

# Unique Variation of the Radial Nerve Involving the Subscapular Artery- A Case Report

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## ABSTRACT

The brachial plexus is a complex network of nerves that supplies sensory, motor and sympathetic innervation of the upper limbs. Variations are often encountered in its anatomy. During routine undergraduate dissection of the axilla of a 75-year-old male cadaver at a tertiary hospital in Vadodara, Gujarat, India a yet to be reported variation was observed on the left side. The radial nerve split into two nerve roots soon after its formation, encircled the subscapular artery and then reunited again to form a single trunk which then coursed into the left lower triangular space. No other anomaly was observed on the left side. The anatomy of the right side was normal. The variation as observed in the present case is not only important from the academic point of view but also has important clinical bearings during various therapeutic and diagnostic procedures performed in this region.

## CASE REPORT

During routine undergraduate dissection of 1<sup>st</sup> year MBBS students 2019-20 batches, in a Parul Institute of Medical Sciences and Research, Parul University, Vadodara, Gujarat, India, the following variation was found in the left axilla of a 75-year-old male cadaver which was preserved in 10% formalin. The brachial plexus was exposed during the dissection of the axilla. Furthermore, the clavicle was cut to get a better view of the same. The anatomy of the cords and their branches was carefully studied. The course of the axillary artery and its branches and their relation to the infraclavicular part of the brachial plexus was also examined. The anatomy of the posterior cord and its branching pattern was found to be as usual. The radial nerve after continuing for about 1.5 cm from the outer border of subscapularis was seen to be splitting into two roots, which encircled the subscapular artery as seen in [Table/Fig-1,2], and immediately re-uniting thereafter to form a single trunk. It then continued behind the third part of the axillary artery to enter in the lower triangular space. No aberration was observed in the lateral and medial cords. Usual anatomy was observed on the right side.



**[Table/Fig-1]:** Lateral view showing subscapular artery (2) passing through two roots (\*) of radial nerve (1).

1: Radial nerve; 2: Subscapular artery; 3: 3<sup>rd</sup> part of axillary artery; 4: Thoraco dorsal nerve; 5: Axillary vein; 6: Teres major muscle

## DISCUSSION

The anatomy of the brachial plexus and its variations often has significant bearings in various surgical and therapeutic procedures

**Keywords:** Brachial, Cord, Plexus, Posterior, Roots



**[Table/Fig-2]:** Anterior view showing subscapular artery (2) passing through two roots (\*) of radial nerve (1).

1: Radial Nerve; 2-Subscapular Artery; 3: 3<sup>rd</sup> Part of Axillary Artery; 4: Axillary Vein; 5: Thoraco Dorsal Nerve; 6: Teres Major Muscle; 7: Lattissimus Dorsi Muscle; 8: Median Nerve; 9: Axillary Nerve; 10: Ulnar Nerve; 11: Medial Cutaneous Nerve of Forearm; 12: Long Thoracic Nerve

undertaken in the axillary region. Therefore, a clear understanding of the unusual anatomy is imperative [1]. The brachial plexus is an intricate plexus of nerves formed by the ventral rami of the spinal nerves C5, C6, C7, C8 and T1 and innervates the muscles and skin of the upper limb [1]. It also supplies the superficial muscles of the back. It can be prefixed (contribution from C4) or post-fixed (contribution from T2) [1]. It has roots, trunks, divisions, cord and branches and can be divided into the supraclavicular and infraclavicular parts.

The C5 and C6 contribute to the formation of the upper trunk, the C7 forms the middle trunk and the C8 and T1 contribute to form the lower trunk. The trunks divide and the divisions reunite to form cords that are named as lateral, medial or posterior as per their relation around the second part of the axillary artery in the axilla. The lateral cord is formed by the anterior divisions of the upper and middle trunks, the medial cord is formed by the anterior division of the lower trunk and the posterior cord is formed by the posterior divisions of all the three trunks. The infraclavicular part includes the cords that branch out in the axilla at the lower border of pectoralis minor, to give the peripheral nerves of the upper extremity [1].

The radial nerve is the largest branch of the posterior cord having root value of C5, C6, C7, C8 and T1 and is responsible for the motor, sensory and sympathetic innervation to the extensor compartment of arm, forearm, and dorsum of the hand. It lies in front of muscles forming the posterior wall of the axilla, namely the subscapularis, the latissimus dorsi and the teres major. It leaves the axilla by passing through the lower triangular space accompanied by the profunda brachii artery, which is a branch of the brachial artery [2].

The subscapular artery is the largest branch of the third part of the axillary artery, given off distal to pectoralis minor muscle. It supplies the axilla and the scapular region by anastomosing with suprascapular and transverse cervical branches of the subclavian artery. After its origin, the subscapular artery passes downward and medially accompanied by thoraco-dorsal nerve along the lateral border of subscapularis muscle, giving off the larger circumflex scapular artery and the smaller thoracodorsal artery [2]. Variations have been reported in the literature about the aberrant anatomy involving the radial nerve and the subscapular artery (detailed subsequently) which in turn could have important clinical ramifications [1,3-6].

Aberrations in the formation and branching pattern of the posterior cord of brachial plexus have ample mentions in literature [1]. Variations in the formation of the radial nerve and its branching pattern have also been reported in the literature [1,7,8]. Variations in the anatomy of the subscapular artery are also frequented enough and have been classified into three types namely as S-type, I-type, and P-type subscapular arterial systems [6].

The concurrent variation involving the radial nerve and subscapular artery in the form of the entrapment of the subscapular artery by the two roots of aberrantly formed radial nerve at its origin from posterior cord [5], a common vascular pedicle arising from the third part of the axillary artery and encircling the two roots of the radial nerve [1], an abnormally formed axillary artery penetrating the main and accessory root of radial nerve at its origin [4], subscapular artery caught in between by two roots of median nerve [8] etc., have been also described in recent literature. However, a variation similar to the one found in the present case scenario, where the radial nerve was seen to be splitting into two roots, thereby encircling the subscapular artery and re-joining soon after to form a single trunk has not been described in documented literature to the best of the knowledge. This variation could easily infringe upon the subscapular artery [3]. It can cause diminished blood supply and subsequent ischaemic changes to the areas supplied by it, during various postures of the arm, especially in absence of adequate anastomosis between the third part of the axillary artery and first part of the subclavian artery [3]. Such an unusual relation could also injure the vessel during anaesthetic blocks performed in this region [3,8]. It could also pose as an impediment during bypass surgeries between the subclavian artery and the axillary artery in cases of blockage of the subclavian

artery or during reconstructive procedures in instances of aneurysm of the axillary artery and its branches [3]. The radial nerve also could get damaged during these procedures. An arthroscopic surgeon must take these aberrations seriously for preventing complications during and after the surgery [1,3].

The numerous aberrations observed in the course of arteries and nerves are thought to have their imprints in the prenatal life. The musculature of the limbs is developed from the myotome of the somites (paraxial mesoderm) and brings along their respective nerves during their migration to the upper limbs. The developing axons are guided in a very systematic and a highly coordinated manner by the chemoattractant and chemorepulsants [1]. Any modification or alteration in the usual process leads to permanent aberrations which persist in postnatal life as well [1]. Also, during the period of angiogenesis and vasculogenesis in prenatal life, the seventh cervical intersegmental artery enlarges and gives rise to the axillary arterial system [1]. Some researchers believe that these variations also could be a consequence of genetic predilection [9].

## CONCLUSION(S)

The variation of the radial nerve and the subscapular artery as found in the present case is important from the academic point of view, as well as during numerous reconstructive surgeries around the shoulder region. Hence surgeons, radiologists and anaesthetists should be aware of the alternate anatomy before proceeding for any type of intervention, be it therapeutic or diagnostic as it will prevent postoperative complications and lead to uneventful convalescence.

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### AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

### PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Apr 01, 2020
- Manual Googling: May 22, 2020
- iThenticate Software: Jun 10, 2020 (15%)

### ETYMOLOGY: Author Origin

Date of Submission: **Mar 31, 2020**  
Date of Peer Review: **May 03, 2020**  
Date of Acceptance: **May 22, 2020**  
Date of Publishing: **Jul 01, 2020**