

# Study of Variations in the Branching Pattern of Lower Subscapular Nerve

SANTOSH MANOHAR BHOSALE<sup>1</sup>, PAVAN PRAHLAD HAVALDAR<sup>2</sup>

## ABSTRACT

**Background:** Variations in the origin of lower subscapular nerve of the posterior cord of brachial plexus are important during surgical approaches to the axilla and upper arm, administration of anesthetic blocks, interpreting effects of nervous compressions and in repair of plexus injuries. The patterns of origin show population differences. Data from the South Indian population is scarce.

**Objective:** To describe the variations in the origin of the lower subscapular nerve of the posterior cord of brachial plexus in the South Indian population.

**Materials and Methods:** Forty brachial plexuses from 20 formalin fixed cadavers were explored by gross dissection.

Origin and order of branching of lower subscapular nerve was recorded. Representative photographs were then taken using a digital camera (Sony Cyber shot R, W200, 7.2 Megapixels).

**Results:** Lower subscapular nerves had origin from axillary nerve in 57.5% of specimens, in 37.5% specimens, it was originating from the posterior cord and in 5% of specimens it arose from common trunk.

**Conclusion:** Lower subscapular nerves in studied population display a wide range of variations. Anesthesiologists administering local anesthetic blocks, clinicians interpreting effects of nerve injuries of the upper limb and surgeons operating in the axilla should be aware of these patterns to avoid in advertent injury.

**Keywords:** Axillary, Common trunk, Lower subscapular, Posterior

## INTRODUCTION

The brachial plexus is formed by platuing of the ventral rami of C5, C6, C7, C8 and T1 which extend from the neck to the axilla and supplies motor, sensory and sympathetic fibres to the upper limb. The plexus extends from the inferior lateral portion of the neck downward and laterally over the first rib, posterior to the clavicle and enters the axilla. The brachial plexus consists of three cords- lateral, medial and posterior which branch inferior to the clavicle. The posterior cord runs posterior to the second part of the axillary artery and gives off the following branches – upper subscapular nerve, thoracodorsal nerve, lower subscapular nerve, axillary nerve and then continues as a large terminal branch, the radial nerve [1].

The lower subscapular nerve is highly variable in its origin, course and supply to the muscles; its variations become important as it is used in neurotisation procedure. Knowledge of nerve variations are useful in clinical/surgical practice since the variation can be the reason for nerve palsy syndrome due to abnormal relation of a nerve and a related muscle [2].

Variations in the origin of lower subscapular nerve are common and significant in the surgical procedures of axilla, scapular fracture, shoulder dislocation, neurotisation procedures and infraclavicular brachial plexus block [3].

The variations in the origin of lower subscapular nerve have been catalogued by many studies, although these have not been extensively described. The occurrence of variation may be due to an unusual formation during the development of the trunks, divisions, or cords and they usually occur at the junction or separation of the individual parts. For a surgeon, to know the variational patterns of origin of the lower subscapular nerve at his finger's ends is essential in the light of not only the frequency with which the surgery is performed in the axilla and the surgical neck of the humerus and the rapid development of microsurgical techniques but also to give explanations when encountering an incomprehensible clinical sign [4]. Thus, knowledge of variations in the branching pattern of

lower subscapular nerve from the posterior cord of the brachial plexus is important to anatomists, radiologists, surgeons and anesthesiologist's and has gained importance due to the wide use and reliance on computer imaging in diagnostic medicine.

The studies on the variations in the origin of lower subscapular nerve of the posterior cord of the brachial plexus among Indians are few and altogether lacking in South Indians. The present study describes the variations in the branching pattern of lower subscapular nerve from the posterior cord of the brachial plexus observed in South Indian population.

## MATERIALS AND METHODS

### Source of Data

The 40 upper limb specimens for the study were obtained from the Department of Anatomy, J.J.M. Medical College, Davangere, India.

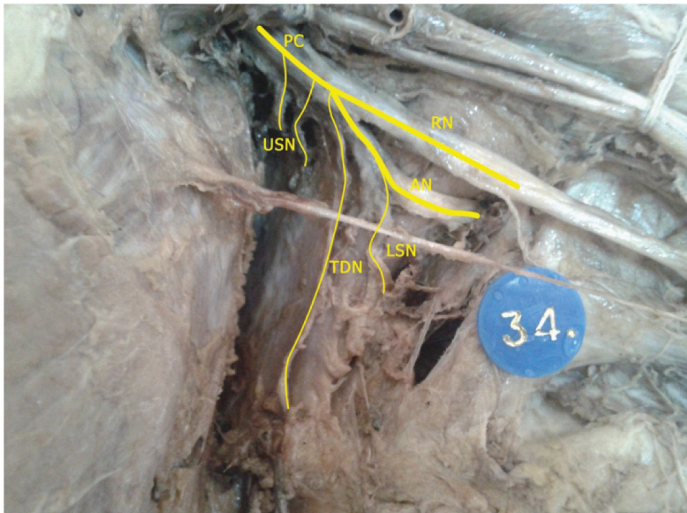
### DISSECTION PROCEDURE

The cadaver was positioned in supine position with upper limb abducted at 90°. The incision made on the skin over lateral part of thoracic wall. The loose connective tissue, fat, and lymph nodes from the axilla were removed to expose its contents. The axillary artery and vein and the large nerves surrounding them were exposed. The smaller tributaries of the vein were removed in order to get a clear view of the nerves.

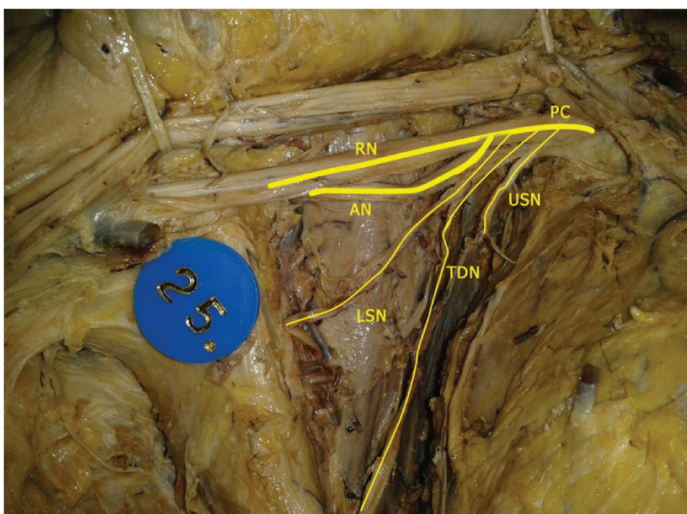
The radial nerve was identified behind the artery. It was traced upwards and at the lower border of subscapularis, the axillary nerve was seen passing backwards with the posterior humeral circumflex artery. The anterior surface of subscapularis was exposed and the upper subscapular nerves entering it were identified. The upper and lower subscapular and thoracodorsal nerves were traced to their origin from the posterior cord of the brachial plexus. The anatomical variations in the origin of lower subscapular nerve of the posterior cord were studied. Representative photographs were taken using a Sony Cybershot R (DSC W50, 7.2MP) digital camera.

Serial No.	Site of Origin	Rt. (N=20)	Lt. (No=20)	Total (N=40)
		n (%age)	n (%age)	n (%age)
1.	Posterior cord	8 (40%)	7 (35%)	15 (37.5%)
2.	Axillary nerve	11 (55%)	12 (60%)	23 (57.5%)
3.	Common trunk	1 (5%)	1 (5%)	2 (5%)

**[Table/Fig-1]:** Showing frequency distribution of origin of lower subscapular nerve from right and left sides



**[Table/Fig-2]:** Showing origin of the lower subscapular nerve from axillary nerve List of abbreviations used: PC- Posterior cord, USN- Upper subscapular nerve, TDN- Thoracodorsal nerve, LSN- Lower subscapular nerve, AN- Axillary nerve, RN- Radial nerve.



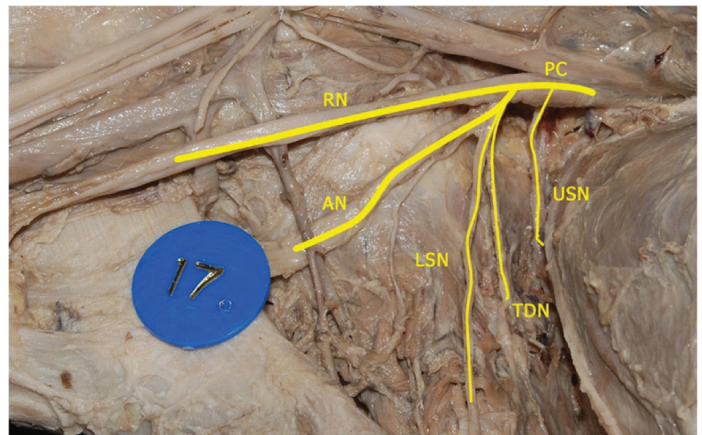
**[Table/Fig-3]:** Showing origin of the lower subscapular nerve from the posterior cord, List of abbreviations used: PC- Posterior cord, USN- Upper subscapular nerve, TDN- Thoracodorsal nerve, LSN- Lower subscapular nerve, AN- Axillary nerve, RN- Radial nerve

## RESULTS

In the present study, the number of lower subscapular nerves is same on both right and left side [Table/Fig-1]. Lower subscapular nerve on the left side have origin from axillary nerve in 60% of specimens, when compared to the lower subscapular nerve of the right side which have origin from axillary nerve in 55% of cases [Table/Fig-2]. In 40% of right upper limb specimens, the lower subscapular nerve take origin from posterior cord in contrast to 35% of left upper limb specimens, the nerve originate from posterior cord [Table/Fig-3] and the common trunk along with the axillary nerve gives origin to lower subscapular nerve in 5% specimens of both right and left sides [Table/Fig-4].

## DISCUSSION

Brachial plexus innervates the upper limb. During the embryonic stage, the upper limb buds lie in the vicinity of the lower five cervical



**[Table/Fig-4]:** Showing origin of the lower subscapular nerve from the common trunk along with axillary and thoracodorsal nerve List of abbreviations used: PC- Posterior cord, USN- Upper subscapular nerve, TDN- Thoracodorsal nerve, LSN- Lower subscapular nerve, AN- Axillary nerve, RN- Radial nerve.

and upper two thoracic segments. When the limb buds begin to develop, the ventral primary rami of the spinal nerves invade into the mesenchyme of the limb bud [1]. Initially each ventral ramus enters with isolated dorsal and ventral branches, but later these branches unite to form large dorsal and ventral nerves for the extensor and flexor muscles of the upper extremity respectively. Immediately after the nerves enter the limb bud, they establish an intimate contact with the differentiating mesodermal condensations and the initial contact between the nerve and muscle cells is necessary for their complete functional and anatomical differentiation [5]. Number of theories has been proposed to furnish the ability of neurons to establish correct connection with each other and with end organs. It has been observed, that at the appropriate time during development, the end organs secrete either a trophic substance (netrin-1 and netrin-2) that attracts correct growth cones or trophic substance {Brain derived neural growth factor (BDNF) and insulin like growth factor (IGF) that supports the viability of growth cones that happen to take right path. This mechanism would account for the formation of nerves in which many axons travel together [6].

Many numbers of signaling molecules and transcription factors have been observed which induce the differentiation of the dorsal and ventral motor horn cells. The unusual expression of any of these signaling molecules can lead to variations in the origin, formation and distribution of particular nerve fibres [7].

In the current study among 40 specimens, lower subscapular nerve have origin from axillary nerve in 57.5%, from posterior cord in 37.5% and 5% from common trunk.

In a study done on 75 posterior cords by Muthoka et al., it was found that 43 (57.3%) lower subscapular nerves were arising from axillary nerve [4]. The same was observed in our study also.

Fazan et al., observed unusual origin of lower subscapular nerve as a branch of axillary nerve in 54% of the specimens, in which 48% of the lower subscapular nerve took origin from axillary nerve on right side and 59% from the axillary nerve on left side [8]. This is similar to the observations in the present study.

Ballesteros and Ramirez had reported the origin of the lower subscapular nerve from the axillary nerve in 54.4% of their study of 57 specimens [9]. This also correlates with the current study.

Kerr had reported the abnormal origin of lower subscapular nerve from axillary nerve in 43.31% of cases [4].

In a study of human subscapularis muscle innervations in 20 dissections, it was found that the lower subscapular nerve arose from the axillary nerve in 25% of the specimens [2].

## CONCLUSION

Majority of lower subscapular nerves in studied population display a wide range of variations. Anesthesiologists administering local

anesthetic blocks, clinicians interpreting effects of nerve injuries of the upper limb and surgeons operating in the axilla should be aware of these patterns to avoid in advertent injury. Further study of the branching pattern of lower subscapular nerve and variations in the diameter of lower subscapular nerve along its course on both the sides is recommended.

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### PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Anatomy, SSIMS&RC, Davangere, Karnataka, India.
2. Assistant Professor, Department of Anatomy, J.J.M.M.C, Davangere, Karnataka, India.

### NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Santosh Manohar Bhosale,  
C/o A.G. Bondade, 3<sup>rd</sup> Main, 5<sup>th</sup> Cross, House No-3459/1F, M.C.C 'B' Block, Davangere-577004, Karnataka, India.  
Phone : 9945316042, E-mail : drsantoshbhosale07@gmail.com

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