

PATTERNS OF CONNECTION BETWEEN THE MUSCULOCUTANEOUS AND THE MEDIAN NERVES

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Summary

The musculocutaneous nerve (MCN) is normally the terminal branch of the lateral cord of the brachial plexus. The MCN is described as having frequent variations. Possible variations include absence of the MCN and possible communicating branches between the musculocutaneous and the median nerves (MN). The following research aims to describe the most common communications between the MCN and MN with respect to the point of entrance of the MCN to the coracobrachialis muscle. Variations of the brachial plexus were observed during routine cadaveric dissection in our department. The branches of the lateral and medial cord of the brachial plexus were carefully dissected and variations were noted. We were able to dissect bilaterally the brachial plexuses of eight cadavers. We found one case of communication between MCN and MN distal to the point of entry of the MCN into the coracobrachialis, and two cases of communications where the MCN did not pierce the coracobrachialis. Despite the limited research we have conducted on upper limbs we have found a relatively rare type of communications according to the preceding research. Our findings could be considered a stimulus for further deeper analysis of the various types of communications between the MCN and MN.

Key words: median nerve, variations, communicating branches, musculocutaneous nerve

Introduction

Variations in the formation of the brachial plexus of nerves are frequently observed during clinical procedures of axillary region and routine dissection. The brachial plexus is formed by the ventral rami of spinal nerves C5-C8 and Th₁. These anterior rami come together in specific way and form the superior, middle and inferior trunks of the brachial plexus and these, in turn, give rise to the lateral, medial and posterior cords.

The subject of this research is the relationship between the musculocutaneous and median nerves. The musculocutaneous nerve extends from the lateral cord, pierces the coracobrachialis and descends laterally between the biceps and brachialis to the lateral side of the arm. It innervates the coracobrachialis, both the heads of the biceps and the brachialis. The musculocutaneous nerve continues distally as the lateral cutaneous nerve of the forearm. The median nerve is formed in the axilla by the union of lateral and medial roots, respectively coming from lateral and medial cords. Initially, the median nerve enters the arm lateral to the brachial artery. Near the insertion of the coracobrachialis it crosses in front of the

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artery and descends medially to the cubital fossa.

The musculocutaneous nerve is a nerve that often variates with respect to its course in the coracobrachialis as well as with respect to its relationship with the median nerve. The most frequently cited variations include:

- absences of course of the nerve in the muscle [1, 2, 3]
- total lack of the nerve, in which case the flexors of the arm are supplied by the lateral root of the median nerve [2,4] or by its trunk [5, 6]
- communications between the musculocutaneous and median nerves occurring proximally [3, 7] or distally from the coracobrachialis [3, 7, 8, 9,10].

Arora J. et al [11] reported two communications between median and musculocutaneous nerves. The proximal communicating trunk was given off before the musculocutaneous nerve pierced the coracobrachialis. The distal communicating branch is found after the musculocutaneous nerve had supplied coracobrachialis and biceps brachii.

Uyaroglu K. [12] describes a rather rare way of communication in which anastomotic branch originates from the median nerve and joins the musculocutaneous nerve.

Our aim was to observe the topography of the musculocutaneous nerve and to describe the abnormal communications between musculocutaneous and median nerves we have found in formalin-fixed upper limbs dissected in department of Anatomy, Histology and Embryology, MU-Pleven.

Results

In three limbs out of sixteen which we have examined we have found communications between the musculocutaneous and median nerves, and in the remaining thirteen upper limbs the musculocutaneous nerve pierces the coracobrachialis and did not communicate with the median nerve.

In the first limb we have found a communicating branch between the nerves after piercing the coracobrachialis (Fig.1, a, b). The length of the communicating branch was 8 cm, and the place of leaving the musculocutaneous nerve was 17 cm above the epicondyle line of humerus.

In the second limb the trunk of the musculocutaneous nerve did not pierce the muscle but after gave off a branch for it, courses distally gave off a communicating branch to the median nerve 5 cm long and 20 cm above the epicondyle line of humerus (Fig.2, a, b).

In the third upper limb we have observed a relatively low formation of the median nerve by the union of its medial and lateral roots. The musculocutaneous nerve was run with the lateral root of the nerve and after leaving median nerve it did not pierce the coracobrachialis. Distally the musculocutaneous nerve gave off a communicating branch to the median nerve and supplied the coracobrachialis, biceps and brachialis in the arm. The length of communicating branch was 3 cm, and the place of leaving the musculocutaneous nerve was 15 cm above the epicondyle line of humerus (Fig.3, a, b).

In the three described limbs the musculocutaneous nerve continues as the lateral cutaneous nerve of the forearm. No vascular anomalies have been observed in these extremities.

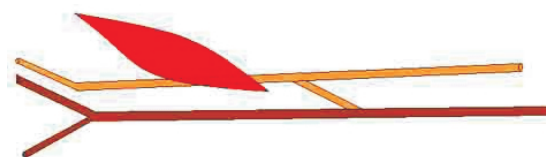
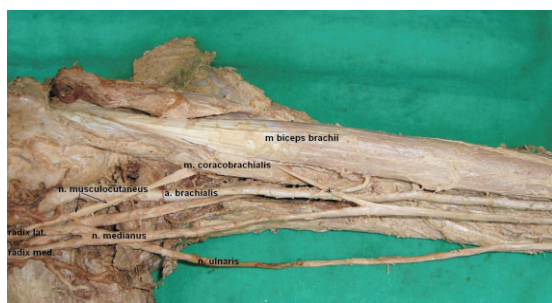


Fig.1. Photograph a) and the schematic diagram b) of the dissected upper limb showing distal communication between the median and musculocutaneous nerves after piercing the coracobrachialis

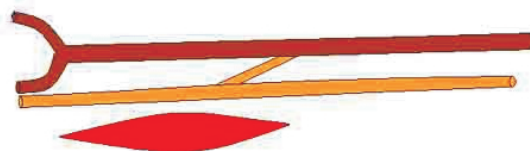
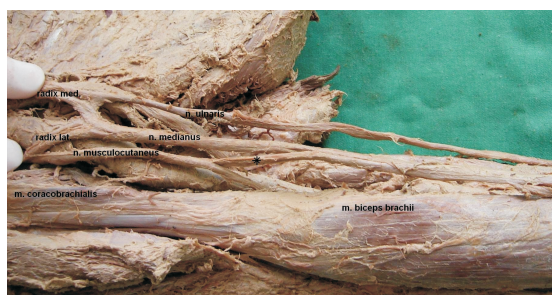


Fig.2. Photograph a) and the schematic diagram b) showing that the trunk of the musculocutaneous nerve does not pierce the muscle but it communicate distally with the median nerve

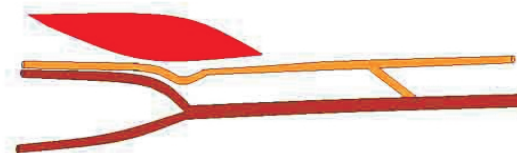
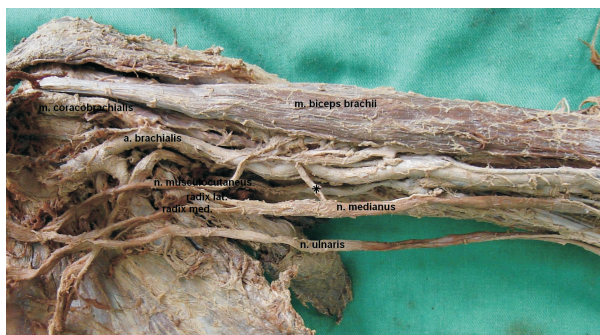


Fig. 3. Photograph a) and the schematic diagram b) showing the musculocutaneous nerve did not pierce the coracobrachialis. In this instance the nerve runs with the lateral root of the median nerve and distally gives off a communicating branch to the median nerve

Discussion

We presented three anatomical communications between the musculocutaneous and median nerves observed during routine cadaver dissection course in 16 upper limbs. The anomalies in formation of the brachial plexus and the communications between the two nerves are described in detail in literature [1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16].

The existence of these communications between the musculocutaneous and median nerves may be attributed to the random factors influencing the mechanism of formation of limb muscles and peripheral nerves during embryonic life or with the fact that the two nerves have common embryogenesis and originate from a common trunk.

There were three most popular classifications of the anatomical communications between the musculocutaneous and median nerves.

Loukas et al. [3] in their study of 258 specimens have discovered variations in 119 of them. They classify them in five types:

Type I (45%) – the communications are proximal to the point of entry of the musculocutaneous into the coracobrachialis

Type II (35%) – the communications are distal to the point of entry of the musculocutaneous into the coracobrachialis

Type III (11%) – here, the musculocutaneous does not pierce the coracobrachialis

Type IV (9%) – in this variation the communications are proximal to the point of entry of the musculocutaneous into the coracobrachialis and additional communication takes place distally.

The second anatomical classification belongs to Le Minor [cited from 8, 9, 10, 13, 14, and 16] who puts the variations between the musculocutaneous and median nerves into 5 categories:

Type 1: there are no communicating fibers between musculocutaneous and median nerves. The musculocutaneous nerve pierces the coracobrachialis muscle and innervates the coracobrachialis, biceps brachii and brachialis muscles

Type 2: although some fibers of the medial root of the median nerve unite with the lateral root of the

median nerve to form the median nerve, some leave to run within the musculocutaneous nerve and after some distance leave it to join their proper trunk

Type 3: the lateral root of the median nerve runs into the musculocutaneous nerve and after some distance leaves it to join their proper trunk

Type 4: the fibers of the musculocutaneous nerve unite with the lateral root of median nerve and after some distance the musculocutaneous nerve emanates from the median nerve

Type 5: the musculocutaneous nerve is absent. Its fibers run within the median nerve along its course.

The simplest classification belongs to Choi according to whom the communications can be divided into 3 patterns:

Pattern 1 – fusion of both nerves

Pattern 2 – presence of one connecting branch between both nerves

Pattern 3 – presence of two connecting branches between both nerves.

Some rare variations could also be found in literature.

Oluyemi A. et al [9] have reported brachial plexus with two cords (lateral and medial) and three abnormal communications (between two cords, between musculocutaneous and median nerves, and between radial and ulnar nerves).

Uzun A. [15] and Seed M. [10] reported an abnormal formation of the median nerve of three and four roots and also communication between the musculocutaneous and median nerves.

Mostafa El-Naggar [1] reported a case in which the coracobrachialis muscle has two heads – superficial and deep. Both heads are innervated by branches of the musculocutaneous and after that the nerve emanates a branch to median nerve.

Conclusion

On the grounds of the existing medical literature and our own observations we have reached the conclusion that the communications in brachial plexus are common and must be taken into consideration during surgical and anesthesiological procedures in axilla.

The communicating branches between the musculocutaneous and median nerves, observed in the present study, could be considered as type two and third according to Le Minor and Loukas' classifications.

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