

## SUPRASCAPULAR NOTCH: A MORPHOMETRIC AND MORPHOLOGIC STUDY IN NORTH INDIAN POPULATION

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### ABSTRACT

**Background:** The suprascapular notch is a semicircular notch located at the superior border of the scapula, just medial to the base of the coracoid process which constitutes the main site of compression of the suprascapular nerve. The aim of present study is to study morphological variations of the suprascapular notch in the North Indian population, classify the suprascapular notch into various types and to correlate the type of notch to the incidence of suprascapular nerve entrapment syndrome.

**Materials and Methods:** Material for the present study comprised of 100 adult scapulae (Right : Left :: 50:50) of unknown age and sex, obtained from Department of Anatomy, Govt. Medical College, Amritsar, Punjab, India.

**Results:** Suprascapular notch was present in 95% bones, was transversely oval in 66%, vertical diameter = 5.9mm (3.29-16.80mm), transverse diameter = 5.96mm(2.93-13.70mm), distance from the base of suprascapular notch to the superior rim of glenoid = 29.98mm (21.7-39.25mm). It was classified as per Natsis et al classification into type I (20%), type II (39%), type III (34%), type IV (5%) and type V (2%). Our results were compared with the studies of other authors.

**Conclusions:** The knowledge of classification and the anatomical variations of suprascapular notch helps the clinician to define easily and quickly the type of notch and be able to correlate suprascapular nerve entrapment with a specific type of notch.

**KEY WORDS:** Suprascapular Notch, Superior Transverse Ligament, Vertical Diameter, Transverse Diameter.

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### INTRODUCTION

The suprascapular notch (SSN) is a semicircular notch [1,2] located at the superior border of the scapula, just medial to the base of the

coracoid process. It constitutes the main site of compression of the suprascapular nerve (SN). Suprascapular nerve supplies motor branches to supraspinatus and infraspinatus muscles and

sensory branches to rotator cuff muscles, ligamentous structures of the shoulder and acromioclavicular joint. The notch is bridged by the superior transverse ligament which is attached laterally to the root of the coracoid process and medially to the limit of the notch [1]. The notch may be converted into a bony foramen by the ossification of this ligament [1,3]. The outcome of this superior transverse scapular ligament ossification is suprascapular osseous bridge [4]. The suprascapular vein and nerve run below the superior transverse scapular ligament, and suprascapular artery runs above it [5-8]. When the ligament is ossified, area below the ligament is reduced which may lead to suprascapular nerve entrapment. Direct trauma, fracture of the scapula, ganglion cysts, lipomas, tumours, occupational overuse and traction injuries are the other causes [9].

The knowledge of classification and the anatomical variations of suprascapular notch helps the clinician to define easily and quickly the type of notch and be able to correlate suprascapular nerve entrapment with a specific type of notch [10]. First described by Kopell and Thompson 1959 [11], suprascapular nerve entrapment is cause of shoulder pain in approximately 1-2% population [12] which is manifested as weakness of the arm, difficulty in external rotation and abduction, and later on, atrophy of supraspinatus and infraspinatus muscles. It is most commonly seen in volleyball players, athletes, baseball players, weight lifters, tennis players, fencers, hunters, dancers, figure skaters and people in an occupation requiring overhead work i.e. extreme abduction and external rotation [13-17]. This notch is an important landmark in arthroscopic shoulder operations for the suprascapular nerve [18,19]. The aim of present study is to study morphological variations of the suprascapular notch in the North Indian population, classify the suprascapular notch into various types as described by earlier authors and 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 scapulae (Right : Left :: 50:50) of

unknown age and sex, obtained from Department of Anatomy, Govt. Medical College, Amritsar. These dried scapulae were labelled from 1-100 with suffix R (Right) or L (Left). Different morphological features of suprascapular notch were observed and morphometric measurements were taken:

**Presence/Absence of notch:** It was observed whether notch is present or absent and if present, its site was noted [20].

**Shape:** Its shape was observed whether ovoid or otherwise [21].

**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 [10] (AB in Fig.1). For measuring this distance a scale was kept touching the 2 corners of the notch and vertical perpendicular distance of the notch from this scale was measured with depth bar of vernier calipers (see Fig.2).

**Transverse diameter:** It was measured with the help of vernier caliper as the diameter perpendicular to vertical diameter approximately at its midpoint [10] (CD in Fig.1).

**Distance from the base of suprascapular notch to the superior rim of glenoid:** It was measured with the help of vernier callipers [22] (BE in Fig.1).

**Type of notch:** It was classified as per Natsis et al 2007 [10] classification as type I, II, III, IV or V.

**Fig. 1:** Showing the Imaginary lines.



**AB:** Vertical diameter of suprascapular notch

**CD:** Transverse diameter of suprascapular notch

**BE:** Distance from the base of suprascapular notch to superior rim of glenoid.

**Fig. 2:** Measurement of vertical diameter of suprascapular notch.



**Fig. 3:** Presence of both notch and foramen.



**Fig. 4:** Presence of both notch and foramen.



**RESULTS AND DISCUSSION**

**Presence/absence of notch:** It was present in 95 (95%) bones and absent in 5(5%) bones.

**Shape of notch:** Table 1 depicts incidence of different shapes of suprascapular notch as observed in the present study.

**Table 1:** Showing comparison of shape of suprascapular notch.

Shape	Right	Left
Transversely oval	35	31
Round	2	5
Vertically oval	1	1
No discrete shape	10	10
Complete foramen	2	3
<b>Total</b>	<b>50</b>	<b>50</b>

**Other parameter of suprascapular notch:** Table 2 depicts mean values and range of different parameters of suprascapular notch as observed in the present study.

**Table 2:** Showing comparison of various parameters of suprascapular notch.

Parameter	Mean(mm)			Range(mm)		
	Right	Left	Both	Right	Left	Both
Vertical diameter	5.8	6.01	5.9	3.70-12.96	3.29-16.80	3.29-16.80
Transverse diameter	5.55	6.36	5.96	2.93-13.05	3.24-13.70	2.93-13.70
Distance from base of suprascapular notch to superior rim of glenoid	30.1	29.86	29.98	21.98-39.25	21.70-35.25	21.70-39.25

**Type of notch:** In the present study, the notch was classified as per the classification given by Natsis et al 2007 [10] and Our results were in consonance with theirs study. According to this classification following types were observed :

- 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 3:** Showing type of suprascapular notch.

Author	Race	N	Type of notch				
			Type I	Type II	Type III	Type IV	Type V
Natsis et al 2007 [10]	German	423	35(8.3%)	177(41.85%)	177(41.85%)	31(7.3%)	3(0.7%)
Present study	North Indian	R(50)	10(20%)	15(30%)	21(42%)	2(4%)	2(4%)
		L(50)	10(20%)	24(48%)	13(26%)	3(6%)	nil(0%)
		T(100)	20(20%)	39(39%)	34(34%)	5(5%)	2(2%)

Table 3 depicts different types of suprascapular notches as observed in the present study and compares the same with the observation made by Natsis et al 2007 [10].

Suprascapular nerve entrapment syndrome has been found to be associated with narrow suprascapular notch. So its typing is clinically very important. The present study classifies the suprascapular notch on basis of specific

geometrical parameters that clearly distinguish each type. The classification also helps to correlate suprascapular nerve entrapment and specific types of suprascapular nerve. The type of notch might then be considered in diagnosing the syndrome [22].

**The various parameters observed in our study are discussed below:**

**Presence or absent of Suprascapular notch:**

It was present in 95 (95%) bones. Out of these, 48 (96%) belonged to the right side and 47 (94%) belonged to the left side. In the rest of the 5 bones (R:L :: 2:3) the suprascapular notch was converted into a foramen. In additional 2 (2%) bones of the right side (sr. no. 18R and 23R) both suprascapular notch and foramen were present (Fig. 3 & 4).

**Shape of suprascapular notch:** In majority of the bones studied (R:L :: 35:31), the suprascapular notch was transversely oval on both the sides. Table I depicts the other shapes observed. 2 bones (sr. no. 12R and 28R) on the right side and 3 bones (sr. no. 62L, 63L and 77L) on the left side showed the presence of foramen. In 2 bones (sr. no. 18R and 23R) of the right side, both notch and foramen were present. Thus, total 7 (7%) bones showed the presence of foramen.

**Vertical diameter of suprascapular notch:** The mean vertical diameter was 5.90 mm (Range=3.29-16.80 mm). On the right side, it was 5.80 mm (Range=3.70-12.96 mm) whereas on the left side, it was 6.01 mm (Range=3.29-16.80 mm). Thus, it was higher on the left side than the right side (Table 2). 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=2.93-13.70 mm). On the right side, it was 5.55 mm (Range=2.93-13.05 mm) whereas on the left side, it was 6.36 mm (Range=3.24-13.70 mm). Thus, it was higher on the left side than the right side (Table 2).

**Distance from base of suprascapular notch to superior rim of glenoid:** The mean distance was 29.98 mm (Range=21.70-39.25 mm). On the right side, it was 30.10 mm (Range=21.98-39.25

mm) whereas on the left side, it was 29.86 mm (Range=21.70-35.25 mm). Thus, it was slightly higher for the right side than the left side (Table 2). Earlier Von Schroeder et al<sup>22</sup> had measured this distance. They found it to be 31.8 mm (Range=28-39 mm). Our results were found to be in consonance with theirs.

**Type of notch:** We classified our bones according to Natsis's classification. Based on it, we classified 20 (20%) bones as type I, 39 (39%) as type II, 34 (34%) as type III, 5 (5%) as type IV and 2 (2%) as type V (Fig. 3 and 4).

Hrdlicka 1942 [23] was the first to separate the suprascapular notches into 5 types. Rengachary et al. 1979 [24] classified the suprascapular notches into 6 types. Type I is identical with our type I, without a discrete notch. Type II is a wide, blunted "V" shaped notch, with its widest point along the superior border of the scapula. Type III is a symmetrical, "U" shaped notch, with nearly parallel lateral margins. Type IV is a very small and "V" shaped notch. Type V is a "U" shaped notch, with partial ossification of the medial part of the superior transverse scapular ligament and type VI is a bony foramen, with a completely ossified superior transverse scapular ligament, identical with our type IV notch.

Ticker et al. 1998 [25] and Bayramoglu et al. 2003 [26] modified the classification of Rengachary et al. 1979 [24] and included only the "U" shaped notch, the "V" shaped notch, and the notch with ossification of the superior transverse scapular ligament. The disadvantage of this simple classification used by these two groups is that it's not based on specific geometrical parameters, as our method.

The new classification suggested by Natsis et al. 2007 [10] simplifies the classification procedure by only requiring two requirements, vertical and transverse diameter. That is why this method is easy to remember and use. It is easy to measure these two diameters on a plain radiograph. The projection in which the suprascapular nerve is visualized clearly is the anteroposterior projection with the X-ray tube angled 15-30° caudally [15]. So, it becomes easy for the clinician to define the type of notch on a plain radiograph, and researchers will be able to determine whether one type has a greater

incidence than the others in patients with suprascapular nerve entrapment syndrome.

**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 [15]. The shape of suprascapular notch may alter the distance between it and the supraglenoid tubercle, which is important for the determination of a 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 [18,27].

## CONCLUSION

The knowledge of morphometric variations of suprascapular notch is essential for clinicians for making a proper diagnosis and for planning a suitable surgical intervention. Further detailed studies like clinical screening of high risk population by specialists of community medicine, sports medicine, orthopaedicians and general surgeons for the incidence of suprascapular nerve syndrome ; confirmation of suprascapular nerve entrapment syndrome by radiologists by using imaging modalities like MRI, CT and ultrasound and surgical interventions for either open or laparoscopic suprascapular nerve entrapment syndrome, coupled with histopathological studies on suprascapular nerve may throw some more light

**Conflicts of Interests: None**

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