

Case Report

Bilateral cadaveric variations of musculocutaneous nerve and median nerve in the anterior brachium: a case report

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ABSTRACT

Formation of the brachial plexus is by the union of ventral rami of C5-T1 spinal nerves. The musculocutaneous nerve is a continuation of the lateral cord, pierces the coracobrachialis and supplies the flexor compartment of the arm. Our case report presents a unique bilateral cadaveric variation in the musculocutaneous nerve and median nerve branching patterns, in the flexor compartment of the arm. A case report of bilateral variations of musculocutaneous nerve and median nerve (R-Right, L-Left) was found during the routine dissection in the Department of Anatomy, Shridevi Institute of Medical Sciences and Research Hospital, Tumakuru. From the right lateral cord, separation of few nerve fibres forming the lateral root of the median nerve was appreciated. The lateral root joins the medial root of the medial cord, after emerging out of the ulnar nerve and forms the initial segment of median nerve. Before the union of lateral and medial roots of initial segment of median nerve, ulnar nerve, medial cutaneous nerve of arm and medial cutaneous nerve of forearm descends along the medial aspect of the right arm. From the left lateral cord musculocutaneous nerve pierces the coracobrachialis. Before piercing the muscle, it gives one vascular branch and a motor branch. After piercing, the musculocutaneous nerve runs downwards and gives a motor branch to left biceps brachii. Variations of brachial plexus are frequently subjected to compression neuropathy. During surgical approaches to the brachium region, awareness about the anatomical variations of lateral and medial cords is mandatory for diagnosing the peripheral nerve entrapment syndrome. An integrated understanding of these branches prevent iatrogenic injuries during surgical procedures.

Keywords: Musculocutaneous nerve, Median nerve, Cadaveric variations, Brachial plexus

INTRODUCTION

Formation of the brachial plexus is by the union of ventral rami of C5-T1 spinal nerves. After the spinal nerves emerges out through the intervertebral foramen, the plexus will form and further categorized into roots, trunk, divisions, cords and branches. The cords are further subdivided into medial, lateral and posterior nerve bundles.¹

The musculocutaneous nerve is a continuation of the lateral cord, pierces the coracobrachialis and supplies the flexor compartment of the arm. Formation of the median nerve is contributed by the medial and lateral terminal roots of the respective cords, located in front of the 3rd part of the axillary artery.^{1,2} Variations in the plexus formation and distribution of the branches are due to the sequences in the embryological development.³

The topographic knowledge of the anatomical variations of the brachial plexus, creates an intense awareness for the

operating surgeons in the axilla and the arm region⁴. Our case report presents a unique bilateral cadaveric variation in the musculocutaneous nerve and median nerve branching patterns, in the flexor compartment of the arm.

CASE REPORT

A case report of bilateral variations of musculocutaneous nerve and median nerve was found during the routine dissection in the Department of Anatomy, Shridevi Institute of Medical Sciences and Research Hospital, Tumakuru. The anatomical variations were observed in the

flexor compartment of the brachium in a male Indian cadaver, aged 68 years. The study was initiated after obtaining the institutional ethical clearance certificate (SIMSRH/IEC/2023-24/268).

A standard guideline was followed while dissecting, according to the Cunningham’s dissection manual of anatomy.² During the dissection, the brachial plexus variations were noted and photographed (Figure 1 and 2). The distance of the branching variations was noted and tabulated on both the sides (Table 1 and 2).

Table 1: Measurements between the brachial plexus branches in the right brachium.

	Inter-distance measurements	Measurements (cm)
Lateral cord on right arm	B-D	3.2
MCNR	B-E	9.6
MNiR	D-E	7.2
1st branch of MNpR in the arm	E-G	2.6
2nd branch of MNpR in the arm	E-H	6
The entire MNR (MNiR+MNpR) till disappearing under the PTR in the cubital fossa	D-F	28.8
The distance between the formation of MNpR to the first branch	E-G	2.6
The inter distance between the 1st and 2nd branch of MNpR	G-H	3.7

Abbreviations:- MCNR: musculocutaneous nerve-right, MNiR: median nerve initial segment-right, MNpR: median nerve proper-right, PT: pronator teres-right.

Table 2: Measurements between the brachial plexus branches in the left brachium.

	Inter-distance measurements	Measurements (cm)
MCNL to trifurcation point	B’-E’	12.5
MCNL to nerve to BBL	B’-G’	10.5
Trifurcation to MNL	E’-I’	5

Abbreviations:- MCNL: musculocutaneous nerve-left, BBL: biceps brachii-left, MNL: median nerve-left.

Anatomical variations of the musculocutaneous nerve and median nerve in the right brachium

Level of musculocutaneous and median nerve origin, course, variations in the branching patterns and their termination were assessed and photographed. In the right axilla, cords of brachial plexus are in the anatomical position in relation to the 2nd part of the axillary artery. The anatomical variations of the musculocutaneous and median nerve in the right brachium are displayed (Figure 1 (i-v)).

From the lateral cord (A-B), separation of few nerve fibres forming the lateral root of the median nerve was appreciated (B-D). The lateral root joins the medial root of the medial cord, after emerging out of the ulnar nerve (C-D) and forms the initial segment of the median nerve (D-E).

Before the union of lateral and medial roots of initial segment of median nerve, ulnar nerve, medial cutaneous nerve of arm and medial cutaneous nerve of forearm

descends along the medial aspect of the right arm. Relations of the initial segment are as follows: medially, the axillary vein and posteriorly, 2nd part of the axillary artery under the cover of pectoralis minor and pectoralis major.

Right musculocutaneous nerve (B-E) is not piercing the coracobrachialis in the right brachium. Initial segment of the median nerve joins with the musculocutaneous nerve and forms the median nerve proper at the junction of upper 1/3rd and lower 2/3rd of the right arm.

From the point E, 2.6 cm below, the first branch (G) emerges out laterally to supply biceps brachii and coracobrachialis.

From the G, 3.6 cm below, the second branch emerges out laterally and trifurcates into the following branches: (a) first, motor branches (G) to biceps brachii and nerve to coracobrachialis, (b) second, motor branches (H) to biceps brachii and right brachialis and (c) third, sensory branch (J) continuing as lateral cutaneous nerve of forearm.

The inter-distance measurements for the branches of brachial plexus and its anatomical variations of the right

brachium are measured with measuring tape and displayed (Table 1).

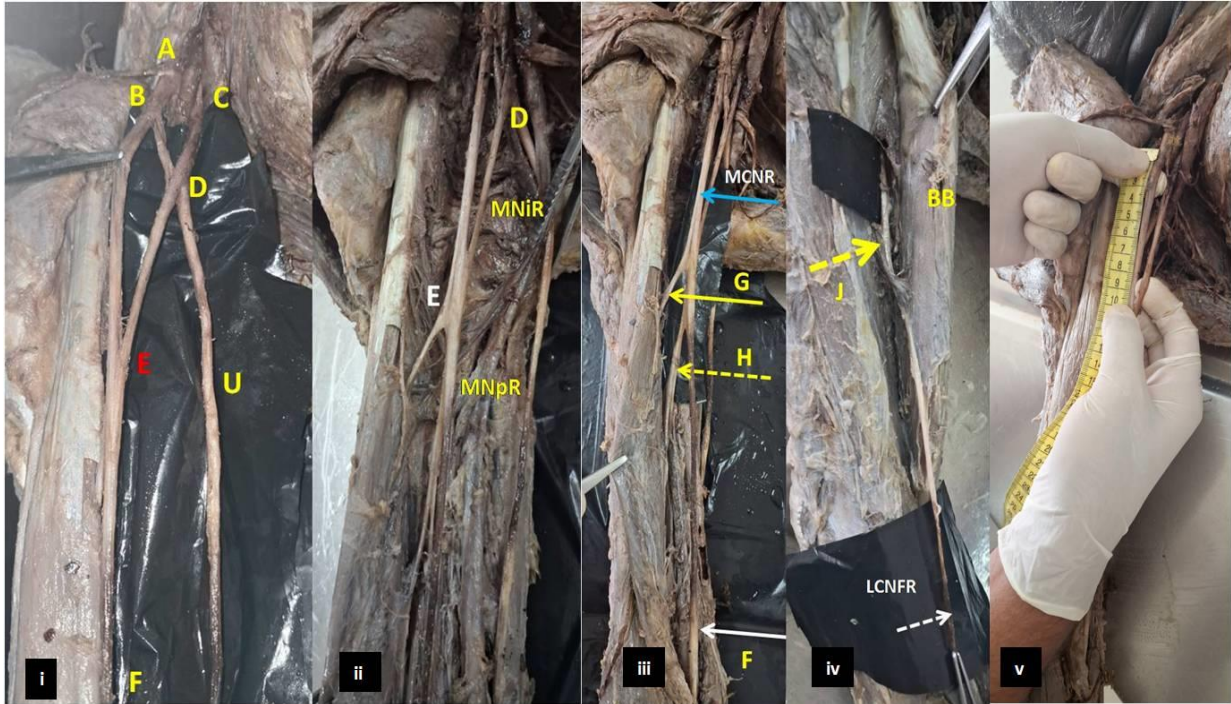


Figure 1: Displays the images of anatomical variations in the MCNR and MNR in the right brachium.

Abbreviations: i) U- ulnar nerve. ii) MNIr- median nerve initial segment-right, MNpR- median nerve proper-right. iii) MCNR- musculocutaneous nerve-right. iv) BB- biceps brachii-right, LCNFR-lateral cutaneous nerve of forearm. v) interdistance measurements with measuring tape.

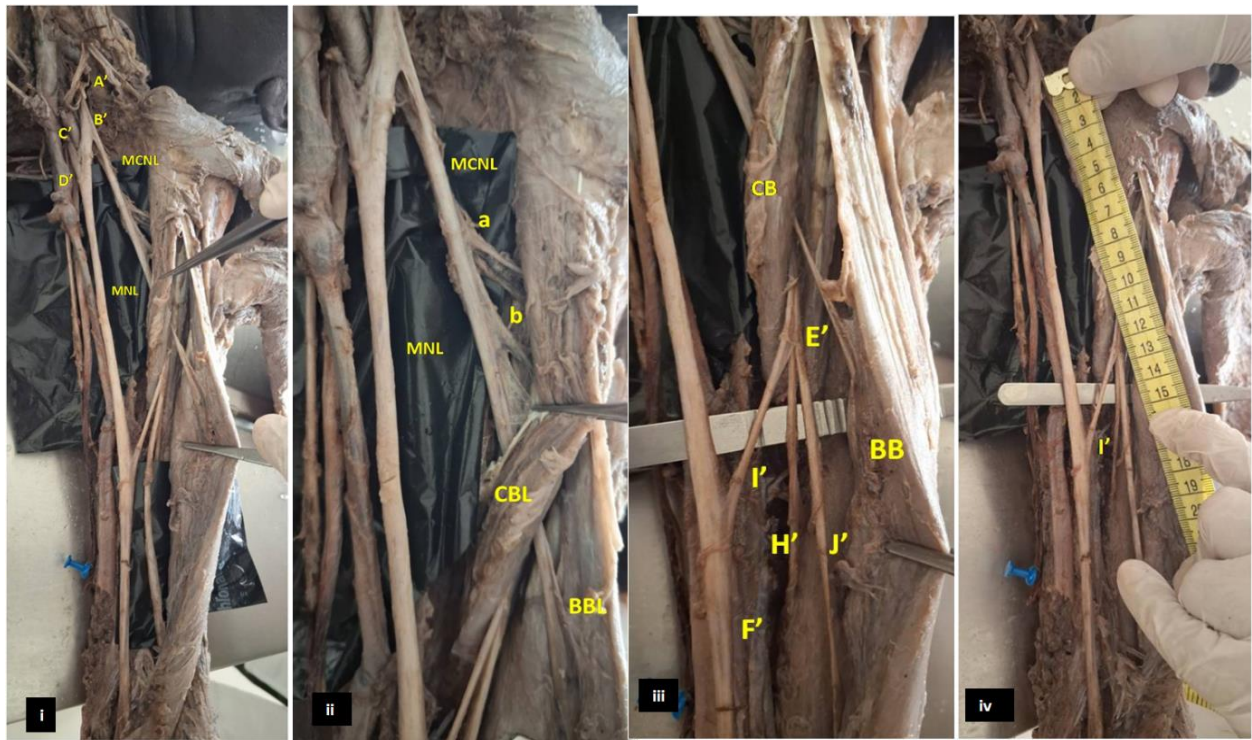


Figure 2: Display the images of anatomical variations in the MCNL and MNL in the left brachium. Abbreviations: i) MCNL: Musculocutaneous nerve-Left, MNL- Median nerve Left. ii) Coracobrachialis Left-CBL. BBL- Biceps brachii- Left, iii) E'-trifurcation point of MCNL. iv) interdistance measurements with measuring tape.

Anatomical variations of the musculocutaneous and median nerve in left brachium

The anatomical variations of the musculocutaneous nerve and median nerve in the left brachium are displayed (Figure 2 (i-iv)).

The formation of left median nerve is by joining of the medial and lateral roots of the respective cords (C'-D') and (A'-B'), followed by which, the nerve runs in the flexor compartment of the brachium medially, to reach the cubital fossa and disappears under the left pronator teres (F').

Before the union of lateral and medial roots to form the median nerve, ulnar nerve, medial cutaneous nerve of arm and medial cutaneous nerve of forearm descends along the medial aspect of the left arm.

From the left lateral cord (A'-B') musculocutaneous nerve branches out and pierces the coracobrachialis. Before piercing the coracobrachialis, it gives one vascular branch (a) and a motor branch (b) to coracobrachialis. After piercing, musculocutaneous nerve runs downwards, under the biceps brachii and gives a motor branch to biceps brachii (G'). Further, the musculocutaneous nerve descends down and trifurcates (E') as follows: (a) one communicating branch (I') with the left median nerve, (b) one motor branch (H') to the left brachialis and (c) one sensory branch (J') continuing as left lateral cutaneous nerve of forearm.

The inter-distance measurements for the branches of brachial plexus and its anatomical variations in the left brachium are measured with a measuring tape and displayed (Table 2).

DISCUSSION

Anatomical variations of brachial plexus have been reported by many authors in the previous literature. Myotomes of the upper limbs are developed from the paraxial mesoderm during embryological development. Outcome of these variations can be due to the alteration in the signalling pattern.^{3,5}

In this current research work, we observed a unique communication between bilateral musculocutaneous nerve and median nerve respectively. Variations mentioned by Standing et al, are as follows:¹ (a) musculocutaneous nerve and median nerve may adhere to each other and pass behind the biceps brachii and (b) cross communication of nerve fibres between the median nerve and musculocutaneous nerve can be expected.

Le minor, did an extensive research study on the musculocutaneous nerve and median nerve variations in man and his study broadly classified the communications into 5 subgroups.⁵ Our study findings in the right brachium did not fall under any of the Le Minor's classification. On

the contrary, in the left brachium, our study variations fell under the 3rd category of Le Minor's classification. Similar to our study Priya et al, reported the communication in 8 cases out of 60 (13.3%). Their study showed 5 communications on the left side and 3 on the right side.⁴ Studies done by Beheiry et al, Chitra et al, Joshi et al, Budhiraja et al, Dahiphale et al, Balachandra et al, reported parallel communications among their study samples, 5%, 26%, 14%, 26.7%, 25% and 5%, respectively.⁶⁻¹¹

According to Choi et al classifications, the fusion of musculocutaneous nerve and median nerve, falls under pattern 1 and his study results shows similar variations among 19.2% cases.¹² Under the classification proposed by Chiarapattanakom et al, our study branching pattern of motor fibres to biceps brachii, falls under the category of type II A on the right side and type I on the left side respectively.¹³ In our study, the inter-distance between G-H on the right side was 1.3 cm. On contrary, study results of Chiarapattanakom et al, shows 2.2 cm (range: 0.5-5.3 cm).

Brachial plexus variations are frequently subjected to compression neuropathy.¹⁴ A detailed understanding of these cadaveric variations helps in clinical diagnosis, happened due to the nervous damage.¹⁵ During mastectomy procedures, for treatment of breast malignancy the coracobrachialis flap is mobilised to camouflage the defect. Henceforth awareness regarding the brachial nerves piercing the coracobrachialis is essential, to avoid inadvertent damage.¹⁶

Restoration of elbow flexion is of surgical importance in patients with traumatic brachial plexus injuries. Therapeutic nerve grafting procedures results in successful outcomes, for restoring plexus injuries.¹⁷ During surgical approaches to the brachium region, knowledge about the multiple branching patterns of lateral and medial cords of brachial plexus will give a clarity in diagnosing the peripheral nerve entrapment syndrome.

CONCLUSION

An integrated understanding of musculocutaneous nerve and median nerve, prevents iatrogenic injuries during surgical interventions. Standard location of the musculocutaneous nerve branches cannot be appreciated between the biceps brachii and coracobrachialis. Extensive dissection in the brachial region may damage the motor branches and leads to complications during nerve transfer. Therefore, microsurgical dissections with the prior knowledge regarding the variations are required for better outcome.

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