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Original Research Article

A STUDY ON THE MORPHOLOGICAL VARIATIONS OF THE SUPRASCAPULAR NOTCH IN THE POPULATION OF EASTERN DELTA REGION OF TAMIL NADU

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ABSTRACT

Background: The etiology in 1-2% of patients with shoulder pain is suprascapular nerve entrapment. The suprascapular notch transmits the surascapular nerve and is bridged by the superior transverse scapular ligament. The size and shape of the suprascapular notch plays a significant role in the impingement of the suprascapular nerve in the notch. The variations in the morphology of suprascapular notch can be correlated to the individuals' predisposition to suprascapular nerve entrapment

Materials and Methods: A total of 176 dried human scapulae irrespective of age and sex were obtained from the Department of Anatomy and were morphologically analysed for the type of suprascapular notch based on the Rengachary et al classification.

Results: Suprascapular notch was absent in four scapulae. Type III was the commonest type with seventy four scapulae[43.03%] and type IV was the least observed with six scapulae[3.48%].The prevalence of Type-I was 11.63%,Type-II was 23.26%,Type-V was 5.81% and Type-VI was 12.79%.

Conclusions: The higher incidence of suprascapular foramen in these studies stresses the need to have a knowledge of the morphology of suprascapular notch.. The determination of the type of notch helps in clinical screening of high risk population while evaluating the patients with shoulder pain.

KEY WORDS: Suprascapular Notch, Morphological types, Suprascapular Nerve Entrapment.

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BACKGROUND

The scapula is a flat bone of the pectoral girdle that lies on the posterior chest wall between 2nd to 6th ribs. The suprascapular notch [SSN] is a depression on the lateral part of superior border of the scapula just medial to the root of coracoid process. The notch is bridged by the superior transverse scapular ligament [STSL] and

it transmits the surascapular nerve. The superior transverse scapular ligament may sometimes get ossified and the suprascapular foramen thus formed now transmits the suprascapular nerve. The suprascapular nerve supplies motor branches to the supraspinatus and infraspinatus muscles and sensory branches to the rotator cuff muscles, shoulder joint, acromioclavicular joint, coracohumeral ligament and coracoacromial ligament [1].

The size and shape of the suprascapular notch plays a significant role in the impingement of the suprascapular nerve in the notch. The variations in the morphology of suprascapular notch can be correlated to the individuals' predisposition to suprascapular nerve entrapment[2]. The partial or complete ossification of the superior transverse scapular ligament is considered the most common predisposing factor for suprascapular nerve entrapment as the ossified ligament further decreases the size of the notch thus increasing the chances for suprascapular nerve entrapment [3].

The etiology in 1-2% of patients with shoulder pain is considered to be suprascapular nerve entrapment [4].This was first reported by Kopell and Thompson in 1959. During abduction movements at shoulder joint, there is traction on the suprascapular nerve and it may get compressed against the superior transverse scapular ligament more so if it is ossified. This is manifested as weakness of the arm, difficulty in external rotation and abduction and atrophy of supraspinatus and infraspinatus. Suprascapular nerve entrapment is more commonly seen in volleyball players, base ball players, weightlifters and tennis players [5].

Suprascapular notch has been varyingly classified by many researchers based on morphometric measurements. Rengachary et al has classified the suprascapular notch into six types based on its morphology. The knowledge about the classification and the anatomical variations of the suprascapular notch will help the clinician to easily define the type of notch and correlate the suprascapular nerve entrapment with a specific type of notch [6]. The purpose of this study was to estimate the prevalence of the various morphological types of the suprascapular notch in the population of eastern delta region of Tamilnadu as per Rengachary's classification and to analyse and compare the observations with its prevalence in other ethnic populations.

MATERIALS AND METHODS

A total of 176 dried human scapulae irrespective of age and sex were obtained from the Department of Anatomy, Thanjavur and Thiruvarur medical colleges. Damaged scapulae were excluded from the study. The scapulae were analysed for the type of suprascapular notch based on the Rengachary et al classification. Rengachary et al classified suprascapular notch into six types: [7]

Type-I- Wide depression in the superior border of scapula.

Type-II-Wide blunted V-shape.

Type-III-Symmetrical U-shape,

Type-IV-Very small narrow V-shape,

Type-V-Partially ossified medial portion of STSL, notch minimal & U-shaped,

Type-VI- Completely ossified STSL.

The type of suprascapular notch was noted and representative photographs were taken. The findings were compared with other morphological studies in various ethnic populations based on Rengachary et al classification. Descriptive statistics was done to express the results.

RESULTS

One hundred and seventy six scapulae were analysed. Suprascapular notch was present in 172 scapulae. Suprascapular notch was absent in four scapulae. The observations of the various types of suprascapular notch according to the specifications of Rengachary et al classification is represented in Fig.1 / Table.1

Type III was the commonest type with seventy four scapulae [43.03%] and type IV was the least observed with six scapulae [3.48%].

Table 1: Frequency of the SSN types as per Rengachary's classification.

Type of Notch	Type.I	Type.II	Type.III	Type.IV	Type.V	Type.VI
Number of scapulae(n)	20	40	74	6	10	22
Percentage(%)	11.63	23.26	43.03	3.48	5.81	12.79

Table 2: Frequency of SSN types in various studies based on Rengachary's classification.

Author	Ethnic race	No.	Type.I	Type.II	Type.III	Type.IV	Type.V	Type.VI
Rengachary 1979 [7]	Americans	211	17(8%)	65(31%)	102(48%)	6(3%)	13(6%)	8(4%)
Sinkeet 2010 [3]	Kenyan	138	30(22%)	29(21%)	40(29%)	8(5%)	25(18%)	6(4%)
Paolo Albino 2013 [11]	Italian	500	62(12.4%)	99(19.8%)	114(22.8%)	156(31.2%)	51(10.2%)	18(3.6%)
Usha kannan 2014 [12]	Indians	400	80(20%)	40(10%)	208(52%)	16(4%)	16(4%)	40(10%)
Present	Indians	172	20(11.63%)	40(23.26%)	74(43.03%)	6(3.48%	10(5.81%)	22(12.79%)

Fig. 1: scapulae with suprascapular notches of different types [Type.I toVI]

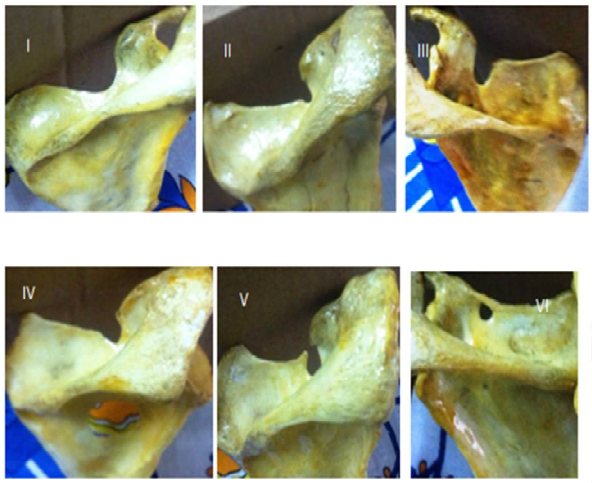

Table 3: A comparison of the frequency of Type.VI SSN (Suprascapular Foramen) in various ethnic races.

Author	Country	Sample size	Frequency
Ticker	America	79	1.27%
Natsis	Greek	423	6%
Sinkeet	Kenya	138	4%
Bayramoglu	Turks	36	12.50%
Hrdicka	Native	2792	2.1-2.9%
Rengachary	America	211	4%
Polguj	Poland	86	7%
Paolo albino	Italy	500	3.60%
DJ Gray	Brazil	221	30.76%
Present Study	India	172	12.79%

DISCUSSION

Suprascapular notch has been variously classified by different authors. Hrdicka [8] in 1942 and Olivier in 1960 classified the suprascapular notch into five types based on visual observations. Based on morphological appearance, Ticker et al [9] classified suprascapular notch as U-shaped and V-shaped. Bayramoglu reported 3 types –U-shaped, V-shaped and J-shaped [10]. The present study is based on Rengachary classification.

In the present study the predominant type was the Type.III which correlates [Table:2] with studies in Americans by Rengachary et al and in Kenyan population by Sinkeet et al whereas Paolo albino has stated Type.IV as the most common type in his study among the Italians[11]. UshaKannan in her study on Indian population also has observed Type III as the commonest type [12].

The size of the SSN has a role in the impingement of the nerve in the notch. Absence of notch or a smaller notch has a higher chance of suprascapular nerve entrapment. The partial or complete ossification of the STSL has been identified as a predisposing factor for suprascapular nerve entrapment. In the present study, forty two scapulae of either absence of notch [n=4], Type IV notch [n=6], Type V [n=10], Type VI [n=22] were noted which predicts an increased chance of occurrence of suprascapular nerve entrapment in the study population.

The prevalence of complete ossification of STSL [Type.VI] varies from 3.7% to 13.6% with an average of 7% [4].In studies conducted on Indian population the prevalence of ossified STSL has been reported in the range of 10.57%- 12.6% [12].In our study the prevalence of Type-VI was 12.79% and this value is within the range described by Polguj and close to that reported by Usha et al. [Table: 3] The prevalence of suprascapular foramen in our study is Comparable with that of Bayramoglu et al. The higher incidence of suprascapular foramen in Bayramoglu et al and DJ Gray [13] studies done on a sample. The higher incidence of suprascapular foramen in these studies done on a sample of 36 and 227 respectively eliminates the doubt of size of sample group but confirms the ethnic correlations.

The tendency of STSL to ossify suggests that the ligament responds to changes in the mechanical load [14]. The variations in the thickness and length of STSL are also considered to have an effect on the suprascapular nerve as it traverses

through the suprascapular notch.Such cases are more prone for suprascapular nerve entrapment as the ossified ligament further decreases the size of the notch and decreases the space available for the suprascapular nerve. The mechanism of suprascapular neuropathy is proposed to be either due to compressive forces or repetitive traction on the nerve with microtrauma.

Hrdicka in 1942 was the first to report the coexistence of a notch and a foramen, the occurrence of which further reduces the space for the suprascapular nerve. An additional anterior coracoscapular ligament which is arranged either parallel or oblique to STSL in the suprascapular notch was first described by Avery et al[15].The ossification of only this anterior coracoscapular ligament without involving the STSL results in the coexistence of notch and foramen thus increasing the possibility of nerve entrapment in the foramen[16]. This type of presentation does not find a place in Rengachary's classification.

There are other classifications of suprascapular notch based on morphometric measurements which take into consideration the absence of notch as well as coexistence of notch and foramen.

Natsis et al in 2007[6] proposed a simple classification based on the vertical and transverse dimensions of the suprascapular notch as follows:

Type-I- Without a discrete notch. Type-II- Notch with longest transverse diameter. Type-III- Notch with longest vertical diameter. Type-IV- A bony Foramen.

Type-V- A notch and a Bony Foramen.

The type.I and Type.V described in this classification is not taken into consideration in Rengachary classification.

Similarly M.Polguj et al in 2011[17] classified the scapulae into five types on the various morphometric measurements.

Type.I- maximum vertical depth [MVD] greater than Superior transverse Diameter [STD].

Type.II- maximum vertical depth, superior transverse diameter and middle transverse diameter [MTD] are equal.

Type.III- maximum vertical depth [MVD] is less than Superior transverse Diameter [STD].

Type.IV- Suprascapular foramen. Type.V- without a discrete notch.

Overhead athletes continually put their arms in the extremes of motion which creates large torques on the shoulder. This causes traction on the suprascapular nerve at the SSN through which it traverses. This is called the sling effect which proposes that in certain functional positions the suprascapular nerve is exposed to damaging sheer stress in the notch. Though suprascapular nerve neuropathy is the cause for shoulder pain in 1-2% of general population, its prevelance in high risk athletic population such as volley ball players is reported as high as 33%.[18,19]

CONCLUSION

The morphological variations of the shape of the suprascapular notch have to be borne in mind by clinicians while evaluating the patients with shoulder pain as the notch is the common site for suprascapular nerve compression.

The knowledge of the morphology of suprascapular notch and the determination of the type of notch helps in clinical screening of high risk population especially in those with activities involving overhead abduction. It helps the radiologists in locating and understanding the cause for shoulder pain.

Conflicts of Interests: None

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