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Morphometric Analysis of Suprascapular Notch in Human Adult Scapulae with Clinical Relevance.

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ABSTRACT

The suprascapular notch (SSN) is situated in the lateral part of the superior border of the scapula, just adjacent to the base of the coracoid process. This notch is converted into a foramen by the superior transverse scapular ligament (STSL) and serves as a passage for the suprascapular nerve. Suprascapular nerve entrapment was first described by Kopell and Thompson in 1959. Incidence of suprascapular neuropathy is 7 –10%. Most of the reported incidence is in overhead athlets like volleyball players accounting 12–33% of athletic population. Present study was conducted on 110 dry scapulae. Different shapes of suprascapular notch were Photographed using digital camera. Measurements were taken in millimeters using sliding vernier caliper. About 47 (42.73%) of the scapula had 'U'shaped SSN, followed by 'J'shape in 29 (26.36%)of the total scapulae studied. Seventy two (70.58%) scapulae had type II notch according to Natsis et al classification of SSN.The mean vertical length of SSN of right scapule is 7.741mm with standard deviation of 2.996mm and 7.869mm with standard deviation of 2.997mm on the left side in type II Natsis classification. The maximum distance between suprascapular notch and supraglenoid tubercle is 31.581mm with standard deviation of 2.859mm which is seen in type III SSN of Natsis classification. The maximum distance between posterior rim of glenoid cavity and base of scapular spine is 19mm which is seen in type IV SSN of Natsis classification. The shape of SSN and ossified STSL has been shown to be associated with increased risk of SN entrapment, resulting in weakness and wasting of supraspinatous and infraspinatous muscles. Anatomical knowledge of such variations should be kept in mind by a radiologist, Orthopaedicians and neurosurgeons as these variations may alter the technique of surgery.

Keywords: suprascapular notch, suprascapular nerve, superior scapular ligament.

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INTRODUCTION

The scapula (shoulder blade) is a triangular flat bone that lies on the posterolateral aspect of the thorax, overlying the 2nd to 7th ribs. The suprascapular notch (SSN) is situated in the lateral part of the superior border of the scapula, just adjacent to the base of the coracoid process. This notch is converted into a foramen by the superior transverse scapular ligament (STSL) and serves as a passage for the suprascapular nerve [1] . Suprascapular nerve (SN) supplies motor branches to the muscles supraspinatus and infraspinatus, and sensory branches to rotator cuff muscles, and ligamentous structures of the shoulder and acromioclavicular joints. Accordingly, this notch is an important landmark of the suprascapular nerve during arthroscopic shoulder operations[2,3]. Morphological variations of the suprascapular notch are important clinically. The size of the notch may play a role in the predisposition for the entrapment [4,5]. Smaller the size of the notch, greater the chance of nerve entrapment. Abduction of the shoulder joint beyond 90^0 may exert traction on the suprascapular nerve, which leads to its compression against transverse scapular ligament. Narrow suprascapular notches have been reported in patients with the nerve entrapment. Suprascapular nerve compression may present with vague pain radiating across the scapula, dull shoulder ache, limitations of shoulder joint movements and wasting of supraspinatus and infraspinatus[5]. Suprascapular nerve entrapment was first described by Kopell and Thompson in 1959[6]. Incidence of suprascapular neuropathy is 7 –10%. Most of the reported incidence is in overhead athlets like volleyball players accounting 12–33% of athletic population [7]. In the whole population, approximately 1–2% all shoulder pain is caused by the suprascapular nerve entrapment syndrome [8]. Knowing the anatomical variations in detail is better for understanding of location and source of the entrapment syndrome. However, the literature focusing on SSN and SN entrapment in Indian population is scarce. Therefore, the present study was done to obtain the morphological data regarding SSN in the population of South Karnataka of India.

MATERIAL AND METHODS

Present study was conducted on 110 dry scapulae collected from the department of Anatomy Sri Siddhartha Medical College, Tumkur, Karnataka, India.

The following parameters were used;

- Side determination of scapula.
- Shape of suprascapular notch on visual observation.
- Dimensions of notch- vertical length and superior transverse diameter.
- Distance between the deepest point of suprascapular notch and supraglenoid tubercle.
- Distance between posterior rim of glenoid cavity and medial wall of spinoglenoid notch.

Shape of suprascapular notch was recorded on gross examination &classified into various types as proposed by Iqbal et al [9]. Different shapes of suprascapular notch were Photographed using digital camera. Measurements were taken in millimeters using sliding vernier caliper (sensitivity 0.1mm) and SSN were classified into 5 types based on Natsis et al classification [10]. Scapulae with indentation, absence of notch and complete ossification of superior transverse scapular ligament (STSL) were excluded from measurement of vertical length and superior transverse diameter. Scapulae with absent SSN were excluded from measurement of distance between deepest point of SSN & supraglenoid tubercle.

RESULTS

In the present study, we analyzed 110 scapulae for various parameters as mentioned above.

About 47 (42.73%) of the scapula had ‘U’shaped SSN, followed by ‘J’shape in 29 (26.36%)of the total scapulae studied. Table 1 shows different shapes of suprascapular notch and also partial ossification of STSL. Side of the scapula was also noted with their shapes.Table 2 shows classification of SSN according to Natsis et al. Scapulae with indentation. Partial ossifications of SSN were excluded in this classification. Seventy two (70.58%) scapulae had type II notch according to Natsis et al classification of SSN.The mean vertical length of SSN of right scapule is 7.741mm with standard deviation of 2.996mm and 7.869mm with standard deviation of 2.997mm on the left side in type II Natsis classification (Table-3). The maximum distance between

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suprascapular notch and supraglenoid tubercle is 31.581mm with standard deviation of 2.859mm which is seen in type III SSN of Natsis classification. The maximum distance between posterior rim of glenoid cavity and base of scapular spine is 19mm which is seen in type IV SSN of Natsis classification (Table 4).

Figure 1: 'U' Shaped suprascapular notch

Figure 2: 'J' Shaped suprascapular notch

Figure 3: 'V' Shaped suprascapular notch

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Figure 4: Indentation suprascapular notch

Figure 5: Absent suprascapular notch

Figure 6: Partial ossification of suprascapular notch

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Table 1: Shape & Sidedness of SSN of scapula

Shape of SSN	L	R	Total
Absent	5	10	15(13.64%)
Indentation	3	5	8(7.27%)
Partial ossification	3	0	3(2.73%)
U	28	19	47(42.73%)
J	13	16	29(26.36%)
V	1	7	8(7.27%)
Total	**52(47.27%)**	**58(52.73%)**	**110(100%)**

Table 2: Distribution of SSN according to Natsis et al classification

Type	No Scapulae
I(Absence)	15(14.70%)
II(Td>Vl)	72(70.58%)
III(Vl>Td)	13(12.75%)
IV(Td=Vl)	2(1.96%)
V(Bony Foramen)	0
VI(Notch And Foramen)	0
Total	**102(100%)**

Table 3: shows the measurements of suprascapular notch in different Natsis types.

Natsis Types	Vertical length Mean+_SD(mm)		Transverse diameter Mean+_SD(mm)	
	Rght	Left	Right	Left
I	-	-	-	-
II	7.741±2.996	7.869± 2.997	11.2±3.411	11.309±3.329
III	7.68±3.014	7.768±2.957	11.426±3.243	11.231± 3.330
IV	9	3	9	3
V	-	-	-	-

Table 4: shows measurements of distance from suprascapular notch in different Natsis types

Natsis Types	Distance between suprascapular notch and supraglenoid tubercle.(AB)		Distance between posterior rim of glenoid cavity and base of scapular spine.(CD)	
	Mean + SD(mm)	Range	Mean + SD(mm)	Range
I	-	-	-	-
II	12.5 ± 2.815	25-36	15.266± 2.421	9-20
III	31.581 ± 2.859	28-36	15.242± 2.439	11-20
IV	30± 0	-	19 ± 0	-
V	-	-	-	-

Table 5: Showing the distance between suprascapular notch and supraglenoid tubercle(AB) and distance between posterior rim of glenoid cavity and base of scapular spine in mm(CD).

Shape	Frequency	Mean length+SD(AB)	Range	Mean length+SD(CD)	Range
U	47	31.62± 2.849	25-36	15.228± 2.468	9-20
J	29	31.505± 2.796	25-36	15.301± 2.430	9-18
V	8	31.453± 2.695	29-33	15.75±1.911	15-20
Indentation	8	-	-	-	-
Partial ossification	3	31.757± 3.0210	28-30	14.888±2.870	16-19
Complete ossification	0	-	-	-	-
Absent	15	-	-	-	-

Table 6: showing the comparison of the results of present study with previous studies

Type of SSN	Natsis *et al* (%) [Greek]	Wang *et al* (%) [Chinese]	Sutaria et al (%) [India]	Present study (%)
Type I	8.3	28	29	14.70
Type II	41.85	58.16	52	70.58
Type III	41.85	28.23	16	12.75
Type IV	7.3	3	2	1.96
Type V	0.7	0	1	0

Table 7: showing percentage of shapes of Suprascapular notch by different studies.

Shapes of SSN	Iqbal et al	Sutaria et al	Pragna et al	Vandana et al	Present study
U	13.2	38	47.50	35	42.73
V	20	7	7.50	5.2	7.27
J	22	22	35	34.3	26.36

DISCUSSION

Variation in the morphology of SSN has been identified as one of the causes of suprascapular nerve entrapment. Several classifications of variations in the shape of SSN have been reported. Ticker et al[11] classified suprascapular notch on basis of morphological appearance as U and V. Iqbal et al[9] reported three types of suprascapular notches, based on their shapes, 'U', 'V',' J' on gross examination, following the observations cited by Bayramoglu et al., [12], Hrdicka [13]. Nastis et al., [10] distinguished V notch on the basis of vertical and transverse diameter measurements and Polguj et al., [6] used geometrical parameters for assessment of V shape suprascapular notch. In our present study, we applied the classification of six types of suprascaular notches, which was stated by Nastis et al. In the present study 70.58% of the scapule were of type II which is similar to other studies (Table-6). In our study 'U' shaped SSN was the most common type which was comparable with other studies (Table-7) except in study conducted by Iqbal et al 'J'shaped SSN was the most common. 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 case of SSN entrapment in various case-reports. 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. 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.

CONCLUSION

The shape of SSN and ossified STSL has been shown to be associated with increased risk of SN entrapment, resulting in weakness and wasting of supraspinatous and infraspinatous muscles. A reduction in the height of the SSN substantially narrows the suprascapular foramen, should be considered as a possible etiologic factor in SN entrapment. Anatomical knowledge of such variations should be kept in mind by a radiologist, Orthopaedicians and neurosurgeons as these variations may alter the technique of surgery.

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