



ABSENCE OF MUSCULOCUTANEOUS NERVE: EMBRYOLOGICAL BASIS

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ABSTRACT

Variation of brachial plexus characterized by the absence of musculocutaneous nerve in right arm was found during routine dissection of a 54 year old male cadaver. After giving lateral pectoral nerve, rest of the lateral cord continued as lateral root of median nerve. An unusual branch was arising from lateral cord which crossed the axillary artery anteriorly and then divided into two branches. One of these branches joined ulnar nerve and other medial root of median nerve. All the muscles of front of arm were supplied by branches of median nerve. These variations are important for the anesthetists, surgeons, neurologists during surgery and for anatomists during dissection in the region of axilla.

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“The knowledge of the variations of the course and distribution of the lateral cord of brachial plexus is very important while performing neurotization of brachial plexus lesions, shoulder arthroscopy by anterior gleno-humeral portal and shoulder reconstructive surgery so that these structures can be identified and protected”

INTRODUCTION

Variations are common in the region of brachial plexus as several spinal nerves unite and divide here. Brachial plexus is formed by union of ventral rami of cervical 5,6,7,8 and thoracic 1st segment of spinal nerve roots. These roots join to form upper, middle and lower trunks. Ventral divisions of upper and middle trunks unite to form lateral cord and ventral division of lower trunk form medial cord. Posterior divisions of all trunks fuse and form posterior cord. Lateral cord gives rise to lateral pectoral nerve, musculocutaneous nerve and lateral root of median nerve. The musculocutaneous nerve (cervical 5, 6 and 7 roots) pierces the coracobrachialis muscle, supplies it and then passes obliquely down to lateral side of arm, between biceps brachii and brachialis muscles. After supplying the above two muscles, it pierces deep fascia lateral to the tendon of biceps brachii near elbow and is continued as the lateral cutaneous nerve of the forearm.¹ Knowledge of anatomical variations in the brachial plexus such as the absence of the musculocutaneous nerve and of the muscles that are innervated by unusual nerves may help clinicians faced with indecipherable clinical signs.

CASE REPORT

During routine dissection of the right upper limb of 54 year old male cadaver in the department of Anatomy, CSM Medical University, UP, Lucknow, it was observed that musculocutaneous nerve was absent in right axilla and arm. The lateral cord after giving lateral pectoral nerve continued as lateral root of median nerve which joined with the medial root of median nerve to form the median nerve. A communicating branch arose from the lateral cord distal to the lateral pectoral nerve which crossed the axillary artery anteriorly and then divided into two branches. One branch joined the ulnar nerve and other joined with the medial root of median nerve. The muscles of flexor compartment of arm i.e.

coracobrachialis, biceps brachii were supplied directly by branches of median nerve. Just distal to the muscular branch to biceps brachii, a branch for brachialis arose which on reaching lower part of arm gave a twig to brachialis and continued as lateral cutaneous nerve of forearm (Figure 1&2).

In forearm and hand the course and distribution of median nerve was normal. The origin, course and distribution of musculocutaneous nerve were normal in left axilla and arm.

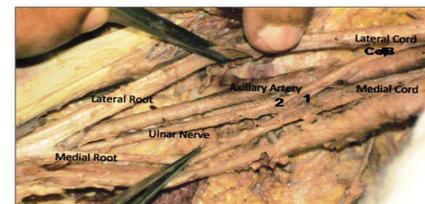


Figure 1 (a)

Figure 1(a): Photograph showing absence of musculocutaneous nerve. (CoB: communicating branch; 1: branch joining medial root of median nerve; 2: branch joining ulnar nerve).



Figure 1 (b)

Figure 1(b): Photograph showing branches of median nerve supplying the muscles of flexor compartment of arm. (LRM: lateral root of median nerve; MRM: medial root of median nerve; MN: median nerve; 1 & 2: muscular branch to biceps brachii; 3: muscular branch to brachialis; 4: lateral cutaneous nerve of forearm).

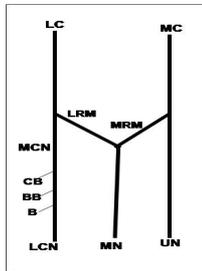


Figure 2(a)

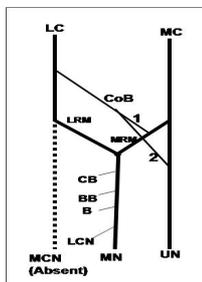


Figure 2(b)

Figure 2: Schematic diagram showing (a) normal formation and distribution of musculocutaneous nerve and its branches (b) variation in the formation and distribution of different nerves and its branches 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; MN: median nerve; UN: ulnar nerve; CB: muscular branch to coracobrachialis; BB: muscular branch to biceps brachii; B: muscular branch to brachialis; LCN: lateral cutaneous nerve of forearm; CoB: communicating branch from lateral cord; 1: branch of CoB joining with the medial root of median; 2: branch of CoB joining with the ulnar nerve).

DISCUSSION

Normally the musculocutaneous nerve is given off opposite the lower border of pectoralis minor

muscle. It pierces the coracobrachialis muscle and descends laterally between the biceps and brachialis muscle to the lateral side of arm. Just below the elbow it pierces the deep fascia laterally to the tendon of the biceps muscle and continues as the lateral cutaneous nerve of forearm. In its course through the arm it supplies the coracobrachialis, biceps brachii and greater part of the brachialis muscle.

In the present case the musculocutaneous nerve (MCN) was found to be absent and the above muscles were supplied by median nerve. The reason behind this variation may be the result of factors influencing the development of the limb muscles and the peripheral nerves during the embryonic life. The development of forelimb muscles by regional expression of five *Hox D* genes occurs from the mesenchyme of paraxial mesoderm in the fifth week of the intrauterine life.^{2,3} The growth cones of the motor axons arrive at the base of the limb bud to form the brachial plexus and continue in the limb bud.² The guidance of the developing axons is regulated by the expression of chemo attractants and chemorepulsant in highly coordinated site-specific fission. Tropic substances such as brain-derived neurotrophic growth factor, c-kit ligand, neutrin-1, neutrin-2, etc. attract the correct growth cones or support the viability of the growth cones that happen to take the right path.⁴ The significant variations in nerve pattern may be the result of altered signaling between the mesenchymal cells and the neuronal growth cones or circulatory factors at the time of fission of brachial plexus cords.⁴

Absence of the MCN is also reported by Le Minor, Gumsburun and Adiguel, Sud, Song et al, Nakatani et al.⁵⁻⁹ The present case was very much similar to the case reported by Sud, in which the MCN was absent and motor nerve to the muscles of the anterior compartment of arm arose from

median nerve.⁷ Literature suggests that a communication may exist between medial and lateral cords at various levels. Le Minor classified communication between musculocutaneous (MCN) and median nerve (MN) into five types. In type 1, there is no communication between the MN and the MCN, in type 2 fibers of medial root of MN pass through the MCN and join MN in the middle of arm, whereas in type 3, the lateral root fibers of the MN pass along the MCN and after some distance, leave it to form the lateral root of the MN. In type 5, the MCN is absent and the entire fibers of the MCN pass through the lateral root and fibers to the muscles supplied by MCN branch out directly from the MN.⁵ Our case falls in type 5 category according to this classification.

Absence of musculocutaneous nerve does not lead to paralysis of the flexor compartment of the arm and hypoesthesia of the lateral surface of the forearm, since the motor and sensitive fibers can arise from the other nerve, as also observed in the present case. But the structural abnormalities and variations of the nerve of brachial plexus have recently become significant because of new imaging techniques such as computed tomography and magnetic resonance imaging in order to proceed for clinical diagnosis and surgical procedures. The knowledge of the variations of the course and distribution of the lateral cord of brachial plexus is very important while performing neurotization of brachial plexus lesions, shoulder arthroscopy by anterior gleno-humeral portal and shoulder reconstructive surgery so that these structures can be identified and protected.

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