

# A cadaveric study on Musculocutaneous nerve and its variations in south Indian population

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## Abstract

Musculocutaneous Nerve is a branch of the lateral cord of Brachial plexus. It pierces the Coracobrachialis muscle and runs downward between Biceps brachii and Brachialis. At the lateral side of the arm, just below the elbow, it continues as Lateral cutaneous nerve of forearm. Musculocutaneous nerve supplies Coracobrachialis, Biceps brachii and Brachialis which are muscles of the front of arm. It also provides sensory innervation for the lateral aspect of forearm. A detailed study of Musculocutaneous nerve was done in 100 limbs of 50 embalmed human cadavers at the Institute of Anatomy, Madras Medical College, Chennai, India. Musculocutaneous nerve was not piercing the Coracobrachialis muscle in 15% of limbs. In 9%, communication was noted between Musculocutaneous nerve and Median nerve. The Musculocutaneous nerve was absent in 6% of limbs. The Musculocutaneous Nerve has significant variations and this knowledge is important for Neurologists, Anaesthesiologists, Orthopaedicians and Surgeons.

**Key Word:** Musculocutaneous nerve, Coracobrachialis, Median nerve, Lateral cutaneous nerve of forearm, Nerve Communication.

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## INTRODUCTION

Musculocutaneous nerve is the nerve of the anterior compartment of arm, supplying Coracobrachialis, two heads of Biceps brachii and most of Brachialis<sup>1</sup>. Musculocutaneous nerve (MCN) (C5,C6,C7) arises from the lateral cord of brachial plexus at the lower border of Pectoralis minor<sup>1</sup>. In the upper part of arm, the nerve runs down between the third part of Axillary artery and Coracobrachialis muscle. Then it pierces the Coracobrachialis muscle and descends laterally between Biceps brachii and Brachialis to the lateral side of the arm. Just below the elbow, it pierces the deep fascia, along the lateral margin of Biceps tendon and continues

as Lateral cutaneous nerve of forearm<sup>2</sup>. The nerve to Coracobrachialis, carrying C7 fibres<sup>3</sup> is given off before the MCN pierces the Coracobrachialis muscle and branches to Biceps brachii and Brachialis leave the nerve after the nerve has pierced the muscle. The nerve to Coracobrachialis may also arise directly from lateral cord. MCN supplies the elbow joint through the nerve to Brachialis and it also gives a small branch to humerus. MCN continues as Lateral cutaneous nerve of forearm and it provides sensory innervation for the skin of lateral part of forearm. Many variations including absence of MCN have been reported in literature. The lateral root of Median nerve arises from the lateral cord and unites with medial root, anterior or lateral to the third part of Axillary artery<sup>1</sup>. Since the MCN and lateral root of Median nerve arise from lateral cord of Brachial plexus, communications between these two nerves are common. When the lateral root of Median Nerve is small, MCN connects with Median Nerve in the arm<sup>1</sup>. Sometimes the fibres of MCN run along Median Nerve and branches to flexor muscles are given off from Median Nerve. Instead of penetrating the Coracobrachialis, the nerve may pass behind it or between it and short head of Biceps Brachii<sup>4</sup>. The knowledge of MCN and its variations is important for clinicians in the diagnosis and management of

peripheral neuropathy and nerve injury. This study was done to provide additional data on MCN in the South Indian population.

**MATERIALS AND METHODS**

100 upper limbs from 50 embalmed human cadavers were studied at the Institute of Anatomy, Madras Medical College, Chennai during routine undergraduate dissection classes. The limbs were dissected according to the standard dissection manual. In all the limbs the Musculocutaneous nerve was studied with regard to its origin, course and communications. Its relation to

Coracobrachialis muscle was specifically noted. The data obtained were recorded and analyzed.

**RESULTS**

Out of 100 upper limbs, variations were noted in 30 limbs (30%). Among which, the Musculocutaneous nerve not piercing Coracobrachialis was the most common variation. It was noted in 15 limbs (15%) [Figure 1]. The second most common variation was the communication between Musculocutaneous nerve and Median nerve which was noted in 9 % of limbs [Figure 2]. The Musculocutaneous nerve was absent in 6 limbs (6%) [Figure 3].

**Table 1:** Variations of Musculocutaneous nerve observed in the present study

Variations	Number of limbs
MCN not piercing Coracobrachialis muscle	15
Communication between MCN and Median Nerve	9
Absent Musculocutaneous Nerve	6
Total	30

The MCN did not pierce Coracobrachialis muscle in 15 limbs (15%). In 5 cadavers (10 specimens) this variation was bilateral and in 5 limbs (5 specimens) it was unilateral. In all the 15 limbs MCN arose from lateral cord, ran between Coracobrachialis and Biceps brachii muscles and continued as Lateral cutaneous nerve of forearm [Fig 1]. In 3 limbs, the branch to Coracobrachialis was a branch of lateral cord. In all the limbs Biceps brachii and Brachialis were supplied by MCN.

**Table2:** Innervation of muscles of Front of arm in 15 limbs where MCN did not pierce Coracobrachialis.

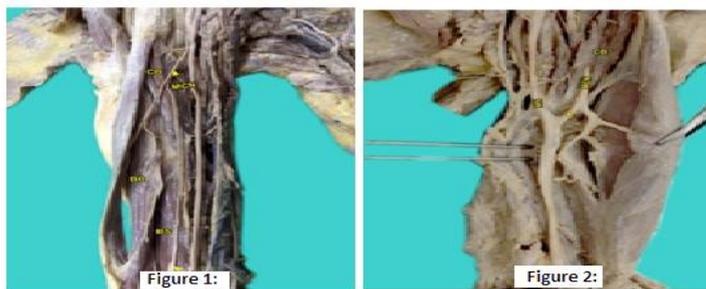
Muscle	Musculocutaneous nerve	Direct branch from lateral cord of Brachial plexus
Coracobrachialis	12	3
Biceps Brachii	15	0
Brachialis	15	0

Communication between Musculocutaneous nerve and Median nerve was noted in 9 limbs (9%). All the communications were single and were noted in the arm after MCN pierced Coracobrachialis muscle [Fig 2]. In one specimen MCN joined the Median nerve after piercing Coracobrachialis muscle. Before joining with Median Nerve it provided branches for all muscles of front of arm and Lateral cutaneous nerve of forearm. Musculocutaneous nerve was absent in 6 limbs (6 %). The Lateral cutaneous nerve of forearm was a branch of Median nerve in all these limbs. All the muscles of front of arm were supplied by Median nerve in 4 limbs [Fig 3]. In the other 2 limbs, Coracobrachialis was supplied by a direct branch from lateral cord and Biceps brachii and Brachialis were supplied by Median nerve [Fig 4].

**Table 3:** Innervations of muscles of front of arm in 6 limbs where MCN was absent

Muscle	Median Nerve	Direct branch from lateral cord of Brachial plexus
Coracobrachialis	4	2
Biceps brachii	6	-
Brachialis	6	-

The Lateral cutaneous nerve of forearm was the continuation of MCN in 94 limbs (94%). In 6 upper limbs where the MCN was absent, Lateral cutaneous nerve was a branch from Median Nerve [Fig 3 and Fig 4].



**Figure 1:** Right front of arm showing Musculocutaneous Nerve (MCN) not piercing the Coracobrachialis (CB) muscle. Branch to Coracobrachialis (CB), Branch to Biceps brachii (BB) and branch to Brachialis(Bs) muscles are seen. The MCN continues as Lateral cutaneous nerve of forearm (LCN). **Figure 2:** Left front of arm showing communication\* between Musculocutaneous Nerve (MCN) and Median nerve (MN). The communication is in midarm after the point of entry of MCN into the Coracobrachialis muscle (CB)



**Figure 3:** Left front of arm with absent Musculocutaneous nerve. Coaracobrachialis(CB), Biceps brachii (BB) and Brachialis muscles are supplied by Median nerve (MN).Lateral cutaneous nerve of forearm (LCN) is a separate branch of MN. **Figure 4:** Left Front of Arm with absent Musculocutaneous nerve. Coaracobrachialis(CB) muscle is supplied by lateral cord (LC) of brachial plexus. Biceps brachii (BB) and Brachialis muscles are supplied by Median nerve (MN).

## DISCUSSION

Variations in the course and branching pattern of the Musculocutaneous nerve is due to developmental inconsistency. Since the primary ventral branches of spinal nerves for MCN and lateral root of Median Nerve are common (C5, C6, C7), communications between these two nerves are not infrequent<sup>5</sup>. Sometimes MCN fails to separate from the Median Nerve and the supposed branches of MCN for the flexor muscles of the arm are given off by Median Nerve. In the present study communication between MCN and Median Nerve was noted in 9 % of specimens which coincides with the results of Apurva Darji *et al* (6%)<sup>6</sup> and Bhattarai *et al* (6.25 %)<sup>7</sup>. Venieratos and Anagnostopoulou<sup>8</sup> reported three types of communications, taking the point of entry of MCN into Coracobrachialis as the reference point.

Type I- Communication proximal to the entry of MCN into Coracobrachialis.

Type II - Communication distal to the entry of MCN into Coracobrachialis (commonest).

Type III- MCN as well as the communicating branch did not pierce the muscle.

Type IV where communications were present proximal as well as distal to the point of entry of MCN into

Coracobrachialis was additionally reported by M. Loukas and H. Aqueelah Loukas<sup>9</sup>. Communications in all the 9 limbs were single and were present after MCN pierced Coracobrachialis muscle. This type corresponds to type II communication of Venieratos. Type I, type III and Type IV were not observed in the present study. MCN joining the Median Nerve after piercing Coracobrachialis is a rare variation, found in one limb in the present study. Lateral cutaneous nerve was given off by MCN before joining the Median Nerve. Similar variation was observed in one case by Jamuna *et al*<sup>10</sup>, Joshi *et al*<sup>11</sup> and in 3.13% of specimens by Bhattarai *et al*<sup>7</sup>. In the present study MCN did not pierce Coracobrachialis in 15% of limbs. This is the most common variation of MCN observed in this study. This result correlates with that of Seema *et al* (20%)<sup>12</sup>. Similar variation was observed by Jagadeesh Babu *et al*<sup>13</sup>, Chitra *et al*<sup>14</sup> and Jamuna *et al*<sup>10</sup>. In the present study, the MCN arose as a branch of lateral cord of Brachial plexus and continued as Lateral cutaneous nerve of forearm. The unusual variation of Brachial plexus with absent MCN and the flexor muscles of arm supplied by Median nerve has been reported in literature<sup>3,15</sup>. Absence or variations of Musculocutaneous nerve may not affect the normal functioning of the limb.

But it has greater clinical significance. In the present study, MCN was absent in 6 limbs (6%). This incidence correlates with that of Jamuna *et al* (6%)<sup>10</sup>, Chitra *et al* (6%)<sup>14</sup> and Balachander *et al* (5%)<sup>16</sup>. In all the studies including the present study, Coracobrachialis was supplied by lateral cord of Brachial plexus or Median nerve; Biceps brachii and Brachialis were supplied by lateral root of Median nerve or trunk of Median nerve. Lateral cutaneous nerve was always given off by Median Nerve.

## CONCLUSION

The knowledge of communications between Musculocutaneous nerve and Median nerve is essential for Neurologists, Orthopaedicians and Traumatologists in the assessment and exploration of nerves in peripheral nerve injuries. This also helps in the interpretation of unexplained clinical symptoms in nerve compressions and prevents unnecessary carpal tunnel release in Musculocutaneous nerve entrapment. Surgeons should be aware of the rare innervation of the flexor muscles by Median Nerve while exploring the axilla and anterior compartment of arm.

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