**Case report:**

**Neurovascular Variations in Upper Limb**

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**ABSTRACT**

According to normal Anatomy, the median cubital vein connects the cephalic vein and the basilic vein in front of the elbow, whereas the radial nerve arises from the posterior cord of brachial plexus to descend in the axilla and in the spiral groove of humerus. On reaching the lateral side of the elbow after piercing the lateral intermuscular septum, the radial nerve descends deep in a groove between brachialis and brachioradialis muscles proximally.

While doing the routine dissection for MBBS Students, in the Department of Anatomy, NRS Medical College, Kolkata, India, few neurovascular variations were found in the superior extremities of two male cadavers in August, 2013. Variations were present in the course of radial nerve and median cubital vein in the right upper limbs of the cadavers concerned. This case report will augment our knowledge in gross anatomy and clinical anatomy.

**Key words:** radial nerve, brachialis muscle, cephalic vein, brachial vein

**INTRODUCTION**

The radial nerve is the largest branch of the brachial plexus. It arises from the posterior cord of brachial plexus with the root value C5,6,7,8, T1, and descends behind the third part of the axillary artery and upper part of the brachial artery. With the profunda brachii artery and its venal comitantes, the nerve inclines dorsally (by piercing the lateral intermuscular septum) and passes through the triangular space below the lower border of teres major, between the long head of triceps and the shaft of humerus1. Here it supplies the long head of triceps and gives rise to the posterior cutaneous nerve of the arm. The nerve spirals obliquely across the back of the humerus, lying posterior to the upper fibres of the medial head of triceps which separates the nerve from the bone in the first part of the spiral groove of humerus. Here it gives off a muscular branch to the lateral head of the triceps and a branch that passes through the medial head of triceps to anconeous1. On reaching the lateral
side of the humerus, radial nerve pierces the lateral intermuscular septum again to enter the anterior compartment. Here the nerve gives muscular branches to the brachialis and brachioradialis muscles. In the elbow, the radial nerve descends deep in a groove between brachialis and brachioradialis proximally and extensor carpi radialis distally.

The nerve divides into superficial terminal branch and the posterior interosseous nerve just anterior to the lateral epicondyle of humerus. The posterior interosseous nerve passes between the two heads of supinator and enters the extensor compartment of forearm to supply all the muscles in that compartment. The radial nerve proper continues into the forearm as the superficial terminal branch deep to brachioradialis and terminates by supplying the skin over the posterior aspect of the thumb, index finger, middle finger and the radial half of the ring finger.

The nerve has given different muscular, articular and cutaneous branches in its long course. The cephalic vein winds around the radial border of the forearm to ascend in the arm (on the lateral side of the biceps brachii muscle), whereas, the basilic vein ascends along the medial aspect of the forearm. In the cubital fossa, the median cubital vein connected the cephalic vein with one of the venae comitantes accompanying the brachial artery (brachial vein), instead of the basilic vein. The cephalic vein was connected with the median cubital vein at right angle on the lateral side of the cubital fossa.

In the right sided arm of one cadaver, the radial nerve, while lying in the spiral groove of humerus, was found to have pierced the brachialis muscle to enter the anterior compartment in the lower part of arm.

In the right upper limb of the other cadaver, the cephalic vein was present as usual on the lateral aspect (of the forearm and arm) in the superficial fascia and the basilic vein was on the medial aspect of the forearm and arm. In the cubital fossa, the median cubital vein connected the cephalic vein with one of the venae comitantes accompanying the brachial artery (brachial vein), instead of the basilic vein. The cephalic vein was connected with the median cubital vein at right angle on the lateral side of the cubital fossa.

MATERIALS AND METHODS
While doing the routine dissection for the MBBS students in August, 2013, few neurovascular variations were found in the superior extremities of two male cadavers, in the Department of Anatomy, NRS Medical College, Kolkata, India. One subject was about sixty-five years old and the other was about seventy years old. Dissection was done properly in both the upper limbs of the two cadavers. All the structures were observed carefully and relevant photographs were taken.

OBSERVATIONS
In the right sided arm of one cadaver, the radial nerve, while lying in the spiral groove of humerus, was found to have pierced the brachialis muscle to enter the anterior compartment in the lower part of arm. In one photograph, the radial nerve was visible once in the axilla, then in the lower part of arm when it pierced the brachialis muscle and lastly in the upper part of forearm while passing deep to the brachioradialis muscle.

In the right upper limb of the other cadaver, the cephalic vein was present as usual on the lateral aspect (of the forearm and arm) in the superficial fascia and the basilic vein was on the medial aspect of the forearm and arm. In the cubital fossa, the median cubital vein connected the cephalic vein with one of the venae comitantes accompanying the brachial artery (brachial vein), instead of the basilic vein. The cephalic vein was connected with the median cubital vein at right angle on the lateral side of the cubital fossa.

In the left upper limbs of both the cadavers no anatomical variation was found.
Figure 1.
The course of the radial nerve in the right limb in one of the cadavers concerned - the nerve has been retracted with forceps in the axilla [A], while piercing the brachialis muscle [B], in the forearm passing deep to the brachioradialis muscle as the superficial terminal branch [C]. The biceps brachii muscle [E], median nerve [F], pronator teres muscle [G], brachioradialis muscle [H] have been indicated also.

Figure 2.
The same radial nerve has been indicated with forceps while piercing the brachialis muscle [A] and in the forearm passing deep to the brachioradialis muscle as the superficial terminal branch [B]. The biceps brachialis muscle [C], brachioradialis muscle [D] and pronator teres muscle [E] have been marked in this photograph.

Figure 3.
The cephalic vein [A] has been connected with one brachial vein [C] through the median cubital vein [B] in front of the right elbow of the other cadaver. The brachial artery [D], the median nerve [E] and the basilic vein [F] have been labeled in this photograph.
DISCUSSION
Radial neuropathy occurs when there is damage to the radial nerve, which travels down the arm. It also controls the ability to bend the wrist backward and helps with the movement and sensation of the wrist and hand. Common lesion of the radial nerve in the arm occurs as it lies alongside the spiral groove, where the nerve is commonly affected by a fracture of the shaft of humerus. This injury can cause weakness of the brachioradialis with wasting and loss of reflexes. There is both wrist and finger drop due to weakness of wrist and finger extensors.

Compression or scarring of the radial nerve at different points along its course may cause denervation of extensor/supinator muscles and numbness or paresthesias in the distribution of the radial sensory nerve (RSN). The result can be pain, weakness, and dysfunction. Although radial nerve palsy associated with a closed humeral shaft fracture, it may be managed by observation, but an open humeral shaft fracture with radial nerve palsy requires exploration of the nerve. Epineural radial nerve repair, done primarily or secondarily, provided a satisfactory return of radial nerve function. Rigid fixation of the associated fracture is the recommended treatment. The anatomical facts are important for humeral surgery including both the anterior and posterior approaches especially for orthopedic interventions. The present case report may be of help in this regard.

In a cadaveric study among Indian population regarding the brachialis muscle innervation by the radial nerve, it was revealed that the radial nerve innervated the muscle in 72.14% specimens. The radial nerve branch to brachialis pierced the muscle in the lower one third of the humerus in 65.71% specimens; on the other hand in the middle one third in 34.29% specimens. The radial nerve branch to brachialis in 50.71% specimens had relatively straighter course before penetration into the muscle, whereas in 49.29% specimens the nerve had relatively curved course and pathway. In the present case the radial nerve itself had pierced the brachialis muscle.

There exists a fair amount of variation of the median cubital vein. This vein and is often used for venipuncture (taking blood). Vollala et al. described a case in 2008, where a perforating vein connected a vein accompanying radial artery (this vein ascended as a brachial vein) and median cubital vein. The brachial veins are venae comitantes accompanying the brachial artery and unite with the basilic vein to form the axillary vein.

CONCLUSION
These two cases will provide information to the clinicians for venipuncture in the cubital region, for surgical approach (specially, for humeral surgery) and regional nerve block in arm and forearm. This case report will also enhance our knowledge in gross anatomy.

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REFERENCES