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# ANATOMICAL VARIATION OF THE MUSCULOCUTANEOUS NERVE: CASE REPORT

# VARIAÇÃO ANATÔMICA DO NERVO MUSCULOCUTÂNEO: RELATO DE CASO

# VARIACIÓN ANATÓMICA DEL NERVIO MUSCULOCUTÁNEO: REPORTE DE CASO

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## ABSTRACT

Understanding the anatomical variations of the brachial plexus is essential in the evaluation and preparation of surgical procedures, aiming to ensure treatment safety. One of the variations observed during routine dissection was present in the course of the musculocutaneous nerve , which is capable of communicating with the median nerve. Through dissection of a male cadaver, it was observed that the musculocutaneous nerve did not pierce the coracobrachialis muscle and that it communicated with the median nerve in the middle third of the arm. This finding is of academic relevance, as it reveals a variation that conforms to the patterns described in recent research. This represents a significant contribution to topographic anatomy, as well as to pre-surgical and intraoperative evaluation procedures.

**Keywords:** Brachial Plexus. Anatomical Variation. Cadaver. Musculocutaneous Nerve. Median Nerve.

## RESUMO

A compreensão das variações anatômicas do plexo braquial é essencial na avaliação e no preparo de procedimentos cirúrgicos, visando garantir a segurança do tratamento. Uma das variações observadas durante a dissecção de rotina estava presente no trajeto do nervo musculocutâneo, que é capaz de se comunicar com o nervo mediano. Por meio da dissecção de um cadáver masculino, observou-se que o nervo musculocutâneo não perfurava o músculo coracobraquial e que se comunicava com o nervo mediano no terço médio do braço. Este achado é de relevância acadêmica, pois revela uma variação que se conforma aos padrões descritos em pesquisas recentes. Isso representa uma contribuição significativa para a anatomia topográfica, bem como para os procedimentos de avaliação pré-cirúrgica e intraoperatória.

**Palavras-chave**: Plexo Braquial. Variação Anatômica. Cadáver. Nervo Musculocutâneo. Nervo Mediano.

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**RESUMEN**
Comprender las variaciones anatómicas del plexo braquial es esencial en la evaluación y preparación de procedimientos quirúrgicos, con el objetivo de garantizar la seguridad del tratamiento. Una de las variaciones observadas durante la disección de rutina estaba presente en el trayecto del nervio musculocutáneo, que es capaz de comunicarse con el nervio mediano. A través de la disección de un cadáver masculino, se observó que el nervio musculocutáneo no perforaba el músculo coracobraquial y que se comunicaba con el nervio mediano en el tercio medio del brazo. Este hallazgo es de relevancia académica, ya que revela una variación que se ajusta a los patrones descritos en investigaciones recientes. Esto representa una contribución significativa a la anatomía topográfica, así como a los procedimientos de evaluación prequirúrgica e intraoperatoria.

**Palabras clave**: Plexo Braquial. Variación Anatómica. Cadáver. Nervio Musculocutáneo. Nervio Mediano.

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## 1 INTRODUCTION

The brachial plexus is a complex network of fundamental nerves in the peripheral nervous system located in the neck, shoulder and upper limbs region, which has as its main nerves originating from the plexus the musculocutaneous nerve , axillary nerve, radial nerve, median nerve and ulnar nerve, each with its own importance since they are responsible for innervating the muscles of the upper limb.

During its course, the brachial plexus plays a crucial role in the motor and sensory innervation of organs such as muscles and skin, as it transmits the nerve signals that coordinate upper limb movements. Furthermore, it conducts sensory information, including sensations of pain, temperature, and touch from the skin and joints of the arm, back to the central nervous system. Furthermore, its nervous structure is formed by communication between the ventral rami of the cervical spinal nerves (C5, C6, C7, C8) and the first thoracic spinal nerve (T1), which combine to form trunks, fascicles, and terminal nerves, a morphology confirmed by (LAPEGUE *et al.,* 2014).

Thus, due to its complexity, the brachial plexus undergoes intricate embryonic development, allowing for anatomical variations. This fact is corroborated by individual genetic differences, with variations capable of affecting the innervation and sensitivity of the upper limbs, requiring special attention in clinical and surgical procedures. Thus, the case report describes a variation in the course of the musculocutaneous nerve , in which it does not pierce the coracobrachialis muscle and merges distally with the median nerve. According to HU et al., 2021, this is a rare and poorly investigated variation.

In this sense, to be considered an anatomical variant, the nerves must deviate somewhat from their described origin or course. The musculocutaneous nerve (MCN) is a mixed nerve, originating in the lateral fascicle of the brachial plexus, responsible for the motor and sensory innervation of the muscles of the anterior compartment of the arm. Traditionally, it emerges opposite the inferior margin of the pectoralis minor muscle, pierces the coracobrachialis muscle , and continues deep between the brachialis and biceps brachii muscles. Upon reaching the forearm, it runs distally as the lateral cutaneous nerve of the forearm (NASCIMENTO et al., 2015). Furthermore, the median nerve is formed by a medial and a lateral root, arising respectively from the medial and lateral fascicles of the brachial plexus. It innervates the skin and muscles of the anterior compartment of the forearm and enters the forearm between the two heads of the pronator teres muscle, passing through the flexor retinaculum distally towards the palm of the hand (GRAY et al., 2020).

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Therefore, the brachial plexus assumes great importance in the innervation of the upper limbs, as knowledge about the variations in the anatomy of this structure directly impacts surgical procedures involving the arm and axilla. After all, the nerves originating from this plexus usually follow a characteristic path, as described in the literature, and findings on changes in this path, such as that of the musculocutaneous nerve , are of clinical relevance.

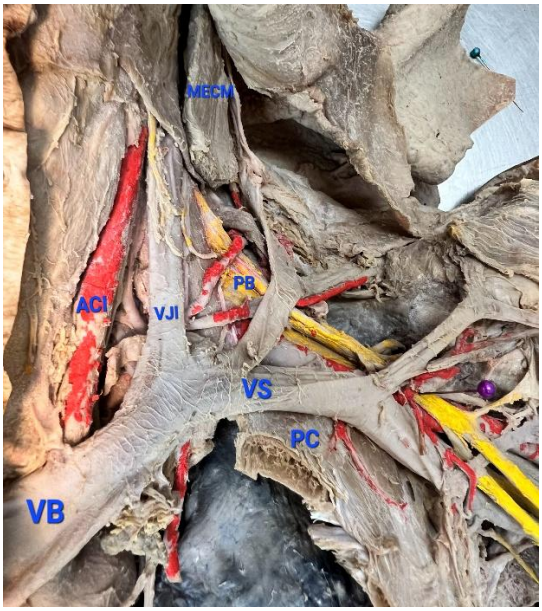
Thus, the present case report aims to analyze the anatomical variations found in the brachial plexus of a cadaver, specifically in the path of the musculocutaneous nerve and its atypical communication with the median nerve, as well as to emphasize their respective clinical importance.

## 2 CASE REPORT

During the dissection of a male cadaver, estimated to be 60 years old, belonging to the Human Anatomy Laboratory of the School of Health Sciences of the State University of Amazonas, a variation in the left brachial plexus was observed. The brachial plexus was maintained in its usual anatomical position, maintaining its anatomical relationships with the anterior and middle scalene muscles, cervicoaxillary canal , and axillary artery, allowing for a study focused on topographic anatomy.

**Figure 1**

*Cervical region - Anterior view*




Legend: Internal Carotid Artery (ICA) and Internal Jugular Vein (IJV), Sternocleidomastoid Muscle (SMCM), Brachiocephalic Vein (BV), Brachial Plexus (BP ), Subclavian Vein (SV), First Rib (PC), Axillary Artery (AA)
Source: UEA Human Anatomy Laboratory (2023).

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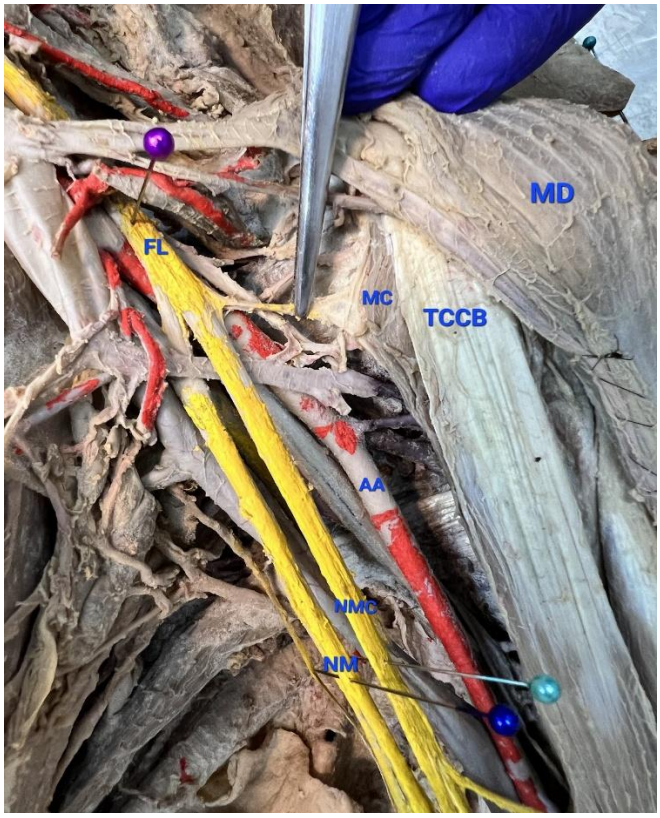
Musculocutaneous nerve path diverged from that described in the current literature. Typically, the lateral fascicle contributed to the median nerve and the musculocutaneous nerve, the latter located laterally at the lower part of the clavicle and the upper border of the pectoralis minor muscle. The CMN did not perforate the coracobrachialis muscle (Figure 2), sending only a branch to innervate the muscle, characterizing the first anatomical variation. Following distally, in the middle third of the arm, a communication between the musculocutaneous nerve and the median nerve was observed (Figure 3), at a distance of 16 cm from the coracoid process , thus characterizing the second anatomical variation observed.

**Figure 2**

Musculocutaneous nerve - Anterior view




Legend: Lateral Fascicle (FL), Deltoid Muscle (MD), Short Head of Biceps Brachii Tendon (SCBT), Median Nerve (MN), Musculocutaneous Nerve (MCN), Coracobrachialis Muscle (MC).
Source: UEA Human Anatomy Laboratory (2023).

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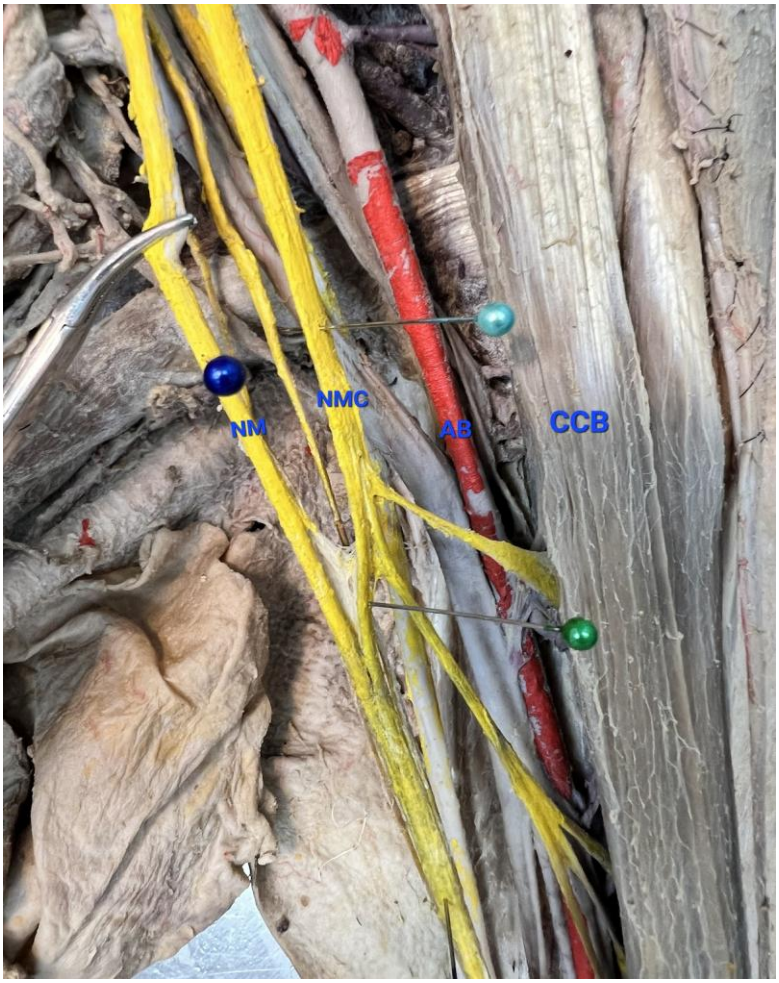
**Figure 3**

*Communication of the musculocutaneous and median nerves in the middle third of the arm. Anterior view*




Legend: Musculocutaneous nerve (MCN), median nerve (MN), brachial artery (BA), short head of biceps brachii (CCB)
Source: UEA Human Anatomy Laboratory (2023).

## 3 DISCUSSION

Considering the anatomical descriptions of the brachial plexus, it is clear that this structure varies among individuals. From an embryological perspective, research suggests that variability in the brachial plexus's arrangement may be related to some morphological factors, such as the segmental position of the subclavian artery, remnants of intersegmental arteries , and the division and reunification of axon bundles around the vessels (LEIJNSE *et al.,* 2020). Based on this, the studies were based on the analysis of the left brachial plexus of a cadaver, focusing on the musculocutaneous nerve , as well as its course and possible connections with other nerves.

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In the cadaver analyzed, the CMN does not pierce the coracobrachialis muscle and sends a 24 mm branch that innervates it, in addition to sending a communication with the median nerve of approximately 30 mm, a fact that disagrees with the literature. According to the studies by Al-Sobhi et al. 2023 and Larrota et al., 2018, in only 10% and 5.7% of cases, respectively, was an anomalous CMN path evidenced, where it did not pierce the coracobrachialis muscle . Similar cases to this have been previously described in the literature, such as in Chentanez (2016), where the musculocutaneous nerve did not pierce the coracobrachialis muscle . From another perspective, Erturk (2023) took as the object of study 102 upper limbs, from 51 fetuses, with ages ranging from 17 to 40 weeks, observing that the musculocutaneous nerve did not perforate the coracobrachialis muscle in 13.7% of cases.

Presenting a higher percentage than the factor previously mentioned, Al-Sobhi (2023) concluded that 60% of 40 specimens analyzed exhibited certain patterns of communication between the musculocutaneous and median nerves. This observation was also described by Ghosh (2022) with a lower incidence, approximately 3.3 % of the upper limbs studied contained the communication between the CMN and MN. Furthermore, Patel (2023) described a percentage of 5%, of a sample of 39 cadaveric specimens, for this communication. This was also observed by Nascimento (2015), in which the musculocutaneous nerve , after supplying the lateral cutaneous branches of the forearm and the brachialis muscle, continued for 29.34 mm and joined the median nerve, identified by the author as 145.90 mm in length.

Kervancioglu 's (2011) findings , based on the analysis of 20 upper limbs (10 right, 10 left), showed that 10% did not present the relationship between the MCN and the coracobrachialis muscle . However, when analyzing the possible communications between the MCN and the MN, only 25% of the arms presented such variation. Thus, it is noted that the studies reached different results, which reinforces the need to identify the possible abnormalities present in this structure.

The region within reach of the brachial plexus is commonly injured. Therefore, analyzing variations in this anatomy, especially of the musculocutaneous nerve, is crucial . Isolated injuries to this structure are present in a variety of clinical situations, such as direct trauma to the anterior shoulder, humerus and clavicle fractures, gunshot wounds, lacerations, dislocations, and others. This fact is corroborated by records showing that, of 35 incidents of brachial plexus injury, nine suffered brachial plexus injuries associated with clavicle fractures

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(KARAHANOGLU et al., 2016). Thus, understanding these variations allows for the interconnection of anatomical and clinical correlations with more precise surgical procedures that pose less risk to the patient.

## 4 FINAL CONSIDERATIONS

In short, research, as well as the knowledge of anatomical variations of the brachial plexus by healthcare professionals, is highly relevant. Alterations in the course of the musculocutaneous nerve , the subject of this report, should be analyzed to reduce risks in more invasive procedures, such as shoulder surgeries, and, consequently, avoid isolated injuries to this nerve. Thus, through such knowledge, it is possible to develop more precise clinical and surgical reasoning in patients with some type of involvement related to the branches of the brachial plexus, such as the musculocutaneous and median nerves.

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