

Case Report



Formation of median nerve without the medial root of medial cord and associated variations of the brachial plexus

Published online February 23rd, 2010 © <http://www.ijav.org>Sharmila BHANU P ⁺

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Received July 28th, 2009; accepted January 20th, 2010

ABSTRACT

The anatomical variations in the formation, course and termination of brachial plexus are well documented and have clinical significance to surgeons, neurologists and anatomists. The present case report describes the unusual origin of median nerve, arising directly from the lateral cord without the union of lateral and medial roots of brachial plexus. A communicating branch existed between the ulnar nerve and anterior division of middle trunk. The lateral pectoral nerve was arising from anterior divisions of upper and middle trunks as two separate branches instead from lateral cord. The branches then joined together to form the lateral pectoral nerve. The medial cord instead of its five terminal branches, had only three branches, the ulnar nerve, medial pectoral nerve and a single trunk for the medial cutaneous nerve of arm and forearm which got separated at the middle of the arm. The variations of the lateral cord and its branches make it a complicated clinical and surgical approach which is discussed with the developmental background. © IJAV. 2010; 3: 27–29.

Key words [median nerve] [brachial plexus] [variations] [medial cord of brachial plexus]**Introduction**

Brachial plexus is an intricate group of nerves formed normally by the union of the ventral rami of the distal four cervical nerves (C5-8) and first thoracic nerve (T1). These rami unite, divide and reunite to form the trunks, divisions, cords and branches of brachial plexus [1,2]. Unusual arrangement and branching pattern of brachial plexus is common and has been well described by many authors [3–5]. These variations are more observed at the level of its formation of trunks, divisions, cords and its terminal branches. The median nerve is one of the branches of the brachial plexus which shows frequent variation in its formation. Usually, the median nerve (C5-T1) is formed anterior or anterolateral to the third part of axillary artery by the union of medial and lateral roots. The medial root comes from the medial cord, coming itself from the anterior division of the lower trunk. The lateral root originates from the lateral cord, coming itself from the anterior divisions of the upper and middle trunks [6]. The lateral cord contains the fibers from C5, C6 and C7, while the medial cord from C8 and T1. Another common variation observed in brachial plexus is in its lateral cord and its branches. Normally the lateral cord is formed from the anterior divisions of upper and middle trunks; its first branch being the lateral pectoral nerve, to pectoralis major muscle. It then divides into musculocutaneous nerve and lateral root of median nerve. The variations of medial cord and its branches are less common. The anterior division of lower

trunk continues as the medial cord and divides into five terminal branches, medial root of median nerve, medial pectoral nerve, medial cutaneous nerve of arm, medial cutaneous nerve of forearm and ulnar nerve. All the branches are usually separated at its origin itself. The variations of the upper limb are very important and some are vulnerable in routine nerve repair and other surgical operations in the axilla in which these unusual branches are more prone to injury.

Case Report

The present case was encountered during the routine dissection of the right upper limb of a 56-year-old male cadaver. A rare unusual branching pattern of brachial plexus in the formation of median nerve was detected. In our observation the median nerve was directly coming from the lateral cord. It did not receive any contribution from the medial cord through medial root. The lateral and medial roots of the respective cords were completely absent. The median nerve was anterolateral to axillary artery at its origin and had the usual course in relation to brachial artery in the arm. The lateral cord gave only two branches instead of three, musculocutaneous and median nerve. The lateral pectoral nerve was arising from anterior divisions of upper and middle trunks. The only usual branch from the lateral cord was the musculocutaneous nerve which pierced coracobrachialis as usual. The other striking variation found in our case is that, a communicating branch between the ulnar nerve and anterior division of middle trunk. This communicating

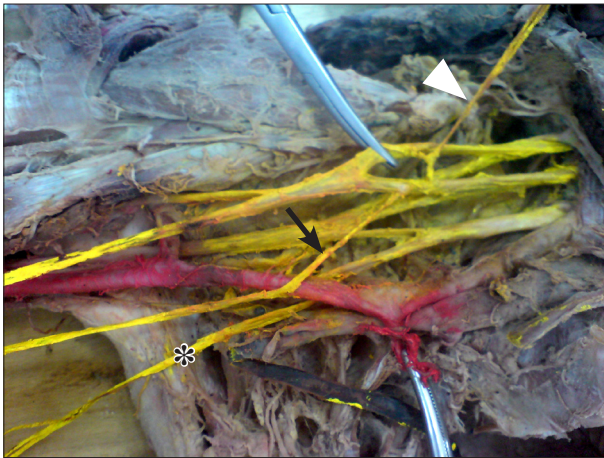


Figure 1. Anterior view of right brachial plexus showing the formation of median nerve without the medial root, and the communicating branch (**black arrow**) between ulnar nerve and anterior division of middle trunk. Note the formation of lateral pectoral nerve from anterior divisions of upper and lower trunk of brachial plexus (**white arrowhead**) and a common trunk for medial cutaneous nerve of arm and forearm (**asterix**).

branch crossed the axillary artery anteriorly by looping around the artery. There were no significant variations found in the origin and branches of the axillary artery. The medial cutaneous nerve of arm and forearm was arising from a common trunk of the medial cord which got separated at the middle of the arm (Figures 1,2).

Discussion

Variant formation of nerve roots and branches of brachial plexus are of clinical and surgical importance. Knowledge of its variations are important to anatomists, radiologists, anesthesiologists and surgeons which may contribute to the explanation of diagnosis and surgical treatment which can prevent any postoperative complications in and around particular regions during surgery. The variations of the brachial plexus at the level of its formation of medial and lateral cords and the distribution of its branches in man have been thoroughly studied and reviewed earlier by Kerr [3], Walsh [5], and other authors. The communicating branches between the cords and its branches have also been reported by Kerr, Uzun & Bilgic, and Walsh [3,4,5]. According to Moore and Dalley [7], sometimes the formation of trunks, divisions or cords may be absent, and lateral and medial cords may receive fibers from anterior divisions proximal or distal to the usual level of its formation. The median nerve formation in our case was very unusual that, it arose directly from the lateral cord without any contribution from the medial cord, and has not been reported earlier. The lateral pectoral nerve was arising from anterior divisions of upper and middle trunks as two separate branches, which after the origin joined together to form lateral pectoral nerve and supplied pectoralis major muscle. The lateral cord was formed by the union of anterior divisions of upper and middle trunks in relation to the second part of axillary artery but it was slightly distal than the usual site of its formation which is similar to the findings of Gupta et al. [8]. Previous studies reporting the additional

branches of lateral cord and its branching pattern in the formation of median nerve have been found to be associated with communicating branches [9–11]. In our study no such additional branches or communicating branches were found in the lateral cord, but there was a communicating branch between the ulnar nerve and anterior division of middle trunk of brachial plexus, which has not been reported earlier. However, in the formation of lateral cord, contribution of lower trunk has been observed by Uzun & Bilgic [4], the communicating branches between the divisions and its terminal branches have rarely been reported. The medial cord of brachial plexus is the continuation of anterior division of lower trunk contributed only by the eighth cervical and first thoracic nerves [1]. In present case, the median nerve was directly coming from lateral cord without the medial root of medial cord of brachial plexus. But the communicating branch between ulnar nerve and anterior division of middle trunk, found in our study may be the fibers of the medial root from medial cord as the contribution to the formation of the median nerve containing the lower nerve fibers of brachial plexus. These fibers instead of arising from medial cord as medial root changed their origin of fibers and may be directed through the communicating branch from ulnar nerve. Though communicating branch between C8 and middle trunk was reported earlier [12], the anterior division of upper trunk, in our case specifically received the communicating branch from ulnar nerve (C8 & T1). This shows the contribution of the medial cord to lateral cord in the formation of median nerve is somehow fulfilled and it cannot be formed only from the lateral cord alone.

The variations found in our case can be interpreted with the consideration of the development and innervation of upper limb. As suggested by Sannes et al. [13], the

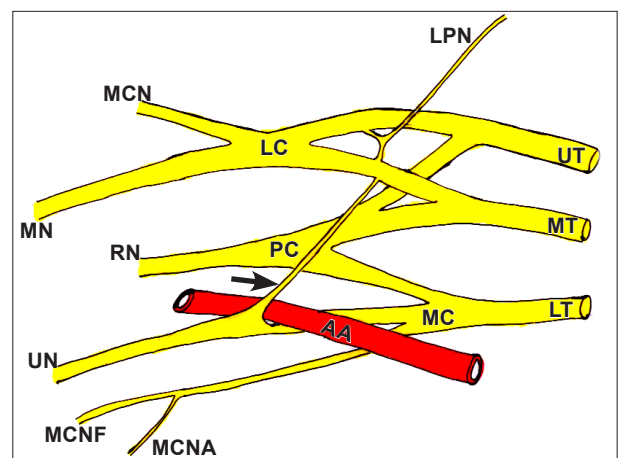


Figure 2. Schematic diagram of Figure 1, illustrating the formation of median nerve and lateral pectoral nerve with the common trunk for medial cutaneous nerve of arm and forearm. (UT: upper trunk; MT: middle trunk; LT: lower trunk; LC: lateral cord; PC: posterior cord; MC: medial cord; MCN: musculocutaneous nerve; MN: median nerve; RN: radial nerve; UN: ulnar nerve; MCNF: medial cutaneous nerve of forearm; MCNA: medial cutaneous nerve of arm; LPN: lateral pectoral nerve; AA: axillary artery; **arrow**: communicating branch between the ulnar nerve and anterior division of middle trunk)

guidance of developing axons is regulated by expression of chemoattractants and chemo-repulsants in coordination with the mesenchymal cells during the development of muscles. As the embryonic somites migrate to form the extremities, they bring their own nerve supply, so that each dermatome and myotome retains its original segmental innervation. The median nerve in our case first arose from lateral cord, without the contribution of medial cord, but as the muscles are developed, the neuronal signaling of these muscles would have gained nerve fibers from the medial cord of brachial plexus by an alternate route. These alterations in signaling between mesenchymal cells and neuronal growth cones can lead to variations which once formed would persist postnatally [14,15]. The variation in the branching pattern and the presence of unusual communicating branches of brachial plexus may be clinically and surgically important. One must be aware of these kind of variations as observed in

our case in which the communicating branch was looping around the axillary artery may lead to the compression of the vessel, and may lessen the blood supply to the upper extremity. However, no abnormalities were found in its origin and branches of the axillary artery in our observation; but the looping of the communicating branch would have led to compression of the artery, resulting in the vascular symptoms of the upper extremity. Exploratory knowledge of the anatomy of brachial plexus at the level of its formation of cords and its branches and especially the unusual branches between them are very important to understand its variations. Keeping in mind these types of variations, help to access it clinically in anesthetic block during the diagnosis of the brachial plexus lesions, especially in post traumatic evaluation of peripheral nerve repair surgeries of the plexus, and also during shoulder arthroscopy and shoulder reconstructive surgeries.

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