

# A Cadaveric Study on the Anatomic Variations of the Musculocutaneous Nerve in the Infraclavicular Part of the Brachial Plexus

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## ABSTRACT

**Background and Objectives:** The musculocutaneous nerve arises from the lateral cord of the brachial plexus, passes inferolaterally and then pierces through the coracobrachialis after supplying it, descends between the biceps and the brachialis, sending branches to both and continues as the lateral cutaneous nerve of the forearm. Variations in the origin, course, branching pattern, termination and the connections of the musculocutaneous nerve are not uncommon. These variations have clinical significance during surgical procedures, in the brachial plexus block and in diagnostic clinical neurophysiology.

**Methods:** A detailed study was carried out on 50 upper limbs by using 25 embalmed cadavers. Dissection of the infraclavicular

part of the brachial plexus was done. The variations in the origin, number and course, and their correlations to the coracobrachialis were noted.

**Results:** Absence of the musculocutaneous nerve was noted in 6% of the limbs. The nerve was found to not pierce the coracobrachialis in 6% of the limbs. In 2% of the limbs, the nerve was found to rejoin the median nerve after piercing the coracobrachialis.

**Interpretation and Conclusion:** The observations show that the musculocutaneous nerve has significant variations and that these variations have clinical significance in post traumatic evaluations and in the exploratory innervations of the arm for peripheral nerve repair.

**Key Words:** Brachial plexus, Musculocutaneous nerve, Coracobrachialis, Absence, Median nerve

## INTRODUCTION

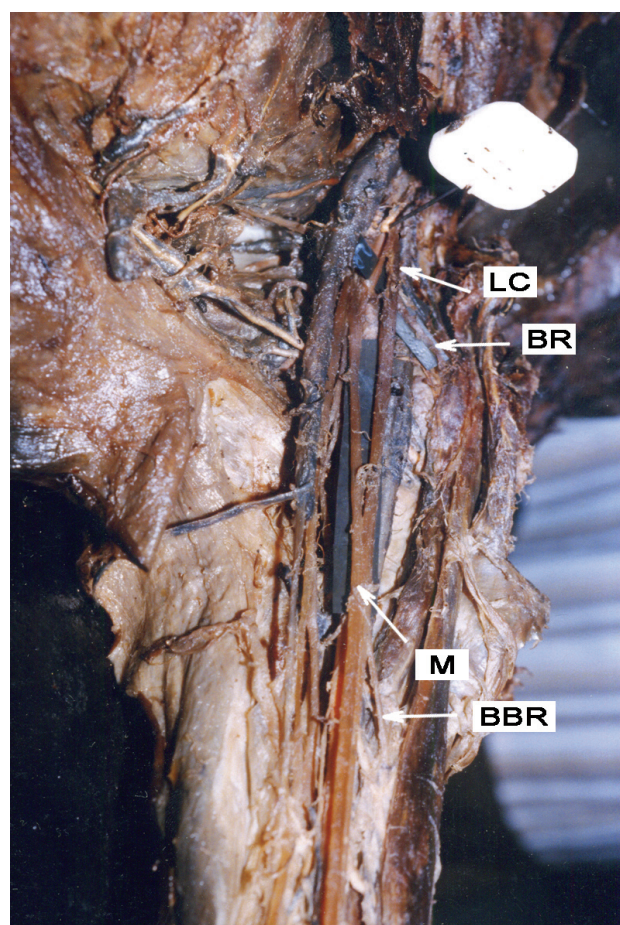
Variations in the formation of the brachial plexus and its terminal branches in the upper extremity are not uncommon and have been reported in the literature [1, 2]. Buch Hansen [3] reported these variations in 65.3% of the population. Variations of the musculocutaneous nerve and its branches have been previously reported [4, 5]. The musculocutaneous nerve was found to be absent, by Prasada Rao [6]. The reported variations of the musculocutaneous nerve also include the nerve not piercing the coracobrachialis [7]. The complete absence of the musculocutaneous nerve and the assumption of its innervation by the median nerve are uncommon [8]. Such variations may be present clinically or may be observed during surgery. Since there is a high incidence of variations, they are important for neurologists, orthopaedicians and traumatologists. So, a detailed study was done to observe the variations of the musculocutaneous nerve in the arm and axilla.

## MATERIALS AND METHODS

Fifty limbs (RT: 25; Lt: 25) from 25 embalmed cadavers were utilized during the study period of three years. The pectoral region, the axilla and the arm were dissected. The cords and the branches of the cords of the infraclavicular part of the brachial plexus were dissected. The variations of the musculocutaneous nerve were noted. The origin and number of the musculocutaneous nerve and the correlation of the musculocutaneous nerve to the coracobrachialis were noted.

## OBSERVATION

The musculocutaneous nerve was found to be absent in 3 limbs. In one case, the nerve was found to be absent in the left upper limb

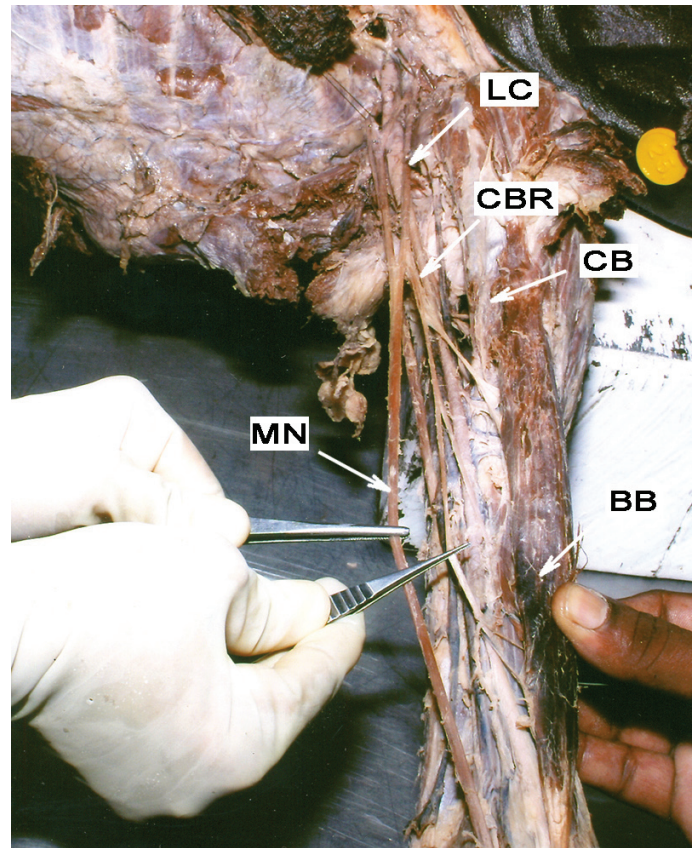


**[Table/Fig-1]:** Absence of Musculocutaneous nerve

LC: Lateral cord; BR: Branch to Coracobrachialis; BBR; Branch to biceps brachii; M: median nerve.

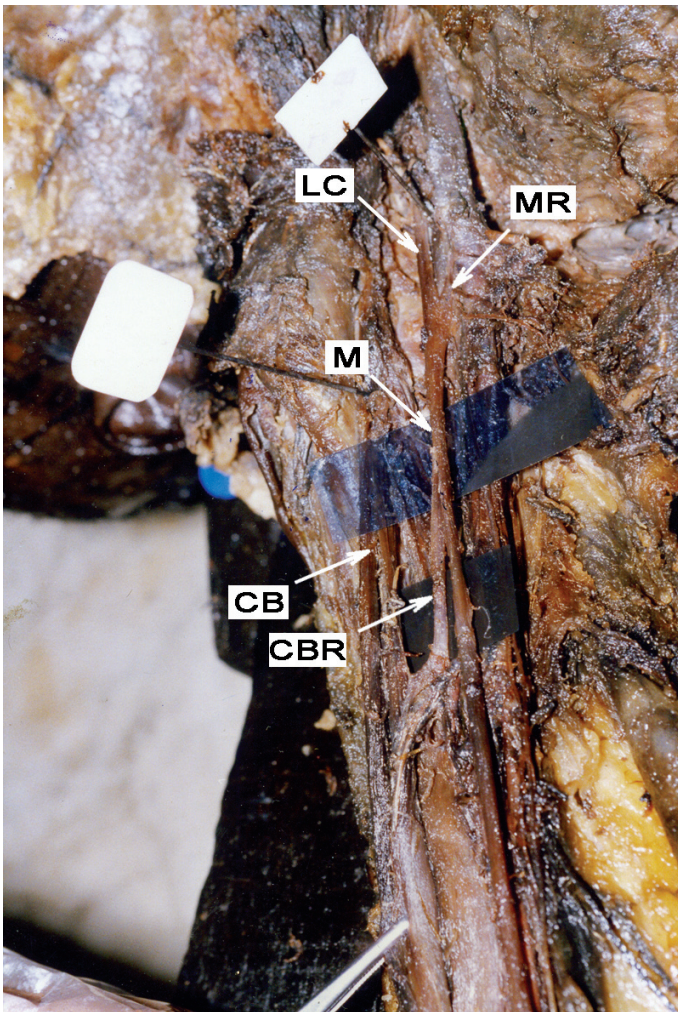


[Table/Fig-1]. The lateral root of the median nerve from the lateral cord was small and the lateral cord continued to run down for 4 cm in the axilla and fused with the median nerve just before the insertion of the coracobrachialis. The nerve to the coracobrachialis was arising from the lateral aspect of the lateral cord and the muscular branches to the biceps and the brachialis were arising from the median nerve after the fusion of the lateral cord with the median nerve. In the second case [Table/Fig-2], the nerve was found to be absent in the right sided axilla. In this case, the lateral cord continued as the lateral root of the median nerve to join with the medial root of the median nerve to form the median nerve. A common branch arose from the median nerve, just before the insertion of the coracobrachialis and ran down for about 3 cm. The muscular branches to the muscles of the anterior compartment of the arm arose from that common branch. In the third case [Table/Fig-3], the nerve was found to be absent in the left sided axilla. In this case, the lateral cord, after giving of the lateral root of the median nerve, ran for 3 cm and joined with the median nerve. The muscular branches to the anterior compartment of the arm were given off by a common branch which was arising from the lateral aspect of the lateral cord, at the level of the fusion of the lateral cord with the median nerve and the common branch continued as the lateral cutaneous nerve of the forearm, after giving of the muscular branches. The musculocutaneous nerve was found to not pierce the coracobrachialis in 3 limbs [Table/Fig-4]. The musculocutaneous nerve, after piercing the coracobrachialis, was found to rejoin the median nerve in the middle of the arm in one left upper limb [Table/Fig-5].



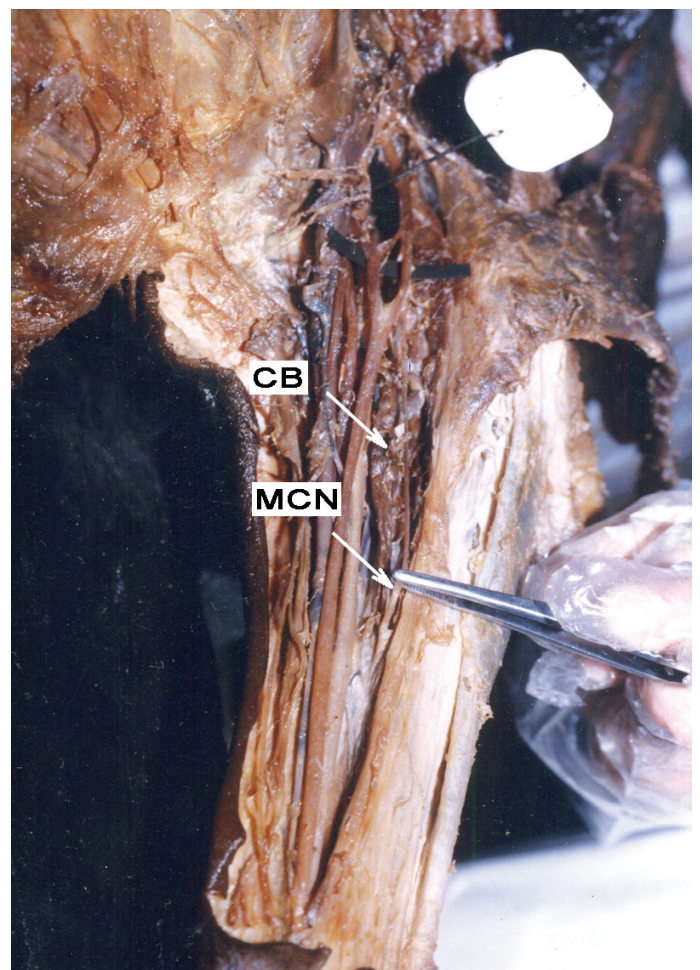
**[Table/Fig-3]:** Absence of Musculocutaneous nerve.

LC: Lateral cord; CBR: Common branch; CB: Coracobrachialis; BB: Biceps brachii; MN: Median nerve.



**[Table/Fig-2]:** Absence of Musculocutaneous nerve.

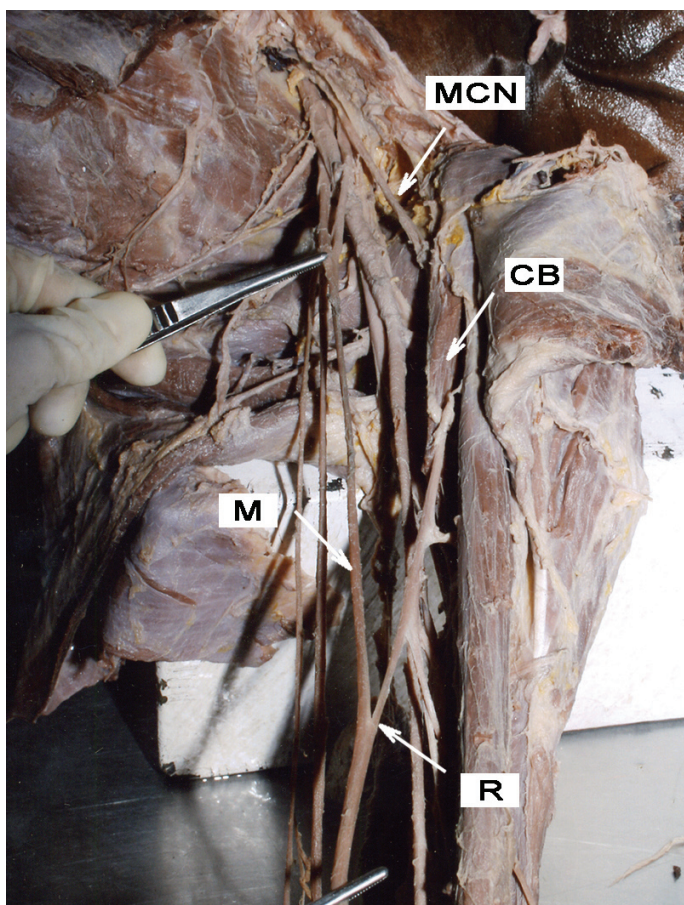
LC: Lateral cord; M: median nerve; MR: Medial root of median nerve; CBR: Common branch; CB: Coracobrachialis.



**[Table/Fig-4]:** Musculocutaneous nerve not piercing Coracobrachialis.

CB: Coracobrachialis; MCN: Musculocutaneous nerve.





**[Table/Fig-5]:** Musculocutaneous nerve rejoining median nerve after piercing Coracobrachialis.

MCN: Musculocutaneous nerve; CB: Coracobrachialis; M: Median nerve; R: Musculocutaneous nerve rejoining median nerve.

## DISCUSSION

The musculocutaneous nerve (C4–C6), a mixed peripheral nerve, arising from the lateral cord of the brachial plexus in the axilla, usually innervates the muscles of the anterior compartment of the arm and then continues as the lateral cutaneous nerve of the forearm [9]. Prasada Rao [6] reported two cases of absent musculocutaneous nerve from the lateral cord of the brachial plexus. In the present study, the absence of the musculocutaneous nerve was observed in 3 specimens. Ihunwo et al [8] reported a case of the bilateral absence of the musculocutaneous nerve from the lateral cord of the brachial plexus, with four branches arising from the lateral side of the median nerve. This report was in discrepancy with that of the present study, where there was only the unilateral absence of the musculocutaneous nerve in 3 cases.

Nakatani et al [10] and Le Minor [11] observed the absence of the musculocutaneous nerve from the lateral cord of the brachial plexus and the branches from the lateral cord directly supplied the anterior compartment muscles of the upper arm. They also observed the formation of the median nerve by the union of the lateral root with the medial root in the upper arm and the lateral root was in fact, a continuation of the lateral cord after giving off the muscular branches. In the cases which are reported here, there was also the absence of the musculocutaneous nerve in 3 limbs, but the median nerve was formed in the axilla and not in the upper arm and in one case [Table/Fig-2], the lateral root of the median nerve was a direct continuation of the lateral cord. In two cases [Table/Fig-1 and 3], after giving off the lateral root of the median nerve, the lateral cord continued to run for a short distance in the axilla and joined the median nerve. Nakatani et al [10] and Le Minor [11]

observed the musculocutaneous nerve to be absent on the left side, which coincides with the findings from two cases [Table/Fig-1 and 3] in the present study, where the nerve was found to be absent on the left side. The complete absence of the musculocutaneous nerve and a complete take over of the innervation of the coracobrachialis, the biceps and the brachialis muscles by the median nerve is an unusual variation of the brachial plexus [5, 12,13]. Nayak [14] reported that in one limb, the musculocutaneous nerve had a low origin and that the nerve was found to not pierce the coracobrachialis. In the present study, the musculocutaneous nerve was found to be absent completely in 3 limbs, but the nerve was found to not pierce the coracobrachialis in 3 specimens [Table/Fig-4]. In some cases, instead of the whole trunk of the nerve piercing the coracobrachialis, only its muscular branch or only its cutaneous branch was found to pierce the muscle. Instead of penetrating the coracobrachialis, the nerve may pass behind it or between it and the short head of the biceps muscle. Occasionally, the nerve perforates not only the coracobrachialis, but also the brachialis or the short head of the biceps muscle [4]. These variations were not observed in the present study. Chitra [15] observed in 2 cases, that the musculocutaneous nerve did not pierce the coracobrachialis. Leminor [11] reported in the type V of his classification, that the musculocutaneous nerve was absent and that the fibres of the musculocutaneous nerve ran within the median nerve along its course and that in this type, the musculocutaneous nerve did not pierce the coracobrachialis muscle. These reports coincide with those of the present study, where the musculocutaneous nerve was found to not pierce the coracobrachialis in 3 limbs. The musculocutaneous nerve rejoining the median nerve after piercing the coracobrachialis is a rare variation and this is rarely reported in the literature. In one specimen [Table/Fig-5], the musculocutaneous nerve was found to rejoin the median nerve after piercing the coracobrachialis and after giving off the lateral cutaneous nerve of the forearm. The musculocutaneous nerve, after piercing the coracobrachialis, rejoined the median nerve in one case which was reported by Joshi [16] and in 3.125% of the cases which were reported by Bhattarai [17]. Iwata [18] explained on the embryological basis, that the brachial plexus appeared as a single radicular cone in the upper limb, which was divided into ventral and dorsal segments. The ventral segments gave roots to the median and the ulnar nerves. The musculocutaneous nerve arose 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 dislocations and frequent arthroscopies may damage the muscle as well as the nerve [19].

## REFERENCES

- [1] Kerr AT. The brachial plexus of nerves in man, the variations in its formation and branches. *AMJ Anat* 1918; 23:285-395.
- [2] Linel EA. The distribution of nerves in the upper limb, with reference to their variabilities and their clinical significance. *Journal of Anatomy* 1921; 55: 79 -112(s)
- [3] Buch – Hansen K. Uber Varietaten des Nervus Musculocutaneus und deren Beziehungen. *Anat Anz* 1955; 102:187-203.
- [4] Bergman RA, Thompson SA, Afifi AK, Saadeh FA: Compendium of the human anatomic variation. *Urban and Schwarzenberg*, Baltimore. 1988; 138-43.
- [5] Williams PL, Bannister LH, Berry MM, Collins P, Dyson M, Dussek JE et al. Nervous system. In: *Gray's Anatomy*. 38<sup>th</sup> edition. Churchill Livingstone, Edinburgh, London 1995: 1267-72.
- [6] Prasada Rao PVV, Chaudhary SC. Absence of the musculocutaneous nerve: Two case reports. *Clin Anat* 2001; 14:31-5.

- [7] Nakatani T, Mizukami S, Tanaka S: Three cases of the musculocutaneous nerve not perforating the coracobrachialis muscle. *Acta Anat Nippon* 1997a; 72:191-4.
- [8] Ihunwo AO, Osinde SP, Mukhtar AU: Distribution of median nerve to the muscles of the anterior compartment of the arm. *Cent Afr J Med* 1997; 43:359-60.
- [9] Romanes G.J. Cunningham's Textbook of Anatomy, 12th edition. Oxford University Press, London. 1991; 774-826.
- [10] Nakatani T, Mizukami S, Tanaka S: Absence of the musculocutaneous nerve with innervation of the coracobrachialis, the biceps brachii, the brachialis and the lateral border of the forearm by the branches from the lateral cord of the brachial plexus. *J Anat* 1997b; 191:459-60.
- [11] Le Minor JM. A rare variation of the median and the musculocutaneous nerves in man. *Archives Anatomy Histology Embryology* 1990; 73:33-42.
- [12] McMinn RMH, editor. Last's Anatomy: Regional and Applied. London, Churchill Livingstone, 9th edition. 1994; 78-80.
- [13] Moore KL. Clinically oriented anatomy. Baltimore, Williams and Wilkins. 3rd edition. 1992; 513-16.
- [14] Nayak S, Samuel VP, Somayaji N: Concurrent variations of the median nerve, the musculocutaneous nerve and the biceps brachii muscle. *Neuroanatomy* 2006; 5:30-2.
- [15] Chitra R. Multiple bilateral neuroanatomical variations of the nerves of the arm. *Neuroanatomy* 2007; 6:43-5.
- [16] Joshi SD, Joshi SS, Athavale SA: Hitch -hiking fibres of the lateral cord of the brachial plexus in search of their destination. *J. Anat. Soc. India* 2008; 57: 26-9.
- [17] Bhattarai C, Poudel PP: Unusual variations in the musculocutaneous nerves. *Katmandu University Medical Journal* 2009; Vol. 7, No.4, 28:408-10.
- [18] Iwata H. Studies on the development of the brachial plexus in Japanese embryos. *Rep Dept Anat Mie Prefect univ Sch Med* 1960; 13:129-44.
- [19] Flatow EL, Bigliani LU, April EW: An anatomic study of the musculocutaneous nerve and its relationship with the coracoid process. *Clin Orthop Relat Res* 1989; 244:166-71.

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