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COMMUNICATION BETWEEN THE MEDIAN AND MUSCULOCUTANEOUS NERVE. AN ANATOMICAL STUDY

HUMBERTO FERREIRA ARQUEZ*

Professor of Human Morphology, Medicine Program, Morphology Laboratory Coordinator, University of Pamplona. Pamplona, Norte de Santander, Colombia, South America.

ABSTRACT

Anatomical variations of median and musculocutaneous nerves are of interest for anatomists, surgeons, orthopaedicians, neurologists. The nerves of extremities are especially vulnerable to injury and entrapment syndromes. A total of 13 cadavers (26 embalmed arms) were used for the study. In 92,4 % of the cases the median and musculocutaneos nerves having a classic pattern of branching without communications and in 7,6% the musculocutaneous nerve fused with the median nerve almost 13,5 cm proximal to elbow joint after the emergence of lateral cutaneous branch for forearm. The communicating branch arose from the musculocutaneous nerve at a distance of 12,6 cms from the tip of coracoid process on right and left side and joined the median nerve a 16,5 cms same bony point. This variations is important to be aware while planning a surgery in the region of arm to avoid injured the nerves during operations and achieve effective nerve blockade.

KEYWORDS: Anatomical variations, musculocutaneous nerve, median nerve, communications, lateral antebrachial cutaneous nerve.

*Corresponding author

HUMBERTO FERREIRA ARQUEZ
Professor of Human Morphology, Medicine Program, Morphology Laboratory *Coordinator,* University of Pamplona. Pamplona, Norte de Santander, Colombia, South America.

INTRODUCTION

To form the median nerve trunk from lateral (C6,7) and medial (C8, T1) cord of brachial plexus the two root of median nerve emerge and unite embracing the third part of axillary artery, either anterior or lateral to it. The lateral root often being smaller than medial one, the median nerve usually passes lateral to axillary artery and continues in upper arm as lateral to brachial artery[1].Musculocutaneuos nerve (C5,6,7) a branch of the lateral cord of the brachial plexus in the axilla, initially accompanies the third part of the axillary artery and pierces the coracobrachialis muscle and supplies the coracobrachialis. Next it appears in between biceps and brachialis muscles, supplies them and just below the elbow it pierces the deep fascia lateral to the tendon of biceps brachii and extends further downward as the lateral cutaneous nerve of the forearm[2]. Usually, there will be no communication between the musculocutaneous and the median nerves. Although the communications between the different nerves in the arm are rare, those between the median nerve (MN) and musculocutaneous nerve (MCN) have been described from nineteenth century[3].Aims and objective of present study is to observe and describe communications between branches of the median and musculocutaneus nerves in human cadavers.

MATERIALS AND METHODS

A total of 13 cadavers of both sexes (12 men and 1 women- 26 embalmed arms) with different age group were used for the study. Bilateral arms were carefully dissected as per the standard dissection procedure in the Morphology Laboratory at the University of Pamplona and was conducted to allow examination of the origin, course, distributions and its communications of the median and musculocutaneous nerves. The topographic details were examined and the variations were recorded and photographed. The history of the individual and the cause of death are not known.

RESULTS

One specimen (7,6%) showed bilateral anatomical variations which result in: The musculocutaneous nerve presented an unusual connection with median nerve, was noted almost 13,5 cm proximal to elbow joint, after emit its usual muscular branches and the emergence of lateral cutaneous branch for forearm. This nervous patterns distribution described as anatomical variables were observed in both arms (figures 1 y 2). The communicating branch arose from the musculocutaneous nerve at a distance of 12,6 cm and 12,5 cms from the tip of coracoid process on right and left side and joined the median nerve a 16,5 cms same bony point. In the remaining 92,4% limbs (24 arms) the course and branching patterns of the median and musculocutaneous nerve was normal having classic pattern of branching without communications as per described in the standard text book of anatomy.

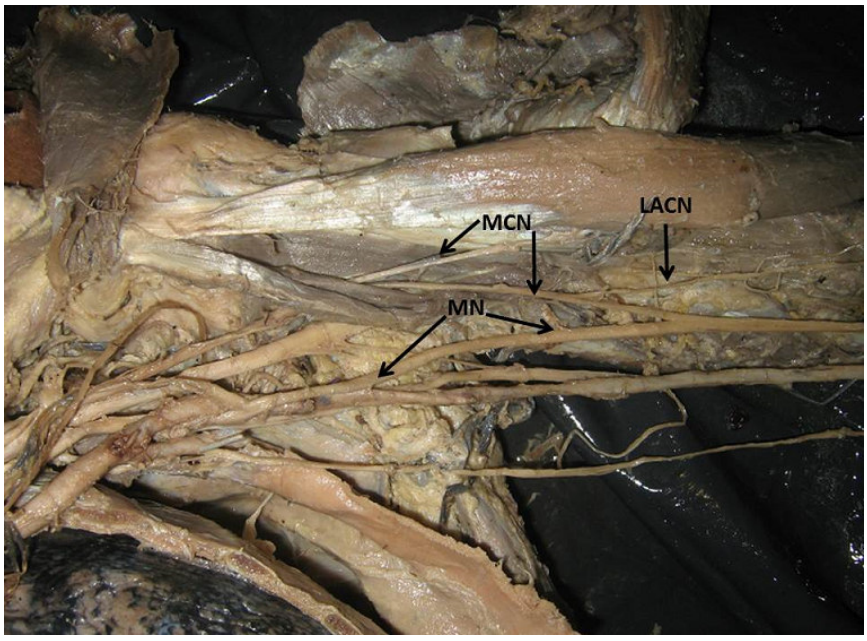

Figure 1
Left arm. The musculocutaneous nerve fused with the median nerve. Abbreviations: MCN–musculocutaneous nerve, MN–median nerve, LACN- Lateral antebrachial cutaneous nerve.

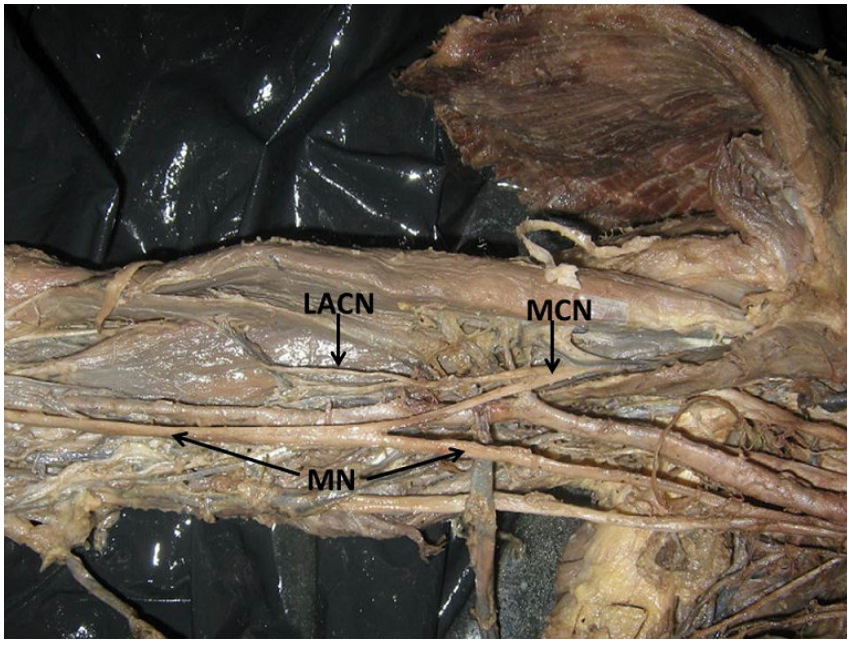

Figure 2
Right arm. The musculocutaneous nerve fused with the median nerve. Abbreviations: MCN–musculocutaneous nerve, MN–median nerve, LACN- Lateral antebrachial cutaneous nerve.

DISCUSSION

Anastomosis between the musculocutaneous nerve(MCN) and the median nerve(MN) is by far the most common and frequent of all the variations that are observed among the branches of the brachial plexus[4]. Table 1 depicts the incidence of communication between musculocutaneous nerve and median

nerve irrespective of its site or type as reported earlier from time to time. It is seen to vary between a wide ranges of 1.4% to 63.5%. Venieratos and Anagnostopolou (1998)[4], studied 79 cadavers and found communications between musculocutaneous nerve (MCN) and median nerve (MN) in 22 cadavers. They reported the following three types of communications between MCN and MN, in relation to coracobrachialis muscle (CBM). In Type I: the communication was proximal to the entrance of the MCN into the CBM (9/22); in Type II: the communication was distal to the muscle (10/22) and in Type III: the nerve as well as the communicating branch did not pierce the muscle (3/22). Choi et al. (2002)[5], showed that such communications have been broadly classified into three types. In type I: the MCN and MN were fused; in type II: there was one connecting branch between the MCN and MN and in type III: two connecting branches were present between the MCN and MN.Li Minor (1992)[6], categorized these communications into following five type: In type I, there is no communication between the MN and the MCN, in type II, the fibers of the lateral root of the MN pass through the MCN nerve and join the MN in the middle of the arm, whereas in type III, 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 IV, the MCN fibers join the lateral root of the MN and after some distance the MCN arises from the MN. In type V, 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[17]. Figure 3.

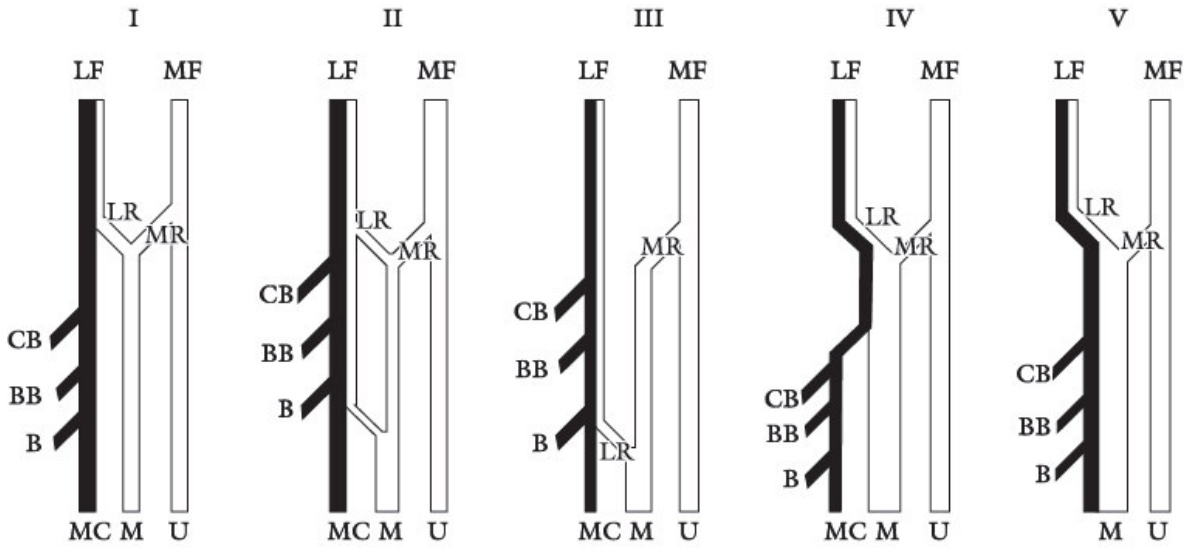

Figure 3

Li minor clasiffication of communications between musculocutaneous and median nerve (type I to V). LF: lateral cord; MF: medial cord; MC: musculocutaneous nerve; M: median nerve; U: ulnar nerve; CB: Coracobrachialis muscle; BB: bíceps brachii muscle; Brachialis muscle.

Table 1
Incidence of communications between Musculocutaneous and median nerve.

Author	Year	Incidence (%)
Wantanabe et al[7]	1985	1,4
Kosugi et al[8]	1986	21,8
Yang et al[9]	1995	12,5
Venieratos and Anagnostopoulou[4]	1998	13,9
Chiarapattnakom et al[10]	1998	16
Rao and Chaudhary et al[11]	2000	33,3
Choi et al[5]	2002	26,4
Loukas and Aqueelah[12]	2008	63,5
Guerri-Guttenberg and Ingolotti[13]	2009	53,6
Maeda et al[14]	2009	41,5
Sawant et al[15]	2012	30
Mariya and Nitya J[16]	2013	6.6
Ferreira H. (present study)	2014	7.6

The presence of such communications may be attributed to random factors influencing the mechanism of formation of limb muscles and the peripheral nerves during embryonic life. Significant variations in nerve patterns may be a result of altered signaling between mesenchymal cells and neuronal growth cones[18]or circulatory factors at the time of fusion of brachial plexus cords[8]. Iwata (1960)[19]believed that the human brachial plexus appears as a single radicular cone in the upper limb bud, which divides longitudinally into ventral and the dorsal segments. The ventral segments give roots to the median and the ulnar nerves with musculocutaneous nerve arising from the median nerve. He further kept the possibility of failure of the differentiation as a cause for some of the fibers taking an aberrant course as a communicating branch. Chiarapattanakom et al. (1998)[10] are of the opinion that the limb muscles develop from the mesenchyme of local origin, while axons of spinal nerves grow distally to reach the muscles and/or skin. They blamed the lack of coordination between the formation of the limb muscles and their innervation for appearance of a communicating branch. Chauhan and Roy (2002)[20] strongly recommend the consideration of the phylogeny and the development of the nerves of the upper limb for the interpretation of the nerve anomalies of the arm. Considering the communication between the musculocutaneous and the median nerve as a remnant from the phylogenetic or comparative anatomical point of view and that the ontogeny recapitulates the phylogeny, they feel that the variations seen are the result of the developmental anomaly[17].In the present study, the musculocutaneous nerve in upper third of the arm, passed medially downwards and joined the MN. It can be considered as the double lateral root of the MN or in other words the MN nerve can be said to be formed by three roots: a) one from the lateral cord; b) one from the MCN; c) and the third from the medial cord. These variations have clinical importance in post- traumatic evaluations and exploratory interventions of the arm for peripheral repair. The Knowledge of the possible communications between musculocutaneus and median nerves is also important in the approach for the fractures de humerus and regional nerve blocked. A clinician's knowledge of musculocutaneous-median nerve communication is important while evaluation of clinical neurophysiology, planning a surgery after trauma and understanding of median and musculocutaneous nerve dysfunction[21]. The presence of the multiple variations is worth of note not only for anatomist but also for clinicians. Because the upper extremity is a frequent site of injury, various surgical and invasive procedures are performed in this region; consequently, it is of utmost importance to be aware of such variations. The anatomical variations and abnormalities of the upper limb

have become significant because of physicians may encounter such abnormalities during imaging with computed tomography and magnetic resonance. Also, these variations are important in order to define the anatomical features of each in relation to the clinical diagnosis and for surgical procedures. Therefore, it should be kept in mind during routine dissection studies, and surgical/ diagnostic procedures[21,22].

CONCLUSION

Communications between musculocutaneous nerve and median nerve may be of considerable significance to anatomist, radiologist, anesthetists, surgeons, neurologists and orthopaedicians when dealing with patients of nerve entrapment or compression syndromes of the upper limb. Anatomical variations of peripheral nerves have clinical and surgical importance especially in posttraumatice valuations and exploratory interventions of the arm for peripheral nerve repair and to some extent during flap dissections, neurotizations.

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CONFLICT OF INTEREST

Conflict of interest declared none

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