

Accessory Branch of Median Nerve Supplying the Brachialis Muscle: A Case Report and Clinical Significance

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ABSTRACT

A very rare case of an accessory branch of the median nerve taking its origin in the region of the right arm was observed to supply the infero-medial portion of the brachialis muscle in a male cadaver. Simultaneously, the ipsilateral musculocutaneous nerve was innervating the muscles of the anterior compartment of the arm. Such an aberrant muscular branch of the median nerve for the brachialis muscle is very rarely reported in the literature. Lesion of the median nerve proximal to the branch's origin site could induce weak flexion of the elbow, whereas injury of the musculocutaneous nerve could lead to misinterpretation of symptoms. We discuss the patterns of brachialis muscle innervation as well as the clinical applications of such a variant.

Keywords: Brachialis muscle, Innervation, Median nerve

CASE REPORT

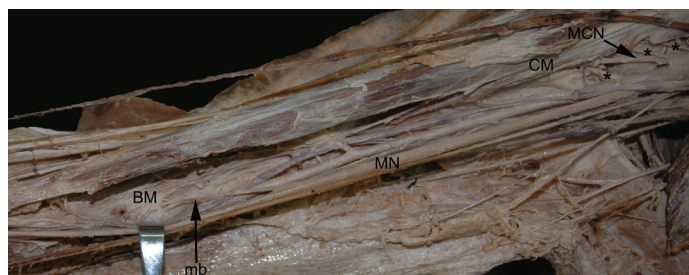
An unusual case of an accessory branch of the right median nerve distributed to the brachialis muscle (BM) was encountered during gross anatomy course for undergraduate medical students of our Faculty. The cadaver that was used for educational and research purposes was an 82-year-old male, whose cause of death was unrelated to the current study. The skin, as well the fasciae of the right axilla and arm, were meticulously incised and reflected in order to visualize the underlying muscular, vascular and neural elements. After careful dissection of the medial bicipital sulcus we observed a single branch taking its origin from the median nerve, just at the limit of its middle and inferior portion. That branch directed downwards and outwards, coursed superficial to the lateral brachial vein and after a distance of approximately 46 mm it was dividing into three rami distributed to the BM. Specifically, the aforementioned rami supplied the infero-medial portion of the BM. The ipsilateral musculocutaneous nerve was present along with three twigs that innervated the coracobrachialis muscle. The musculocutaneous nerve was found to innervate the muscles of the anterior compartment of the arm, as normally does. No branches of the radial nerve were observed distributing to the BM [Table/Fig-1]. There was no any similar variation noticed in the contralateral upper limb, whereas the innervation pattern of the ipsilateral upper limb was normal. There was no evidence of previous surgical interference on the arm and the shoulder region. Furthermore no pathologic conditions of the exposed regions were reported in the cadaver's medical history. The topographic relationship of the examined anatomic structures was documented by repeated photographs, whereas the measurements were made by a digital sliding caliper with an accuracy of 0.1 mm.

DISCUSSION

The BM is mainly a flexor of the elbow joint with the forearm either prone or supine whether or not the movement is resisted [1]. Various standard anatomical textbooks until the end of the previous century reported that the BM was innervated solely by a single nerve, the musculocutaneous nerve [2,3]. However, the last two decades many researchers have conducted scientific works focused on the BM's dual innervation from the musculocutaneous and radial nerve. In specific, it has been shown that the infero-lateral part of the BM is innervated by branch or branches of the radial nerve with a variable prevalence of 66.7 - 100 % [4-6]. The great variability as concerns the prevalence of BM's innervation by the radial nerve is attributed to the ethnic differences, the sample size and the precise dissection

technique. Such double BM's innervation is attributed to the fact that BM is the result of the fusion of two muscular primordia, the extensor or dorsal embryonic premuscular mass and the flexor or ventral embryonic premuscular mass [7].

Very rarely it is possible for the BM to be innervated by branches of the median nerve or direct branches of the lateral root of the brachial plexus in cases of musculocutaneous nerve's absence [8,9]. Such an absence of the musculocutaneous nerve has been reported with incidence ranging from 1.4 to 15% [10]. Since the musculocutaneous nerve arises as an offshoot of the median nerve during the embryologic development, any disturbance occurring in the 4th-7th week of development may lead to such variations concerning the BM's innervation [11,12]. As it is widely known the median nerve provides in the arm vascular branches to the brachial artery and usually a branch to the pronator teres, but no branch to the muscles of the anterior compartment of the arm [1]. According to Maeda et al., [13], the median nerve can supply the BM when musculocutaneous nerve is absent or when there is anastomoses with branch from the musculocutaneous nerve. Extremely rare cases in which distinct branches of the median nerve supply the inferior portion of the BM have been cited in the literature. Hur et al., [14] observed such a branch originating from the upper edge of the median nerve innervating the infero-medial portion of BM, whereas Won et al., [15] noticed the median nerve supplying the lower quarter of the BM in 15% and the BM's uppermost quarter in 5% of the specimens. Our case, that corresponds to type III according to Won's et al., classification, resembles with that of Hur et al., with the difference of branching site that was located at the limit between middle and inferior portion of the median nerve.



[Table/Fig-1]: Anterior aspect of the right arm demonstrating the muscular branch (mb) of the median nerve (MN) distributed to the infero-medial portion of the brachialis muscle (BM). The musculocutaneous nerve (MCN) is present along with three rami (*) for the coracobrachialis muscle (CM)

CONCLUSION

The awareness of such variant should be taken into consideration by surgeon during interpretation of symptoms induced by musculocutaneous or median nerve lesion after trauma in the axilla or arm. We consider that median nerve's lesion proximal to the branching point of that accessory branch could potentially cause slight reduction of the elbow flexion. The physician must be aware of unexpected symptoms in patients with thoracic outlet syndrome, whereas the surgeon of the region should take care of not to denervate the BM's medial half during anterior surgical approach of the humerus. Moreover, that unusual branching pattern of the median nerve should be kept in mind by the anesthetist performing peripheral nerve stimulation and the neurologist interpreting unusual findings in the electromyographic examination of the upper limb.

REFERENCES

- [1] Williams PL (ed). Gray's Anatomy. 38th ed. Edinburgh: Churchill Livingstone; 1995.
- [2] Moore KL, Dalley AF. Clinically oriented anatomy. 4th ed. Philadelphia: Lippincott, Williams and Wilkins; 1999.
- [3] Hall-Craggs ECB. Anatomy as a basis for clinical medicine. 3rd ed. London: Williams and Wilkins; 1995.
- [4] Ip MC, Chang KS. A study on the radial supply of the human brachialis muscle. *Anat Rec*. 1968;162:363-71.
- [5] Srimathi T, Umapathy S. A study on the radial nerve supply to the human brachialis muscle and its clinical correlation. *J Clin Diag Res*. 2011;5(5):986-89.
- [6] Blackburn SC, Wood CPJ, Evans DJR, Watt DJ. Radial nerve contribution to brachialis in the UK Caucasian population: position is predictable based on surface landmarks. *Clin Anat*. 2007;20:64-67.
- [7] Carlson BM. Human embryology and developmental biology. *St Louis: Mosby*; 1994.
- [8] Le Minor JM. A rare variant of the median and musculocutaneous nerves in man. *Arch Anat Histol Embryol*. 1990;73:33-42.
- [9] Kaur P, Kumar R, Jain A. Variations in innervation of muscles in anterior compartment of arm-a cadaveric study. *J Clin Diagn Res*. 2014;8(5):AC01-3.
- [10] Guerri-Guttenberg RA, Ingolotti M. Classifying musculocutaneous nerve variations. *Clin Anat*. 2009;22:671-83.
- [11] Prasada Rao PV, Chaudhary SC. Absence of musculocutaneous nerve: two case reports. *Clin Anat*. 2001;14:31-35.
- [12] Uzun A, Seelig L. A variation in the formation of the median nerve communicating branch between the musculocutaneous and median nerves in man. *Folia Morphol*. 2001;60:99-101.
- [13] Maeda S, Kawai K, Koizumi M, Ide J, Tokiyodhi A, Mizuta H. Morphological study on the communication between the musculocutaneous and median nerves. *Anat Sci Int*. 2009;86:34-40.
- [14] Hur MS, Woo JS, Lee KS. Median nerve branch innervating the brachialis muscle. *Korean J Phys Anthropol*. 2010;23:24.
- [15] Won SY, Cho YH, Choi YJ, Farero V, Woo HS, Chang KY, et al. Intramuscular innervation patterns of the brachialis muscle. *Clin Anat*. 2014; (doi:10.1002/ca.22387).

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