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An Anatomical Study on Variations in Relation to Musculaocutaneous and Median Nerve of Upper Limb

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Abstract- Background: Variations in the formation of brachial plexus and in the course of its branches are not as uncommon as was once thought. Anatomical knowledge of the variations about formation, course, termination of median and musculocutaneous nerve is extremely important in surgical exploration and administration of neuromuscular blocks in axillary region. This awareness helpful while planning reconstructive flap surgeries and treatment of fracture of humerus.

Materials and Methods: This study was carried out on 40 normal formalin fixed upper limb specimens of 20 cadavers. Dissection was performed according to standard techniques. Variation in the origin, course, branching pattern, termination and relationship between median and musculocutaneous nerve were noted and documented.

Results: In the present study, out of 40 specimens absence of musculocutaneous nerve was noted in 5% of the limbs. In those 5% limbs median nerve showed variation in origin, course and termination.

Conclusion: This study will serve to understand the anatomical relationship between median and musculocutaneous nerve and it will help in various surgical procedures done on upper limb.

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ANATOMICAL STUDY ON VARIATIONS IN RELATION TO MUSCULO CUTANEOUS AND MEDIAN NERVE OF UPPER LIMB

Strictly as per the compliance and regulations of:



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I. INTRODUCTION

Ventral rami of spinal nerves from C5 to T1 form Brachial plexus. Brachial plexus also convey sympathetic nerves for upper limb from T2 to T6 spinal segments. Their formation starts in Posterior triangle and they give terminal branches in Axilla. Roots give branches to Serratus Anterior (C5, 6, 7) and Rhomboideus (C5). Roots C5 and C6 join to form Upper Trunk. Root C7 continues as Middle Trunk. C8 and T1 Roots join to form Lower Trunk. Trunks are found in

Posterior triangle. Upper Trunk gives a branch to Subclavius muscle (C5, 6) and Suprascapular nerve. Each trunk divides in an anterior and a posterior division so that three anterior and three posterior divisions are formed. The anterior divisions of Upper and Middle Trunk join to form Lateral Cord. Anterior division of Lower Trunk continues as Medial Cord. Posterior divisions of all the three Trunks join to form the Posterior Cord. Cords are seen in Axilla and named according to their relation with second part of Axillary artery. Branches from Cords are given around third part of Axillary artery. Branches of Lateral Cord are: 1) Lateral Pectoral 2) Musculocutaneous 3) Lateral Root of Median nerve. Branches of Medial Cord are: 1) Medial Pectoral 2) Medial Cutaneous nerve of arm 3) Medial Cutaneous nerve of fore arm 4) Ulnar nerve 5) Medial root of Median nerve. Branches of Posterior Cord are: 1) Upper Subscapular 2) Nerve to Latissimus Dorsi also known as Thoracodorsal nerve 3) Lower Subscapular 4) Axillary nerve 5) Radial nerve. Median Nerve (Mn) is formed by union of Lateral Root from Lateral Cord and Medial Root from Medial Cord of Brachial plexus. Median nerve does not give any branch in the arm unless the nerve to Pronator Teres is unusually high. Musculocutaneous nerve (Mcn) supplies Coracobrachialis, Biceps and Brachialis muscles. It gives articular branches to Shoulder and Elbow joint, its cutaneous supply includes skin over anterolateral aspect of fore arm till the base of Thenar eminence.^[1]

II. MATERIALS AND METHODS

Forty limbs (Rt: 20; Lt: 20) from 20 embalmed cadavers were utilized during the study period of three years. The pectoral region, the axilla, the arm, cords and the branches of the infraclavicular part of the brachial plexus were dissected. The variations of median and musculocutaneous nerve were noted.

Observations: The musculocutaneous nerve was absent in 2 upper limbs of the same cadaver, median nerve showed varied anatomical pattern in respect to origin, course and termination.

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Fig. 1 : Left upper limb specimen showing absence of Musculocutaneous nerve and 3 roots of Median nerve

In left upper limb, the musculocutaneous nerve was found absent and median nerve was arising from three roots (2 from lateral cord and 1 from medial cord of brachial plexus), during its course in arm it was observed that nerve giving one proximal and one distal

branch. Proximal branch supplying coracobrachialis, biceps brachii, and brachialis. Distal branch arise from lateral side of nerve and passes below the biceps brachii to continue as lateral cutaneous nerve of forearm.

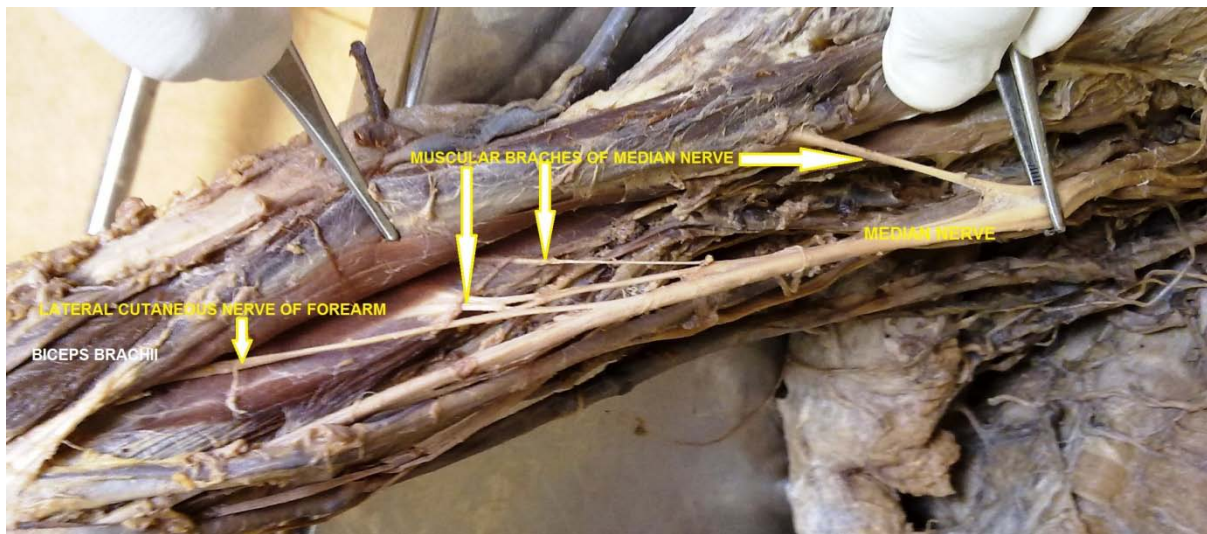


Fig. 2 : Right upper limb showing absence of Musculocutaneous nerve and separate muscular branches arising from Median nerve

In right upper limb of the same cadaver, musculocutaneous nerve was found absent. The median nerves arising normally, but during its distal course in the arm it was observed that the nerve was giving separate individual branches to all the muscles of anterior compartment of arm and passing under the brachial artery from lateral to medial side.



Fig. 3 : Right upper limb showing Median nerve passing under the brachial artery

Lateral cutaneous nerve of forearm arising separately from the median nerve in the lower third of the arm passing below the biceps brachii and emerge on its lateral side distally. In rest of the specimens normal anatomy of both nerves and their relationship was maintained.

III. DISCUSSION

Multiple variations of Brachial plexus have been documented by Henry Hollinshead in 1969^[2]. Uzan^[3] found three Roots from Lateral Cord and one Root from Medial Cord. These roots united to form Median nerve. In the present study one specimen shows two roots from lateral cord and one from medial cord. Jahanshahi M^[4] described absence of Musculocutaneous nerve and muscles normally supplied by it were supplied by Median nerve, however the Median nerve was formed in normal way. In our case Median nerve has three Roots, which is a variation, as Median nerve is normally formed by two Roots. Satyanarayan N^[5] describes three unilateral cases of variations in the formation of Median nerve. In the first case, the Median nerve was formed on the medial side of Axillary artery and also at a higher level. Later the Median nerve continued behind the Brachial artery and received a communicating branch from Lateral Cord of Brachial plexus. In the second case, formation of Median nerve was by three Roots, two Roots from Lateral Cord and one Root from Medial Cord. In the third case, Median nerve was formed by four Roots, three Roots from Lateral Cord and one root from Medial Cord. We have found three Roots of Median nerve in one left limb specimen which was in agreement with second case of above mentioned author. The musculocutaneous nerve (C4–C6), a mixed peripheral nerve, arising from the lateral cord of the brachial plexus in the axilla, usually innervates the muscles of the anterior compartment of the arm and then continues as the lateral cutaneous nerve of the

forearm^[6]. PrasadaRao^[7] reported two cases of absent musculocutaneous nerve from the lateral cord of the brachial plexus. In the present study, the absence of the musculocutaneous nerve was observed in 2 specimens of same cadaver. Ihunwo et al^[8] reported a case of the bilateral absence of the musculocutaneous nerve from the lateral cord of the brachial plexus, with four branches arising from the lateral side of the median nerve. This report was in correspondence with that of the present study with little anatomical variations. Combination of absence of Musculocutaneous nerve and three roots of Median nerve as seen in the present case is a rare occurrence. Knowledge of this variation is crucial while performing block dissection of Axilla, reconstructive flap surgeries, treating Humeral fractures by open reduction and even while performing incision and drainage of an Axillary abscess. Presence of such variation should always be kept in mind while testing of muscle after administration of neuromuscular block.

a) Embryological Explanation

William Larsen^[9] quotes that ventral column motor axons sprout from spinal cord in craniocaudal direction around day 30 in a developing embryo. An apical structure "Growth Cone" is formed at the growing tip of axon. The Growth Cone decides the path to reach the target organ. Filopodia present on Growth Cone grow towards the target organ by sensing molecular markers secreted by surrounding tissue. Location and innervations of the target organ (muscle, joint, skin) is dependent on secretion of certain tropic substances by target organs and its identification by growing axon. Absence of Musculocutaneous nerve in the present case can be explained that growth cone Filopodia of ventral column motor axon sprouting from C5, C6 and C7 spinal segments took an unusual path and travelled from Lateral Cord to form Median nerve via Lateral Root of Median nerve. However the growth cone recognized their target organs correctly and innervated them.

Median nerve had two medial roots because fibres from C8 and T1 spinal segments joint lateral root of median nerve separately.

IV. CONCLUSION

Roots of brachial plexus seen in root of neck in way to axilla where they form chords. So any surgeries involving axilla and posterior triangle of neck needs utmost care and sufficient knowledge of formation of median nerve and variation in origin of musculocutaneous nerve. Although musculocutaneous nerve found absent in bilateral side of specimen surgeon should need to know about multiple variation of this nerve which have clinical significance in post-traumatic evaluations and exploratory innervations of the arm for peripheral nerve repair. Even though median nerve is main nerve of forearm it supplies arm when absence of musculocutaneous nerve, so it is necessary to gain awareness about such variations before any interventions in treatment of fracture of Humerus and surgeries related to elbow joint.

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