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## Research Article

### VARIANT NERVES IN THE INFRACLAVICULAR PART OF BRACHIAL PLEXUS

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#### ARTICLE INFOABSTRACT

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Ulnar nerve usually is a branch of the medial cord of brachial plexus. In a study conducted on 20 upper limbs, variation in its origin was observed in one right upper limb. Ulnar nerve had two roots of origin, one arising from the medial cord and another from the lateral cord. The rest of the course of the ulnar nerve was as usual. In another left upper limb a communicating branch was observed between the musculocutaneous nerve and median nerve. This type of variation would be important while planning surgery in the region of axilla or arm as these nerves is more liable to be injured during operations.

## INTRODUCTION

Brachial plexus is a network of nerves which innervates the muscles of the back and the upper limb. It is formed by the ventral rami of C5-C8 and T1 spinal nerves. It also receives occasional contribution from C4 and T2. The plexus has supraclavicular and infraclavicular parts. The supraclavicular part includes the roots, trunks and divisions. The infraclavicular part consists of the cords and its branches. C5 and C6 roots unite to form the upper trunk, C7 root continues as the middle trunk and C8 and T1 roots unite to form the lower trunk. Each trunk divides into anterior and posterior divisions. The anterior division of the upper and middle trunks unite to form the lateral cord, anterior division of the lower trunk continues as the medial cord and the posterior divisions of all the trunks unite to form the posterior cord with respect to the 2<sup>nd</sup> part of the axillary artery. The cords finally give off the branches to supply the flexors and extensors of the upper limb. The ulnar nerve is a branch arising from the medial cord. Its root value is C7, C8 and T1. Several studies have shown variations in the branching pattern, formation of cords, absence of cords. In this study we intended to observe the gross variations in the formations and branching pattern of the brachial plexus.

## MATERIALS AND METHODS

Twenty formalin-fixed upper limbs were meticulously dissected following the instructions of the Cunningham's practical manual. The variations were noted and photographed.

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## RESULTS

Out of the twenty upper limbs, variations were observed in two upper limbs. In one right upper limb (R<sub>1</sub>) it was observed that the ulnar nerve had two roots. One root aroused from lateral cord and the other from the medial cord. The lateral root passed beneath the medial root of the median nerve. It was 3.7cms in length. Two communicating branches were observed between the musculocutaneous nerve and the median nerve. The first communicating branch was observed proximal to the entry of musculocutaneous nerve into the coracobrachialis muscle and the other was observed distal to the coracobrachialis muscle. The length of the first communicating branch (CB<sub>1</sub>) was 5.7cms long and the second communicating branch (CB<sub>2</sub>) was 4.3cms (Fig. 1. and Fig. 2.). In one left upper limb (L<sub>1</sub>), a similar communicating branch was observed between the musculocutaneous nerve and the median nerve. This communicating branch was 2cms long and joined the median nerve after the musculocutaneous nerve pierced the coracobrachialis muscle in the middle of the arm (Fig. 3.).

## DISCUSSION

Variations of the brachial plexus are very common. These variations must be well kept in mind for the failure of any local and regional anaesthesia of the brachial plexus (Shetty *et al.*, 2011). Knowledge of variations in anatomy is important to the radiologists, anaesthesiologists and surgeons, and had gained more importance due to the wide use and reliance on computer imaging in diagnostic medicine (Harry *et al.*, 1997).



Fig. 1. Right arm (R1) showing A – Brachial artery, LR – Lateral root of median nerve, MR – Medial root of median nerve, UN – Ulnar nerve, MN – Median nerve, MCN – Musculocutaneous nerve, CB<sub>1</sub> – First communicating branch, \* - Lateral root of Ulnar nerve.

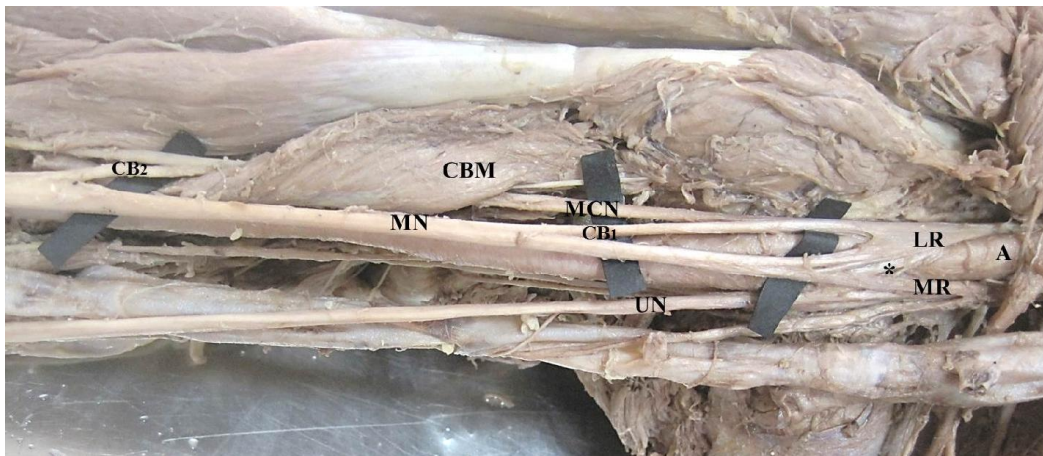


Fig. 2. Right arm (R1) showing A – Brachial artery, LR – Lateral root of median nerve, MR – Medial root of median nerve, UN – Ulnar nerve, MN – Median nerve, MCN – Musculocutaneous nerve, CB<sub>1</sub> – First communicating branch, CB<sub>2</sub> – Second communicating branch, \* - Lateral root of Ulnar nerve, CBM – Coracobrachialis muscle.

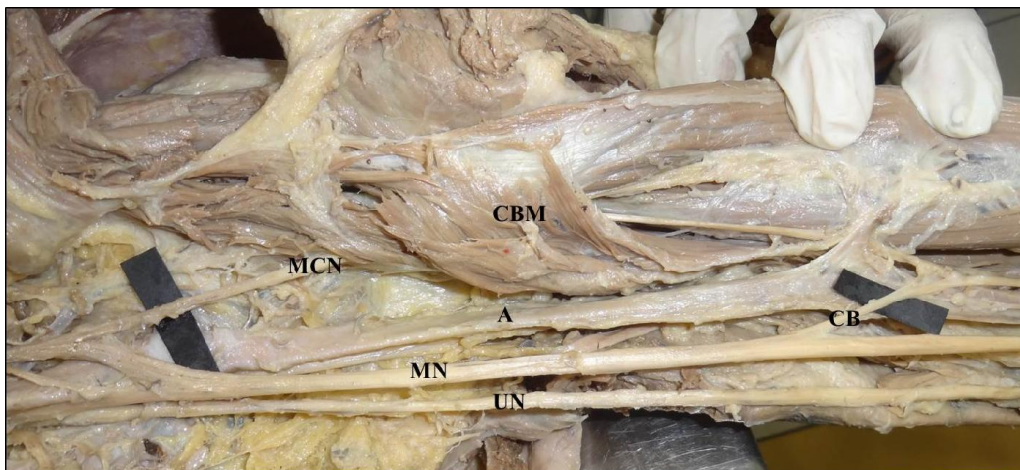


Fig. 3. Left arm (L1) showing MCN – Musculocutaneous nerve, CBM – Coracobrachialis muscle, A – Brachial artery, MN – Median nerve, UN – Ulnar nerve, CB – Communicating branch

Variations in the formation of Ulnar nerve are very rare. Ulnar nerve is a branch of the medial cord with the root value C7, C8 and T1. C7 fibres from the lateral cord pass into the ulnar nerve. To have C7 root in it the ulnar nerve must receive the contribution from lateral cord. It is a common variation of the brachial plexus to find contribution to ulnar nerve from lateral cord. Ulnar nerve may even receive a small branch from lateral cord which is sometimes called lateral root of ulnar nerve (Hollishead, 1985). Communication between the median and ulnar nerves in the forearm were termed as Martin Gruber communication named after the authors who first found it (Sonck, 1991). A study conducted on 60 upper limbs showed the presence of lateral root of ulnar nerve arising from the lateral root of median nerve in the axilla in two cases (Chaudhary *et al.*, 2013). In this study, the lateral root of ulnar nerve passed deep to the medial root of median nerve and joined the ulnar nerve. The length of the lateral root of ulnar nerve was 2.8cms. A similar variation was found in our study. But the length of the lateral root of ulnar nerve was found to be 3.7cms in length (Fig. 1. and Fig. 2.).

Fuss, in his study, classified the variation into type a (few fibres of medial root of median nerve passed behind the lateral root of ulnar nerve) and type b (all fibres of medial root of median nerve passed in front of the lateral root of ulnar nerve) (Fuss, 1989). The variation seen in the present study belongs to type b. Another variation observed in the present study was the presence of two communicating branches between the median and ulnar nerves in R1 (Fig. 1. and Fig. 2.) and a single communicating branch in L1 (Fig. 3.). Fibres of the median nerve run along with the musculocutaneous nerve, which after travelling some distance, leave the latter to join the parent trunk (Williams *et al.*, 1995). According to Venieratos and Anagnostopoulou, communication between median and musculocutaneous nerves were classified into three types in relation to coracobrachialis muscle –

- Type 1 – communication between musculocutaneous nerve and median nerve is proximal to the entrance of musculocutaneous nerve into coracobrachialis muscle.
- Type 2 – communication between musculocutaneous nerve and median nerve is distal to the coracobrachialis muscle.
- Type 3 – neither the nerve nor its communicating branch pierced the muscle (Venieratos *et al.*, 1998).

In the present study, Type 1 and Type 2 was observed in R1 (Fig. 1. and Fig. 2.) and Type 2 was observed in L1 (Fig. 3.). A similar communicating branch after piercing the coracobrachialis muscle was observed by Gupta *et al* in their study on 25 formalin-fixed upper limbs (Gupta *et al.*, 2011). According to the elaborate classification proposed by Kaur *et al.*, 2013, in the present study, the variation observed in R1 (Fig. 1. and Fig. 2.) belongs to Type II group B and Type II group C, where the communicating branch containing the fibres of lateral root of median root leave the musculocutaneous nerve before and after the latter pierces the coracobrachialis muscle respectively. According to the same classification, the variation observed in L1 (Fig. 3.) belongs to Type II group C. Embryological significance – During the formation of brachial plexus, the nerve cells remain with their original muscles as they migrate. Based on this, every muscle bud migrates preserving its own innervation. The nerve fibres may eventually group differently from the general pattern, but every muscle

preserves the fibres coming from a certain neuromere (Sadler, 2004). Thus Knowledge of such possible variations is of great clinical importance for the physicians and surgeons. Lesions of the communicating nerve may give rise to patterns of weakness which may prove to be difficult for proper diagnosis. Clinical implication of this could be that the injury of musculocutaneous nerve proximal to the communicating branch may lead to unexpected presentation of weakness of forearm flexors and thenar muscles (Sunderland, 1978). The communicating branch may lead to compression of the brachial artery leading to vascular teasing of the distal part of upper extremity (Sargon *et al.*, 1995).

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