ISSN: 2322 - 0902 (P)
ISSN: 2322 - 0910 (O)

International Journal of Ayurveda and Pharma Research

Case Study

ABSENCE OF MUSCULOCUTANEOUS NERVE: A RARE ANATOMICAL VARIATION

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Article info

Article History:
Received: 29-01-2022
Revised: 22-02-2022
Accepted: 02-03-2022

KEYWORDS:
Musculocutaneous Nerve, Brachial Plexus.

ABSTRACT

Neural variation of the brachium constitutes a significant anatomical and clinical entity. The absence of Musculocutaneous Nerve is occasional in humans and accordingly there may be unforeseen clinical implication regarding the atypical innervations of musculature otherwise supplied by the Musculocutaneous Nerve. The present study is an absence of Musculocutaneous nerve observed during our routine educational dissection, where the lateral cord of brachial plexus took over the area of supply of Musculocutaneous Nerve by giving both the muscular and sensory branches. Knowledge of these variations is important in surgeries and during the administration of regional anaesthesia near shoulder joint and upper arm.

INTRODUCTION

The brachial plexus supplies upper limb and is formed by the ventral rami of lower four cervical nerves and first thoracic nerve (C5, C6, C7, C8 and T1). Sometimes they may be joined by branches of fourth cervical (C4) and second thoracic (T2) nerves. The C5 and C6 roots unite to form the Upper trunk, C8 and T1 unite to form Lower trunk, C7 root continues as middle trunk. On approaching clavicle, even before entering the axilla, each of three trunks splits into anterior and posterior division. Anterior divisions of upper and middle trunks unite to form Lateral cord, anterior division of lower trunk continues as Medial cord, posterior division of all three trunks assemble to form the Posterior cord. Therefore, lateral cord carries fibres from C5, C6, C7. Medial cord carries fibres from C8, T1 and posterior cord conveys fibres of C5, C6, C7, C8, T1.[1]

The median nerve is formed in axilla by the union of medial and lateral roots. The medial root is derived from medial cord of brachial plexus and conveys the fibres from C8 and T1. It crosses downward and laterally in front of third part of axillary artery and joins with lateral root.

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https://doi.org/10.47070/ijapr.v10i3.2317

The lateral root is the continuation of lateral cord of brachial plexus and conveys fibres from C5, C6, C7. After its formation the median nerve descends along lateral side of third part of axillary artery and proximal part of brachial artery. At the middle of arm, opposite insertion of coracobrachialis, the nerve crosses from lateral to medial usually in front of the artery and then accompanies along the medial side of the brachial artery. It appears in the cubital fossa beneath the bicipital apponeurosis and rests on brachialis. The nerve leaves the fossa through a gap between superficial and deep heads of pronator teres muscle. The median nerve does not give motor branches in arm, but gives vascular branches to brachial artery and articular branches to elbow joint.[2]

The Musculocutaneous nerve is derived from the lateral cord and conveys the fibres C5, C6, C7. The nerve initially accompanies the lateral side of the third part of axillary artery and pierces the coracobrachialis muscle, it supplies the coracobrachialis even before piercing the muscle and the fibres are derived from C7.[1] The nerve then passes downward and laterally across the front of the arm in between the biceps brachii and brachialis. It supplies both heads of biceps and the medial part of brachialis. It gives articular twigs to elbow joint and a nutrient branch to humerus. Just below the elbow it pierces the deep fascia lateral to the tendon of biceps brachii, extends further downwards as lateral cutaneous nerve of the forearm to supply the skin of antero-lateral region of arm as far distally as the base of the thenar eminence.[3]

Case Report

Usually musculocutaneous nerve is branch of lateral cord of brachial plexus. During our routine dissection in Department of Anatomy, MVR Ayurveda Medical college, Parassinikkadavu, Kerala, the female cadaver aged 76yrs showed a variation in Rt upper extremity of absence of musculocutaneous nerve. It was noticed that here lateral cord of brachial plexus in the right axilla did not give off musculocutaneous nerve and gives a twig to coracobrachialis. It then pierces through the muscle and gives a branch to both heads of Biceps brachii and brachialis. Just below the elbow it pierces the deep fascia lateral to tendon of biceps brachii and extends further downwards as lateral cutaneous Nerve of forearm. Also in this case median nerve was found to be derived from medial cord only.

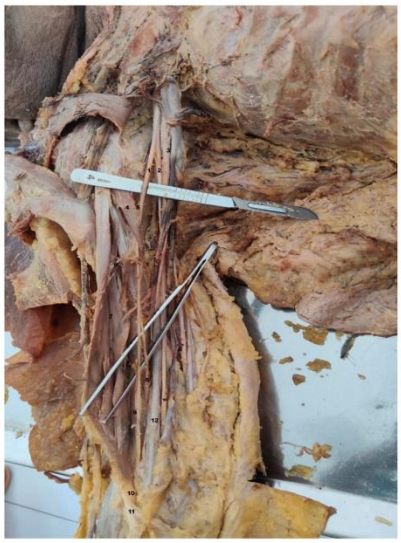

Fig:1
1-Lateral cord 2-Medial cord ,3- axillary artery 4-Coracobrachialis muscle 5- Branch to - Coracobrachialis, 6-Branch to Biceps muscle- 7- Biceps muscle 8-Branch to Brachialis muscle 9-Brachialis muscle 10-tendon of - Biceps 11-Bicipital aponeurosis 12-Brachial artery,13- Median nerve

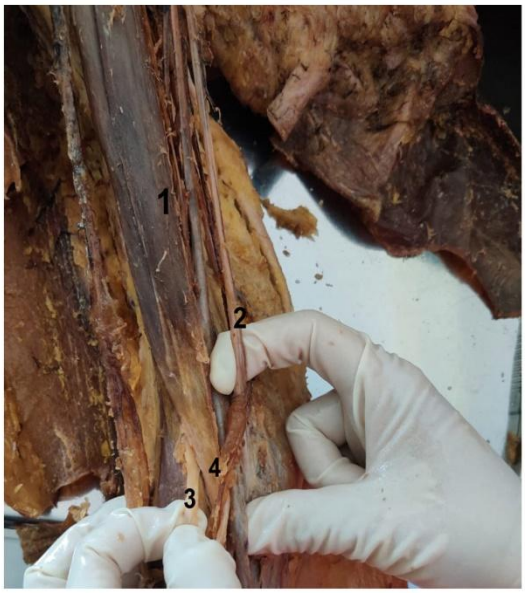

fig: 2 : 1 - Biceps Brachii, 2- Median Nerve, 3- Lateral cutaneous nerve of forearm 4-tendon of biceps

DISCUSSION

In general**,** musculocutaneous nerve arises from lateral cord of brachial plexus and the median nerve is formed by union of medial and lateral roots of medial and lateral cord of brachial plexus.

Anatomical variations of Brachial plexus have been reported by several authors. The musculocutaneous nerve and median nerve are the two major nerves which have numerous variations in their formation and branching pattern. The absence of Musculocutaneous Nerve was reported in a range of 5%-15 % in different studies.[4] According to Tountas and Bergaman (1993), Musculocutaneous Nerve arises from lateral cord in 90.5%, from lateral and posterior cord in 4%, from medial cord in 2% and as separate bundles from medial and lateral cord cord in 1.4%.[5]

The absence of Musculocutaneous nerve and its complete replacement by Median nerve was observed by Parchand, Patil and Gumusburun et al,[6,7] while Srimani et al[8] and Zhang et al[9] have found that only biceps brachii and brachialis received nerve supply from the median nerve and the coracobrachialis received innervations from the lateral root of median nerve or directly from the lateral cord.

In some cases, some fibres of medial root of the median nerve unite with the lateral root of median nerve and form the median nerve; the remaining medial root fibres run in the musculocutaneous nerve and then leave it after an expanse joining the main trunk of median nerve. In some cases, the lateral root of median nerve runs in the musculocutaneous nerve instead of forming the median nerve with the lateral root. It leaves the musculocutaneous nerve after a distance to join the main trunk of the median nerve.[10,11]

Sometimes the fibres of the musculocutaneous nerve unite with the lateral root of median nerve instead of going its way into the coracobrachialis. After some distance, the musculocutaneous nerve arises from the median nerve.

According to Abuel-Markarem *et al*., 2007 the lateral cord supplied the coracobrachialis and communicated with medial root of median nerve twice. The lateral cord then supplied two heads of biceps and

brachialis. The lateral root then joined the medial root to form median nerve which innervated third head of biceps and continued as lateral cutaneous of forearm.[12] Sometimes absence of musculocutaneous nerve is associated with presence of three head of biceps. The presence of 3 head of biceps was also noticed in study of Pacholczak *et al* 2011.[13]

The most recurring variations is the presence of communicating branch that separates from Musculocutaneous nerve and goes distally to join the median nerve.[14,15]

In some rare cases, when the musculo-cutaneous nerve is absent, the fibres of musculo-cutaneous nerve run within the median nerve through its course without piercing the coracobrachialis. In 1997, Nakatani *et al* [16] reported 3 cases of the Musculocutaneous nerve not perforating the coracobrachialis muscle. According to Wadha *et al*. 2008[17] branches from lateral cord supplied coraco-brachialis, biceps brachii, brachialis muscles and give rise to lateral cutaneous nerve of forearm. In our case a branch from lateral cord supplied coracobrachialis, then it pierced coracobrachialis, give branches to both head of biceps, further gives a branch to brachialis and later continued as lateral cutaneous nerve of forearm. In our study, right side variation of absence of musculocutaneous nerve belongs to type V of Le Minor (1992) variation.[18]

This anatomical variation may be explained by embryological development of the upper limb. The development of forelimb muscles by regional expression of five Hox D genes occurs from the mesenchyme of paraxial mesoderm in the fifth week of the intrauterine life. The growth cones of the motor axons arrive at the base of the limb bud to form the brachial plexus and continue in the limb bud.[19,20] The guidance of the developing axons is regulated by the expression of chemo attractants and chemorepulsant in highly coordinated site-specific fission. Tropic substances such as brain derived neurotropic growth factor, c- kit ligand, neutrin-1, neutrin-2, attract the correct growth cones or support the viability of the growth cones that happen to take the right path. The significant variations in nerve pattern, may be result of altered signaling between the mesenchymal cells and the neuronal growth cones or circulatory factors at the time of fission of brachial plexus cords.[21]

Clinical Implications

The anatomical variation has practical implications, since injuiry to the high median nerve occurring in the absence of musculocutaneous nerve would have an atypical clinical presentation specifically, weakness in shoulder and elbow flexion, weakness in supination and also cutaneous sensory loss to lateral forearm.[22] One study found that the musculocutaneous nerve contributes to 42% of the muscle power that flexes the elbow. Proximal injuries to the median nerve could occur in case of a fractured humerus.[23,24,25] Furthermore, in humerus fracture fixations, whether by the anterolateral of medial approach, identification of median nerve and musculocutaneous nerve need to be identified intraoperatively. The absence of the musculocutaneous nerve could, therefore lead to surgical confusion during fracture fixation.[26]

Further confusion may be encountered with regard to nerve transfer surgeries in the reconstruction of musculocutaneous nerve and its branches. Example of such nerve transfer candidates include the spinal accessory nerve, intercostal nerve, medial pectoral nerve, ulnar nerve and perhaps especially noteworthy, the median nerve.[27]

This is a unique case of unilateral absence of musculocutaneous nerve and lateral cord of brachial plexus itself supplying the flexor muscles. Anatomical abnormalities of brachial plexus may affect the procedures of various brachial plexus blockades that have been extremely utilized as a component of anaesthesia for upper extremity.[28]

CONCLUSION

Hence it is important to report the variations in the formation, relation and distribution of the brachial plexus to enrich the knowledge and statistics of variations so that unexpected complications during various surgical procedures can be avoided. Lastly, this case report also emphasizes the importance of vigilant anatomical dissection.

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Cite this article as:
Giridhar M Kanthi, Sunitha Valsan. Absence of Musculocutaneous Nerve: A Rare Anatomical Variation. International Journal of Ayurveda and Pharma Research. 2022;10(3):96-99.
https://doi.org/10.47070/ijapr.v10i3.2317
Source of support: Nil, Conflict of interest: None Declared

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