

Anatomical Study of the Ulnar Nerve Variations at High Humeral Level and their Possible Clinical and Diagnostic Implications

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Abstract

Background: Descriptive consideration and evaluation of nerve variations have a key role in the clinical and surgical practice. The anatomical variation of a nerve sets a risk of nerve palsy syndrome. Ulnar nerve (UN) arises from the medial cord of brachial plexus and is one of the common nerves to be involved in neuropathy. In the current anatomical study, the different variations in the UN have been spotted and identified along its potential surgical and clinical implications have been reviewed.

Materials and Methods: Thirty upper limb dissected specimens were examined for possible UN variations. Any communication or any aberrant formation in relation to UN was carefully examined.

Results: Out of the 30 upper limbs specimens, UN in two specimens (4%) showed the abnormal formation and communication with the neighboring nerves of the brachial plexus.

Conclusion: In understanding the severity of the UN neuropathy and its related complications, clinicians such as anesthesiologists, neurologists, radiologists, anatomist, orthopedic, and neurosurgeons should keep these variations that should be taken into consideration. The aim of the study is to layout further additional information about abnormal brachial plexus and there clinical insinuation.

Key words: Cadaver, Dissection, Neuropathy, Ulnar nerve, Upper limb, Variations

INTRODUCTION

Brachial plexus is been formed by the ventral primary rami of spinal nerves from C5 to T1. However, it may receive fibers those originate from ventral rami of C4/T2 called prefixed or post-fixed, respectively.^[1]

Ulnar nerve (UN) takes its origin from the medial cord of brachial plexus, present in the axilla. It is made up of fibers of ventral rami of C8 and T1 spinal nerves. It is seen that the nerve occasionally receives additional contributions of

C7 fibers from lateral root of median nerve. UN runs medial to axillary artery in the axilla and at the higher humeral level; it runs medially, close to the brachial artery. In the arm, the only important branches are a few fibers to blood vessels.^[2]

Unusual communications and emergence of UN in axilla prove to be of great importance. Because, it sometimes adds complications during surgeries.^[3] Division of trunks and formation of cords of the brachial plexus showed notable anomalies. Although, arrangement of terminal branches showed no such anomalies.^[4] This study's objective is to identify anomalies related to UN. Potential clinical importance is also to be discussed.

MATERIALS AND METHODS

The present study has been carried out in the Anatomy Department, AIIMS Rishikesh, India. Thirty embalmed

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human cadavers of both sexes from North Indian population were included in the study. Standard landmarks and skin incisions were carried out according to the Cunningham practical manual and the axillary region and arm of cadavers were dissected and exposed. Aberrant formations and communications of UN, with neighboring peripheral nerves were perceived at the higher humeral level.

RESULTS

Out of 30 upper limbs, only two UN variations were observed which made up 4% of incidence cases. Both the variations were noted in the upper limb of the right side. In all 30 upper limb specimens, UN was present. In two limbs, aberrant formation was seen unilaterally with lateral cord of brachial plexus contributing significantly to the UN formation [Figure 1]. The UN received contributions from the lateral cord on its lateral aspect. The contributing branch passed from the lateral to medial side, deep to the median nerve formation. UN had similar emergence as that of median nerve. However, in the arm, the nerve followed a normal course after its aberrant formation. There was no abnormal communication of UN with the neighboring nerves observed, except, in one case, where it was seen that the UN originated from the lateral cord of the brachial plexus and a communication was found between the median nerve and musculocutaneous nerve in the upper arm [Figure 2].

DISCUSSION

Adequate awareness of all potential anatomical variations allows for an effective brachial plexus blockade. These include atypical origin or variant communication between its branches. Variation in UN formation is uncommon. There are only a few reported cases. Sachdeva and Singla reported a rare case of origin of UN from the median nerve.^[5] In their study, median nerve bifurcated into median nerve proper and UN. Another similar kind of variation was noted by Gupta *et al.* in the formation of the UN. Nevertheless, in this case, only a root from median nerve contributed.^[6]

Ramachandran *et al.* observed the lateral root of median nerve giving contribution to the UN.^[7]

In this study, significant contributions from lateral cord of the brachial plexus in two of the 30 upper limbs were noted. Variations in their origin, course, dispensation, and distribution makes them prone to entrapment neuropathies.^[8] Therefore, aberrant formation of UN must be ruled out before a diagnostic approach.

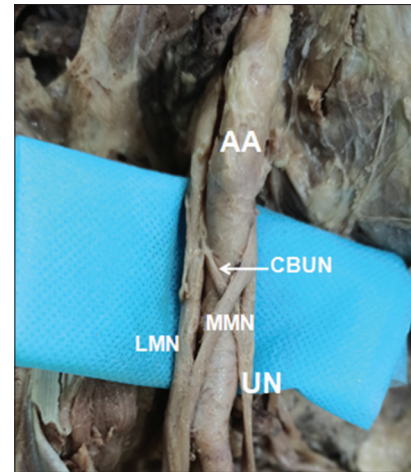


Figure 1: Atypical origin of ulnar nerve with adding contribution from both lateral & medial cords of brachial plexus

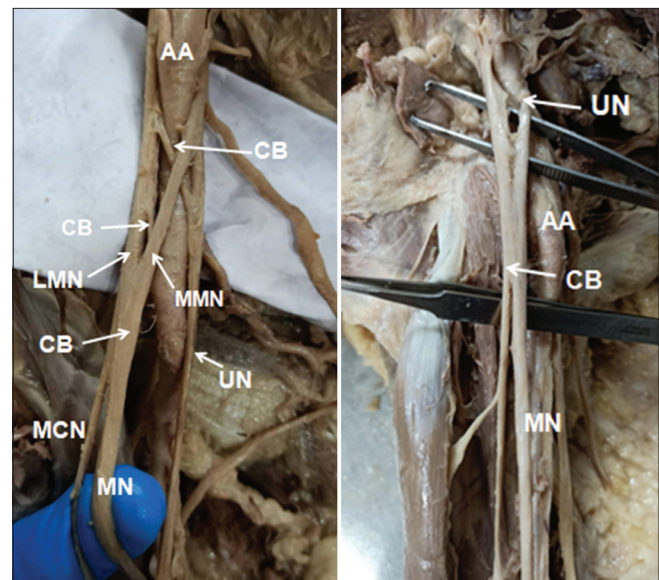


Figure 2: Atypical or unusual formation of the ulnar nerve from lateral cord & medial cord of brachial plexus & showing communication between median and musculocutaneous nerve in the upper arm

Anomalous communications are often observed between the various branches of the brachial plexus in medial and lateral cords.^[9] Hence, it is the case between radial and UN over dorsal surface of the hand, at the high humeral level, it is a rare finding.^[10,11]

In a study conducted by Fazan *et al.* demonstrated a 30% pervasiveness of cases wherein the UN received a communicating branch from musculocutaneous nerve.^[12] The incidence of the MCN-MN communication has been brought up reported in diverse and manifold population groups with a wide variability between 2.1% and 63.5%.^[13,14] However, in the present study, we found zero communication between the UN

and its nearby peripheral nerves, but in one case of our study, we figured that the UN took its origin from lateral cord of brachial plexus along with median nerve and the musculocutaneous nerve communicating with each other in the arm.

There are limited reports of this variation.^[6,15,16]

In this study, there was no communication observed between ulnar and radial nerves. The UN rarely communicates with the medial cutaneous nerve of forearm. Few studies found the MCN of forearm to communicate with the MCN of arm and radial nerve.^[6,17] Clinically, this knowledge is beneficial in nerve graftings.

Kroll *et al.* study showed that neuropathies related to UN are the most common nerve injuries, which accounts for a majority with the prevalence of 33%, followed by 23% of incidence cases by brachial plexus injuries.^[18]

Knowledge of the variations among the pattern of peripheral nerves is of great use for the radiologists and anesthetists while performing the diagnostic interpretations such as computed tomography scan and magnetic resonance imaging or administering anesthetic drugs.^[19]

CONCLUSION

Huge number of surgeries performed in the high humeral regions for various reasons. This requires awareness of the abnormal communications of UN. It is also useful in diagnostic approaches and management of ulnar neuropathy. It also helps clinicians in finding out the severity. Knowing these variations would be immensely helpful in preventing otherwise avoidable iatrogenic injury to the UN by interventional radiologists, orthopedicians and neurologists during radiological procedures or operations on fractured patients.

CONFLICTS OF INTERESTS

There are no conflicts of interests concerning the publication of this paper.

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