TOPOGRAPHICAL ANATOMY OF ULNAR NERVE IN THE HAND – A CADAVERIC STUDY

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ABSTRACT

Topographical assessment and evaluation of the nerves play a major role in giving a detailed background of the course and possible variation that the nerve can possess. This study is aimed at assessing the course, distribution, communications of ulnar nerve in the hand. Ulnar nerve is frequently involved in entrapment neuropathy at the region of Guyon's canal. Therefore, the topographical assessment of ulnar nerve in the hand plays a vital role in diagnosis and management of ulnar nerve entrapment syndrome. The course, distribution and communication patterns of ulnar nerve in the hand was studied in upper extremities of 40 formalin preserved cadavers. Specimens were carefully dissected and ulnar nerve anatomy was studied. A possible anomalous course of ulnar nerve anatomy can lead to a compression syndrome leading to sensori – motor deficit.

KEYWORDS: Ulnar nerve, Trifurcation, Guyon's canal, Sensori – motor deficit

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INTRODUCTION

Ulnar nerve is the continuation of medial cord of brachial plexus, which is given off in the axilla. The root value of ulnar nerve is ventral rami of C7, C8, T1, and C7 fibers are received through lateral root of median nerve. In the axilla, ulnar nerve lies between the axillary vein and axillary artery on a deeper plane. In the arm, it lies medial to the arm it gives only few vaso motor twigs. Ulnar nerve enters the forearm by passing between the two heads of flexor carpi ulnaris. In the forearm, it gives muscular branches to medial half of flexor digitorum profundus [FDP], flexor carpi ulnaris [FCU] and cutaneous branches. In the hand it supplies the muscles of hypothenar eminence and medial two lumbricals, four dorsal interossei, adductor pollicis, palmar cutaneous branch for medial one and half fingers, nail beds and dorsal aspects of distal phalanges and few vaso motor branches. Previous literature suggests anomalous branching pattern, communicating branches in the forearm and hand. The present study aims at assessing the course, anomalous distribution and communication pattern in hand.

MATERIALS AND METHODS

The present study was conducted at the department of Anatomy, Saveetha Medical college and hospitalChennai, Tamilnadu, India. Upper extremity of 40 formalin preserved cadavers of fixed age 45 – 60 years were dissected, in which 23 were male and 17 were female cadavers. Total 80 hands were dissected, 40 right and 40 left sided specimens. An incision was performed along the radial border of flexor carpi ulnaris tendon, then in a zig zag fashion across the proximal wrist crease, continuing in a line to the ring finger. To open the roof of the Guyon's canal, the palmar carpal, palmaris brevis muscle were dissected. Ulnar nerve was carefully dissected with no damage to nearby structures. Abnormal branching pattern and communicating patterns were meticulously observed. Relevant photographs of representative specimens were taken and produced.

RESULTS AND DISCUSSION

The dissection showed variation regarding branching and communication pattern. Out of the 80 hand specimens dissected, normal division of ulnar nerve into two branches was found in 49 specimens as shown in the figure 1. Trifurcation of the nerve was found in 31 specimens, right sided specimen were more than the left. Bonnel gave the classical descriptions of ulnar nerve branching state, that it divides into deep and superficial branches which is a most common pattern seen in most of the cases in our present study (70%). McFarlane observed the anatomy of the ulnar nerve at the wrist described the branching pattern of the ulnar nerve, 70% of hands revealed bifurcation and 30% had trifurcation branching pattern of the ulnar nerve. In 54% of cases it was demonstrated that a single nerve entered the canal and divided into two trunks, one superficial and one deep, then exited the Guyon's canal. The bifurcation occurred predominantly just after entering the canal inlet. The typical trifurcation pattern is demonstrated in our present study single trunk entered the canal and divided into two, and then one of the two bifurcated, producing a trifurcated pattern with two superficial and one deep bundle.

![Figure 1](image)

(1) Superficial branch of ulnar nerve (2) Medial proper palmar digital nerve of the little finger (3) Fourth common digital nerve
Figure 2

*shows deep branch of ulnar nerve (DBU) supplying the intrinsic muscles of the hand.*

Trifurcation has been reported previously in 11 out of 50 cases, and in four of these, the trifurcation occurred in Guyon's canal Bonnel F. In the study, the ulnar nerve divided into a deep branch and two superficial branches, a proper digital nerve for the medial side of the little finger and a common palmar digital nerve to the ring and the little fingers. In the present study, we have also documented that in addition to the classical deep and superficial branches, the third is a muscular branch, which was also reported in a previous study done by Mounir.

Table 1

<table>
<thead>
<tr>
<th>Division</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bifurcation</td>
<td>34 (73.9%)</td>
<td>15 (44.1%)</td>
<td>49 (72.5%)</td>
</tr>
<tr>
<td>Trifurcation</td>
<td>12 (26.1%)</td>
<td>19 (55.9%)</td>
<td>31 (27.5%)</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Division</th>
<th>Right</th>
<th>Left</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bifurcation</td>
<td>32 (80%)</td>
<td>17 (42.5%)</td>
<td>49</td>
</tr>
<tr>
<td>Trifurcation</td>
<td>8 (20%)</td>
<td>23 (57.5%)</td>
<td>31</td>
</tr>
</tbody>
</table>

Trifurcation is division of ulnar nerve into deep branch, medial superficial branch and a lateral superficial branch at the same level as shown in the figure 3. Careful dissection was done to observe the division and was not provoked by dissection. Further, branching of superficial branch (sensory) was studied. Superficial branch, dividing into two branches was found in 47 specimens and in 33 specimens, it divided into three branches. Consisting of ulnar proper palmar digital nerve of the 5th digit, common palmar digital nerve of the 4th intersosseous space and communicating branch joining the median nerve.

Figure 3

*Higher origin of division and trifurcation of the ulnar nerve shown within the circle.
Table 3

<table>
<thead>
<tr>
<th>Division of the Superficial branch</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bifurcation</td>
<td>25</td>
<td>22</td>
<td>47(58.75%)</td>
</tr>
<tr>
<td>Trifurcation</td>
<td>15</td>
<td>18</td>
<td>33(41.25%)</td>
</tr>
</tbody>
</table>

The communication pattern was assessed. The communication of the ulnar nerve with the superficial branch of the median nerve was constant. Communicating branches between the ulnar and median nerves have been described throughout anatomical history. A communicating branch as first recorded by Berrettini\(^6\) in his anatomical drawings of Don Griot et al\(^7\). Gehwolf et al\(^8\), Meals et al\(^9\) and Sunderland et al\(^10\) described communicating branches. All these branches arose within the hand itself. In the present study, the communicating branch separated from the ulnar nerve and joined the common palmar digital nerve of the third interosseous space of the median nerve as shown in figure 4. In few cases the median and ulnar nerves gave off branches which formed a true junction in the little finger. The communication of the median nerve with the superficial branch of the ulnar nerve was constant Bonnel\(^15\). In forty-six cases this branch separated from the ulnar nerve and joined the common palmar digital nerve of the third interosseous space of the median nerve. In one case, they observed a junction between the dorsal cutaneous branch arising from the ulnar nerve trunk in the forearm and the ulnar proper palmar digital of the little finger. This type of sensory anomaly can be compared to cases in the literature in which a double sensory branch in the canal of Guyon passes around the pisiform and joins the medial proper palmar digital nerve to the little finger (Engber\(^11\); MacCarthy\(^12\); Meals\(^9\). In this present study we did not detect the other innervation anomalies reported by Björksten et al\(^13\) who, in 153 cases of ulnar paralysis observed the lumbricals innervated by the median nerve in fifteen cases (10%) the lumbricals of the middle and ring fingers innervated by the ulnar nerve in sixty-three cases (41%), the lumbricals of the index, middle and ring fingers innervated by the ulnar nerve in twenty-seven cases (18%), and all the lumbricals innervated by the ulnar nerve in thirty-seven cases (24%).

Communications between the dorsal branch of the ulnar nerve and ulnar digital nerves of the fingers have been referred to as Kaplan’s anastomoses Paraskevas et al\(^14\). Anastomoses between the dorsal branch and sensory branches of the ulnar nerve in the palm were reported in a rare case where the dorsal branch had a high origin from the ulnar nerve near the medial epicondyle Lama et al\(^15\). No such variation was found in this present study. The second variation is the Riche-Cannieu anastomosis, by which the median and ulnar nerves cross-connect in the palm. In such cases, the motor fibers that typically are part of the median nerve might be carried in the ulnar nerve to the level of the hand and cross over in the palm. With this anomaly, a patient with advanced carpal tunnel syndrome resulting in a markedly compromised median nerve might have near normal thenar function, both clinically and electrophysiologically Refaeian\(^16\).

Figure 4

*The communication between the Ulnar nerve and Median nerve is indicated within the circle. Separate communicating branch was found to be in 21(18.3%) cadavers and constant communicating branch was present in 59 (81.7%) cadavers.*

**CONCLUSION**

A clear awareness of ulnar nerve morphology concurring abnormal branching pattern in hand plays a very vital role during surgical procedures in hand and for management of ulnar neuropathy. Knowledge about possible anatomical variations of peripheral nerves is therefore essential for the clinician in understanding the possible manifestation that can result due to neuropathy.

**Authors’ Contribution**
CONFLICTS OF INTEREST

Conflict of interest declared none.

REFERENCES

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