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## CASE STUDY

### VARIABLE ORIGIN OF MUSCULOCUTANEOUS NERVE IN NORTH INDIAN POPULATION (A CADAVERIC STUDY)

\*<sup>1</sup>Gurbachan Singh Gindha, <sup>2</sup>Ratesh Munjal, <sup>1</sup>Sidharth Sankar Maharana and  
<sup>1</sup>Rakesh Kumar Agarwal

<sup>1</sup>M M Medical College and Hospital, Kumarhatti, District: Solan (Himachal Pradesh), India  
<sup>2</sup>Gian Sagar Medical College, Ramnagar, Rajpura, District Patiala, India

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#### ABSTRACT

The musculocutaneous nerve is a nerve of anterior compartment of arm and also cutaneous nerve on lateral side of anterior compartment of the forearm. Root value of this nerve is C<sub>5</sub>-C<sub>7</sub>. The variations in origin, course and distribution is not uncommon. The knowledge of variable origin and course is important for surgeons, traumatologist and orthopedicians. Operative treatment in arm should be done with keeping in mind such variations which will prevent the chances of iatrogenic injuries to the musculocutaneous nerve.

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#### INTRODUCTION

The musculocutaneous nerve is the branch of brachial plexus. The brachial plexus gives the three cords and the musculocutaneous nerve is the direct branch from the lateral cord of brachial plexus after the lateral cord giving the lateral root of median nerve. The musculocutaneous nerve arises from lateral cord opposite the lower border of the pectoralis minor muscle and derives from 5<sup>th</sup> to 7<sup>th</sup> cervical ventral rami. It gives a branch to the shoulder joint and then pierces the coracobrachialis muscle and here it supplies to the coracobrachialis muscle and descends laterally between the biceps brachii and brachialis muscles to lateral side of the arm. Just below the elbow joint it pierces the deep fascialateral tendon of biceps brachii muscle and continues as lateral cutaneous nerve of the forearm. The musculocutaneous nerve supplies the coracobrachialis muscle, both heads of biceps brachii and most of the brachialis muscle. The branch to the coracobrachialis muscle leaves the musculocutaneous nerve before it enters the muscle. Its fibres arise from the 7<sup>th</sup> cervical ramus and may be direct branch from the lateral cord. The branches to the biceps brachii and brachialis muscles leave after the musculocutaneous nerve pierce the coracobrachialis muscle.

The branch to the brachialis muscle supplies the elbow joint. The nerve also gives a small branch to the humerus entering with the nutrient artery. The musculocutaneous nerve has frequent variations. It may run behind the coracobrachialis muscle or adhere for some distance to the median nerve and pass behind the biceps brachii muscle. Some fibres of the median nerve may run in the musculocutaneous nerve, leaving it to join their proper trunk (Standring et al., 2008). On embryological basis (Iwata, 1960) explained the brachial plexus appears as a single radicular cone in the upper limb, which was divided into ventral and dorsal segment. The ventral segment give the roots to the median and ulnar nerve. The musculocutaneous nerve arise from the median nerve. During shoulder surgery, it is important to identify or palpate the musculocutaneous nerve, as it is vulnerable to injury from retractors which are placed under the coracoid process. During the coracoid process grafting, shoulder joint dislocation and frequent arthroscopies may damage the muscle as well as the nerve (Flatow, 1989).

The musculocutaneous nerve arises from the lateral cord of the brachial plexus (C5, C6, C7) in more than 50% of cases and it contains the nerve to the coracobrachialis muscle. The nerve descends between the axillary artery and coracobrachialis muscle, sends a branch to coracobrachialis muscle and then pierce it to continue distally between biceps brachii and brachialis muscles, often communicating with the median

\*Corresponding author: Gurbachan Singh Gindha,  
M M Medical College and Hospital, Kumarhatti, District: Solan  
(Himachal Pradesh), India.

nerve. At the level of the elbow, it pierce the deep fascia between biceps brachii and brachialis muscles as the lateral cutaneous nerve of forearm. The muscular branch pass to the coracobrachialis, bicep brachii and brachialis muscles. The musculocutaneous nerve also sends twigs to the marrow and to the periosteum of the distal anterior surface of the humerus and to the brachial artery (Romanes, 1995).

The embryological development of upper limb may help in explaining this anatomical variations. The mesenchyme, which comes from the dorsolateral part of the somite migrates and forms the muscles in the limb bud. At the same time, the mesenchyme is penetrated by the ventral primary rami of appropriate spinal nerve, located opposite to the bud. Contact between nerves and a muscle cell is necessary to provide mesenchymal condensation to form muscles. Nerves supplying the limbs are joined by connecting loop of nerve fibres to form plexus. The median nerve is formed by the combination of ventral segmental branch and the musculocutaneous nerve arises from it. Distribution in these process, taking place in the 4<sup>th</sup>- 7<sup>th</sup> week of development lead to anatomical variations in the innervations of muscle by appropriate nerves (Rao, 2001; Uzun and Seelig, 2001).

(Venieratos and Anagnostopoulou, 1998) suggested classification in relation to the coracobrachialis muscle. According to their classification they described the communication into three types. In type I, communication between musculocutaneous nerve and median nerve is proximal to the entrance of the musculocutaneous nerve into coracobrachialis. Whereas in type 2, the communication is distal to the muscle and in type 3 neither the nerve nor its communicating branch pierce the muscle

## MATERIALS AND METHODS

The present study has been conducted in the Department of Anatomy, Maharishi Markandeshwer Medical College and Hospital, Kumarhatti, District; Solan (H.P.) India. Both upper limbs of 15 cadavers were dissected of both the sexes (male and female) which were embalmed with 10% of formaldehyde solution and fixed. Out of 15 cadavers, 10 cadavers were adult male and 5 cadavers were adult female. All the 30 limbs were dissected carefully in the shoulder and arm region according to Cunningham's Manual of Practical Anatomy<sup>8</sup>. The cords of brachial plexus were exposed and cleaned. The origin of median, ulnar and musculocutaneous nerves were noted. Any variation in origin and branching pattern was noted and recorded. The photographs were taken and this study was compared with previous studies done by other writers.

## DISCUSSION

Variations in branching pattern of musculocutaneous nerve and median nerve have been well described by many authors (LeMinor, 1992) classified these variations into five types.

**Type 1:** No communication between the median nerve and musculocutaneous nerve.

**Type 2:** The fibres of median root of median nerve pass through the musculocutaneous nerve and join the median nerve in the middle of the arm.

**Type 3:** Fibres of lateral root of the median nerve pass through the musculocutaneous nerve and after some distance leave it to form lateral root of median nerve.

**Type 4:** The musculocutaneous nerve fibres join the lateral root of the median nerve after some distance the musculocutaneous nerve arise from the median nerve.

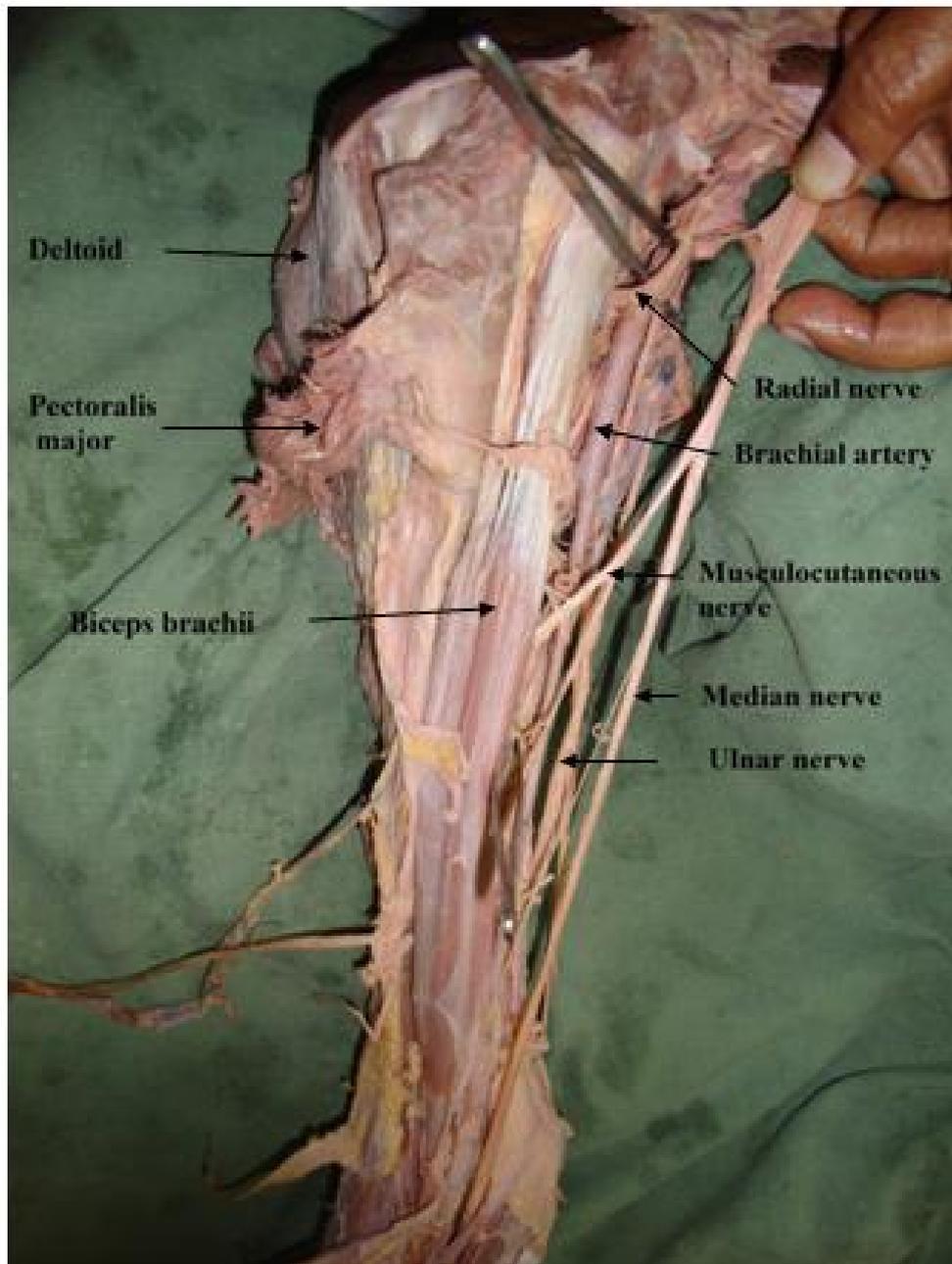
**Type 5:** The musculocutaneous nerve is absent and entire fibres of musculocutaneous nerve pass through the root of median nerve and fibres to the muscle supplied by musculocutaneous nerve branch out directly from median nerve. In this type the musculocutaneous nerve does not pierce the coracobrachialis muscle.

Variations in brachial plexus along with its terminal branches have been revealed by many authors. The Study done by (Nakatani et al., 1997) revealed three variations in which musculocutaneous nerve did not pierce the coracobrachialis muscle. (LeMinor, 1990) described a case of a lateral small branch that first pierced the coracobrachialis muscle and then one of its terminal branch joining the median root forming the median nerve.

(Tsikaras, 1983) reported that the musculocutaneous nerve arose from the median nerve unilaterally in a male cadaver. The unusual course, branching pattern of musculocutaneous nerve is a clinical important during flap dissection, post traumatic evaluation of the arm or peripheral nerve repair and even for peripheral nerve stimulation in practise of anaesthesia (Bhattarai and Poudel, 2009). The communication between the musculocutaneous nerve and median nerve as a remnant from phylogenetic or comparative anatomical point of view and that the ontogeny recapitulates the phylogeny, they feel that the variations seen are the result of the developmental anomaly (Chauhan and Ray, 2000). (Guerrri-Guttenberg and Ingolotti, 2009) dissected 56 upper limbs from fetuses and adult cadavers and recorded anatomical variations in the musculocutaneous nerve. Communicating nerve seen between the musculocutaneous nerve and median nerve in 53.6% of the dissection from which 84.6% were proximal, 7.7% distal and 7.7% had one proximal and one distal communication to the point of entry of musculocutaneous nerve into coracobrachialis muscle.

In the present study, we found that musculocutaneous nerve was arising from the median nerve. Out of 30 arms this variation was seen in one case in male and was of right side i.e. in 3.33% of cases (Figure 1).

In the present study we found that the musculocutaneous nerve was not piercing the coracobrachialis muscle. The coracobrachialis muscle was supplied by a branch from posterior cord. The musculocutaneous nerve was running along with the median nerve in upper one third of the arm, then left the median nerve and divided into branches which supplied to the biceps brachii and brachialis muscles. The terminal branch passed by the lateral side of tendon of the biceps brachii and gave the cutaneous branch on the lateral side of flexor compartment of forearm. Our findings correlate with the classification given by (Le Minor 1992) his type 4, in this type he described that the musculocutaneous nerve fibres join the lateral root of the median nerve after some distance the musculocutaneous nerve arise from the median nerve.



**Fig. 1. Musculocutaneous nerve arising from median nerve**

Most of authors reported the variations of median nerve and musculocutaneous nerve on the right side and more common in male and it was unilateral. In the present study we found in 3.3% cases. The variation was noted in male and on the right side and it was unilateral. No variation was seen in any case bilateral and no variation was seen in female. This variation in males may due to more physical work. Most of the persons are right handed so the variations are more common in the right side arm. The clinical implication of this could be that the injury of musculocutaneous nerve proximal the anastomotic branch between musculocutaneous nerve and median nerve may lead to unexpected presentation of weakness of forearm and thenar muscles.

### Conclusion

The variation in origin of musculocutaneous nerve from median nerve and other variations like communications have clinical importance in posttraumatic evaluation and exploring

innervations of the arm for the peripheral nerve repair. The knowledge of such variations in the arm is important for the orthopedician, traumatologist and surgeons during treatment of fracture of humerus and also during the surgery of the arm.

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