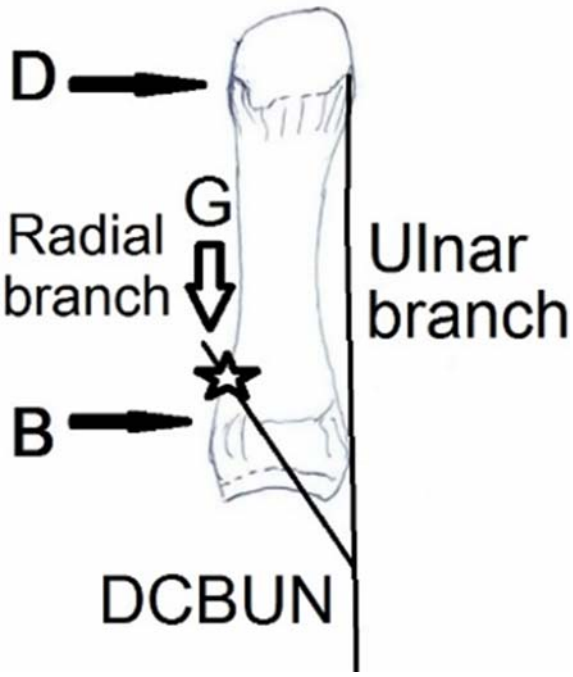


Figure 5. Demonstration of DCBUN and the point G where the most radial branch of DCBUN cross over the most radial side of the fifth metacarpal bone in dorsal view.

over the proximal half of the fifth metacarpal bone may injure the radial branch.

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Potential conflicts of interest

The authors declared no conflicts of interest.

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