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Case Report

Unilateral Variation of the Median Nerve in a Human Cadaver's Arm

Hyeon Seung Song[1], Minseo Kim[1], Sang-Pil Yoon[2], Jinu Kim[2,3]

[1]*Medical Course, Jeju National University College of Medicine*
[2]*Department of Anatomy, Jeju National University College of Medicine*
[3]*Interdisciplinary Graduate Program in Advanced Convergence Technology & Science, Jeju National University*

Abstract : Despite numerous reports highlighting variations in the formation and branching of the brachial plexus, limited familiarity persists among physicians, residents, and medical students. This case presents a unilateral anatomical variation discovered during routine educational dissection. In the right arm, the median nerve, instead of the musculocutaneous nerve, exclusively innervated the biceps brachii and brachialis muscles. The absence of the musculocutaneous nerve in this scenario represents a noteworthy anatomical aberration. These variations in the formation, location, and course of the brachial plexus may be attributed to an abnormal embryological relation. This case contributes to the growing understanding of brachial plexus variations, emphasizing their clinical relevance in accurate diagnosis and treatment planning.

Keywords : Median nerve, Musculocutaneous nerve, Biceps brachii muscle, Brachialis muscle, Coracobrachialis muscle

INTRODUCTION

The brachial plexus, a crucial anatomical structure, gives rise to the nerves of the upper limb and adjacent regions. Originating from the union of fibers branching from the anterior rami of the lower four cervical and the first thoracic spinal nerves, it exhibits various terminal branches [1]. Among these, the musculocutaneous nerve pierces the coracobrachialis muscle and then courses down the anterior compartment of the arm, superficial to the brachialis muscle but deep to the biceps brachii muscle. It innervates these muscles and extends as the lateral cutaneous nerve of the forearm [2]. In contrast, the median nerve is formed by two roots: the lateral root from the lateral cord and the medial root from the medial cord. As it crosses the brachial artery from the lateral to the medial side in the middle of the arm, the median nerve does not give rise to any branches in the arm [3]. While various investigators have reported that variations in the formation and branching of the brachial plexus [1-3], familiarity with its variants is still limited among physicians, residents, and medical students. In this case, we present a description of a unilateral variation of the median nerve in the arm of a human cadaver.

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Correspondence to: Jinu Kim, Ph.D. (Department of Anatomy, Jeju National University School of Medicine 102 Jejudaehak-ro, Jeju, 63243, Republic of Korea)
E-mail: jinu.kim@jejunu.ac.kr

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CASE REPORT

During a routine educational dissection of the anterior aspect of the arm of a cadaver, a 72-year-old Korean female who had succumbed to stomach cancer, at the Department of Anatomy, Jeju National University in 2023, we encountered a unique case involving the muscular branches of the median nerve supplying the muscles of the right arm.

On the anterior aspect of the left arm, both the musculocutaneous nerve and median nerve exhibited a typical appearance of innervation (Fig. 1). The musculocutaneous nerve pierced through the coracobrachialis muscle and descended between the biceps brachii muscle and brachialis muscle. It then extended toward the lateral cutaneous nerve of the forearm. The median nerve descended down the arm, passing through the cubital fossa, and did not give rise to any branches within the arm itself. However, on the anterior aspect of the right arm, the branches of the median nerve, instead of the musculocutaneous nerve, supplied the biceps brachii muscle and brachialis muscle (Fig. 2). There were four branches: one branched early and entered the short head of the biceps brachii muscle, the next three intermediate branches entered the brachialis muscle, the following branch entered the long head of biceps brachii muscle, and the last one continued to the lateral cutaneous nerve of the forearm. The main branch of the median nerve descended down the arm, passing through the cubital fossa. The musculocutaneous nerve was not identified.

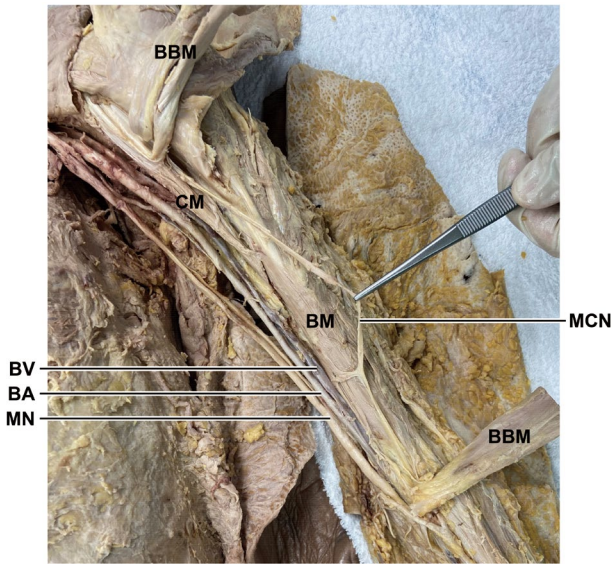

Fig. 1. The typical anterior aspect of the left arm. The biceps brachii muscle (BBM) was cut and reflected. The musculocutaneous nerve (MCN) passed through the coracobrachialis muscle, ran between the biceps brachii muscle (BBM) and brachialis muscle (BM), and extended to the lateral cutaneous nerve of the forearm. The median nerve (MN) descended down the arm without any branches within the arm itself. BV, brachial vein; BA, brachial artery; CM, coracobrachialis muscle.

DISCUSSION

The variation in the neural architecture of the brachial plexus is more common than not. In a study with 200 brachial plexus specimens from spontaneously aborted fetuses, the authors found that 46.5% exhibited the typical plexus organization, whereas 53.5% showed a notable variation [4]. As a result, variations in the nerves of the arm carry clinical implications, emphasizing the significance of documenting and reporting them during cadaver dissection.

The present case primarily focuses on the variation in innervation and course of the median nerve, as well as the absence of the musculocutaneous nerve in the unilateral arm. Typically, the musculocutaneous nerve originates from the C5 and C6 spinal root fibers, traveling through the upper trunk and lateral cord of the brachial plexus. Consequently, in this case, it is suggested that both C5 and C6 fibers passed through the lateral root to the median nerve, distributing to the muscles in the anterior compartment of the upper arm, as well as anterolateral cutaneous area of the forearm through the branches of the median nerve.

The complete absence of the musculocutaneous nerve and the exclusive takeover of innervation for the coracobrachialis, biceps brachii, and brachialis muscles by the median nerve represent an unusual anatomical variation [5-8]. Ihunwo et al. [5] reported the bilateral absence of the musculocutaneous nerve in a male Ugandan cadaver, where the flexors of the arm were supplied by branches from the median nerve. Similarly, Gumusburun and Adiguzel [6] reported the bilateral absence of the musculocutaneous nerve in a female Turkish cadaver, where the median nerve supplied the biceps brachii and brachialis muscles and also gave off the lateral cutaneous nerve of the forearm. Notably, Beheiry [7] classified variations in the musculocutaneous and median nerves of Egyptians into 5 types. Type 1: no communicating fibers exist between the musculocutaneous and median nerves. The musculocutaneous nerve pierces the coracobrachialis muscle and innervates

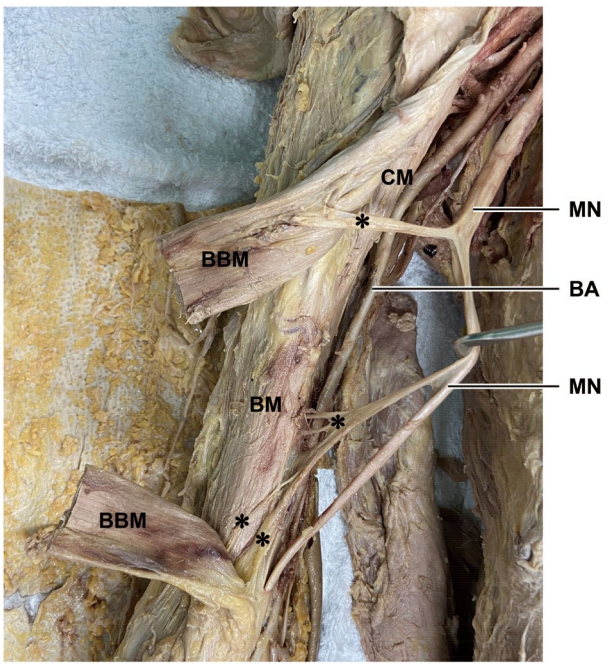

Fig. 2. The unusual anterior aspect of the right arm. The biceps brachii muscle (BBM) was cut and reflected. The branches (asterisks) arising from the median nerve (MN) supplied the biceps brachii muscle (BBM) and brachialis muscle (BM). The final branch continued to the lateral cutaneous nerve of the forearm. BA, brachial artery; CM, coracobrachialis muscle.

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 to form the median nerve, some leave to run within the musculocutaneous nerve and later rejoin 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 its proper trunk. Type 4: The fibers of the musculocutaneous nerve unite with the lateral root of the median nerve and, after some distance, diverge from the median nerve. Type 5: The musculocutaneous nerve is absent, and its fibers run within the median nerve along its course. The Type 5 variation is similar to what we observed in the present case, indicating one upper limb out of 60 (1.7%). In the study conducted by Uzun [8] on 75 upper limbs of the Turkish, the Type 5 variation was found in 3 cases (4.0%). On the other hand, the median nerve typically forms through the fusion of the lateral root from the lateral cord and the medial root from the medial cord. Variations such as originating from more than two roots due to nerve splitting and abnormal connections with neighbouring nerves including musculocutaneous nerve and ulnar nerve can occur [9,10]. However, the formation of median nerves in both arms observed in the present case was typical.

During the embryogenesis, the somites migrate to form the limbs, bringing their own nerve supply along. This ensures that each myotome retains its original segmental innervations [11]. The cords of brachial plexus are typically observed in connection with the seventh cervical segmental artery, which serves as the origin for the axillary artery passing between the lateral and medial cords. Occasionally, the subclavian-axillary stem may arise from the sixth or eighth segmental arteries, resulting in an abnormal relation to the cords of brachial plexus. The appearance of the brachial plexus as a single radicular cone in the upper limb bud is established during development. This cone longitudinally divides into dorsal (gives rise to the radial and axillary nerve) and ventral (median and ulnar nerve) divisions [12]. A study indicates that the variation of the cords and the median nerve are primarily associated with developing anomalies [13]. The various variations in the formation, location, and course of the brachial plexus may be attributed to an abnormal embryological relation between the cords of brachial plexus and cervical segmental branches of the dorsal aorta.

In clinical practice, when encountering a patient with weakness in forearm flexion and supination due to a high median nerve paralysis in the axilla or proximal arm, it is crucial to consider the possibility of the median nerve innervating the forearm flexors. This anatomical variation underscores the importance of recognizing diverse nerve patterns to ensure accurate diagnosis and appropriate treatment strategies. Additionally, surgeons performing procedures related to neoplasms or repairing trauma in the axillary region should be aware of these variations.

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