



## Case Report

# Multiple neurovascular variations in the upper limb — a rare case report

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## Abstract

Variation in the nerves and vessels of upper limb are not uncommon, but the presence of such multiple variations in a same case is very rare. Here we report a rare case with multiple variations in left upper limb noted in a 56-year-old male cadaver. There was complete absence of musculocutaneous nerve and its area was supplied by median nerve. A communicating branch was noted between the medial and lateral roots of median nerve overlying the third part of axillary artery. A high origin of superficial ulnar artery was noted on the left side, which terminated in the palm by forming incomplete superficial palmar arch. The brachial artery continued as radial artery below the level of elbow which is also found to be superficial throughout forearm and terminated in the palm by forming deep palmar arch. The common interosseous branch in this case arose from the radial artery just below the level of elbow. As this variation is concerned with anesthetic blocks and various surgical procedures, this case was studied and reported. A combination of these variations in a same case, to our knowledge, has not been previously described in the available literature.

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**Key words** [musculocutaneous nerve] [superficial ulnar artery] [median nerve] [axillary artery] [incomplete superficial palmar arch] [radial artery]

## Introduction

The brachial plexus is a complex structure which is divided into roots, trunks, divisions and cords. The brachial plexus is formed by the union of ventral rami of C5, C6, C7, C8 and greater part of T1. These ventral rami are the roots of brachial plexus, almost equal in size but variable in their mode of junction. Ventral rami of C5 and C6 unite at the lateral border of the scalenus medius to form upper trunk and C7 continues as middle trunk while C8 and T1 unite behind scalenus anterior to form lower trunk. All these trunks incline laterally, just above or behind the clavicle where each one bifurcates into anterior and posterior divisions. The anterior divisions of upper and middle trunks unite to form a lateral cord, lateral to the axillary artery and the anterior division of the lower trunk descends at first behind, then medial to the axillary artery, forming medial cord. Posterior divisions of all the three form the posterior cord, at first above and then behind the axillary artery [1]. The axillary artery is the continuation of subclavian artery from the lateral edge of first rib and continues as brachial artery as it crosses the lower border of teres major. Just distal to the elbow the brachial artery divides into radial and ulnar arteries. The ulnar artery gives rise to common interosseous artery. Both ulnar and radial arteries terminate in the palm by forming superficial and deep palmar arches [2]. The brachial plexus is a complex

structure, where variations in formation of roots, trunks, divisions and cords are common and so the vessels of upper limb. The aim of this presentation is to contribute to existing knowledge of the variations in the anatomy of brachial plexus and vessels of upper limb explaining its morphological and clinical significance.

## Case Report

During routine dissection of an adult male cadaver in the Department of Anatomy, Tagore Medical College and Hospital, Chennai, Tamilnadu State, India, on reflection of the skin the following variations were noted on left side of upper limb of a 56-year-old male cadaver. It is observed on the infraclavicular part of brachial plexus on left side that there was complete absence of musculocutaneous nerve and its area was carried out by fibers of median nerve. An unusual communication was also found between the medial root and lateral root of median nerve in front of axillary artery (Figure 1).

There was also an unusual high origin of superficial ulnar artery from the brachial artery in upper part of the arm was noted on left side and it was found to be superficial throughout forearm and terminated in the palm by forming incomplete superficial palmar arch (Figures 2, 3, 4).

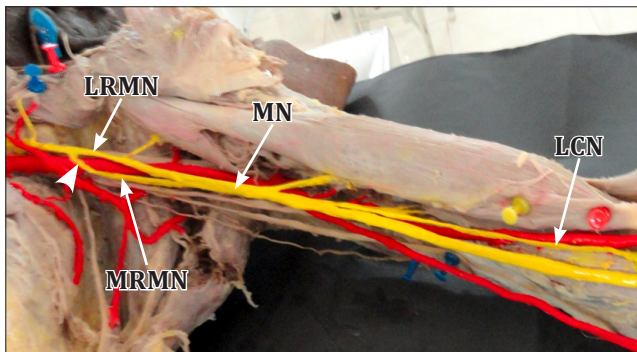
The brachial artery continued as radial artery which gave out common interosseous branch just below the level of

elbow and continued as superficial radial artery throughout forearm (Figure 3). The radial artery terminated in the palm by forming deep palmar arch which was completed by a branch from ulnar artery. The right upper limb showed no variations.

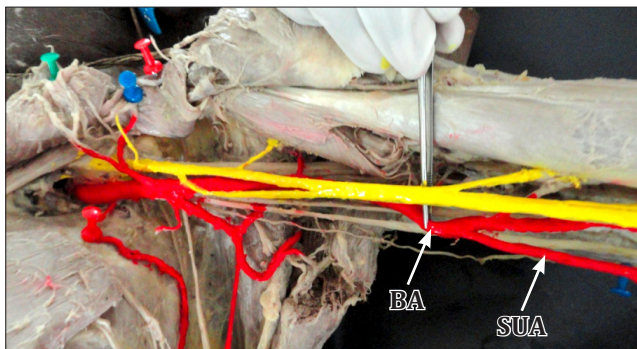
### Discussion

Variations of the brachial plexus and its terminal branches are not uncommon. Buch-Han-sen (1955) observed these variations in 65.3% of cases [3]. Many authors widely documented these variations. Walsh (1877) was the first to describe anatomical variation in the formation of brachial plexus in man. He reported an unusual brachial plexus in 2 of the 350 cases [4].

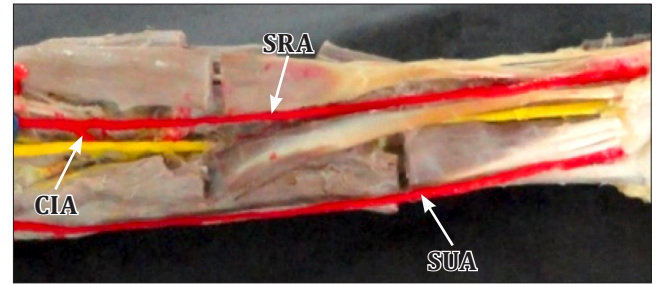
The musculocutaneous nerve is a motor and sensory peripheral nerve arising from lateral cord of brachial plexus. The musculocutaneous nerve has many variations [1, 2]. It may run behind coracobrachialis or adhere for some distance to the median nerve and pass behind biceps. Some fibers of median nerve may run in musculocutaneous nerve, leaving it to join their trunk and vice versa, median nerve sends a branch to musculocutaneous nerve. The musculocutaneous nerve



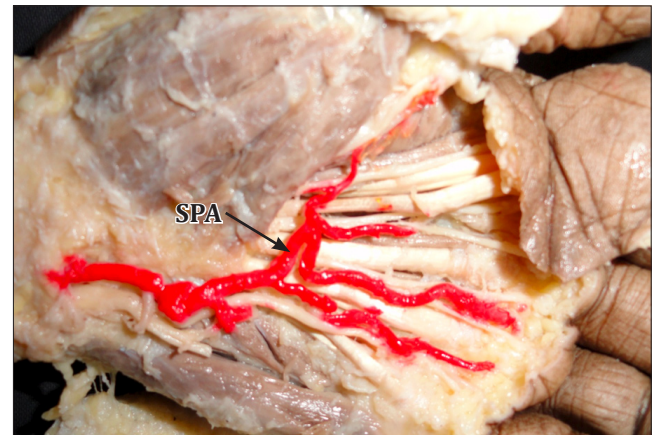
**Figure 1.** An unusual communication (arrowhead) was also found between the medial root and lateral root of median nerve in front of axillary artery. (MN: median nerve; LRMN: lateral root of median nerve; MRMN: medial root of median nerve; LCN: lateral cutaneous nerve of forearm)



**Figure 1.** Unusual high origin of superficial ulnar artery (SUA) from the brachial artery (BA) in upper part of the arm.



**Figure 3.** Superficial ulnar artery (SUA) was found to be superficial throughout forearm. (CIA: common interosseous artery; SRA: superficial radial artery)



**Figure 4.** Incomplete superficial palmar arch (SPA).

may be absent or have not separated from median nerve but its real prevalence is unknown. It fails to get separated from median nerve, and the latter therefore gives off the muscular branches that should arise from the musculocutaneous nerve.

Mane et al., and many authors described about the absence of musculocutaneous nerve and its distribution by median nerve [5]. In the present case report also there is complete absence of musculocutaneous nerve and the nerve supply to the muscles of anterior aspect of arm is supplied by branches of median nerve.

Nayak (2007) found an unusual communication between the medial root and lateral root of median nerve crossing and compressing the axillary artery [6]. In this case also we observed an unusual band between two roots of median nerve in front of the axillary artery. These bands may compress the axillary artery and produce vascular symptoms. The median nerve was also observed to be formed in front of axillary artery which might compress the axillary artery at this point and vice versa producing neurovascular symptoms.

Variations in the vascular patterns are the result of unusual developmental conditions during the formation of blood vessels in any part of the body. The earliest studies of variations

in the arterial system have been reported by Senior [7] and Singer [8]. The morphology of upper limb arterial variations have been studied and classified by Rodriguez-Niedenfuhr [9]. Arteries of upper limb initially start as a capillary plexus which gradually enlarge, differentiate and regress to form the appropriate blood vessels of the respective areas of the limb. Variations in the formation of stages of this capillary plexus forming into definitive blood vessels gives rise to variations of the arterial pattern of the upper limb [10].

In the present case the left side showed variation in the vascular pattern in which an unusual high origin of superficial ulnar artery was noted from the brachial artery in upper part of the arm. The ulnar artery was found to be superficial throughout forearm and terminated in the palm by forming incomplete superficial palmar arch. The ulnar artery that we found was somewhat similar to the variation described by Srinivasalu et al. [10] and the same was described as superficial brachio ulnar artery by Rodriguez-Niedenfuhr et al. [11]. But in our case the superficial ulnar artery terminated in the palm by forming incomplete superficial palmar arch which is not usual. Bhanu et al. have reported about the higher origin of radial artery which is one of the common variations of upper limb arteries [12]. In the present case also we report the presence of superficial radial artery but unlike the case reported by above authors, it doesn't have higher origin instead it is the continuation of the brachial artery just below the level of elbow. In the forearm it runs superficially throughout its course and terminates by forming deep palmar arch.

### Clinical Significance

The variations of brachial plexus and its branches are of great clinical importance. For clinical investigation and the surgical treatment of peripheral nerve injury, a more precise knowledge of these nerves than described in the classical anatomy texts is essential. The variations reported here should be considered in patients presenting with difficulty

in flexion and supination of forearm along with symptoms of high median nerve paralysis. Such variations also have importance in posttraumatic evaluation and exploratory interventions of arm for peripheral nerve repair. For an exploratory intervention of the arm in a patient with this variation for peripheral nerve repair, surgeons have to be aware and specifically look for the presence of such variation. If a surgeon is unaware of this, there are possibilities of unexpected nerve damages during flap dissections. Knowledge of these variations are also important in distinctive diagnosis cases of nerve lesions. Presence of unusual band between the two roots of median nerve in front of axillary artery may compress the artery and produce neurovascular symptoms. The presence of both superficial ulnar and radial artery in same limb makes it more vulnerable and prone for injury at times of surgical procedures, accidents, crush injuries and thus cause severe hemorrhage and ischemia of limbs. Also in a clinical setting they can be easily mistaken for a vein and such misinterpretation could lead to intra-arterial injection and difficulties in angiographic procedures.

### Conclusion

The variations observed in our case may be significant in clinical point of view especially. The knowledge of this type of variation is important to vascular and plastic surgeons and also in diagnostic purposes like cardiac catheterization, arterial grafting and other angiographic procedures. The presence of both superficial ulnar artery and superficial radial artery along with variation in branches of brachial plexus in the same case, to our knowledge, has not been described in the available literature.

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