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Variations of musculocutaneous nerve – A cadaveric study

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ABSTRACT

Background: Musculocutaneous nerve (MCN) is a mixed nerve arising from the lateral cord of brachial plexus having root values C5, 6, and 7. It supplies the muscles of the flexor compartment of the arm namely; coracobrachialis, most part of brachialis and both heads of biceps brachii. It is cutaneous to the lower lateral part of forearm. Variations in the origin, course, branching pattern, termination, and connections of MCN are very common. Knowledge about these variations is important while evaluating unusual presentations of peripheral nerve injuries, during surgical procedures such as arthroscopy of shoulder joint, corrections of fracture humerus, brachial plexus block, and so on. **Aims and Objectives:** The study was conducted to find out any variations in the origin, course, branching pattern of the MCN. The secondary objective was to understand about the communication of the MCN with any other nerve. **Materials and Methods:** A descriptive study was conducted in 60 upper limb specimens dissected from 10% formalin embalmed 30 cadavers (adult) in the Department of Anatomy, Government Medical College, Kottayam. All limbs were carefully dissected and studied about the origin, course, termination, and variations of MCN. **Results:** Out of 60 specimens studied, in 46 specimens MCN Originate from lateral cord, eight from medial cord, and in six from the lateral root of the median nerve (MN). In 52 specimens, MCN supplies coracobrachialis but only in 34 it pierces this muscle. In four specimens, there is a communication between MCN and MN was seen. **Conclusion:** The MCN has significant variations and knowledge of these variations is clinically important in diagnosis and management of peripheral nerve injuries as well as surgical interventions in the arm.

Key words: Musculocutaneous nerve; Coracobrachialis; Median nerve; Lateral cord

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INTRODUCTION

Musculocutaneous nerve (MCN) is the nerve of anterior compartment of arm. It arises from the lateral cord of brachial plexus in the axilla. In addition to MCN, lateral pectoral nerve and lateral root of median nerve (MN) are also branches of lateral cord. MCN is a mixed nerve. It pierces the coracobrachialis muscle on its way to front of the arm and supplies this muscle. It courses down lying between biceps brachii and brachialis muscles and supplies these muscles. The branch to brachialis gives supply to elbow joint. After supplying these muscles, it comes out of the intermuscular plane laterally and passes in front of the elbow. It pierces the deep fascia and reaches the forearm where it becomes the lateral cutaneous nerve of the forearm below the elbow.

The present study was conducted to find about the variations in the origin, course, and branching pattern of MCN since the variations have clinical significance. They are important for neurologists, vascular surgeons, and orthopedicians. Hence a detailed study about the MCN was done.

Aims and objectives

To find out the variations in the origin, course and branching pattern of musculocutaneous nerve.

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MATERIALS AND METHODS

A descriptive study was conducted in 60 upper limb specimens (30 embalmed adult cadavers) in the Department of Anatomy, Government Medical College, Kottayam during the study period of 6 months. Stepwise careful dissection of the pectoral region, axilla, arm, and forearm were done. The MCN was traced from its origin to its termination. Any variation in its origin, course, and branching pattern was noted. Branches to muscles supplied by it were also noted. Findings were tabulated and photographed.

Ethics

Ethical clearance was obtained from the Institutional Ethical Committee.

Statistics

This was a descriptive study design. Analysis by proportions of cases. Data are represented as percentages.

RESULTS

Origin of MCN

All the 60 specimens had MCN. Forty-six of them originated from the lateral cord of brachial plexus. Eight of them arose from the MN as in Figure 1. Six nerves arose from the lateral root of MN (Table 1).

Course of MCN

In 34 cases, we saw the nerve piercing the coracobrachialis as in Figure 2. In nine specimens nerves passed beneath the muscle while supplying it. In 17 specimens, the MCN was seen passing near (medial to) the muscle while providing a branch to the muscle (Table 2).

Supply of coracobrachialis

We searched whether MCN is the one which is supplying all the flexor muscles of arm (which is generally so). In four cases, we found out that coracobrachialis is supplied by a small branch from the lateral cord before the origin of MCN from the cord (Figure 3). In one case, lateral root of MN is the one supplying the coracobrachialis. In three cases, it is the MN which supplies the coracobrachialis. Among the three, in one case, we saw three branches from MN supplying the flexor muscles of forearm, and the distal one among them continued as MCN (Figure 4). The other two specimens showed only coracobrachialis getting a nerve supply from MN; biceps and brachialis by musculocutaneous itself (Table 3).

Communication between MCN and MN

We also checked for the communication with MN. We found four such cases. In three cases where MCN had normal origin and pierced the muscle, we saw a branch of

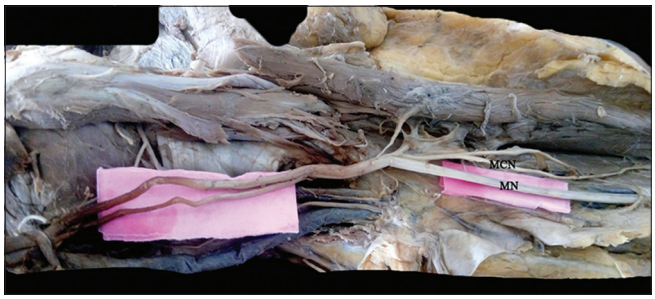

Figure 1: MCN arising from MN

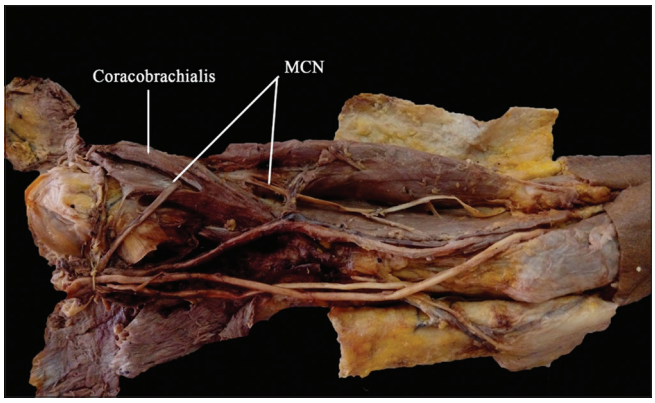

Figure 2: MCN piercing coracobrachialis

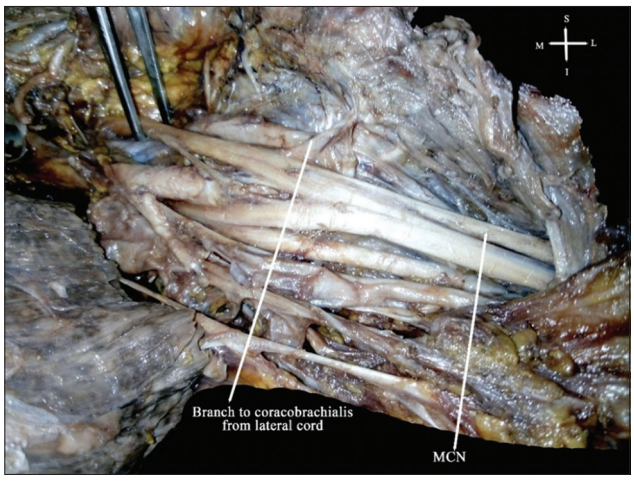

Figure 3: Lateral cord supplying coracobrachialis before the origin of MCN

MCN joining the MN at the middle of the arm (Figure 5). In one case, where MCN originates normally but not piercing the coracobrachialis gave a connecting twig to the MN by the middle of the arm.

DISCUSSION

During the embryological development, the upper limb develops from mesoderm during 5th week of intrauterine life. Under the influence of Hox D gene, the axons of spinal nerve grow distally.[1] Any problem in the signaling leads to variations.

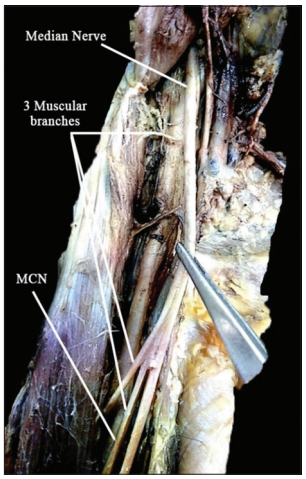

Figure 4: Three branches from MN to supply the forearm muscles; the distal one continues as MCN

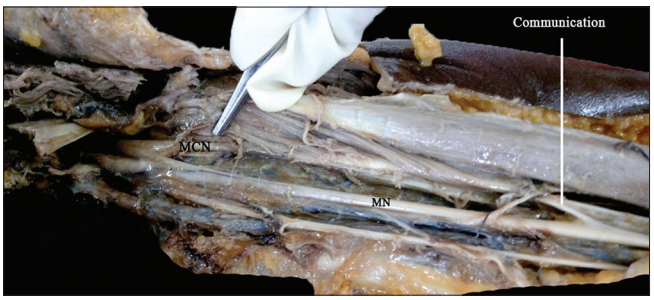

Figure 5: MCN communicating with MN

Table 1: Origin of musculocutaneous nerve	
Normal origin	76%
From median nerve	13%
From lateral root of median nerve	10%

Table 2: Course of musculocutaneous nerve	
Piercing Coracobrachialis	56%
Beneath the coracobrachialis (not piercing)	15%
Medial to coracobrachialis (not piercing)	28%

Table 3: Supply of coracobrachialis	
Musculocutaneous nerve	86%
Lateral cord	6%
Lateral root of median nerve	1.6%
Median nerve	5%

Although in this study, we found MCN in all 60 specimens, there are studies showing the absence of this nerve. Padur et al.,[2] observed two cases of absent MCN among 82 dissected upper limbs. Both were unilaterally seen. Among these cases, the muscles supplied by MCN were supplied by MN. Sarkar and Saha[3] found a bilateral case of absent MCN. In this, the coracobrachialis, biceps brachii, and brachialis were supplied by MN; except on the left side where coracobrachialis was supplied by branch of lateral cord. Jamuna and Amudha[4] studied 50 limbs and in 54% MCN were present. Among 54%, 6% MCN was not piercing coracobrachialis. Priya et al.,[5] found out that the MCN was absent only in three out of 60 cases (5%). In the absence of the MCN, the muscles of the anterior compartment of the arm were innervated by the MN. The absence of MCN was also reported by Sud and Sharma[6] and Nakatani et al.[7]

A study conducted by Jain[8] in 120 specimens, pierces coracobrachialis in all specimens. Nakatani et al.,[7] found that in three cases, musculocutaneous was not piercing coracobrachialis muscle. In our study, 26 out of 34 (76%) cases showed a similar pattern.

Priya et al., also observed in 13.33% of specimens a communication between the MN and the MCN was seen. Jatthavath and Vijayalakshmi[9] dissected 60 upper limbs and out of 60, only in 56 MCN were present. In 56 upper limbs, MCN pierces coracobrachialis in 52 limbs. They also observed that in three cases out of 52, MCN gave twig to coracobrachialis and communicated with MN.

According to the classic textbooks, MCN originates from the lateral cord of brachial plexus. However, Leng et al.,[10] observed 160 specimens, and they classified MCN variations depending on the origin.

- Type I: Was the normal type – MCN was the continuation of lateral cord of brachial plexus. This type was observed in 88.75%
- Type II: Was multi-branched type – MCN originated as two branches from the lateral cord. Found in 1.87%
- Type III: Was mixed type – MCN originated from lateral cord as well as MN. Found in 6.3%
- Type IV: Was the absence type – MCN originated from MN. Found in 3.12%
- Type V: combining type – MCN originated from lateral cord of brachial plexus. After which, it gave branches to the muscles supplied by it and then it joined the MN. Found in 5.63%.

The present study also identified Type I, Type III, and Type IV variations.

A study conducted by Jain[8] in 120 specimens; there was no communication between MCN and MN. Arora et al.,[11] in their case report encountered intercommunication between MCN and MN at two sites. The proximal communicating trunk was given off by MCN before piercing coracobrachialis muscle. The distal communication was 12.4 cm from coracoid process. It was given off by MN and join MCN after MCN pierces coracobrachialis muscle.

Le Minor[12] classified about the connection between MCN and MN. The classification was as follows:

- Type I: There are no connecting fibers between the musculocutaneous and MN. The MCN pierces

the coracobrachialis muscle and innervates the coracobrachialis, the biceps brachii, and brachialis muscle
- Type II: Although some fibers of the medial root of the MN unite with the lateral root of the MN and form the main trunk of MN, remaining medial root fibers run in the MCN leaving it after a distance to join the main trunk of MN
- Type III: The lateral root of the MN from the lateral cord, runs in the MCN then leaves it after a distance to join the main trunk of MN
- Type IV: The fibers of the MCN unite with the lateral root of the MN. After some distance, the MCN arises from the MN
- Type V: The MCN is absent. The fibers of the MCN run within the MN along its course. In this type, the MCN does not pierce the coracobrachialis muscle.

In the most recent observations recorded by Choi et al.,[13] communications between MCN and MN have been broadly classified into three patterns. In pattern 1, the two nerves are fused. In Type 2, there was one communicating branch between the MCN and the MN. In pattern 3, two connecting branches are between the two nerves.

Venieratos and Anagnostopoulou[14] done study in 79 cadavers and found communication between MCN and MN. It was classified as follows:
- Type I: communicating branch was proximal to MCN piercing coracobrachialis
- Type II: communicating branch was distal to MCN piercing coracobrachialis
- Type III: MCN as well as communicating branch did not pierce the coracobrachialis muscle.

Limitations of the study

Nerves are assumed to be so by anatomical knowledge; no confirmatory procedures done.

CONCLUSION

Musculocutaneous nerve presents varied distribution.Its knowledge is important for surgeons.

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Author's Contributions:
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