Morphometric Study of Suprascapular Notch in Indian Dry

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ABSTRACT

Background: The suprascapular notch is a semicircular notch at the superior border of scapula, just medial to the base of the Coracoid process, is bridged by the superior transverse scapular ligament, which is sometimes ossified and the foramen which is thus completed, transmits the suprascapular nerve to the supraspinatus fossa. Variations in the morphology of suprascapular notch have been identified as one of the causes of suprascapular nerve entrapment.

Aim of study: To study morphological variations of suprascapular notch in Indian dry scapulae and to classify the suprascapular notch into various types as described by the earlier authors and correlate to correlate the type of notch to the incidence of suprascapular nerve entrapment syndrome.

Materials and Methods: The material for the present study comprised of 100 adult human dry scapulae of known sex (Right 70 and Left 30) and unknown age, which were obtained from the Department of Anatomy, Narayana Medical College, Nellore. The type of suprascapular notch was noted and it was recorded as per the description given by Rengachary et al (1979) and Natsis et al (2007). The results of the present study were compared with the results of previous authors in different populations.

Results: In our study, out of 100 scapulae, the frequencies of various types of suprascapular notches according to Natsis et al (2007) were: Type I - 19%, Type II – 25%, Type – III 23%, Type - IV 21%, Type – V 12%.

Conclusion: Since the suprascapular nerve entrapment syndrome might be caused by complete ossification of superior transverse scapular ligament with formation of **suprascapular** foramen and other morphometric variations of suprascapular notch, the knowledge on such variations is essential for clinicians, for making a proper diagnosis and for planning the most suitable surgical intervention.

KEY WORDS: Morphology, Morphometry, suprascapular notch, Superior Transverse Scapular Ligament.

Introduction

The scapula is a large flat, triangular bone which lies on the postero lateral aspect of the chest wall, covering parts of the second to the seventh ribs. The Suprascapular notch is situated in the lateral part of the superior border of the superior border of the scapula, just adjacent to the base of Coracoid process. This notch is converted by superior transverse ligament into foramen which serves as a passage for suprascapular nerve. This nerve being a motor nerve supplies its motor branches to supraspinatus, Infraspinatus and sensory branches to the Rotator Cuff muscles, and the ligaments of the shoulder and Acromio-clavicular joint.

The suprascapular notch and its morphological variations are well known. Koepell and Thompson (1959) were the first to describe the suprascapular nerve entrapment syndrome. In the whole population, approximately 1-2% of the shoulder pains is due to compression. They reported that abduction or horizontal adduction of the shoulder exerted traction on the suprascapular nerve, which led to its compression against the superior transverse scapular ligament. Furthermore, variations in the morphology of suprascapular notch have been identified as one of the causes of suprascapular nerve entrapment. Rengachary et al classified this notch into six types, based upon its shape and they also stated that the size of suprascapular notch played a role in the predisposition for suprascapular nerve entrapment syndrome. In their opinion a small notch gave a greater chance of nerve impingement than a larger one. Morphological variations of the suprascapular notch are very important clinically for possible predisposing factors for compression of the suprascapular notch in this region. This type of entrapment is found in volley ball players and athletes whose frequency is more due to stress on the shoulder joint.

Knowing the anatomical variations in detail is better for understanding of location of the entrapment syndrome. The purpose of this study is to document the incidence variation and clinical significance of SSN and partial and complete ossification of suprascapular transverse ligament.

Materials and Methods: The material for the present study comprised of 100 adult human dry scapulae of unknown age and sex, which were obtained from the Department of Anatomy, Narayana Medical College, Nellore. The type of suprascapular notch was noted and it was recorded as per the description given by Natsis et al (2007).

Type I – No notch.
Type II – Notch with greater transverse diameter.
Type III – Notch with greater vertical diameter.
Type IV – Notch is converted into bony foramen.
Type V – Notch with bony foramen.
The other morphological features that were considered were

Presence or Absence of notch: It was observed whether notch is present or absent and if present, its site wad noted.
The results of the present study were compared with the results of previous authors in different populations.

Shape: It was observed whether ovoid or otherwise.

Vertical diameter: It was measured with the help of Vernier calipers as the maximum vertical diameter of notch perpendicular to imaginary line that joins the two superior corners of notch. For measuring this distance a scale was kept touching the two corners of the notch and vertical perpendicular distance of the notch from this scale was measured with depth bar of Vernier calipers.

Transverse diameter: It was measured with the help of Vernier calipers as the diameter perpendicular to the vertical diameter approximately at its mid point.

Results and Discussion

In our study, out of 100 scapulae, the frequencies of various types of suprascapular notches according to Natsis et al (2007) were: Type I - 19%, Type II – 25%, Type – III 23%, Type - IV 21%, Type – V 12%.

Presence / Absence of notch: The notch was notch was seen in 90 (90%) of the scapulae of which it was absent in only 10 scapulae (10%).

Vertical and Transverse Diameters of suprascapular notch:

Table 1 depicts the mean values and range of different parameters of suprascapular notch as observed in our study.

Table 1: Showing comparison of various parameters of suprascapular notch.

Parameters	Sex	Mean	Standard Deviation	Std. Error Mean
SSNL	Right	8.1930	2.91204	.38571
	Left	9.4583	3.38769	.69151
SSNB	Right	7.6842	4.62199	.61220
	Left	9.2917	5.93793	1.21208

Type of the notch:

In the present study the notch was classified as per the as per the classification given by Natsis et al (2007) and our results more or less matched with their result. Natsis et al (2007).

Type I – No notch.
Type II – Notch with greater transverse diameter.
Type III – Notch with greater vertical diameter.
Type IV – Notch is converted into bony foramen.
Type V – Notch with bony foramen.

Table 2: showing according to Natsis classification

Classification	Percentage (%)
Type I (without a discrete notch)	19%
Type II (TD>VL)	25%
Type III (VL>TD)	23%
Type IV (a bony foramen present)	21%
Type V (a notch and a bony foramen)	12%

Table 3: Showing classification of suprascapular notch on the basis of its shape.

Shape of the notch	Number of scapulae	Percentage (%)
U	10	10%
J	13	13%
V	10	10%
Identation	15	15%
Absent	19	19%
Partial Ossification	03	03%
Complete Ossification	30	30%
Total	**100**	**100%**

Table 4:

Author	Population (N)	SSN + foramina
Kanjava, 1925 (7)	Finnish (200)	15%
Vallois (17)	French (200)	6.5%
Ticker et al, 1998 (16)	NorthAmerican (79)	1.27%
Natsis et al, 2007 (9)	Greek (400)	0.75%
S.R. Sinkeet	Kanyan (138)	2.9%

Table 5:

Author	Population (N)	SSN I	SSN II	SSN III	SSN IV	SSN V	SSN VI
Nassis et al 2007 (9)	Greek (423)	6%	24%	40%	13%	11%	6%
Renganchary et al, 1979 (12,13)	American (211)	8%	8%	48%	3%	6%	4%
S.R. Sinkeet	Kanyan	22%	21%	29%	5%	18%	4%

All the above parameters can be discussed under the following headings:

Presence or absent of Suprascapular notch:

It was present in 81 (81%) bones. Out of these, 60 (74%) belonged to the right side and 21 (25%) belonged to the left side. In the rest of the 19 bones(R: L: 11:10) the suprascapular notch was converted into a foramen. In additional 12 (12%) bones of the right side both suprascapular notch and foramen were present.

Shape of suprascapular notch:

The mean vertical diameter was 14 mm (Range 3mm to 14 mm). On the right side , it was 8.19 mm whereas on the Left side, it was 9.453 mm. Thus, it was higher in Left side than on the right side. Earlier Piyawinijwong et al 2004 [20] had commented that vertical diameter and shape of suprascapular notch are variable.

Transverse diameter of suprascapular notch:

The mean transverse diameter was 5.96 mm (Range=3-22mm). On the right side, it was 7.68 mm (Range=3-13 mm) whereas on the left side, it was 9.27 mm (Range=4- 22 mm). Thus, it was higher on the left side than the right side.

Rengachary et al classified the suprascapular notch (SSN) into six types based on the inferior shape of the SSN as well as the degree of ossification of Superior transverse scapular ligament4. This classification was difficult to use when transition between these types is being found. The classification given by Natsis et al seems to be simple and includes all the anatomical variations based on thevertical and transverse diameters of the SSN5.The classification by Iqbal et al also provides an easy method of distinction of SSN based on its shape (U, V, and J) without involving any measurements 6. On gross examination without involving any measurements, the results of the present study correspond with that of Sinkeet et al who also reported the U shaped notch as most common (29%) and the complete ossification of STSL as least common (4%) in Kenyan Population 7.Iqbal et al reported the J shaped notch the commonest (22%) in their study in the population of Pakistan 6. Variation in the morphology of the STSL which include their partial or complete ossification have been identified to be one of the predisposing factor in cases of suprascapular nerve entrapment in various case reports 9,10,11.

The incidence of complete ossification of STSL varies widely in different populations. In Brazilian population its incidence is reported to be 30.76%

12 as compared to Vallios who reported the incidence to be 6.5% in Italian population 13 and Kajava who reported the incidence of complete ossification of STSL to be 1. 5% in Finish Scapulae 14. In the present study the incidence of complete ossification of STSL was observed in 2.06% of cases. This indicates that there are differences in different populations, therefore population specific studies are required to know the incidence of complete ossification of the STSL. The differences in morphology of the SSN can be explained by the fact that the shape of the SSN is influenced by the ossification of coracoid process. Odita et al reported that epiphyseal centers of coracoids process appear earlier in Nigerian infants than Caucasians 15.

Although it has been hypothesized that suprascapular nerve entrapment is more likely to be associated with a narrow 'V' shaped notch, no direct correlation between notch type and suprascapular nerve entrapment has been shown clinically 16.

Therefore, rather than the shape and diameter of the notch, the morphology of the STSL has been identified to be associated with suprascapular nerve entrapment. The most common causes of the SSN entrapment syndrome are occupational overuse related to shoulder depression and abduction, tumors, lipoma, trauma to the shoulder region 3.

Suprascapular neuropathy can usually be diagnosed confidently on the basis of symptoms and signs alone.

However, nerve conduction studies are helpful in confirming the diagnosis, quantifying the severity, and ruling out involvement of other nerves. A scan is not Usually necessary, but may be helpful if a tumor or other compressive lesion is suspected (17). Initial treatment consists of related rest from the offending activity, compression wrap, ice and non –steroidal anti-inflammatory medications to help reduce inflammation and pain. Stretching exercises of shoulder muscles may be helpful. Persistent symptoms are often relieved by an injection of corticosteroid. However, if symptoms persist after 3 to 6 months of conservative treatment, surgery may be necessary. It is also indicated to relieve pressure from a cyst (180.

Present study demonstrates that complete ossification of STSL (superior traverse scapular ligament) is common in Indian population. The anatomical knowledge of the ossified STSL is of extreme importance for clinicians while dealing with painful syndrome of shoulder. This anatomical curiosity should be kept in mind by students and surgeons who may manipulate in this area.

Clinical Significance:

Suprascapular notch typing has clinical significance for suprascapular nerve entrapment. A narrow suprascapular notch in combination with an anomalous superior transverse scapular ligament causes sufficient constriction to be considered as a risk factor for suprascapular nerve entrapment. The shape of suprascapular notch may alter the distance between it and the supraglenoid tubercle, which is important for the determination of potential safe zone to minimize the risk of iatrogenic injury of the suprascapular nerve during arthroscopic procedures and other open procedures requiring dissection of the posterior glenoid neck.

Conclusion:

Since the suprascapular nerve entrapment syndrome might be caused by complete ossification of superior transverse scapular ligament with formation of suprascapular foraman and other morphometric variations of suprascapular notch, the knowledge on such variations is essential for clinicians, for making a proper diagnosis and for planning the most suitable surgical interventions. Further detailed ventures like : a) clinical screening of high risk population by specialists of community medicine, sports medicine, orthopaedicians and general surgeons for the incidence of suprascapular nerve entrapment syndrome, b) confirmation of suprascapular nerve entrapment syndrome by radiologists by using imaging modalities like MRI, CT and Ultrasound and , c) surgical interventions for either open or laparoscopic suprascapular nerve entrapment syndrome, coupled with histopathological studies on suprascapular nerve may throw fresh information on this issue.

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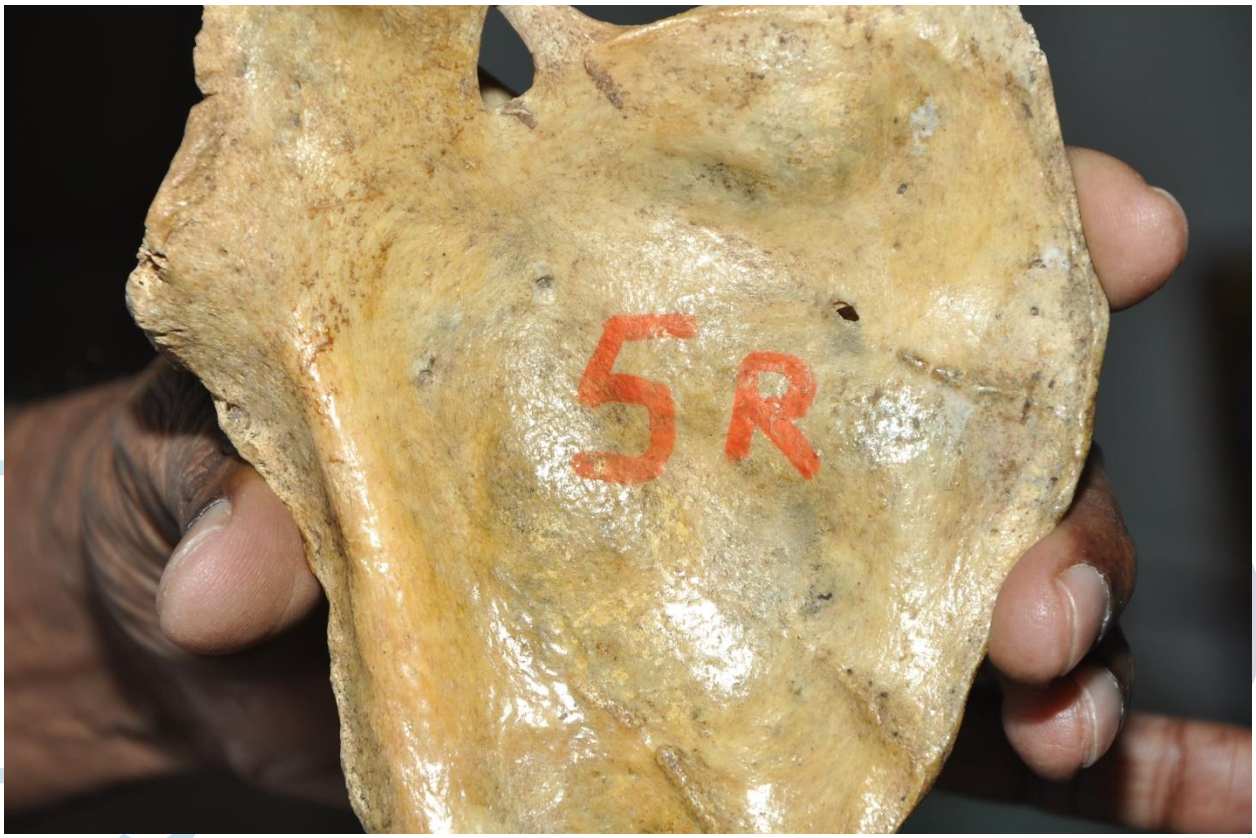
01. COMPLETE OSSIFICATION OF SUPERIOR TRANSVERSE SCAPULAR LIGAMNENT



PARTIAL OSSIFI

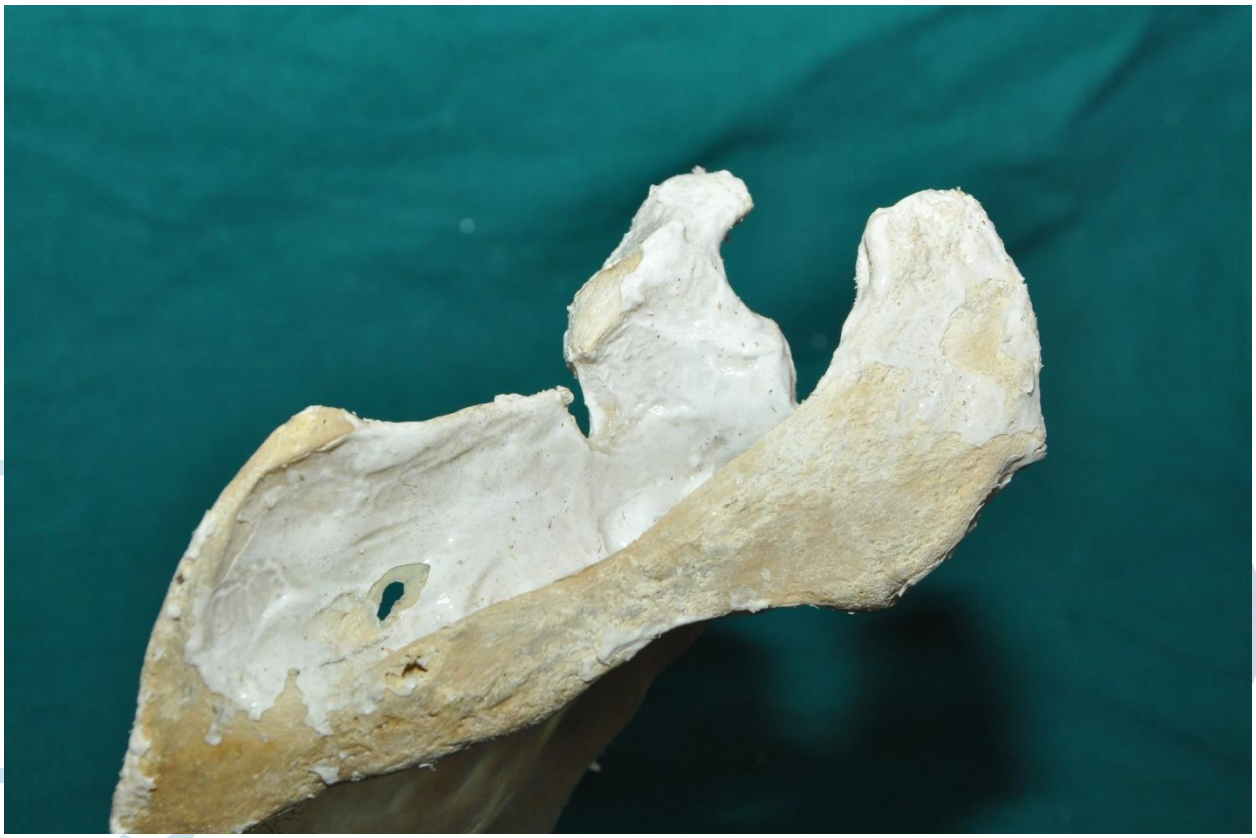
CATION OF SUPERIOR TRANSVERSE LIGAMENT.

02. THE SCAPULA WITH BONY FORAMEN (SUPERIOR TRANSEVERSE SUPRASCAPULAR LIGAMENT WAS COMPLETELY OSSIFIED

03. SHALLOW SUPRASCAPULAR NOTCH

04. NO SUPRASCAPULAR NOTCH

05. "J"SHAPED SUPRASCAPULAR NOTCH



06. "U" SHAPED SUPRASCAPULAR NOTCH

07. "V" SHAPED SUPRASCAPULAR NOTCH