COMMUNICATION PATTERN BETWEEN MUSCULOCUTANEOUS AND MEDIAN NERVE IN ARM: A CADAVERIC STUDY

Allin Pradhan, Chhiring Palmu Lama, Shaligram Dhungel

Department of Human Anatomy, Nepal Medical College Teaching Hospital, Attarkhel, Gokarneshwor-8, Kathmandu, Nepal

ABSTRACT

The brachial plexus is a major nerve network that supplies upper limb. Musculocutaneous nerve (MCN) and median nerve (MN) are two of the branches of cords of brachial plexus which may communicate resulting in the most common variation of the plexus. Recognition and knowledge of such possible anatomical variation will be helpful in the field of neurology, anesthesia and surgery. This study aims to determine the incidence of communication pattern between MCN and MN. Formalin fixed, 50 cadaveric upper limbs of both sides available in the Department of Anatomy were dissected over a period of one year from August 2024 – July 2025. The brachial plexus, MCN and MN were exposed carefully. If Communication was present between MCN and MN, it was classified with reference to Le Minor classification. Variation that does not relate with Le Minor classification was presented as other pattern. The communication between MCN and MN were found in 13 upper limbs (26.0%) and in remaining 37 upper limbs (74.0%) it was absent. Regarding classification of the communication patterns, distribution were found to be; Type I in 37 (74.0%), Type II in 8 (16.0%), Type V in two (4.0%) and other types in three (6.0%) upper limbs (Le Minor classification). MCN communicates with MN after piercing through the coracobrachialis muscle in eight of the upper limbs (Type II). While in two specimen, the communication was present before piercing the coracobrachialis muscle, grouped as other type. MCN was completely absent in two of the upper limbs (Type V).

KEYWORDS

Brachial plexus, musculocutaneous nerve, median nerve

CORRESPONDING AUTHOR

Dr. Allin Pradhan
Associate Professor
Department of Human Anatomy,
Nepal Medical College Teaching Hospital,
Attarkhel, Gokarneshwor-8, Kathmandu, Nepal
Email: meallinsh@gmail.com
Orcid No: https://orcid.org/0000-0001-5729-8811
DOI: https://doi.org/10.3126/nmcj.v27i4.88100

***Received on**: May 4, 2025*
***Accepted for publication**: September 04, 2025*

Cite this paper as: Pradhan A, Lama CP, Dhungel S. Communication pattern between musculocutaneous and median nerve in arm: a cadaveric study. *Nepal Med Coll J* 2025; 27: 257-62.

INTRODUCTION

The brachial plexus is a major nerve network that supplies upper limb which begins at neck and extend into axilla.[1] It is a union of the ventral rami of the lower four cervical nerves (C5-C8) and the greater part of the first thoracic (T1) ventral ramus. The most common arrangement of the brachial plexus is as follows: the fifth and sixth cervical rami unite as the upper trunk; the seventh becomes the middle trunk; the eighth cervical and first thoracic rami join as the lower trunk. Each of the three trunks bifurcates into anterior and posterior divisions. The anterior divisions of the upper and middle trunks form a lateral cord, anterior division of the lower trunk descends as the medial cord, and posterior divisions of all three trunks form the posterior cord.[2] Branches from roots, trunks, divisions and cords of brachial plexus innervate the structures of upper limb.

Musculocutaneous nerve (MCN) is the terminal branch of lateral cord, receiving fibres from C5-C7. It exits axilla by piercing coracobrachialis and then descends between biceps brachii and brachialis. After supplying both of the muscles, it continues as lateral cutaneous nerve of forearm. Its area of innervation is, all the muscles of anterior compartment of arm and skin of lateral aspect of forearm.[1]

Median nerve (MN) has two roots; lateral root nerve is the direct continuation of the lateral cord (C5-C7) and medial root arises from the medial cord (C8-T1) of the brachial plexus. These two roots join to form the median nerve trunk, and this passes downward on the lateral side of the third part of axillary artery.[3] It descends through arm adjacent to brachial artery, with nerve gradually crossing anterior to artery to lie medial to artery in cubital fossa. The median nerve gives off no branches in the axilla while it innervates all the muscles of anterior compartment of forearm except for flexor carpi ulnaris and ulnar half of flexor digitorum profundus. It also innervates five intrinsic muscles in thenar half of palm and palmar skin.

The course of the brachial plexus, its relations with surrounding structures and unique primary and secondary divisions result in its wide range of anatomical variations. Most of these variations were detected during anatomical dissections and studies. It has been found that 53.0% of studied brachial plexuses contained variations. The communication between musculocutaneous and median nerves is the most common variation of infraclavicular part of brachial plexus.[4] Such communications have been noted in the literature for well over a century, and numerous studies have attempted to quantify their rate of incidence and classify their different patterns. Most communications occur close to the brachial plexus in the proximal arm; communications distal to the musculocutaneous nerve perforation of the coracobrachialis have been reported with less frequency, and several rare and unique communication patterns have been reported as case studies. According to Le Minor[5] (1990), the variations of the musculocutaneous and median nerve may be classified in five types based on the positional relationship between musculocutaneous nerve and coracobrachialis muscle.

Type I (Normal): There are no communicating rami between musculocutaneous nerve and

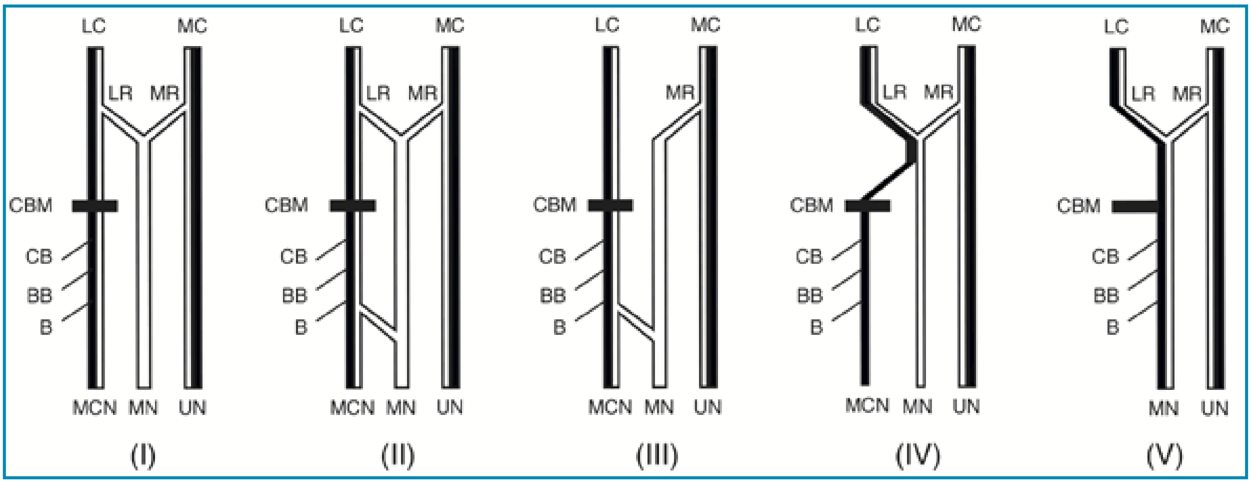

Fig. 1: Classification of variations of the median nerve and the musculocutaneous nerve according to Le Minor (1990). CBM: position of the coracobrachialis muscle; CB: coracobrachialis ramus (nerve); BB: biceps brachii ramus (nerve); B: brachialis ramus (nerve) ; LR: lateral root forming the median nerve; MR: medial root of the median nerve; LC: lateral cord; MC: medial cord; MCN: musculocutaneous nerve; MN: median nerve; UN: ulnar nerve.[6]

median nerve. The musculocutaneous nerve pierces the coracobrachialis muscle and innervates the coracobrachialis, the biceps brachii, and the brachialis muscle.

Type II: This pattern is similar to the normal but an extra ramus connects the musculocutaneous nerve and the median nerve while it gives the branch for the brachialis muscle.

Type III: Fibers from the lateral root follow the musculocutaneous nerve distally and leave it to unite with the medial head of the median nerve only after the musculocutaneous nerve innervates coracobrachialis, biceps brachii and brachialis muscles.

Type IV: The musculocutaneous nerve arises from the median nerve as a proper and independent nerve after the origin of the median nerve.

Type V: The musculocutaneous nerve is absent. The fibers of the musculocutaneous nerve run into the median nerve along its course. All the brachial flexors are innervated by median nerve rami.

The brachial plexus has been reported to show different variations with its formation, course, branches and distribution patterns. One of the more commonly reported variations is communication between musculocutaneous and median nerves. Considering clinical importance, recognition and knowledge of such possible anatomical variation will be helpful in the field of neurology, anesthesia and surgery. Awareness and effective classification of MCN nerve variations is of clinical importance both in terms of diagnosis of peripheral nerve pathology and for surgical interventions. Therefore, the aim of this study is to demonstrate anatomical variation of musculocutaneous nerve, median nerve and pattern of communication whenever present between two.

MATERIALS AND METHODS

This observational, descriptive and cross-sectional study was carried out in Department of Human Anatomy of Nepal Medical College (NMC), Kathmandu over a period of one year from August 2024 – July 2025, after obtaining ethical approval from the Institutional Review Committee (IRC) of NMC. Formalin fixed, 50 cadaveric upper limbs of both sides available in the department, as well as upper limbs dissected during routine dissection classes of first year medical undergraduates were included in the study.

A straight incision was made in the anterior compartment of the arm following the anterior midline, beginning in the supraclavicular region, and ending in the apex of cubital fossa. Two flaps including the skin and subcutaneous tissue were reflected laterally. The same was done in relation to the arm fascia, thereby exposing the whole musculature. The brachial plexus was dissected carefully from proximal to distal, with special concern to the exposure and topographic localization of the musculocutaneous nerve and median nerve regarding the variations of its origin (formation manner), course, and branching pattern. If Communication was present between MCN and MN, it was classified with reference to Le Minor classification. Variation that does not relate with Le Minor[5] classification were presented as other pattern. The anomalous connections were observed and later documented by digital camera. All collected data were analyzed statistically by using SPSS-16. Frequency and percentage of the variations in communication pattern of nerves were calculated.

RESULTS

Fifty cadaveric upper limbs were studied for the incidence and pattern of communication

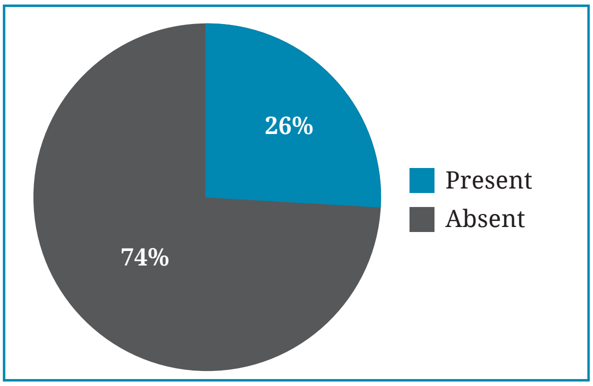

Fig. 2: Incidence of communication between MCN and MN

between MCN and MN. The communication was found in 13 upper limbs (26.0%) and in remaining 37 (74.0%) upper limbs; communication between MCN and MN was absent (Fig. 2).

Regarding classification of the communication patterns according to of Le Minor[5] classification distribution were found to be; Type I in 37 (74.0%) upper limbs, Type II in 8 (16.0%), none of the specimen had type II and IV pattern, Type V in two (4.0%) upper limbs and other types were found in three (6.0%) upper limbs (Fig. 3).

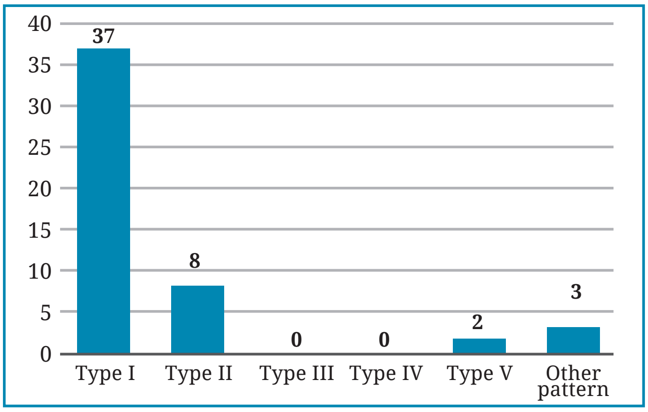

Fig. 3: Frequency of communication pattern according to Le Minor[5] classification

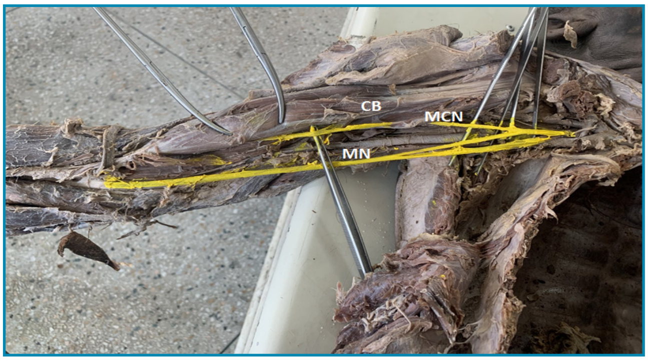

Fig. 4: Type I (Normal): no communicating rami between MCN and MN

There were no communicating rami between MCN and MN in 37 out of 50 upper limbs as seen in Fig. 4. The musculocutaneous nerve pierces the coracobrachialis (CB) muscle and innervates it along with, the biceps brachii, and the brachialis muscle.

Fig. 5: Type II: MCN and MN communicates while innervating brachialis muscle

The next pattern found in eight upper limbs was Type II where communicating rami was present between MCN and MN, after MCN pierces and innervates coracobrachialis muscle and then course to innervate brachialis muscle as seen in Fig. 5.

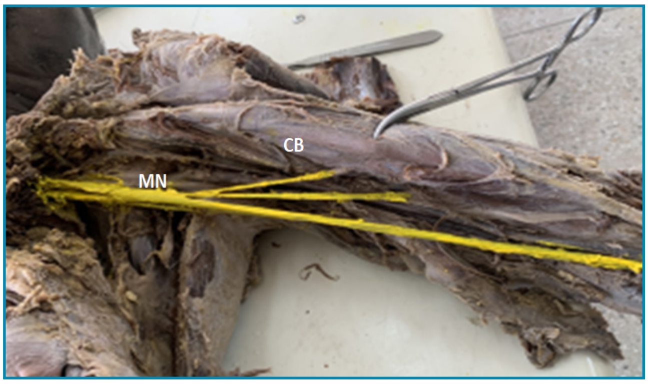

Fig. 6: Type V: MCN absent

In two upper limbs specimens, MCN was completely absent. MN after union of its medial and lateral root give rises to one branch which then innervates all the muscle of anterior compartment of arm as in Fig. 6.

Out of 50 specimens, three upper limbs had a nerve communication between MCN and MN which was different than the one classified by Le Minor[5]. In the present study, the communication patter which does not fits into any of the categories of Le Minor[5] classification has been grouped as other type. Out of three such upper limbs, two specimen had an extra ramus which connects the two nerves before the MCN pierces coracobrachialis muscle and were grouped as "Other Type –I" (Fig. 7).

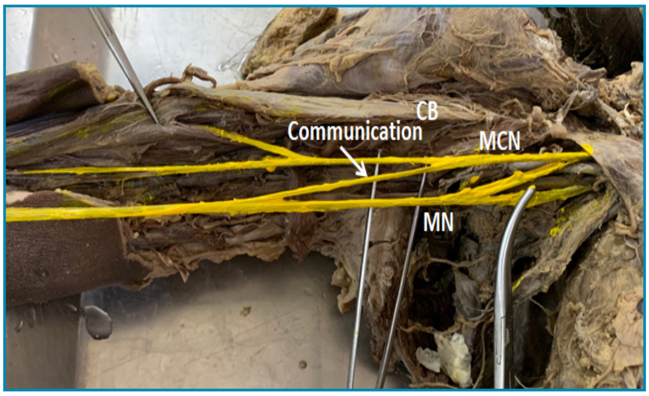

Fig. 7: Other Type - I

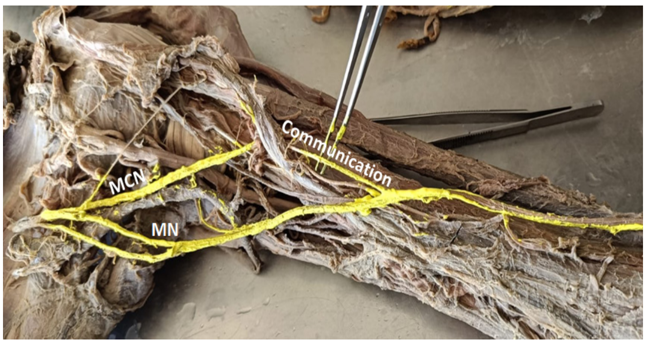

Fig. 8: Other Type - II

One of the specimens had a very unique communication pattern where the MCN originates and innervates the muscles of anterior compartment of arm normally but afterward it was united with MN so grouped as "Other Type –II" (Fig. 8).

DISCUSSION

The present study was conducted to determine incidence of communication between two important branches of brachial plexus; MCN and MN, and classification of its communication pattern. The communication was found in 13 upper limbs (26.0%) and in remaining 37 (74.0%) upper limbs, communication between MCN and MN were absent. Similar study was conducted by Choi *et al*[7] in British population with presence of communication in 26.4%, Pacha *et al*[8] in 28.3% of Spanish population and Kervancioglu *et al*[9] in 25.0% of Turkish population. In contrast to this study, authors observed slightly lower incidence of 5.0% in Egyptian population by Beheiry *et al*,[10] 9.1% of Indian population by Krishnamurthy *et al*,[11] 6.3% of Nepalese population by Bhattarai *et al.*[12] The variability in incidence of nerve communication reported by diverse authors (Table 1) might be due to the difference in sample size of the studies and the methodology used during the dissection procedure.

In this study MCN was completely absent in two of the specimen similar to a study conducted by Shin *et al*[19] and Raza *et al*[20] who also reported a case with absent MCN. In such case the branches of the median nerve supplied the coracobrachialis, biceps brachii and brachialis muscles.

MCN communicates with MN after piercing through the coracobrachialis muscle in eight of the upper limbs which had been classified as Type II according to Le Minor.[5] While in two specimen, the communication was present before piercing the coracobrachialis muscle which does not perfectly come under any of the classifications proposed by Le Minor[5] so it had been grouped as other type.

One very unique pattern was noted in this study where the MCN pierces the coracobrachialis muscle and innervates the flexor muscles of arm and then after it unites with median nerve at mid-arm. Such unique pattern was also noted by Gelmi *et al*[21] in a case study where MCN joined the median nerve only at the level of the cubital fossa. Similarly, Hussain *et al*[22] described a case of a communicating branch between the MCN and MN, distal to the origin of the brachialis muscle. Sachdeva *et al*[23] also mentioned such variation where MCN after its origin from lateral cord gave a branch to corachobrachialis muscle and then fused completely with MN.

The incidence of communication present between MCN and MN was 26.0% with the most common type of communication in an order of type II (16.0%), other type (6.0%) and type V (4.0%). MCN communicates with MN after piercing through the coracobrachialis muscle in eight of the upper limbs (Type II). While in two specimen, the communication was present before piercing the coracobrachialis muscle which does not perfectly come under any of

Table 1: Incidence of MCN-MN communication in diverse population

Authors, years	Population	Sample size	Incidence (%)
Choi *et al.*, 2002[7]	British	276	26.4
Beheiry. 2004[10]	Egyptian	60	5.0
Loukas *et al.*, 2005[13]	American	258	46.1
Pacha *et al.*, 2005[8]	Spanish	46	28.3
Krishnamurthy *et al.*, 2007[11]	Indian	44	9.1
Bhattarai *et al.*, 2009[12]	Nepalese	32	6.3
Guerri-Guttenberg *et al.*, 2009[14]	Argentinean	26	53.6
Maeda *et al.*, 2009[15]	Japanese	453	18.8
Uysal *et al.*, 2009[16]	Turkish	140	10.0
Budhiraja *et al.*, 2011[17]	Indian	116	20.7
Kervancioglu *et al.*, 2011[9]	Turkish	20	25.0
Ballesteros *et al*, 2014[18]	Colombian	106	17.0
Present study	Nepalese	50	26.0

the classifications proposed by Le Minor so it had been grouped as other type. MCN was completely absent in two of the upper limbs (Type V).

The anatomical knowledge of such possible variation will be helpful in the field of neurology, anesthesia and surgery. Awareness and effective classification of MCN nerve variations is of clinical importance both in terms of diagnosis of peripheral nerve pathology and for surgical interventions.

ACKNOWLEDGEMENTS

We would like to express our sincere gratitude to all the faculties and staff of Anatomy Department, Nepal medical college for their valuable support and encouragement.

Conflict of interest: None

Source of research fund: None

REFERENCES

1. Moore KL. Clinically oriented anatomy. 6th ed. Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins; 2010:1134.
2. Ellis H. Pectoral Girdle and Upper Limb. In: Standring S, editor. Gray's Anatomy: The Anatomical Basis of Clinical Practice. 39th ed. Edinburg, London: Churchchill Livingstone, 2004.
3. Snell RS. Clinical Anatomy by Regions. 8th ed. Zuidpoolsingel: Lippincott Williams & Wilkins; 2007: 944.
4. Falougy H, Selmeciova P, Kubikova E *et al.* The variable communicating branches between musculocutaneous and median nerves: a morphological study with clinical implications. *Bratisl Med J* 2013; 114: 290-94. DOI: https://doi.org/10.4149/bll_2013_061]
5. Le Minor JM. A rare variation of the median and musculocutaneous nerves in man. *Arch Anat Histol Embryol* 1990; 73: 33-42.
6. Pedrini FA, Mariani GA, Orsini E *et al.* Unilateral absence of Casserio's nerve and a communicating branch to the median nerve. An additional variant of brachial flexors motor innervation. *Ital J Anat Embryol* 2019; 124: 16-25. DOI: https://doi.org/10.13128/IJAE-25466
7. Choi D, Rodríguez-Niedenführ M, Vázquez T *et al.* Patterns of connections between the musculocutaneous and median nerves in the axilla and arm. *Clin Anat* 2002; 15: 11-7.
8. Pacha DV, Forcada PC, Carrera AB *et al.* Innervation of biceps brachii and brachialis: anatomical and surgical approach. *Clin Anat* 2005; 18: 186–94.
9. Kervancioglu P, Orhan M, Kilinc N. Patterns of motor branching of the musculocutaneous nerve in human fetuses and clinical significance. *Clin Anat* 2011; 24: 168–78.
10. Beheiry EE. Anatomical variations of the median nerve distribution and communication in the arm. *Folia Morphol* 2004; 63: 313–18.
11. Krishnamurthy A, Nayak SR., Venkatraya LP *et al.* The branching pattern and communications of the musculocutaneous nerve. *J Hand Surg Eur* 2007; 32: 560–62.
12. Bhattarai C and Poudel PP. Unusual variation in musculocutaneous nerves in Nepalese. *Kathmandu Univ Med J* 2009; 7: 408-10.
13. Loukas M and Aqueelah H. Musculocutaneous and median nerve connections within, proximal and distal to the coracobrachialis muscle. *Folia Morphol* 2005; 64: 101-08.
14. Guerri-Guttenberg RA and Ingolotti M. Classifying musculocutaneous nerve variations. *Clin Anat* 2009; 22: 671-83.
15. Maeda S, Kawai K, Koizumi M *et al.* Morphological study of the communication between the musculocutaneous and median nerves. *Anat Sci Int* 2009; 84: 34–40.
16. Uysal II, Karabulut AK, Büyükmumcu M *et al.* The course and variations of the branches of the musculocutaneous nerve in human fetuses. *Clin Anat* 2009; 22: 337–45.
17. Budhiraja V, Rastogi R, Asthana AK *et al.* Concurrent variations of median and musculocutaneous nerves and their clinical correlation--a cadaveric study. *Ital J Anat Embryol* 2011; 116: 67-72.
18. Ballesteros LE, Forero PL, Buitrago ER. Communication between the musculocutaneous and median nerves in the arm: an anatomical study and clinical implications. *Rev Bras Ortop* 2015; 50: 567-72. DOI: https://doi.org/10.1016/j.rboe.2014.08.009
19. Shin MT, Htoo PM. Pattern of musculocutaneous and median nerve communication in adult cadavers. *Anat J Afr* 2023; 12: 2519-30. DOI: https://doi.org/10.4314/aja.v12i3.9
20. Raza K, Singh S, Rani N, *et al.* Anomalous Innervation of the Median Nerve in the Arm in the Absence of the Musculocutaneous Nerve. *Sultan Qaboos Univ Med J* 2017; 17: 106-08. DOI: https://doi.org/10.18295/squmj.2016.17.01.019
21. Gelmi CA, Pedrini FA, Fermi M, *et al.* Communication between median and musculocutaneous nerve at the level of cubital fossa - a case report. *Transl Res Anat* 2018; 11: 1-4. DOI: https://doi.org/10.1016/j.tria.2018.04.001
22. Hussain NS. Cadaveric Study of Anatomic Far Distal Musculocutaneous and Median Nerve Communication. *Cureus* 2016. DOI: https://doi.org/10.7759/cureus.r7
23. Sachdeva K and Singla RK. Communication between median and musculocutaneous nerve. *J Morphol Sci* 2011; 28: 246-9.