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Case Report

Variant median nerve and lateral antebrachial cutaneous nerve associated with anomalous brachial vein: case report

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ABSTRACT

During educational dissections some rare anatomic variations were encountered in the left upper limb of a human adult male cadaver. The variations were unilateral and included the median nerve presenting three roots, two from the lateral and one from the medial cord of the brachial plexus, communication between median nerve and musculocutaneous nerve in the distal half of the arm, the lateral antebrachial cutaneous nerve showing a loop and the brachial vein passing between the medial and lateral roots of median nerve to drain into the axillary vein. The abnormal root of median nerve coming from the lateral cord had a very close oblique course over the distal part of the axillary artery. These kinds of variations are more prone to injury in radical neck dissections and in other surgical operations of the axilla. The very close course of the unusual branch with the axillary artery may lessen the blood supply of the upper extremity by compressing the vessel. The communicating branch from median nerve to the musculocutaneous nerve can be explained on the basis of its embryologic development. Injury to such a variant median nerve in the proximal arm may lead to paresthesia along the preaxial border of the forearm, weakness of elbow flexion, in addition to other manifestations of median nerve injury. The clinical implications as well as the possible clinical symptoms resulting from these anomalies are discussed. © **Neuroanatomy. 2008; 7: 28–32.**

Key words [brachial vein] [median nerve] [musculocutaneous nerve] [lateral antebrachial cutaneous nerve]

Introduction

The brachial plexus is formed by the ventral rami of the lower four cervical and first thoracic spinal nerves, with a variable contribution from C4 and T2. All the nerves of the brachial plexus are formed and remain in two planes, anterior and posterior. The anterior plane comprises the branches of the lateral and medial cords of brachial plexus while the posterior plane comprises the branches of posterior cord. The musculocutaneous nerve (C5, C6, C7) arises from the lateral cord of the brachial plexus in the axilla and innervates coracobrachialis, biceps brachii and brachialis muscles. It terminates as the lateral cutaneous nerve of the forearm which supplies the skin of the anterolateral region of forearm as far distally as the base of the thenar eminence. The median nerve will be formed in the axilla by fusion of its medial and lateral roots, derived from the respective cords of the brachial plexus [1].

Variations in the formation of the brachial plexus, as well as the course and distribution of its terminal branches in the upper extremity, have been reported in the literature [2–6]. Such variations may be observed at surgery, autopsy, and cadaveric dissection. Distribution of the median nerve in the arm is not usually subjected to variation [7]. Generally, it does not give any muscular branch in the arm, except for a variable branch to the pronator teres muscle given off proximal to the elbow joint [8]. Some of the reported variations of median nerve include; anomalous formations [2, 9–11], anomalous position [12, 13], loop formation surrounding the median artery [14, 15] and duplication proximal to the carpal tunnel [16].

Variations in the course and distribution of musculocutaneous nerve have been reported previously [5, 17]. It may communicate with the median nerve in the arm [18–25] or be absent [7, 26-28].

Variant anatomy recognized during routine cadaveric dissection has important learning potential, provides a framework to review the embryogenesis of the structure in question, and provides insight into its surgical, medical, and radiologic implications. Moreover, it imparts the concept of patient uniqueness and subsequent individualization of medical and surgical therapies.

Although there are reports regarding variations of median nerve and musculocutaneous nerve, anatomic variations involving brachial vein and lateral antebrachial cutaneous nerve (LABCN) are rare. The brachial veins are venae comitantes accompanying the brachial artery and unite with the basilic vein to form the axillary vein.

Case Report

This report involved the upper limb dissections of a 45–year–old male cadaver of South Indian origin in the department of anatomy, Melaka Manipal Medical College, Manipal, India. The dissections of upper limbs were carried out according to the instructions by Cunningham's manual of practical anatomy [29]. Both upper extremities (right and left) of the body were

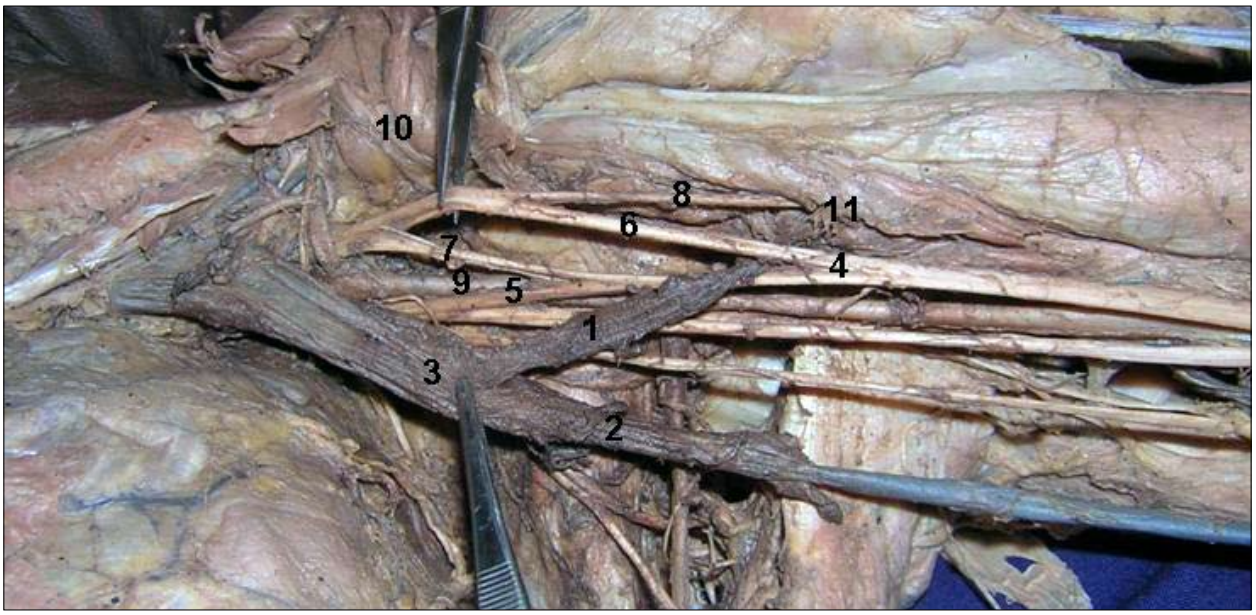

Figure 1. Anomalous brachial vein and variant median nerve. Color version of figure is available online. (***1:*** *brachial vein;* ***2:*** *basilic vein;* ***3:*** *axillary vein;* ***4:*** *median nerve;* ***5:*** *medial root of median nerve;* ***6:*** *normal lateral root of median nerve;* ***7:*** *accessory lateral root of median nerve;* ***8:*** *musculocutaneous nerve;* ***9:*** *axillary artery;* ***10:*** *pectoralis minor;* ***11:*** *coracobrachialis)*

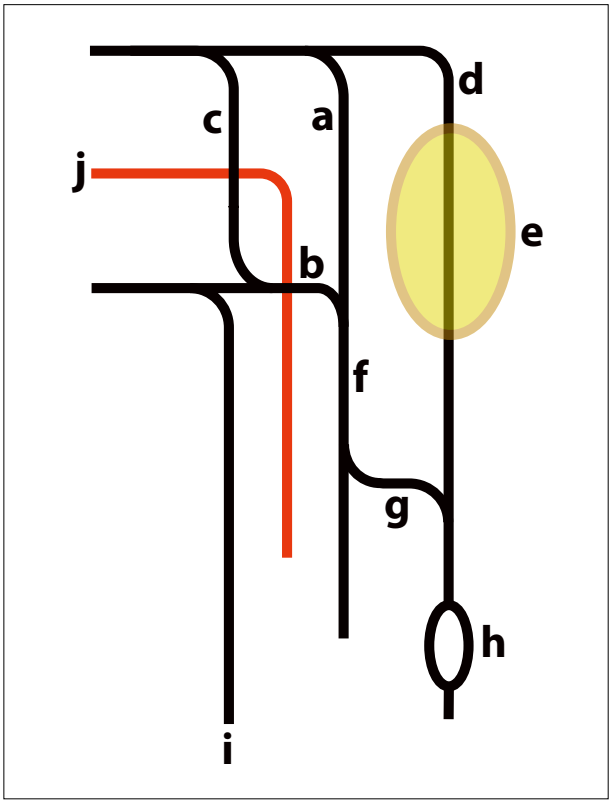

Figure 2. Schematic drawing showing anomalous formation of median nerve, its communication with the musculocutaneous nerve, and loop of lateral antebrachial cutaneous nerve. Color version of figure is available online. (***a:*** *lateral root of median nerve;* ***b:*** *medial root of median nerve;* ***c:*** *accessory lateral root of median nerve;* ***d:*** *musculocutaneous nerve;* ***e:*** *coracobrachialis;* ***f:*** *median nerve;* ***g:*** *communication between median nerve and musculocutaneous nerve;* ***h:*** *loop of lateral antebrachial cutaneous nerve;* ***i:*** *ulnar nerve;* ***j:*** *axillary artery)*

dissected. Upper limbs were dissected, by a median longitudinal incision at the anterior aspect of the arm from the level of the acromion process to the middle of the forearm. Then the skin, subcutaneous fat, and fascia were removed to expose the muscles, nerves and vessels of the anterior compartment of the arm and the forearm. The dissections took place during 2005–2006. The body was preserved by the injection of formalin based preservative (10% formalin) and stored at -4ºC.

The present rare anatomic variations were encountered in the left upper limb of a human adult male cadaver. The variations were unilateral. On the left side, the brachial vein was passing between the medial and lateral roots of median nerve to drain into the axillary vein (Figure 1). The median nerve was formed by the fusion of three roots: two from the lateral cord and one from the medial cord of the brachial plexus. One of the branches arising from the lateral cord was the normal lateral root of the median nerve, whereas the other was an abnormal contribution. This variant lateral root of the median nerve came from the lateral cord proximal to the origin of the musculocutaneous nerve and joined the medial root proximal to the union of medial and normal lateral root of the median nerve. The anomalous lateral root of the median nerve pursued an oblique course anterior to the third part of the axillary artery. A communicating branch arose from the median nerve 12 cm distal to its formation and coursed downward and laterally for about 3 cm before joining the musculocutaneous nerve about 15 cm distal to its origin from the lateral cord (Figure 2). The course and branches of the median nerve in the forearm and hand were normal. The LABCN showed a loop through which a perforating vein was passing and connecting the vein accompanying radial artery and median cubital vein (Figure 3).

Discussion

There are two similar reports in the literature related to formation of the median nerve by union of two lateral roots and one medial root as in the present case [2, 9]. In this case there was a communicating branch to the musculocutaneous nerve in the distal half of the arm. It is possible that combined lesions of the musculocutaneous and median nerves would occur. The present variation may be important to clinicians. If the surgeon finds it necessary to isolate and trace the median or/and musculocutaneous nerve, he or she must be very careful to communications that may be present between them.

The existence of this anomaly may be attributed to random factors influencing the mechanism of formation of limb muscles and peripheral nerves during embryonic life. Embryologically, the brachial plexus appears as a single radicular cone of axons of spinal nerves, growing distally to reach the muscles and skin of the upper limb; later these axons divide to form ventral and dorsal divisions [4]. The ventral divisions give rise to the median and ulnar nerves; the musculocutaneous nerve is derived later from the median nerve [30, 31]. It seems that nerve fibers from the fifth and sixth cervical ventral rami passed along the median nerve through its variant lateral root and rejoined the musculocutaneous nerve in the lower half of the arm. The present study confirms the primitive embryologic origin of the musculocutaneous nerve from the median nerve, reflected in the presence of a communication from the median to the musculocutaneous nerve. Injury to such an anomalous median nerve in the arm may lead to paresis of the biceps brachii, brachialis, and coracobrachialis muscles, and sensory anesthesia on the lateral aspect of the forearm, in addition to other motor and sensory dysfunctions of the median nerve.

The very intimate relationship of the variant lateral root of the median nerve to the axillary artery may result in its compression leading to ischemic pain or variable arterial insufficiency during certain postural maneuvers of the shoulder joint. It may also complicate an anterior surgical approach to the shoulder joint.

Knowledge of anatomical variations of the brachial plexus and median nerve may prove valuable in traumatology of the shoulder joint, repair operations of the axilla and shoulder, radical neck dissections, and in the management of fracture dislocations of the surgical neck of the humerus [32, 33]. According to Roberts, variant nerves having an abnormal origin, course, and distribution are usually more prone to accidental injuries and entrapment neuropathies [34].

The musculocutaneous nerve can be damaged by a number of mechanisms but isolated injury is rare compared to other peripheral nerves. It may be injured in the axilla as it pierces the coracobrachialis muscle, or more distally where just the sensory branch (LABCN) is affected resulting only in an altered sensation. Anterior dislocation of the shoulder can result in axonal damage to the musculocutaneous nerve as well as the axillary nerve. A number of isolated musculocutaneous nerve injuries also have been reported secondary to weight lifting, malpositioning during anesthesia and traumatic arm extension. The nerve is also involved in neuralgic amyotrophy. Rarely an anomalous portion of the biceps brachii muscle may injure LABCN. The LABCN may be injured during antebrachial phlebotomy [35, 36]. Phlebotomy related nerve injuries have been reported for both the routine venipuncture and blood donation populations. These have included injury to LABCN, medial antebrachial cutaneous nerve, superficial radial nerve, and dorsal ulnar sensory branch in the hand [37, 38]. Nerves are susceptible to injury during phlebotomy

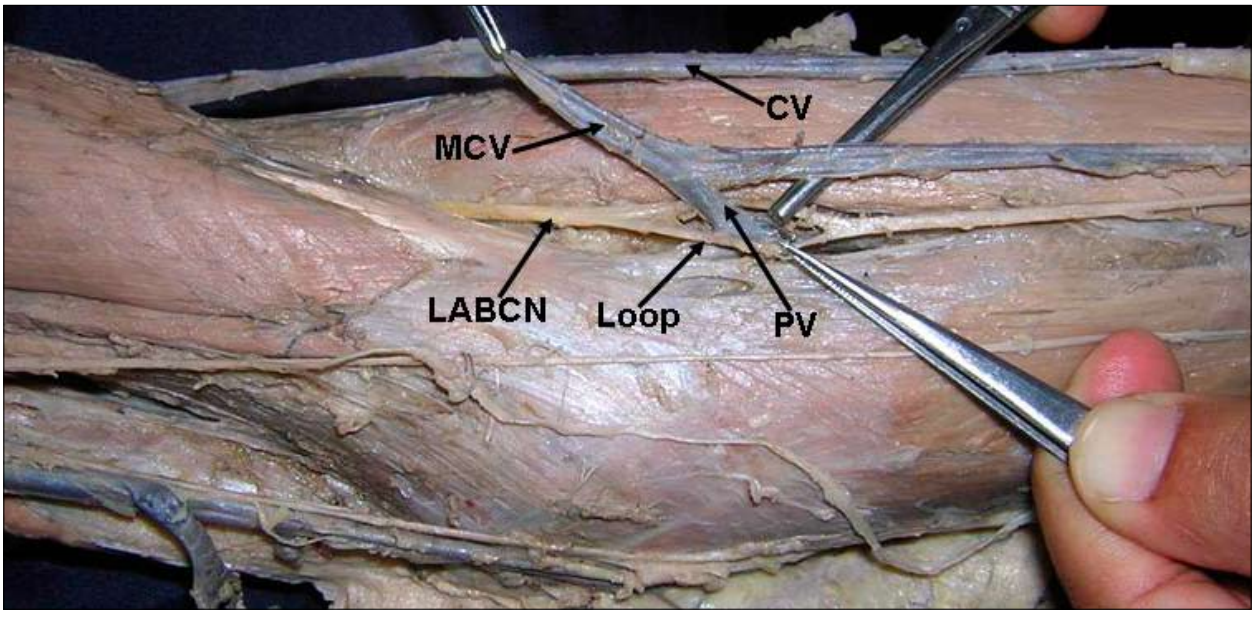

Figure 3. Loop of lateral antebrachial cutaneous nerve traversed by perforating vein. Color version of figure is available online. (***LABCN:*** *lateral antebrachial cutaneous nerve;* ***MCV:*** *median cubital vein;* ***PV:*** *perforating vein;* ***CV:*** *cephalic vein)*

because they lie on a plane just beneath and in close proximity to the veins, where they are vulnerable to injury during this procedure [39].

In the present specimen the LABCN showed a loop through which a perforating vein was passing and connecting the vein accompanying radial artery and median cubital vein (Figure 3). During increased venous return, the LABCN may be compressed by the perforating vein passing through the loop leading to paresthesia over its area of distribution. There are several reports on compression syndromes of LABCN [40–42]. A study by Beldner et al., in 37 cadaveric forearms showed LABCN running parallel to the cephalic vein within the subcutaneous fat. In 31 specimens it ran volar to the vein and in 5 specimens the nerve crossed under the cephalic vein at the elbow and ran dorsal to the vein in the forearm. One specimen had 2 branches with 1 on either side of the vein [43]. But in their study the LABCN did not present any loop. So, the current finding is a unique report. Knowledge of anatomic variations of the peripheral nervous system is helpful in explaining unusual clinical signs and permits correct interpretation of clinical neurophysiology.

The brachial vein can be defined as a vein formed from the joining of the medial brachial vein and the lateral brachial vein. Its origin is in the arm, presenting valves and representing an important route of collateral circulation of the upper limb, connecting the arm to the axilla, and can be useful in surgeries in the management of chronic venous insufficiency [44]. In the current report the brachial vein passed between the two normal roots of the median nerve and opened into the axillary vein. The compression of brachial vein while passing between the roots of median nerve may lead to dilatation of deep veins of forearm. When the brachial vein is used as autogenous vein its normal course and variations like this must be held in mind [45]. A segment of brachial vein containing a competent valve can be transplanted into a lower extremity vein during vein valve transplantation operation to treat the sequelae of lower extremity venous hypertension resulting from valvular dysfunction [46].

Conclusion

Presence of three roots for median nerve is a rare finding in Indian population. The anomalous root of median nerve in the current study had a very close oblique course over the distal part of the axillary artery; this may lessen the blood supply of the upper extremity by compressing the vessel. Injury to the present variant median nerve in the proximal arm may lead to paresthesia along the preaxial border of the forearm, weakness of elbow flexion, in addition to its other manifestations. In the current report the compression of brachial vein while passing between the roots of median nerve may lead to dilatation of deep veins of forearm. Knowledge of anatomical variations of the peripheral nervous system observed during cadaveric dissection, surgery and autopsy is helpful in explaining unusual clinical symptoms and permits correct interpretation of clinical neurophysiology. The variations of the current study may prove interesting to anatomists and clinicians.

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