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Variant branching Pattern of musculocutaneous nerve with respect to communication with median nerve and its embryological basis: A cadaveric study

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Abstract

The nerve supply of upper limb is from brachial plexus which is important for anatomists and clinicians. The variations in the origin, course, branching pattern and connections of MCN are common. The Musculocutaneous Nerve (MCN) and the Median Nerve (MN), the two branches of the brachial plexus may have several connections between them. Aim of the study was to observe the variations in branching pattern of MCN and its communication with the MN. 15 embalmed cadavers were taken for the study during the period of 3 years in Department of Anatomy, Adesh Medical College, Shahabad, Haryana. The dissection was done on pectoral region, axilla and the arm. After exposing the infraclavicular part of brachial plexus, MCN was identified. Its origin, course and any communications with MN was studied. In 2 limbs of a female cadaver, MCN was giving three branches. A communication with MN was also present. Study of variation in the peripheral nerves have clinical significance during surgical procedures such as in the brachial plexus blocks, in post-traumatic evaluations or in exploring arm of peripheral nerve repair.

Keywords: Musculocutaneous Nerve, Median Nerve, Communication, Lateral Cord, Brachial Plexus.

Introduction

The brachial plexus is formed by union of ventral rami of lower four cervical (C5, C6, C7 and C8 and first thoracic (T1)) nerve roots located in posterior triangle of the cervical region. These nerve roots unite to form upper, middle and lower trunks and each trunk further splits into anterior and posterior divisions. The divisions join to form lateral, medial and posterior cords which near the third part of axillary artery give rise to their terminal branches that supply motor, sensory and sympathetic fibres to upper extremity. MCN is the terminal branch of the lateral cord of brachial plexus, arises at lower border of Pectoralis minor in the axilla. Root value is ventral rami of C5-C7 segments of spinal cord. It pierces the Coracobrachialis and descends infero-laterally between the Biceps brachii and Brachialis. Just below the elbow it pierces the deep fascia and continue as lateral cutaneous nerve of forearm. It supplies coracobrachialis, biceps brachii and brachialis muscles in the anterior compartment of arm. Normally MCN and MN pass through the flexor compartment of the arm without having any communicating branch between them. [1]

The reported variations of MCN in the literature include its total absence [2] and communications with the median nerve at various levels. [3, 4] We studied the course of MCN during routine dissection of formalin embalmed 15 cadavers in a period of three and half years. Knowledge of variations of MCN is essential during surgeries of upper limbs, in brachial plexus blocks. During flap dissections, an unexpected damage can also occur to MCN. Thus the present study was aimed to study the branching pattern of MCN and its communication with MN.

Aim

Aim of the study was to observe the variation in branching pattern of MCN and its communication with MN and correlate with clinical implications

Material and methods

The study was conducted on 15 embalmed cadavers (n=30 upper limbs). Dissection of axilla and arm was carried out. The dissection was performed according to the standard procedures of Cunningham's manual of practical anatomy vol I. [5] Brachial plexus was exposed and its cords and branches were cleaned. The variation in the origin, distribution of branches derived from the cords to flexor compartment of arm was noted. Nerve supply to biceps brachii and brachialis were also noted. All the structures were observed carefully and relevant photographs were taken.

Observations and results

Dissection of brachial plexus was done on 15 cadavers in which 10 were male and 5 were female cadavers. Out of 30 limbs, 28 showed that MCN was originating from lateral cord of brachial plexus and it was seen piercing the coracobrachialis and ended by supplying brachialis and biceps brachii. No communication was found between MCN and MN.

We found few variations in both the limbs of one female cadaver.

On both sides

In both right and left arms, MCN was arising from lateral cord. MCN was not piercing coracobrachialis and was giving three branches. First branch was supplying coracobrachialis, second branch was supplying biceps brachii and a third branch was supplying brachialis muscle as shown in fig 1.

On left side

MCN was communicated with MN at the level of junction of distal and middle third of arm.

Fig 1: Branches of MCN on right side of a female cadaver

1- MN, 2-MCN

a- Branch to coracobrachialis

b- Branch to biceps brachii

c- Branch to brachialialis

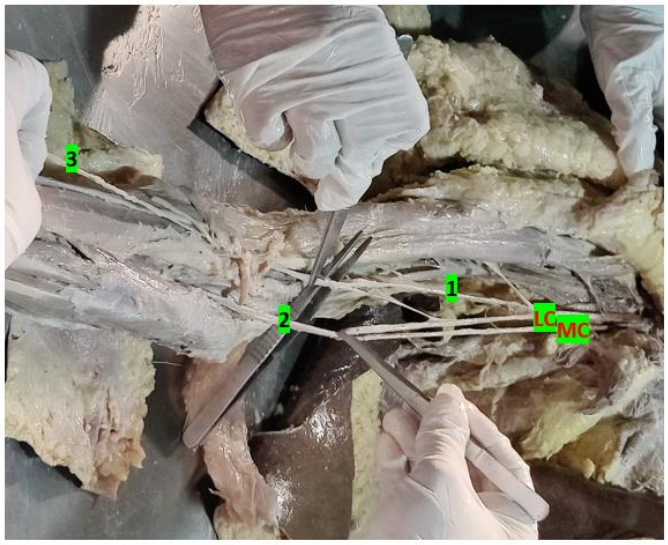

Fig 2: Main trunk of MCN is forming LCN and communication between MN and MCN On left side of arm of a female cadaver.

1- MCN, 2- MN, 3-LCN

1- MCN

2- MN

3- Lateral cutaneous nerve of forearm

LC- Lateral cord

MC- Medial cord

Discussion

Musculocutaneous nerve shows many variations. It may run behind the coracobrachialis or pass behind the biceps [1]. Complete absence of MCN has been reported by Bhojak NR et al. [6, 7] In our study MCN was not piercing coracobrachialis which is in congruence with studies done by various authors. [8, 9]

These variations can be explained embryologically. During embryogenesis, each myotome and dermatome has its own innervations of upper limb formation. During the 5th week of intrauterine life, muscles are developed from the mesenchymal cells of paraxial mesoderm. Expression of 5 HOX D is responsible for formation of muscles. The spinal nerve axons grow distally and reach mesenchyme of growing limb. During this process, some of the nerve's somite come into close proximity and fuse in a particular pattern, forming a plexus in fetal life. Variations in nerve patterns may be the result of altered signaling between mesenchymal and neuronal growth cones or factors at the times of brachial plexus cords. [10] Several authors have reported communicating branch between MCN and MN as shown in table 1but in our study main trunk of MCN was communicating with the MN. These communications between MN and MCN have been classified into five types according to Le Minor. [11] Communication between MN and MCN in present study could not be included in his description. Venerators and Anagnostopoulos have described only three types of communication between MCN and MN in relation to coracobrachialis muscle. [12] In type I, communication between MCN and MN is proximal to entrance of the MCN into coracobrachialis, in type II communication is

distal to muscle and in type III neither the nerve nor its communicating branch pierced the muscle. Our variation falls in the combination of type II and type III classification as given by Venerators and Anagnostopoulos which is rare and after review of literature, we could not come across any similar variation. These variations are clinically significant because in cases of injury to lateral cord of brachial plexus, lesions of MCN and part of MN can occur. The possible reason for these variations could be due to stages of embryonic development. During embryonic development some fibers which were originally part of median nerve traverse through MCN. These fibers separate from MCN to form a communicating branch to join back with median nerve. [13] This common origin of median and MCN explains the frequent presence of communicating branches between these two nerves.

Different communications between MCN are important in repairs of shoulder trauma and in musculocutaneous nerve dysfunction. [14,15] As axillary vein lies close to median nerve, in cases of axillary lymph node dissection in breast carcinoma, injury to median nerve can occur.

For surgical point of view, such variations are of great importance. During flap dissections an unexpected damage could also occur to MCN. Different communications involving MCN are important in repairs for trauma to shoulder.

Conclusion

Our study may provide additional information for variations in the course of MCN and communication between MN and MCN. Such variations are important to note during clinical practices since injury to median nerve could occur in cases of open or closed trauma to the arm. Knowledge about variation in these nerves will be useful for Anatomists, surgeons and radiologists.

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