



RESEARCH ARTICLE

STUDY OF VARIATIONS IN THE ORIGIN AND DISTANCE OF ORIGIN OF UPPER SUB SCAPULAR NERVE IN CENTRAL KARNATAKA

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ABSTRACT

Background: Upper subscapular nerve is one of the most varied nerves of Brachial plexus. Variations in the origin of upper subscapular nerve of the posterior cord of brachial plexus are essential in surgical approaches to the axilla and upper arm, administration of anesthetic blocks, interpreting effects of nervous compressions and in repair of plexus injuries. The plethora of variations in the origin shows population differences. Data from central Karnataka population is scanty and needs detailed documentation.

Objective: To describe the variations in the origin of upper subscapular nerve of the posterior cord of brachial plexus and its distance of origin from mid-clavicular point in the Central Karnataka population.

Material and Methods: Forty brachial plexuses from 20 formalin fixed cadavers were explored by gross dissection. Origin and number of upper subscapular nerve was recorded. The distance of origin from mid-clavicular point was measured. Representative photographs were then taken using a digital camera.

Results: Upper subscapular nerve had origin from the posterior cord in 100 % specimens and 17.5% of specimens showed two upper subscapular nerves. Upper subscapular nerve in 63.8% specimens had origin at a distance of 3.6 – 4.0 cm, 19.1% of specimens at a distance of 3.1 – 3.5 cm and 17% of specimens at a distance of 4.1 – 4.5 cm.

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INTRODUCTION

The brachial plexus is a complex network of nerves which extends from the neck to the axilla and supplies motor, sensory and sympathetic fibres to the upper extremity. The brachial plexus is formed by platuing of ventral rami of the lower four cervical and the first thoracic nerves. 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 is divided into supraclavicular part and infraclavicular part. The infraclavicular part consists of three cords-lateral, medial and posterior. The posterior cord runs posterior to the second part of the axillary artery behind the pectoralis minor muscle 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. The upper subscapular nerve is variable in its origin and supply

to the muscles; its variations become important as it is involved fracture of scapula and explorations of axilla during oncosurgery of breast. Observations of nerve variations are useful in clinical/surgical practice since an anatomical variation can be the cause of a nerve palsy syndrome due to a different relation of a nerve and a related muscle. Information of variations in the branching pattern of upper subscapular nerve from posterior cord of the brachial plexus is highly important in the surgical exploration of axilla, fracture of scapula, shoulder dislocation, and infraclavicular brachial plexus block. Anatomical variations in the origin of upper subscapular nerve have been explained by various researchers, but these have not been extensively documented. These may be due to variant 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, knowledge of the patterns of variations in the upper 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 rapid development of microsurgical techniques but also to give explanations when encountering an incomprehensible clinical

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sign. Thus observations of variations in the branching pattern of upper subscapular nerve from the brachial plexus and its distance of origin from fixed point that is mid-clavicular point is pre-requisite to anatomists, radiologists, surgeons and anaesthesiologists and has acquired significance due to the extensive use and dependance on software imaging in diagnostic fields. Cataloguing of the variations in the origin of upper subscapular nerve from the posterior cord of the brachial plexus and its distance of origin from mid-clavicular point among Indians is deficient and altogether lacking in Central Karnataka. The present study describes the variations in the branching pattern of upper subscapular nerve from the posterior cord of the brachial plexus observed in South Indian population.

MATERIALS AND METHODS

Source of data

The specimens for the study were obtained from the Department of Anatomy, S.S.I.M.S & R.C, and Davangere. Requisite consent had been obtained from the Head of the Department to conduct the study.

Sample size

The study was carried out on forty upper limbs of adult human cadavers of both sex and age group between 30-60 years.

Inclusion criteria

All normal cadavers were included for the study.

Exclusion criteria

Deformed or traumatized upper limbs were excluded from the study.

Materials

Dissection instruments
Measuring scale
Geometric radius
Sony cyber shot camera.

Dissection procedure

The cadaver was positioned in supine position with upper limb abducted at 90degrees. The incision made on the skin over lateral part of thoracic wall in the mid axillary line at the level of nipple which is carried up to the lateral wall of axilla at the junction of anterior 2/3 and posterior 1/3. 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 pectoralis minor was cut across and the axillary vessels were followed to the outer

border of the first rib. The anterior surface of subscapularis was exposed and the upper subscapular nerves entering it were identified. The upper subscapular nerve was traced to their origin from the posterior cord of the brachial plexus. The distance of origin of upper subscapular nerve from mid-clavicular point was noted and the origin of upper subscapular nerve was studied. Representative photographs were taken using a Sony Cybershot R (DSC W50, 7.2 MP) digital camera.

RESULTS

A. Origin:

1) Upper subscapular nerve:

Upper subscapular nerves originated from posterior cord in all (100%) the specimens of right side and from the 96% of specimens on the left side. In 4% of specimens on left side it originates from common trunk Table 1. 17.5% of specimens showed two upper subscapular nerves Table 1.

Table 1. Frequency distribution of origin and distance of origin of upper subscapular nerve from mid-clavicular point

	Right (n= 22)	Left (n=25)
Origin :		
Posterior cord	22 (100%)	24 (96%)
Axillary nerve	-	-
Common trunk	-	1 (4%)
Number :	22 (46.8%)	25 (53.2%)
Distance :		
3.1 – 3.5 cm	07 (31.8%)	02 (8%)
3.6 – 4.0 cm	12 (54.5%)	18 (72%)
4.1 – 4.5 cm	03 (13.7%)	05 (20%)

B. Distance from mid-clavicular point:

1) Upper subscapular nerve:

Upper subscapular nerve of the right side in 22 specimens had origin at a distance of 3.6– 4.0 cm in 54.5% of cases, 31.8% of specimens at a distance of 3.1 – 3.5 cm and 13.7% of specimens at a distance of 4.1 – 4.5 cm. Table 1. Upper subscapular nerve of the left side in 25 specimens had origin at a distance of 3.6– 4.0 cm in 72% of cases, 20% of specimens at a distance of 4.1 – 4.5 cm and 8.0% of specimens at a distance of 3.1 – 3.5 cm Table 1.

DISCUSSION

The upper limb of human is mainly built for prehension. The scapular muscles acting on shoulder aid in the lever action of upper limb and also help in stabilizing the inherently mobile and fragile shoulder joint by acting as dynamic ligaments. Keeping in mind the medical and surgical aspects, the nerve supply of subscapularis muscle and variations in its innervation is very important. The brachial plexus habitat in the axilla and relations of upper subscapular nerve with the scapula, subscapularis muscle and vascular structures makes it vulnerable to injury. (Uzun and Bilgic, 1999) During the early stages of development the upper limb buds lie opposite the lower five cervical and upper two thoracic segments. As soon as the limb buds form, the ventral primary rami of the spinal nerves penetrate into the mesenchyme of the limb bud.

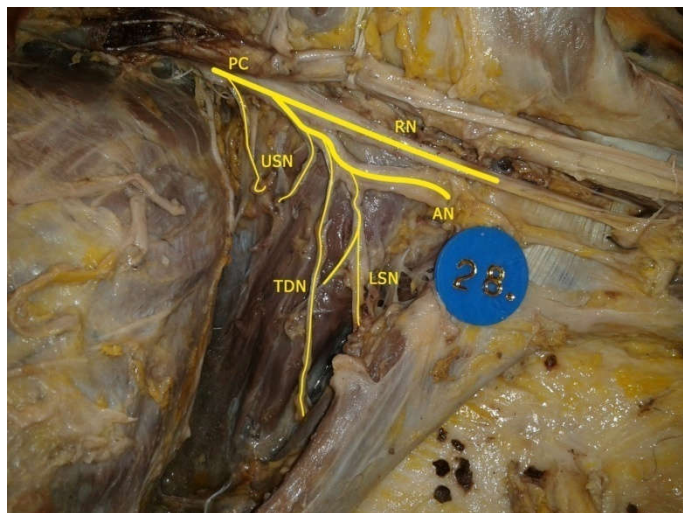


Figure 1. The origin of upper subscapular nerve from common trunk

List of abbreviations used:

PC- Posterior cord, USN- Upper subscapular nerve, TDN- Thoracodorsal nerve, LSN- Lower subscapular nerve, AN- Axillary nerve, RN- Radial nerve.

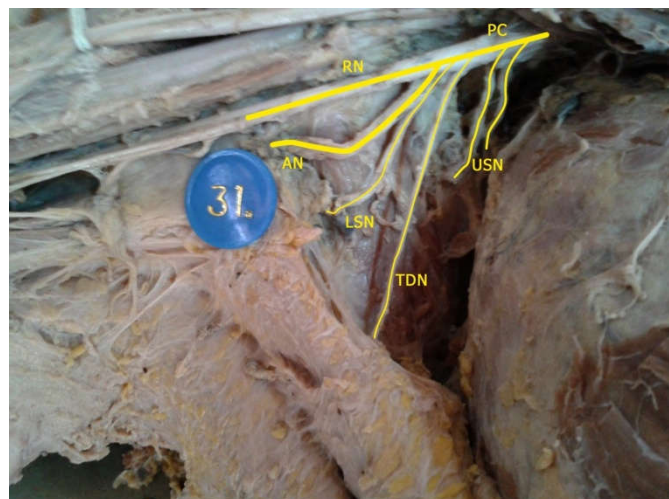


Figure 2. The origin of two upper subscapular nerves.

List of abbreviations used:

PC- Posterior cord, USN- Upper subscapular nerve, TDN- Thoracodorsal nerve LSN- Lower subscapular nerve, AN- Axillary nerve, RN- Radial nerve

(Standring, 2008) At first each ventral ramus enters with isolated dorsal and ventral branches, but soon these branches unite to form large dorsal and ventral nerves for the extensor and flexor musculature 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 early contact between the nerve and muscle cells is a prerequisite for their complete functional differentiation. (Saddler, 2006) Numerous signalling molecules and transcription factors have been identified which induce the differentiation of the dorsal and ventral motor horn cells. Misexpression of any of these signalling molecules can lead to abnormalities in the formation and distribution of particular

nerve fibres. (Satyanarayana *et al.*, 2009) A thorough understanding of the anatomy of upper subscapular nerve, as well as an appreciation of anatomic variations is required for effective brachial plexus blockade. (Ozguna *et al.*, 2010) The present study focuses on the variations in branching pattern upper subscapular nerve of the posterior cord of brachial plexus and the distance of origin of each branch. The variant number of upper subscapular nerve is common and it is documented by various workers. Fazan *et al.* who studied 54 posterior cords, mentioned the variant origin of upper subscapular nerve in 59% of cases. (Fazan *et al.*, 2003) Bergman *et al.* (2006) have reported the following variations for the subscapular nerves: the upper subscapular may arise from C4, C5, or C6 spinal nerves. (Bergman *et al.*, 1988) In a case report, two upper subscapular nerves arose from posterior division of upper trunk. Posterior cord gave thoracodorsal nerve and continued as radial nerve. (Chaware *et al.*, 2012) In another case, there were three upper subscapular nerves on the left and two on the right side with variations in their origin. (Aggarwal *et al.*, 2009) In our study we found two specimens had double upper subscapular nerve on right side and five specimens had double upper subscapular nerve on left side. Muthoka *et al* in the study of 75 posterior cords observed that upper subscapular nerve was given off by the posterior cord in 54 (72%) and originated as a single nerve in 56 (74.6%) specimens and as 2 separate branches in 5 (6.7%) specimens. (Muthoka *et al.*, 2011) In present study 82.5% of specimens showed single subscapular nerve and 17.5% specimen showed two independent subscapular nerve.

In a study of 62 specimens by R. Shane Tubbs *et al.* the upper subscapular nerve originated as a single nerve in 90.3% (56) of the cases, as two independent nerve trunks in 8% (5) of the cases and as three independent nerve trunks in 1.6% (1) of the cases. (Tubbs *et al.*, 2007) In the current study there was no observation of three independent trunks of upper subscapular nerve. In his specimens, Kerr found that the upper subscapular nerve was a single branch in 53.5% and a double branch in 40.7% specimens. (Kerr, 1918) In a study of the subscapular nerves in 50 specimens, 82% of the specimens revealed three independent nerves. 16% demonstrated four nerves and 2% demonstrated two nerves. (McCann *et al.*, 1994) There was no finding of four upper subscapular nerves in the present study. Conclusion: Upper subscapular nerves showed plethora of variations in the origin and number. These variations are important and prerequisite for anesthesiologists administering local anesthetic blocks, the location, distance and number of upper subscapular nerves is essential for clinicians in diagnosing the unexplained nerve syndromes, palsies and neurotisation procedures. Further study in variations of upper subscapular nerve and variations in the diameter from its origin till its entry into the subscapularis muscle is recommended.

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