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CASE REPORT

A Communicating Branch between the Musculocutaneous Nerve and the Median Nerve: A Case Report

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Abstract

Anatomical variations of peripheral nerves are commonly reported in the literature. These anomalies are clinically important, contributing to atypical clinical presentations, cause difficulty with imaging and nerve conduction studies, and lead to challenges in the operating room for surgeons. We report here a communicating branch between the musculocutaneous and median nerves found during cadaveric dissection in a Doctor of Nursing Practice course in the Department of Nurse Anesthesia at Samford University. Although the case described here is among the most common anatomical variations of the peripheral nerves, there are classification systems for this variation that need to be recognized and applied by surgeons, clinicians, and anatomists.

Key Words: *Musculocutaneus nerve; Median nerve; Communication; Anatomic variation; Clinical significance*

Introduction

The brachial plexus is made up of the C5, C6, C7, C8, and T1 nerve root anterior rami, with a small communicating branch of the C4 nerve root. The medial, lateral, and posterior cords of the brachial plexus are named based on their anatomical relationships to the second part of axillary artery. These cords then transition into peripheral nerves (terminal branches of the brachial plexus) at the region of the axilla base, and these branches supply the innervation to the upper limb. The musculocutaneous nerve (C5-C7) is a terminal branch of the lateral cord, while the median nerve (C5-T1) is terminal branch of the merging of the lateral and medial cords. Functionally, the musculocutaneus nerve supplies branches to innervate the anterior arm

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musculature (coracobrachialis, biceps brachii, and brachialis) and then it becomes the lateral cutaneous nerve of the forearm, providing sensory innervation to the radial side of the forearm. The majority of the muscles of the anterior forearm and radial hand are innervated by the median nerve, and its branches include the anterior interosseous, the palmar cutaneous, and the lateral digital cutaneous nerves. The anterior interosseous nerve off the median nerve is a purely motor branch, while the palmar cutaneous and digital cutaneous branches supply sensory innervation [1].

Anatomical anomolies of the brachial plexus and peripheral nerves are quite common and have been documented since the 19th century [2]. The anatomical variations between the musculocutaneous and median nerves are commonly reported in the scientific literature [3-7]. Knowledge of nerve variations is important for understanding patient presentations of nerve injuries, for interpretation of imaging and nerve conduction studies, and to avoid challenges while operating on the upper limb [8].Therefore, surgeons must be aware of these anatomical variations to avoid misinterpretation and ensure appropriate treatment and a good outcome.

We present here a case of a communicating branch found between the musculocutaneous and median nerves found in a cadaver lab in a Doctor of Nursing Practice course in the Department of Nurse Anesthesia at Samford University. The case report reported here did not require Institute Review Board review or approval.

Case Report

An 89-year-old Caucasian male cadaver, with "diabetic chronic renal disease" as the cause of death, was presented by Samford University for cadaver lab dissection during the spring 2023 semester in Homewood, Alabama. Upon postmortem inspection, there were no scars that suggested significant surgical history, and height and weight appeared normal on the cadaver. We are unaware if the subject had an signs or symptoms related to this anatomical variation.

Communication Between Musculocutaneus and Median Nerves

The existence of a communicating branch between the musculocutaneus nerve and median nerve was discovered during the anterior arm and axilla dissection of the right (R) upper limb (Figure 1). With the cadaver supine, the muscles of the anterior compartment of the arm were recognized and then isolated from the surrounding fascia. The musculocutaneous nerve was located traveling through the coracobrachialis muscle, and the nerve was followed as it emerged from the coracobrachialis muscle and continued through the plane of loose connection between the brachialis muscle and biceps brachii muscle. The median nerve was then followed from axilla distally to the cubital fossa (Figure 2). While following the median nerve distally in the anterior arm, a 3.175 cm nerve connecting the musculocutaneous nerve and median nerve was discovered (Figure 3). The musculocutaneous nerve gave rise to this communication 1.27 cm after the musculocutaneous nerve exited the coracobrachialis muscle (Figure 3) and just before the musculocutaneous nerve gives its muscular branches to the brachialis and biceps brachii. This variation was observed unilaterally, and the brachial plexus anatomy was normal.

Figure 1) *Right anterior arm and axilla.*

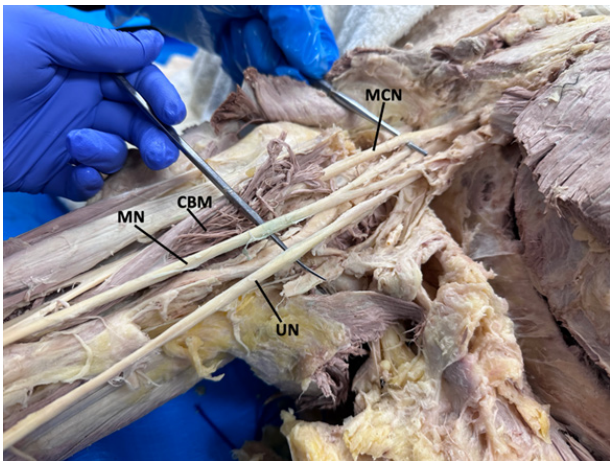

Figure 2) *Dissection of the right anterior arm and axilla highlighting the musculocutaneous nerve (MCN) traveling through the coracobrachialis muscle (CBM), the median nerve (MN), and the ulnar nerve (UN).*

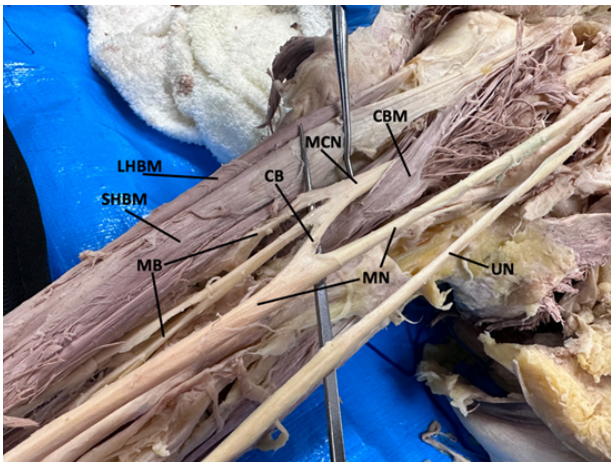

Figure 3) *Dissection of the right anterior arm highlighting the musculocutaneous nerve (MCN) traveling through the coracobrachialis muscle (CBM) with communicating branch (CB) connecting MCN and median nerve (MN). Muscular branches (MB) of the MCN, long head of biceps brachii muscle (LHBM), short head of biceps brachii muscle, and ulnar nerve (UN) are also highlighted.*

Discussion

Anatomical anomolies of the musculocutaneous nerve and median nerve are not uncommon, with a wide variability in the documented prevalence ranging from 2.1% to 63.5% [3-6,9]. Due to the high prevalence of this variation, classification systems are used to describe the types of anatomical variations between these nerves. Seven different classification methods have been published [10-12], making it challenging for anatomists and health care providers to accurately classify these anatomical variations due to the multiple nomenclatures described for the same variation [12]. However, it is important to accurately classify these anatomical variations to better understand their frequency for clinical and surgical applications. Guerri-Gutenberg et al. [12] proposed a four-step algorithm, which is described below.

First Step

To determine if the musculocutaneous nerve is present.

0=nerve is absent, 1=nerve is present.

Second Step (when musculocutaneous nerve is present)

To determine if the musculocutaneous nerve perforates the coracobrachialis muscle.

A=nerve perforates muscle, B=nerve does not perforate muscle

Third Step

To determine the presence of communications of the musculocutaneous nerve and median nerve.

0=no communications, 1=one communication, 2=2 or more communications, 3=musculocutaneous nerve joins with median

nerve, 4=distal origin of the musculocutaneous nerve

Fourth Step

To determine the anatomical proximity of the communication(s) between the musculocutaneous nerve and median nerve with the entry point of the musculocutaneous nerve into the coracobrachialis muscle.

P=communications are proximal to the point of entry of the musculocutaneous nerve into coracobrachialis muscle, D=communications are distal to the muscle, PD=Communications are both proximal and distal

Second Step (when musculocutaneous nerve is absent)

To determine the nature of the motor branches that innervate the coracobrachialis, biceps brachii, and brachialis muscles, and the sensory branch that innervates the lateral forearm.

1=branches originate from a common trunk arising from the median nerve, 2=branches originate from the median nerve itself

Based on the aforementioned classification system described by Guerri-Gutenberg et al. [12], the variation presented in this case report is consistent with 1-A-1-D.

Eglseder et al. [13] dissected 108 upper arms on American cadavers and discovered communicating branches between the musculocutaneous and median nerves in 36% of cadavers, with an average length of these communication branches to be 1.8 cm. However, Ballesteros et al. [9] and Gelmi et al. [4] found communicating branches that were much longer than 1.8 cm, with one branch extending from axilla down to the level of the elbow. The communicating branch found in this case report was 3.175 cm in length, about twice as long as reported by Eglseder et al. [13].

This communicating branch is likely a contribution of the lateral cord of the brachial plexus, that rejoins the median nerve. This communicating branch may be a consequence of an overlapping of C5-C7 nerve fibers, but this would need to be confirmed electrodiagnostically and not through dissection alone.

Due to the high prevalence of a nerve branch connecting the musculocutaneous and median nerves, this variant should be included in anatomy courses for those in training in medical fields. It may be advantageous for clinicians to determine if a patient presents with these anatomical variations to optimize diagnosis and treatment outcomes. A communicating branch between musculocutaneous and median nerves may cause atypical symptom presentation in patients with brachial plexus injuries or peripheral nerve lacerations. An entrapment of the musculocutaneous nerve in the arm may mimic carpal tunnel syndrome, leading to diagnostic confusion and delays [14]. Other clinical cases that the variation reported in this case report may have relevance include arthroscopic shoulder reconstruction surgeries, nerve blocks, any surgery performed for pathologies involving the coracobrachialis muscle, humerus fractures, breast carcinomas [8].

Conclusion

The case described here is among the most common anatomical abnormalities of the peripheral nerves and does have different classification systems that need to be recognized and applied by clinicians,

anatomists, and surgeons. This anatomical variation may contribute to atypical clinical presentations, cause difficulty with imaging and nerve conduction studies, and lead to surgical challenges during surgeries of the arm.

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Authors' contributions

RMC and NBW were responsible for idea conceptualization. CRR, KMJ, HEC, CBP, JNH, ARV, and NBW were responsible for dissection of the cadaver and literature review of this anatomical variation. CRR, RMC, WMS, KEM, and NBW were responsible for writing and approving manuscript prior to submitting.

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