CASE REPORT

# MULTIPLE ANATOMICAL VARIATIONS IN THE ARM IN AN INDIAN CASE

**Sushma RK, Radhakrishnan P, Divya Shenoy, Kumar MR Bhat***

Correspondence: Dr. Kumar MR Bhat, Additional Professor Dept. of Anatomy, Kasturba Medical Collage Manipal University, Manipal-576104, India. Phone- +91-820-2922327 (Office), Fax- +91-820-2570061. Email- kumar.mr@manipal.edu

## SUMMARY

Variations in the arm have clinical implications as this region is a frequent site of injury and also useful in many invasive procedures. During routine dissection, we observed an unusual combination of anatomical variations in the right arm of a 55-year-old male cadaver. In this arm, the musculocutaneous nerve was absent and its regular branches to the muscles of the and the cutaneous nerve were arising directly from the lateral cord of brachial plexus and also from the median nerve. In the same arm, we also found a common trunk from the brachial artery for the posterior circumflex humeral, radial collateral and posterior descending branches of profunda brachii artery. Additionally, a small slip of accessory fibers of biceps brachii was found arising from the main bulk of the muscle and inserted on to the deep fascia of the lateral cubital region. We present multiple variations in the same limb some of which have not been reported yet. Awareness of these rare variations is therefore necessary to avoid complications during radiodiagnostic and surgical procedures.

**Key words: Musculocutaneous nerve, Biceps brachii, Brachial artery, Posterior circumflex humeral artery.**

## INTRODUCTION

Anatomical variations in the upper limb are frequent, but the coexistence of multiple neuromuscular and vascular variations are rare. These variations are worthy of note for clinicians since they influence and interfere in surgical and diagnostic procedures.

The axillary artery normally gives rise to the superior thoracic artery from its first part, thoracoacromial and lateral thoracic arteries from its second part, anterior and posterior circumflex humeral artery, subscapular artery from its third part. Further, the axillary artery continues as the brachial artery which then gives rise to profunda brachii, superior and inferior ulnar collateral arteries in the arm (Standring, 2005).

The biceps brachii normally has two heads, a short head from corocoid process and a long head from the supraglenoid tubercle. Distally, these two heads join to form a common tendon which inserts into the radial tuberosity, and some aponeurotic fibres form the bicipital aponeurosis which merges with the deep fascia of the forearm (Standring, 2005). The biceps brachii is one of the most variable muscles in the human body, in terms of number and morphology. Accessory heads of biceps brachii have been reported by many authors (Bergman, 1988). In this case, we present an unreported, additional insertion of the biceps brachii.

Normally the musculocutaneous nerve (C5, C6, C7), a branch of the lateral cord of the brachial plexus pierces the coracobrachialis muscle and supplies all the muscles in the front of the forearm. Finally it continues as the lateral cutaneous nerve of the forearm after piercing the deep fascia lateral to the tendon of biceps brachii just superior to

the lateral epicondyle of the humerus (Standring, 2005). The musculocutaneous nerve has frequent variations. Here we report a case of absence of the musculocutaneous nerve and its usual branches arising from the lateral cord and median nerve.

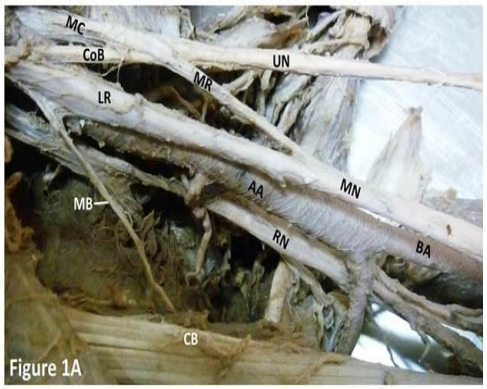
## CASE

Multiple variations were observed in the right arm of a 55 year old male cadaver during routine dissection in the Department of Anatomy, Kasturba Medical College, Manipal, India.

In the arm, the lateral cord of the brachial plexus, after giving rise to the lateral pectoral nerve, divided into a large lateral part and a small medial part. The large lateral part then continued as lateral root of the median nerve. The small medial part was then joined the medial cord. The medial root of the median nerve from the medial cord was comparatively smaller (Figure 1A). Musculocutaneous nerve was completely absent. A small branch from the lateral cord was found supplying the corocobrachialis muscle. Further, the biceps brachii and brachialis were innervated by the branches from the median nerve. One large branch arising from the median nerve, after passing through the brachialis muscle continued as the lateral cutaneous nerve of the forearm (Figure 1B).

In the same arm, the brachial artery gave off a large common trunk just below the lower border of teres major muscle. This common trunk then divided into three branches namely the posterior circumflex humeral artery, radial collateral and posterior descending branches of the profunda brachii artery. Radial collateral and posterior descending arteries had a normal course (Figure 2A). The posterior circumflex humeral artery was largest and curled upward winding round the lower border of teres major muscle to reach the surgical neck of the humerus to accompany the axillary nerve (Figure 2B). However, the small anterior circumflex humeral artery arose from its normal site, the third part of the axillary artery.

The biceps brachii muscle had additional fibers arising from the fleshy part of the muscle at the level of insertion of coracobrachialis. The fibers were initially fleshy, later turned tendinous and were seen to blend with the deep fascia around the lateral epicondyle as an additional insertion (Figure 3).



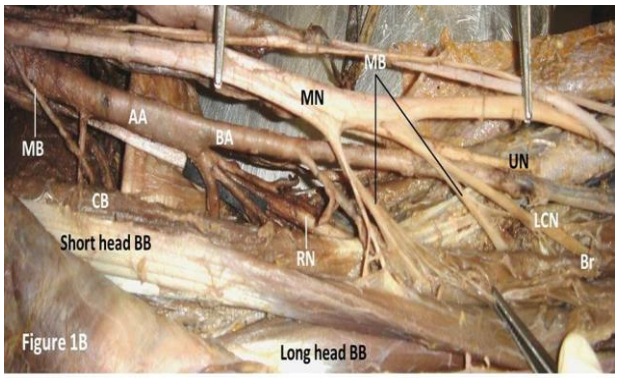
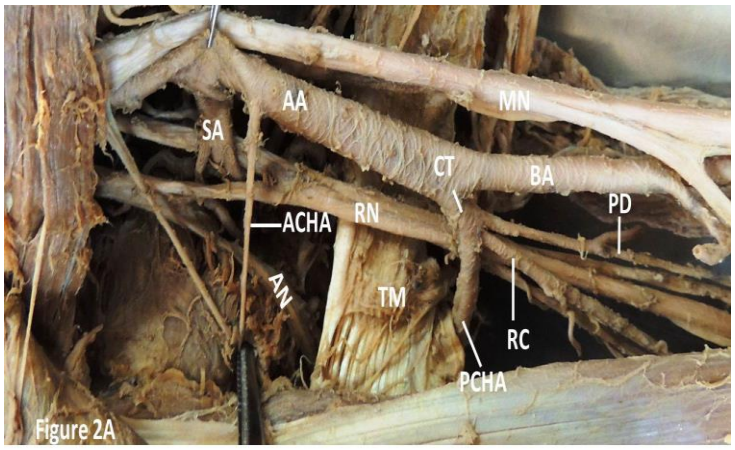




**Figure *1A*-** Photograph **s**howing a muscular branch (MB) from the lateral root (LR) of the median nerve (MN) supplying the corocobrachialis muscle (CB). A communicating branch (CoB) from the lateral cord was crossing the axillary artery (AA) and joining the medial cord of the brachial plexus (MC) before the origin of medial root (MR) of the Median nerve (MN). **Figure *1B*-** Musculocutaneous nerve was absent. A muscular branch (MB) from the lateral root of the median nerve supplying the CB and the rest of the muscles of the front of the arm i.e., biceps brachii (BB) and brachialis (Br) were innervated by the muscular branches (MB) from the MN. One large branch arising from the median nerve, after supplying the brachialis continued as the lateral cutaneous nerve of the forearm (LCN). AA- Axillary artery, BA –Brachial artery, RN- Radial nerve, UN- Ulnar nerve, BB- Biceps brachii.



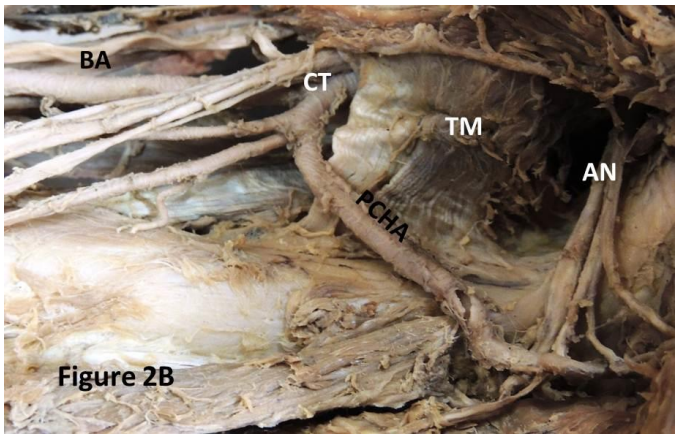




**Figure 2A-** Showing a common trunk (CT) from the brachial artery (BA) giving rise to posterior circumflex humeral (PCHA), Radial collateral (RC) and Posterior descending (PD) of profunda brachii aftery. The anterior circumflex humeral (ACHA) and subscapular (SA) arteries were arising normally from the third part of the axillary artery (AA). The RC & PD were then passing through the lower triangular space along with the radial nerve (RN). **Figure *2B*-**The PCHA however curled upward winding round the lower border of the teres major muscle (TM) to reach the surgical neck of the humerus unaccompanied by the axillary nerve (AN).

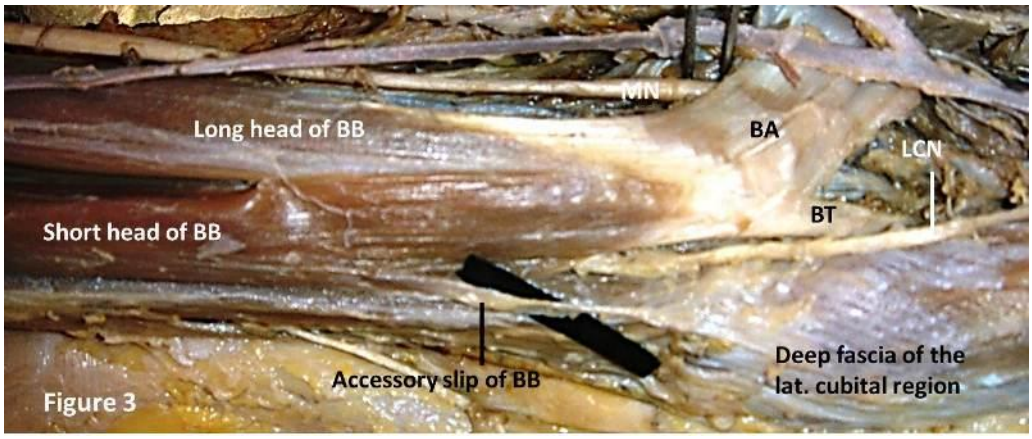



**Figure 3:** Showing a small slip of accessory fibers of biceps brachii (BB) arising from the main bulk of the muscle and inserting on to the deep fascia of the lateral cubital region. In addition the lateral cutaneous nerve of the

forearm (LCN) was arising from MN lateral to biceps after piercing the brachialis muscle. BT- Biceps tendon, BA- Bicipital aponeurosis, MN- Median nerve

## DISCUSSION

Variations in the arterial anatomy of the upper extremities are quite common. The branches of axillary and brachial arteries more often show a variant pattern. Anomalous origin or absence or some of the branches, presence of additional common trunks have been reported (Mc Cormack et al, 1953). A common trunk from the second part of the axillary artery, giving rise to lateral thoracic, posterior circumflex humeral, thoracodorsal, subscapular arteries has been reported (Huelke, 1959). A common origin of the subscapular artery, circumflex humeral arteries and arteria profunda brachii from the third part of axillary artery is also documented (Bannister et al, 1995). Reports have also shown the axillary artery giving rise to all of its common branches (except superior thoracic and anterior circumflex humeral) from a single trunk (Bhat et al, 2008). A common trunk from the brachial artery giving rise to profunda brachii and superior ulnar collateral arteries is also stated (Chakravarthi, 2012). However, in the present case, both the branches of profunda brachii and posterior circumflex humeral arteries were arising from a common trunk from the initial part of the brachial artery. The posterior circumflex humeral artery also had anomalous course to reach the surgical neck of the humerous to accompany the axillary nerve. Such finding is not reported earlier.

The origin of these anomalies is attributed to defects in the embryonic development of the vascular plexi of the upper limb buds. An arrest at any stage of development, showing regression, retention, or reappearance, may produce various variations in the arterial origins and courses of the major upper limb vessels (Hamilton et al., 1972). Awareness of these variations may serve as a useful guide for both radiologists and vascular surgeons. It may help to prevent diagnostic errors, influence surgical tactics and interventional procedures and avoid complications during surgeries.

Earlier the biceps muscle has been widely studied for its supernumerary heads based on its origin, insertion, size, innervation and racial differences (Bergman et al, 1988). Biceps brachii has been described as three, four, five and seven headed muscle (Lee et al, 2011). In another study, ununited two heads of biceps brachii was found in which short head continued as a bicipital aponeurosis and long head as a bicipital tendon (Avadhani and Chakravarthi, 2012). However, the present case reports a small fleshy accessory fiber of biceps brachii separating from the main bulk of the muscle in the lower one third of the arm and inserting on to the deep fascia covering the lateral cubital region. This is rare and not reported. Such scenarios can confuse a surgeon who performs procedures on the arm and may lead to iatrogenic injuries (Nakatani et al, 1998).

In the past, many variations have been described regarding the course and branches of the musculocutaneous nerve (Bergman et al, 1988; Watanabe et al, 1985; Nakatani et al, 1997; Lee Minor, 1992; Virupaxi et al, 2009) However, the present case shows, that the nerve to coracobrachialis is derived directly from the lateral root of the median nerve instead of the musculocutaneous nerve and rest by the median nerve. Even though, these anatomical variations have no clinical manifestation, it has practical implications, since injury to the median nerve in the axilla or arm would, in this case, have caused unexpected paresis or paralysis of the flexor musculature of the elbow and hypoesthesia of the lateral surface of the forearm, in addition to the classical signs of median nerve injury.

Although it is not usually reported, the presence of the multiple variations is a common case encountered in dissection laboratories and during diagnostic procedures and is worth of note, not only by anatomist but also clinicians. Because the upper extremity is a frequent site of injury, various surgical and invasive procedures are performed in this region; and hence the importance of these variations.

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