

## Case Report

# ONTOGENY RECAPITULATES PHYLOGENY: COMMUNICATION BETWEEN THE MEDIAN AND THE MUSCULOCUTANEOUS NERVE: A CASE REPORT

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## ABSTRACT

Neural variations of the brachium constitute important anatomical and clinical entity. Abnormal variations of median nerve, musculocutaneous nerve and their communicating branches have been reported very frequently by the anatomists in the past. The nerves of the extremities are particularly vulnerable to injury because of their long course and superficial distribution.

Present report describes a case of a single abnormal communication between median and musculocutaneous nerve encountered in a 55 year old Indian male cadaver during routine undergraduate dissection. Knowledge of such anatomical variations is important while planning surgery in the region of axilla or arm as these nerves are more liable to be injured during surgical procedures as well as may result in unusual entrapment neuropathies. Clinical significance of such type of variation in the light of its developmental origin has been discussed.

**KEY WORDS:** Median nerve, Musculocutaneous nerve, Anatomical variations.

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## INTRODUCTION

Anatomical variations in the formation and branching pattern of brachial plexus are very common and have been described in humans by many authors (Hollinshed, 1976 [1]; Williams et al. 1995 [2]; Chouhan and Roy 2002 [3]; Choi et al. 2002 [4]; Vollala et al. 2005 [5]). The median, musculocutaneous and ulnar nerves (MN, MCN, UN), after their origin from brachial plexus, pass through the anterior compartment

of the arm without receiving any branch from any nerve in the neighborhood (Hollinshed 1976; Williams et al. 1995) [1,2]. The muscles of anterior compartment of arm (coracobrachialis, brachialis, biceps brachii) are innervated by musculocutaneous nerve, a continuation of the lateral cord of brachial plexus [6]. Although communications between the nerves in the arm are rare, the communication between the median nerve and musculocutaneous nerve were

described from nineteenth century [7,8]. The lateral root of median nerve carries fibers that may pass through the MCN, and a communicating branch from the later usually joins the MN in the lower third of the arm [9]. In the arm, the MCN passes through the coracobrachialis muscle and innervates the coracobrachialis as well as the brachialis and the biceps brachii muscles and later continues as the lateral cutaneous nerve of the forearm without exhibiting any communication with the MN or other nerves. We recently observed unilateral single communication between MN and MCN in the dissected cadaver [10], believed it to be the most frequent variant of this nerve where some fibers of lateral root of the MN run along with the MCN and after travelling some distance, leave the latter to join the ultimate destination(the median nerve). Our aim is to analyze the exact topography of this variation and to discuss its morphological and clinical significance. The knowledge of the anatomical variations of the peripheral nerves in the upper extremities is important as these nerves could be injured during surgical procedures and they also explain unusual clinical symptoms.

### CASE REPORT AND OBSERVATIONS

During undergraduate anatomy dissection of embalmed cadaver of seventy year old male in the Department of Anatomy, Medical College, Kolkata, an anatomical variation in the form of

communication between MN and MCN was observed in the right upper limb. Following features were reported:

- 1) The MCN (Musculocutaneous nerve), arose normally from the lateral cord of brachial plexus, pierced the coracobrachialis muscle from its medial side, lateral to axillary artery about 8.2 cm from the tip of coracoid process.
- 2) The MN (Median nerve), arose normally from both the lateral and medial cords by two roots. On exploring further, a communicating branch was observed, arising from MCN at a distance of about 11.6 cm from the tip of coracoid process and joined the MN about 12.5 cm from the same bony point. The muscular branches from the MCN were seen to be arising earlier than the communicating branch. After giving the communicating branch, MCN continued as lateral cutaneous nerve of forearm.
- 3) Further course, branching pattern and termination of MCN and MN in arm, forearm and hand followed the normal pattern.
- 4) The other limb of the cadaver did not show any such variation of lateral or medial cord. Absolutely normal relation, formation and branching pattern of brachial plexus were noted.
- 5) No other arterial or muscular variation was observed in either of the limbs.

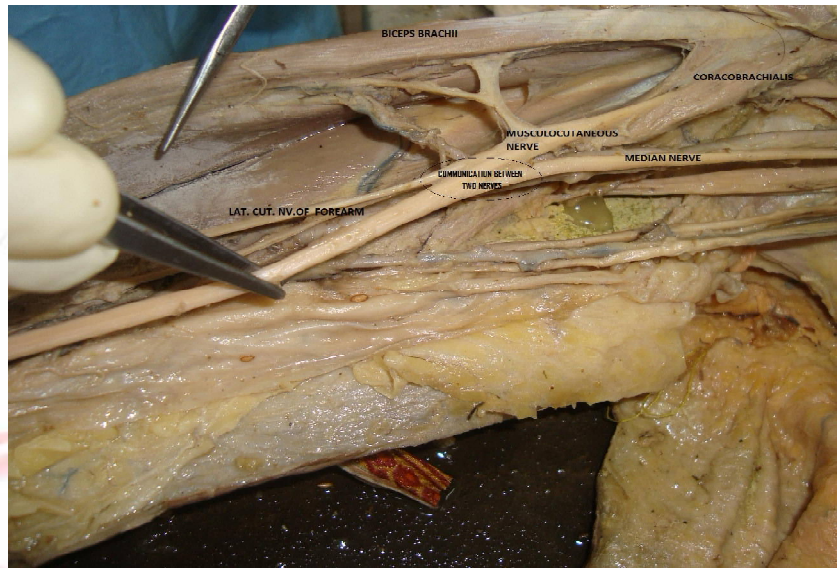
Dissection was carried out according to the methods described by Romanes (1995) in Cunningham's Manual of Practical Anatomy.

**Fig. 1:** Showing normal location of Musculocutaneous nerve, Median nerve and Ulnar nerve in the right axilla.

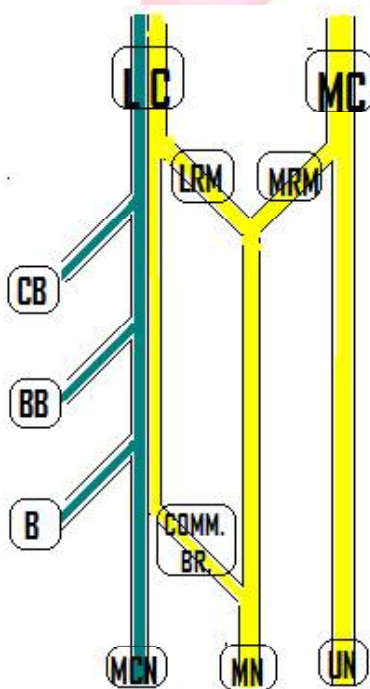




**Fig. 2:** showing the communicating ramus from the Musculocutaneous nerve(MCN) to Median nerve(MN) in the right upper arm.



**Fig. 3:** Line diagram showing communication between Median Nerve (MN) and Musculocutaneous Nerve(MCN) in the present case.



LC-Lateral Cord,MC-Medial Cord,LRM-Lateral root of median nerve,MRM-Medial root of median nerve, MCN-Musculocutaneous Nerve (continued as lateral cutaneous nerve of arm),MN-Median nerve,UN-Ulnar nerve,CB-Branch to Coracobrachialis,BB-Branch to Biceps brachii,B-Branch to brachialis.

## DISCUSSION

Communications between median and musculocutaneous nerves had been reported earlier by several authors [3,11,4]. Venieratos and Anagnostopoulou (1998) [10] believed it to be the most frequent variant of this nerve,

where some fibers of the lateral root of median nerve run along with the musculocutaneous nerve, and after travelling some distance, leave the latter to join the ultimate destination(the median nerve) thus giving the appearance as if there are two lateral roots of median nerve. The communication between the MCN and MN have been classified into different types by Li Minor (1992) [12], Venieratos and Anagnostopoulou (1998) [10] and Choi et al (2002) [4].

Venieratos and Anagnostopoulou (1998) [10] classifications:

TYPE-I: The communication is proximal to the entrance of the musculocutaneous nerve into the coracobrachialis muscle.

TYPE-II: The communicating branch arises distal to the coracobrachialis muscle from the musculocutaneous nerve.

TYPE-III: The communicating branch and the musculocutaneous nerve do not pierce the coracobrachialis muscle.

Choi et al (2002) [4] classifications: was based on a study on 138 cadavers.

Pattern 1: Fusion of both nerves (19.2%)

Pattern 2: Presence of one supplementary branch between both nerves (72.6%)

Pattern 2a: Single root from musculocutaneous nerve, contributes to the connection (69.9%)

Pattern 2b: There are two roots from musculocutaneous nerve (2.7%)

Pattern 3: Presence of two branches between both nerves (6.8%)

Our case report fits into Type-II of Venieratos and Anagnostopoulou(1998) [10] or into Type2a of Choi et al (2002) [4]. It must be noted that the primary ventral branches of the spinal nerves that form the musculocutaneous nerve and the lateral root of median nerve are common to these two nerves(from C5 to C7).This common origin of the MN and MCN explains the frequent presence of communicating branches between the two nerves, which are found in up to one third of all individuals [13].

**Ontogeny recapitulates in the phylogeny:** The presence of communications between nerves of brachium may be attributed to the random factors influencing the mechanism of formation of the limb muscles and peripheral nerves in the embryonic life. Kosugi et al. (1986) [14] reported that there was only one trunk equivalent to the MN in the thoracic limb of the lower vertebrates (amphibians, reptiles and birds). In the context that ontogeny recapitulates phylogeny; it is possible that the variation seen in the current case report, is the result of developmental anomaly. In man, the forelimb muscles develop from the mesenchyme of the para axial mesoderm during 5<sup>th</sup> week of IUL [15]. The axons of spinal nerves grow distally to reach the limb bud mesenchyme.The peripheral processes of the motor and sensory neurons grow in the mesenchyme, in different directions [2]. During this complex developmental process, there are innumerable possibilities for the route adopted by developing axons and thus for their fusion with the main trunk. Once antenatally formed, the defect will definitely persist until postnatal period [16]. As the guiding factor of the developing axons is regulated by signaling chemo attractants and chemo repellants in a uniquely coordinated site specific manner, so any altered signaling between the mesenchymal cells and neuronal growth cones can result in significant variations in nerve patterns [17]. Alternatively, these variations may be due to circulatory factors at the time of fusion of the brachial plexus cords [14]. Phylogenetically, the limbs with no musculocutaneous nerve are equated with amphibians, reptiles and birds and limbs with communications between MN and MCN are equated with dogs thus supporting

the dictum “Ontogeny recapitulates Phylogeny” [3].

**Clinical Significance:** Knowledge of communicating branches between the MCN and MN may prove valuable in traumatology of shoulder joint and/or upper arm as well as in relation to surgeries requiring tracing of MN and /or MCN distally [13]. They also accused that such communications may be responsible for entrapment syndromes of the MCN in which a part of MN also passes through the coracobrachialis muscle exhibiting the signs and symptoms similar to those seen in the median nerve neuropathy(as in the carpal tunnel syndrome or the pronator syndrome).Awareness of the communicating branch may be valuable for clinicians thereby avoiding unnecessary carpal tunnel release in such cases (Venieratos and Anagnostopoulou, 1998) [10], Sunderland (1978) [18] opined that the lesions of the communicating nerve may give rise to patterns of weakness that may impose difficulty in the diagnosis. Nevertheless, an injury to the MCN proximal to the anastomotic branch (between MCN and MN) may lead to unexpected presentation of weakness of the forearm flexors and the thenar muscles. In diagnostic clinical neurophysiology, such communications may have some significance [4]. Leffert (1985) [19] stressed upon the fact that such communications should definitely be ruled out to prevent the unwanted outcomes of operations conducted on the musculocutaneous nerve.

**Conflicts of Interests: None**

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