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Case Report

Absent posterior cord of brachial plexus with third head of biceps brachii

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Abstract

The posterior cord of brachial plexus is formed by union of dorsal divisions of all the three trunks. Branches of posterior cord arise in the following order: upper subscapular, thoracodorsal, lower subscapular, axillary and radial nerves.

This case reports the absence of posterior cord of brachial plexus in the right axilla of an adult male cadaver. The above-mentioned branches of posterior cord were seen arising directly from the 3 dorsal divisions.

In the same cadaver, we also observed 2 other variations. One was that of the long thoracic nerve on the right side arising only from C6 nerve root and the other was the bilateral presence of a third head of biceps brachii.

The details of this variation and its clinical significance are discussed herein.

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Key words [posterior cord] [radial nerve] [long thoracic nerve] [biceps brachii]

Introduction

The brachial plexus is a complex network of nerves, which extends from the neck to the axilla. It is formed by the ventral primary rami of C5-8, T1 spinal nerves. The upper trunk of the plexus is formed by the union of C5 and C6 roots; middle trunk is formed by the C7 root and the lower trunk is formed by C8 and T1 roots. Each trunk divides into ventral and dorsal divisions. The ventral divisions of upper and middle trunks join to form the lateral cord; the ventral division of the lower trunk forms the medial cord and the dorsal divisions of all the three trunks join to form the posterior cord [1].

The brachial plexus supplies the upper limb and the thoracic wall through its numerous branches from the roots, trunks and cords. The posterior cord gives 5 branches, i.e., upper subscapular, thoracodorsal, lower subscapular, axillary and radial nerves.

Radial nerve (C5-8, T1) which is the continuation of the posterior cord in the axilla, supplies the extensor compartment of the arm and forearm. Axillary nerve (C5-6) supplies the shoulder muscles [2]. Upper and lower subscapular nerves (C5-6) supply subscapularis. Thoracodorsal nerve (C6-8) supplies latissimus dorsi and the long thoracic nerve (C5-7) supplies the serratus anterior.

Biceps brachii is characteristically described as a two-headed muscle (bi: two; cep: head). The long head originates from the supraglenoid tubercle of the scapula, and the short head originates from the tip of the coracoid process of the scapula [3]. The two heads fuse in the upper half of the arm to form the bulk of the biceps brachii muscle which is inserted into the radial tuberosity. This muscle mainly contributes to flexion of the forearm and supination in midflexed position of elbow [4].

Case Report

During routine classroom dissection, we found a unilateral variation of posterior cord of brachial plexus in the right axilla of a middle-aged male cadaver. The posterior cord was absent and all the branches of the posterior cord were seen arising directly from the dorsal divisions of upper, middle and lower trunk.

The fibers forming the radial nerve arose from all the three dorsal divisions separately and were seen hitchhiking to reach their destination. Axillary nerve and upper and lower subscapular nerves (as a common trunk) were seen arising from the dorsal division of upper trunk and the thoracodorsal nerve was seen arising from the dorsal division of middle trunk (Figures 1, 2).

The root values of these nerves were as follows: radial nerve (C5-T1), axillary nerve (C5, C6), upper and lower subscapular nerves (C5, C6), thoracodorsal nerve (C7).

In the same cadaver, we also observed 2 other variations. One was that of the long thoracic nerve on the right side arising only from C6 nerve root (Figure 1), (usually C5-7) and the other was the bilateral presence of a third head of biceps brachii, originating from the superomedial aspect of the brachialis and part of shaft of humerus above it and joining the other two heads near the elbow (Figure 3).

The course and relations of the axillary artery of both sides and formation and branches of brachial plexus on the opposite side have shown no variations.

Discussion

The variations in the formation and branching of the brachial plexus are common and have been reported by several investigators.

Gupta et al. [5] described the variations in plexus patterns to be due to unusual formation during the development of trunks, divisions or cords.

Pandey and Shukla [6] have reported absence of the posterior cord in 3.5% of cadavers, 2.3% on the right side, 0.6% on the left and 1.2% bilaterally. In this group, the lateral and the medial cords were joined together with superior and inferior communicating branches in four of the six cadavers. However, in the present case, the lateral and the medial cords were not joined by any communicating branch.

A study conducted by Chaudhary et al. [7], on branching pattern of the posterior cord of the brachial plexus showed the normal branching pattern of posterior cord in 86.67%, and the remaining (13.33%) being variants in one form or the other. The upper subscapular and thoracodorsal nerves were seen to be originating from the posterior division of the upper trunk in 8.33% and 3.33%, respectively. The lower subscapular nerve took its unusual origin from the axillary nerve in 3.33%. The axillary nerve was found to originate from the posterior division of the upper trunk in 1.66%.

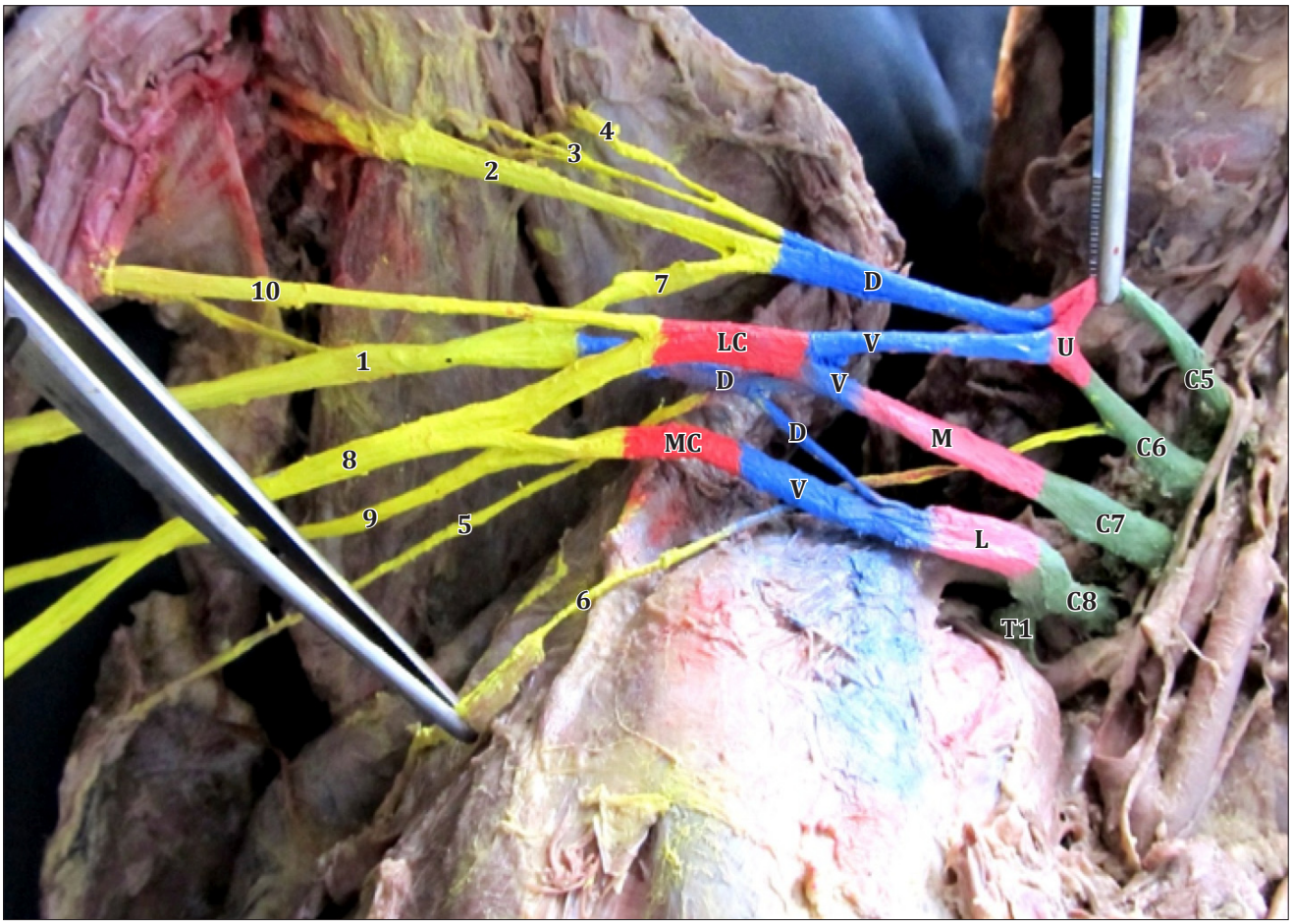

Figure 1. Photograph of dissected and colored right axilla, showing formation and branches of variant brachial plexus. Roots are colored in *green, trunks in pink, divisions in blue, cords in orange, and branches in yellow. (**U**: upper trunk; **M**: middle trunk; **L**: lower trunk; **D**: dorsal divisions; **V**: ventral divisions; **LC**: lateral cord; **MC**: medial cord; **1**: radial nerve; **2**: axillary nerve; **3**: lower subscapular nerve; **4**: upper subscapular nerve; **5**: thoracodorsal nerve; **6**: long thoracic nerve; **7**: branch of dorsal division of upper trunk; **8**: median nerve; **9**: ulnar nerve; **10**: musculocutaneous nerve)*

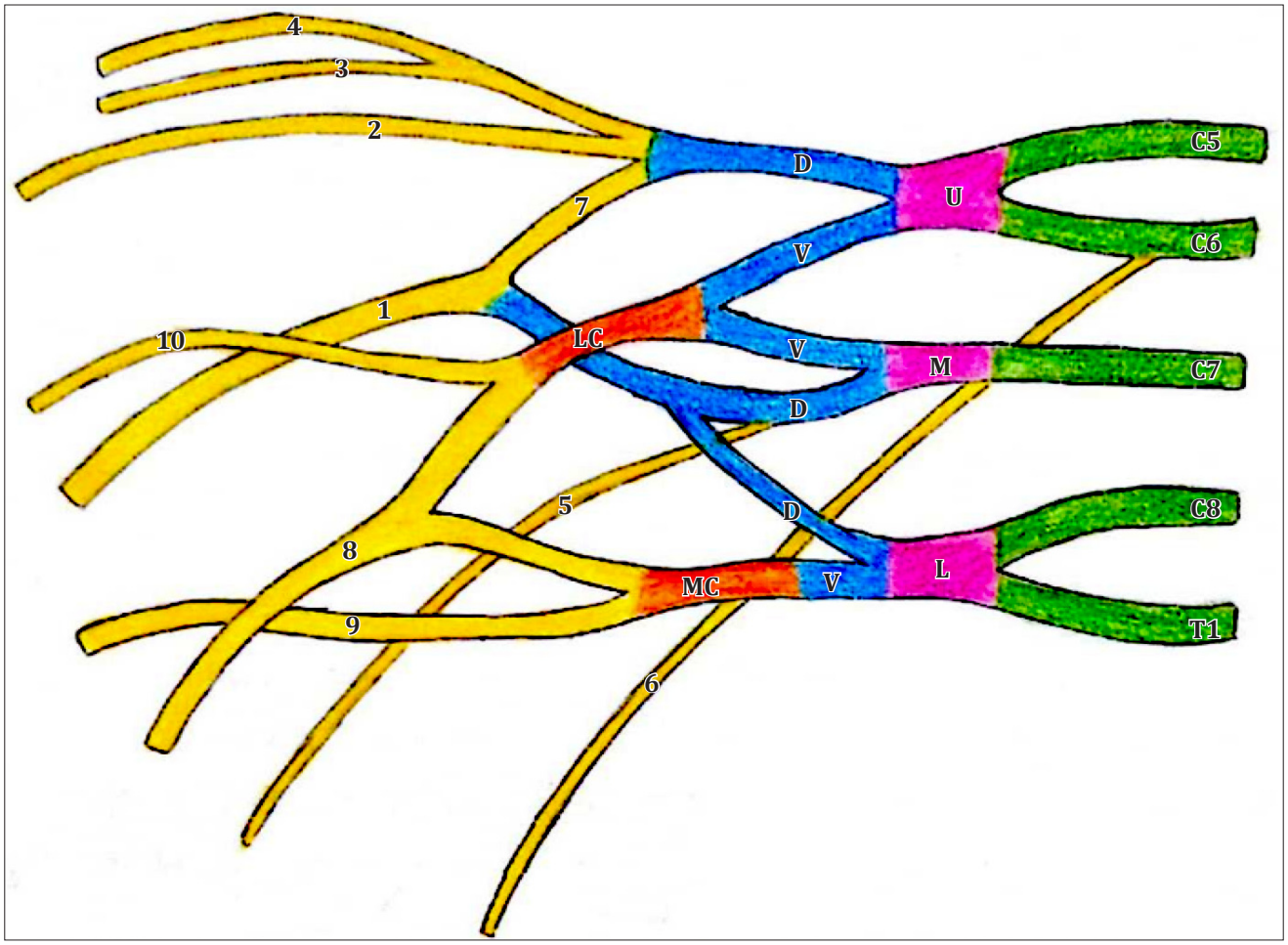

Figure 1. Diagrammatic representation of variant brachial plexus on the right side. *(**U**: upper trunk; **M**: middle trunk; **L**: lower trunk; **D**: dorsal divisions; **V**: ventral divisions; **LC**: lateral cord; **MC**: medial cord; **1**: radial nerve; **2**: axillary nerve; **3**: lower subscapular nerve; **4**: upper subscapular nerve; **5**: thoracodorsal nerve; **6**: long thoracic nerve; **7**: branch of dorsal division of upper trunk; **8**: median nerve; **9**: ulnar nerve; **10**: musculocutaneous nerve)*

Bhat and Grijavallabhan [1] reported that the posterior cord divided into two roots, enclosing the subscapular artery and the two roots fused to continue as radial nerve. The axillary nerve was seen originating from the thick posterior root of the cord.

Rai et al. [3] conducted a study on Indian population on presence of third head of biceps brachii. Among the 42 superior extremities studied, three arms were found to have a three-headed biceps brachii muscle. In Gray's Anatomy [8], the incidence of this variation is reported as 10%, in which the third head arises from the superomedial part of brachialis and is attached to the bicipital aponeurosis and medial side of tendon of insertion.

Asvat et al. [9] reported an incidence of third head of biceps brachii in 21.5% of their study group consisting of blacks. It appears that the incidence varies among ethnic groups.

Embryological Basis

Early in development, the successive anterior primary rami supplying the limb buds are joined by connecting loops to form the cervico-brachial plexus. These nerves grow into the muscles and follow them as they migrate caudally into the limb. There is an intrinsic migration of individual muscles too. The muscles split into a ventral/flexor group and a dorsal/extensor group. Likewise, the posterior divisions of these trunks supply the extensor muscles, while anterior divisions supply the flexors. Changes in the pattern of migration can result in modification of the primitive segmental arrangement of nerves or their loops forming the brachial plexus, as well as the variation in the origin of muscles as formation of third head of biceps here [10].

Clinical significance

Knowledge of variations in anatomy is important to anatomists, radiologists, anesthesiologists and surgeons.

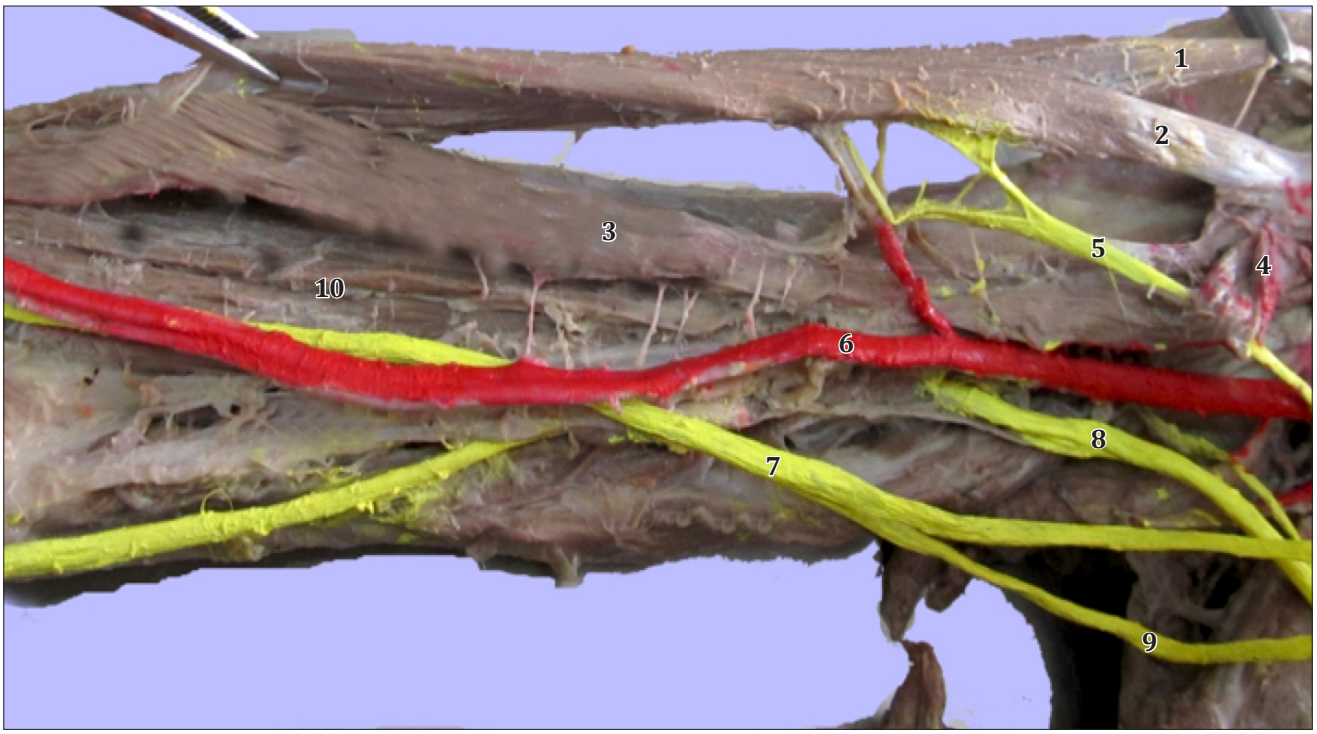

Figure 3. Photograph of right arm showing three heads of biceps brachii. *(**1**: long head; **2**: short head; **3**: third head; **4**: coracobrachialis; **5**: musculocutaneous nerve; **6**: brachial artery; **7**: median nerve; **8**: radial nerve; **9**: ulnar nerve; **10**: brachialis)*

Descriptions of nerve variations are useful in clinical and surgical practice, since an anatomical variation can be the cause of nerve palsy syndromes and vascular problems. In particular, anatomical variations of the human brachial plexus are very important to note during neck dissections, while managing axillary tumors, where these unusual distributions are prone to damage. They also have clinical importance in diagnosis of injuries of the plexus [1].

Knowledge of existence of the third head of biceps brachii may become significant in preoperative diagnosis and during surgery of the upper limb [3].

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