

# Anatomical Variation in the Innervation of the Median Nerve and the Absence of Musculocutaneous Nerve: A Case Report

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## ABSTRACT

The median nerve is one of the five main nerves originating from the brachial plexus and provides motor and sensory innervation to parts of the

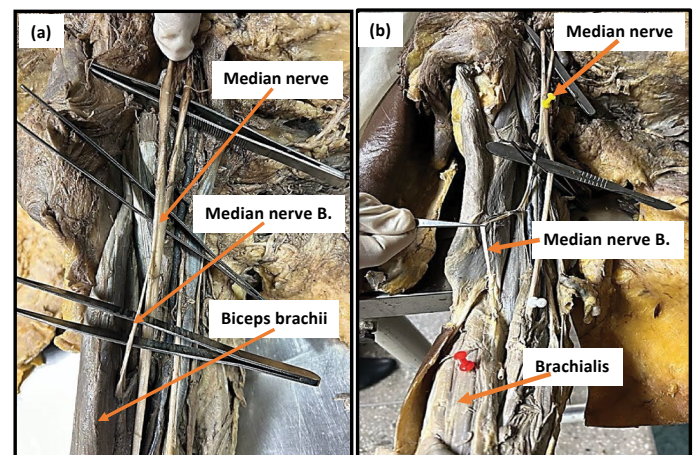
forearm and hand. We reported unusual innervation of the median nerve in the arm during routine dissection. Imaging was done using a Canon EOS R50 with a 24.2-megapixel effective resolution. Biceps brachii and brachialis muscles were observed innervated by the median nerve branches, and the musculocutaneous nerve was not found during routine dissection. This rare variation may result in unexpected clinical presentations in cases of traumatic injuries or paralysis. Knowledge of such variations is, therefore, of clinical and surgical importance.

## INTRODUCTION

The median nerve is formed from a lateral root from the lateral cord and a medial root from the medial cord of the brachial plexus [1]. It forms from nerve roots originating at C5-T1 [1]. In the axilla, the median nerve lies lateral to the axillary artery. It enters the arm from axilla at the inferior margin of teres major muscle and descends medially between biceps brachii and triceps brachii [14]. In the arm, the median nerve courses laterally to the brachial artery and then crosses it, usually anteriorly, from lateral to medial [1-4]. It lies initially on coracobrachialis, then brachialis. In the cubital fossa, the median nerve lies medial to the brachial artery and the biceps brachii tendon [1]. The median nerve leaves bicipital aponeurosis, enters the forearm between the two heads of the pronator teres muscle, and gives off the anterior interosseous nerve [1-4]. It courses towards the wrist deep to flexor digitorum superficialis and superficial to flexor digitorum profundus muscle [1]. It emerges lateral to flexor digitorum superficialis about 5 cm proximal to the wrist (giving off the palmar cutaneous branch) and enters the hand through the carpal tunnel, passing deep to the flexor retinaculum at the wrist. On entering the palm, it gives off motor and cutaneous branches [1-4]. The muscular branch of the median nerve just above the elbow supplies the pronator teres muscle; at the elbow, it supplies the remainder of the superficial layer of forearm flexors (except flexor carpi ulnaris) and the intermediate layer of the forearm flexors [1]. The anterior interosseous branch of the median nerve supplies flexor pollicis longus, pronator quadratus, and radial half of flexor digitorum profundus [1-4]. The Palmar cutaneous branch of the median nerve provides cutaneous innervation to the palm and skin over the thenar eminence [1-4]. Its motor branch in the hand supplies thenar muscles and the radial two lumbricals [1-4]. Its digital cutaneous branch innervates the palmar aspect, dorsal nail beds of the thumb, index, and middle fingers, and the radial half of the ring finger [1-4]. Articular branches of the median nerve innervate the elbow, wrist, carpal, and phalangeal joints [1-4].

## CASE REPORT

During the dissection of an elderly male cadaver in the Department of Anatomy, Hamdard Institute of Medical Sciences and Research, New Delhi, the musculocutaneous nerve was not seen, and branches of the median nerve were observed innervating biceps brachii and brachialis muscles. The first branch from the right median nerve was seen innervating both the heads of the biceps brachii muscle and another branch was reported to supply the brachialis muscle (Figure 1). Imaging was done using a Canon EOS R50 with a 24.2-megapixel effective resolution. The camera supports high-speed



**Figure 1** (a) Branch from median nerve supplies Biceps brachii muscle, (b) Branch from median nerve supplies Brachialis muscle; B. Branch

electronic shutter capture, achieving up to 15 fps for JPEG (max 28 frames) and up to 7 fps for RAW. It also offers a burst rate of 12 fps for JPEG (max 42 frames) and seven fps for RAW. The focal length ranges from 18 to 45mm (29 to 72 mm in 35mm equivalent), with a maximum aperture of f/4.5 to 6.3.

## DISCUSSION

Variations of the median nerve and its distribution patterns have important clinical and surgical implications, especially when dealing with traumatic injuries of the shoulder, upper arms, or axillae [5,6]. The present study reported that the median nerve was found to be innervating the biceps brachii and brachialis muscles in the absence of the musculocutaneous nerve. In a previous study, numerous variations were observed in the course and distribution of musculocutaneous nerve. They reported that this nerve arose from the lateral cord (90.5%), from lateral and posterior cords (4%), from the median nerve (2%), as two separate bundles from medial and lateral cords (1.4%), or from the posterior cord (1.4%). They also reported double, unusually short, or absent musculocutaneous nerve [7]. Previous studies worldwide reported the absence of musculocutaneous nerve [8-14]. In the line and length of the present case report, Sud in 2000, observed

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that the motor nerve to the muscles of the anterior compartment of the arm arose from the median nerve [13]. It has been observed that the flexor muscles of the arm were innervated by the median nerve proper, except for the coracobrachialis muscle, which was innervated directly by a branch from the lateral root of the median nerve [15]. A previous case report noted a single branch arising from the lateral root of the median nerve, supplying both the heads of the biceps brachii muscle [16]. Le Minor reported that the musculocutaneous nerve was found to be absent, and all the flexor muscles of the arm were seen innervated by the median nerve [17]. Pacholczak et al. described a case in which the lateral cord innervated coracobrachialis muscle and continued as the lateral root of the median nerve; this subsequently led to two branches supplying the flexor muscles of the arm and one branch continuing as the lateral cutaneous nerve of the forearm. The lateral root joined the medial root of the median nerve at the mid-arm and continued as the median nerve proper [18]. Additionally, it has been reported that the lateral root of the median nerve bifurcates into two branches, one supplying the coracobrachialis muscle and the other branch functioning as a common trunk supplying the rest of the muscles of the arm and continuing as the lateral cutaneous nerve of the forearm [19]. Knowledge of anatomical variations in the brachial plexus, such as the absence of musculocutaneous nerve and muscles innervated by unusual nerves, is essential for orthopedic and neurosurgeons to explain paradoxical motor and sensory loss in patients. Additionally, anesthesiologists need to be aware of the atypical formation and location of the median nerve, which is critical for anesthesiologists performing brachial plexus block. Additionally, these variations may present atypically in cases of arm flexor paralysis. Knowledge of these variations is essential in surgeries involving the median nerve.

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#### ETHICAL STATEMENT

The authors state that every effort was made to follow all local and international ethical guidelines and laws that pertain to the use of human cadaveric donors in anatomical research.

#### CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts of interest with the contents of the case report.

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#### AUTHORS CONTRIBUTIONS

**Conceptualization:** PA; **Methodology and Resources:** PA, MAK; **Writing—original draft preparation:** PA, RD; **Writing—review and editing:** PA, MAK, RD. All authors have read and agreed to the published version of the manuscript.

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