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Case Report

ANOMALOUS BRANCHES OF MEDIAN NERVE IN THE ARM

Ishita Ghosh [1], Gairik Sengupta [2], Pallab Basu *[3], Alpana De (Bose) [4].

[1] Junior Resident, Dept. of Anatomy, R. G. Kar Medical College & Hospital, Kolkata, India.
[2] Assistant Professor, Dept. of Pharmacology, College of Medicine & Sagore Dutta Hospital, Kolkata, India.
*[3] Assistant Professor, Dept. of Biochemistry, College of Medicine & Sagore Dutta Hospital, Kolkata, India.
[4] Head of the Dept., Dept. of Anatomy, R. G. Kar Medical College & Hospital, Kolkata, India.

ABSTRACT

Background: Dissection of right and left upper limbs and demonstration of the origin and the course of median nerve.
Result: Median nerve in the right upper limb is formed normally but it supplies brachialis muscle and both head of the biceps in the arm which is anomalous. In the left arm of the patient the course and supply of median nerve is normal.
Conclusion: The patient has unilateral anomalous supply of median nerve in the arm – this can result in trauma to this nerve while undergoing any surgery in right arm.
KEY WORDS: Median nerve, Brachialis muscle, Both head of the biceps brachii, Pronator teres.

Address for Correspondence: Dr. Pallab Basu, 53, Rishi Arabinda Sarani, Kolkata – 700090, India. Phone: +919433232481. **E-Mail:** basu_pallab@yahoo.co.in

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BACKGROUND

Brachial Plexus innervates the upper limb. As it is the point of formation of many nerves, variations are common. The presence of anatomical variations of the peripheral nervous system is often used to explain unexpected clinical signs and symptoms. Median nerve is normally formed by the union of medial and lateral root arising from the medial and the lateral cords of the brachial plexus respectively. However, variations in the formation, its relation with the axillary vessels, its course and its supply to different muscles are not uncommon. Anomalies in the formation, course and the branches of the median nerve are of interest to anatomists, radiologists, and surgeons. Knowledge of these variations are not only useful for the surgeons during surgery as these variations may be vulnerable to damage in surgical operations [1], but also their knowledge helps in the interpretation of a nervous compression having unexplained clinical symptoms.

CASE REPORT

During routine dissection of a 50 years old male cadaver, few anomalies of median nerve were encountered. Dissection of right upper limb of the cadaver shows that origin of the median nerve was normal. In the arm median nerve supplied brachialis muscle and both heads of the biceps brachii muscle which was anomalous. Again in the cubital fossa it supplied pronator

teres muscle normally. Dissection of the left upper limb of the cadaver shows no anomaly – origin to entire course is normal. So this is an asymmetric anomaly.

Fig. 1: Window dissection of the right arm. It highlights nerve to biceps brachii from median nerve (anomalous) and absence of usual brances from musculocutaneous nerve.

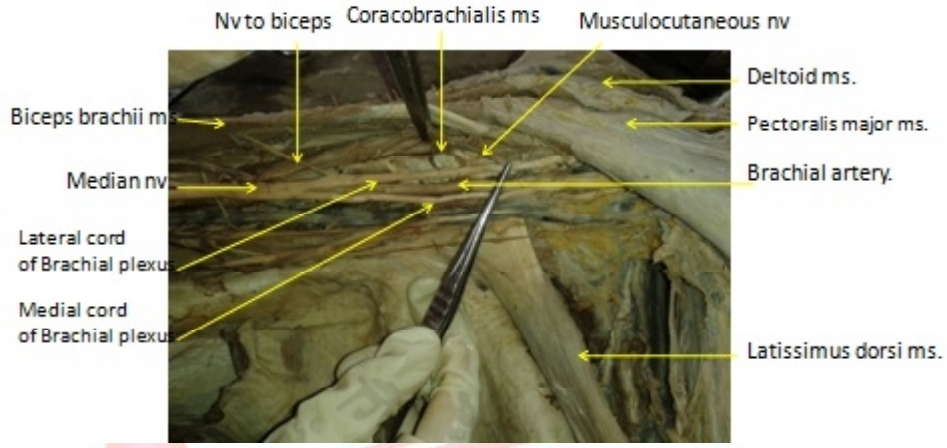

Fig. 2: Window showing branch of median nerve supplying brachialis muscle (anomalous).

Fig. 3: Window showing nerve to pronator teres muscle from median nerve (normal).

DISCUSSION

a) NORMAL ANATOMY: The brachial plexus is consisting of roots, trunks, divisions and cords. Roots are constituted by the anterior primary rami of spinal nerves C_{5-8} and T_1 with Contributions from anterior primary rami of C_4 and T_2. The origin may shift upward with contribution of C_4 and in that case the contribution of T_2 is absent. Or the trunk may shift downward as contribution of C_4 is absent but contributed by T_2. The upper trunk is consisting of roots C_5 and C_6 joined together. Root C_7 forms the middle trunk and roots C_8 and T_1 join to form the lower trunk. Each trunk is further divided into ventral and dorsal divisions. The divisions join to form cords. The lateral cord is formed by ventral divisions of upper and middle trunks, ventral division of lower trunk forms medial cord and the posterior cord is formed by the union of dorsal division of all three trunks. Branches of the lateral cord are: Lateral pectoral (C_{5-7}), Musculocutaneous (C_{5-7}), Lateral root of the median nerve (C_{5-7}). Branches of the medial cord are: Medial pectoral (C_8, T_1), Medial cutaneous nerve of arm (C_8, T_1), Medial cutaneous nerve of forearm (C_8, T_1), Ulnar nerve (C_7, C_8, T_1), Medial root of the median nerve (C_8, T_1). After origin median nerve embraces the 3rd part of axillary artery – uniting anterior or lateral to it. The median nerve enters the arm at first lateral to the brachial artery; near the insertion of coracobrachialis it crosses in front of the artery, descending medial to it to the cubital fossa where it is posterior to the bicipital aponeurosis and anterior to brachialis. It usually enters the forearm between the heads of

pronator teres, crossing to the lateral side of ulnar artery and is separated from it by deep head of pronator teres [2]. It gives vascular branch to brachial artery and muscular branch to pronator teres[3, 4]. Variations in the formation and course of median nerve were also reported earlier by some workers. Most of the variations reported were related to the anomalous relationship between median and musculocutaneous nerves. Some authors reported that the lateral root of brachial plexus was small and the musculocutaneous nerve was connected with median nerve in the arm [5]. Two other workers documented that musculocutaneous nerve failed to separate from the median nerve. Thus median nerve gave off the branches to coracobrachialis, biceps brachii and brachialis, which should arise from musculocutaneous nerve [6]. Another case documented is the supply of the anterior compartment muscles of the upper arm including brachialis by the median nerve in the absence of the musculocutaneous nerve [7]. Workers also described supply of a branch from the median nerve to the brachialis muscle which later continued as the lateral cutaneous nerve of the forearm.[8]. Another worker reported that in 1.7% cases where musculocutaneous nerve is absent, median nerve gave muscular branches to the brachialis and to both heads of the biceps brachii muscle [9]. In our case we found that though musculocutaneous nerve is present, median nerve is supplying brachialis and both head of biceps brachii muscles in the arm which should be supplied by the musculocutaneous nerve instead.

b) DEVELOPMENTAL ANATOMY: The upper limb buds are located opposite the lower 5 cranial and upper 2 thoracic segment. Just after the buds form, the ventral 1 rami of the spinal nerves penetrate into the mesenchyme of limb bud; they establish intimate contact with the differentiating mesodermal condensations. An early contact between nerve and muscle cells is an essential factor for their complete functional differentiation [10]. The growth and the approach of nerve fibres towards the target is dependent upon concentration gradient of some cell surface receptors in the environment [11]. Some signaling molecules and transcription factors are identified which induce the differentiation of ventral and dorsal motor horn cells. Wrong expression of any of these signaling molecules can end up with anomalies in the formation and distribution of a particular nerve fibre. In human being, the forelimb muscles develop from the mesenchyme of paraxial mesoderm in the fifth week in utero. The local expression of five Hox D genes result in upper limb development [12]. The highly coordinated site specific expression of chemoattractants and chemorepulsant guide and regulate the developing axons.Two principal theories are there regarding the directional growth of nerve fibres. One is the principle of contact guidance of Weiss [13] and the other is the neurotropism-chemotropism hypothesis of Ramon et al [14]. Adhesion to the structures with which the growth cone contacts play an important role. Some tropic substances such as the brain-derived neurotropic growth factor, neutrin-1, neutrin-2, Some cell surface receptors (such as, neuronal cell adhesion molecule), L1 and the Cadherins act as transcription factors which recognize and bind to the ECM (extracellular matrix). Thus axonal path finding may involve cell-cell and cell-matrix interactions [11, 15]. The salient feature of chemotropism is that axonal growth cones act as sensors to concentration gradient, towards the target. Contact guidance mechanism and neurotropism run hand in hand. Excess or low expressions of one or more aforesaid transcription factors are responsible for the variation in the formation, relation and distribution of motor nerve fibres [11].

CONCLUSION

The anomalous branches of median nerve in the arm bear remarkable clinical significance. Some workers suggested that the clinicians and surgeons should be cautious of such variations while performing surgical procedure in this region [16]. When Injury occurs to such a variant nerve in the proximal arm, there may be sensory, motor, vasomotor and trophic changes in the distal area to the injury [17]. These variations have also clinical importance when a surgeon is approaching for operating on an entrapment syndromes in the arm [18]. Hence this study will enrich the knowledge of surgeons about the possible anomalous branches of

median nerve in the arm and in light of that they will remain cautious while operating on that area.

ABBREVIATIONS:

C = Cervical vertebrae,

T = Thoracic vertebrae,

ECM = Extra-cellular matrix.

Conflicts of Interests: None

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