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Anatomical variations in suprascapular notch

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Abstract
30 dried scapulae of unknown sex and age were studied to see the variations in suprascapular notch. Suprascapular nerve and vessels pass through suprascapular notch which is converted into foramen after bridging by superior transverse scapular ligament. The shape, size of suprascapular notch and ossification of superior transverse scapular ligament is related to entrapment of suprascapular nerve. In the present study out of 30 scapulae, shallow and deep suprascapular notches were seen in 10 and 18 scapulae respectively. In two scapulae ossification of superior transverse scapular ligament was seen to convert into foramen. This incidence is very rare. Knowledge regarding suprascapular notch and its variations will be helpful for orthopedic surgeons during suprascapular nerve decompression procedure.

Keywords: suprascapular nerve, suprascapular foramen, scapula, superior transverse scapular ligament, suprascapular nerve entrapmen

Introduction
Suprascapular notch (SSN) is present on the superior border of scapula at the base and medial side of coracoid process. Suprascapular nerve and vessels supply supraspinatus and infraspinatus muscle after passing through SSN. SSN is converted in to suprascapular foramen (SSF) by superior transverse scapular ligament which is attached to edges of SSN. This not only gives protection to the neurovascular bundle but also keeps the structures in place. The suprascapular nerve can get compressed if the area of the notch or foramen is small. This can happen in case of small SSN or ossification of superior transverse scapular ligament of small SSN. This phenomenon of ossification or calcification of superior transverse scapular ligament is rare but it is possible. Its occurrence is frequently seen in animals but its prevalence is said to be very low in humans [1]. Often the STSL is ossified to produce compression of the suprascapular nerves which results in symptoms like pain in the shoulder region, wasting and weakness of the supraspinatus and infraspinatus muscles [2]. An early and correct diagnosis requires a thorough anatomical knowledge of its possible sites of entrapment. The suprascapular nerve is commonly susceptible to compression mainly at two major sites i.e. at the level of the suprascapular notch and at the base of the spine of scapula [3]. Nevertheless, variations in its thickness and length and its tendency to ossify, suggest that the ligament responds to changes in mechanical load [4]. Variations in superior transverse scapular ligament can be seen as ossification or calcification, completely or incompletely and unilaterally or bilaterally. The ossified STSL is a potential risk factor in the formation of suprascapular nerve entrapment [5] the incidence of appearance of SSF because of ossification of superior transverse scapular ligament varies throughout the world. Chances of entrapment of suprascapular nerve are higher in smaller SSN than shallow SSN. During investigation in case of entrapment of suprascapular nerve the region of SSN on scapula is not focused in X ray or MRI usually and so accurate diagnosis may not be achieved. Knowledge regarding focusing on involvement of SSN in terms of shape and size and number of SSF will be very useful during investigating and or decompression of suprascapular nerve entrapment for flawless outcome.
To see the incidence of SSF in terms of number, side and size and SSN in terms of shape we studied 30 dried scapulae which belonged to the department of anatomy.

Materials and Methods
28 dried scapulae of unknown sex were studied and 2 scapulae were of known sex and age. These two scapulae were retrieved during routine retrieval process of 43 years old male who donated the body.
SSN and presence of SSF was observed.
Transverse diameter (TD) was taken by measuring distance between two edges of SSN with digital Vernier caliper (image no 5).
Vertical diameter (VD) was taken by measuring the distance between floor of SSN and midpoint of transverse diameter with digital Vernier caliper (image no 1).
SSN was classified on the basis of transverse and vertical diameter
Type I- Absence of SSN
Type II- TD > VD
Type III- VD > TD
Type IV- Presence of SSF
Type V- Presence of SSF and SSN

Observations and Results
1. 18 scapulae were of left side and 12 scapulae were of right side.
2. In none of the scapulae discrete SSN was observed.

3. Out of 28 scapulae, TD of SSN is more than VD of SSN was seen in 17 (10 left side: and 7 right side) scapulae (Image no 2)
4. Out of 28 scapulae, VD of SSN is more than TD of SSN was seen in 11 (9 left side: and 2 right side) scapulae (Image no 3)
5. In two scapulae one from each side SSF was observed (Image no 4).
6. Existence of SSN on left side and SSF on right side scapula was observed in same cadaver whose age and sex was known (Image no 5).

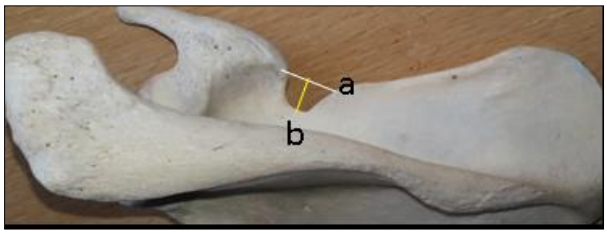

Fig 1: Image no 1 shows a- transverse diameter
b- Vertical diameter

Fig 2: Image no 2 shows TD of SSN > VD of SSN

Fig 3: Image 3 shows VD of SSN > TD of SSN

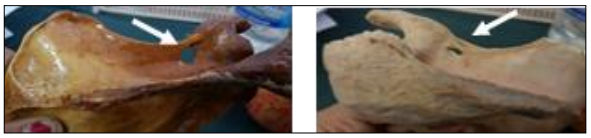

Fig 4: Image no 4 shows SSF

Fig 5: Image no 5 shows SSN (left side) and SSF (right side) in same cadaver

Table 1: shows comparison of data

S. No	Type of SSN		Natsis *Et al* [10]	Present study
1	I	Absence of SSN	8.3%	--
2	II	TD > VD	41.85%	56.66%
3	III	VD > TD	41.85%	36.66%
4	IV	Presence of SSF	7.3%	06.66%
5	V	Presence of SSN & SSF	0.7%	--

Discussion

Wide literature is available on study of SSN and SSF which tells various types of SSN and existence of SSF is seen with variety of incidences throughout the world. It also focuses that the phenomenon of SSF formation because of superior transverse scapular ligament ossification which is rare but possible.

Various authors studied different types of SSN on the basis of their shape [6, 7, 8, 9] and on the basis of transverse and vertical diameter of SSN [10, 11, 12]

Suprascapular nerve entrapment in SSN may lead to restricted movements of shoulder and can get aggravated if ignored. Any alteration in the shape of SSN may lead to entrapment of suprascapular nerve. Deformities in the shapes of SSN are said to play a major role in this regard [13]. Anatomical variations of SSN are possible cause of suprascapular nerve entrapment, especially in individuals involved in repetitive and forceful overhead activities (e. g volleyball players and basketball pitchers) [12]. While aberrant course of suprascapular artery through the SSN can lead to suprascapular nerve compression [14]. However clinical studies indicate that there is no direct co-relation between type of the notch and nerve entrapment [15]. Suprascapular plays crucial role in shoulder pain, its possible role is often overlooked in differential diagnosis of shoulder discomfort [16]. We have found 11 out of 28 scapulae (39.28%) in which vertical diameter is more than transverse diameter and in 17 out of 28 scapulae (60.71%) in which transverse diameter is more than vertical diameter. We did not come across any absence of SSN and presence of SSN with SSF. As per table no 1 incidence of absence of SSN is 8.3% and coexistence of SSN and SSF is 0.7% [10]. Clinicians will be able to define easily and quickly the notch on a plain radiograph and perhaps be able to co-relate suprascapular nerve entrapment with specific type of SSN [10].

Along with the diameters of SSN knowledge of ossification of superior transverse scapular ligament which bridges SSN to form SSF will be helpful in understanding the basis of suprascapular nerve entrapment. Though its occurrence is rare it is seen unilaterally, along with SSN, completely and or partially. Many authors have documented its incidence of complete ossification of STSL ranging from 3.7 to 13.6% [6, 11, 14, 17, 18, 19, 24] in western population and in Indian population the incidence is 10.57% [25], 4.92%[26], 19.44% [27]. In our study, the incidence is 6.6%.

The ossified suprascapular ligament narrows the suprascapular foramen therefore, it causes compression of suprascapular nerve and complaints of suprascapular nerve entrapment [28]. Ossification of superior transverse scapular ligament may be influenced by age, mechanical load on the ligament and sex [26]. It can be affected genetically[29]. SSF may be associated with SSN but we have not come across such combination.

For most suprascapular nerve injuries, initial nonsurgical

treatment is preferred [30, 31]. It is hypothesized that repetitive overhead motion or trauma contributes to ossification of the ligament. Treatment for compression of the suprascapular nerve begins with physical therapy aimed at strengthening the rotator cuff musculature. If conservative treatment fails, surgical decompression of the suprascapular ligament is recommended [32, 33]. Arthroscopic decompression may facilitate a more rapid recovery especially when the entrapment is caused solely by the ossified ligament [30].

During resection of ossified superior transverse scapular ligament in decompression of suprascapular nerve orthopedic surgeons should take extra care of suprascapular nerve. This study of variations of SSN and existence of SSF will be very much useful for orthopedic surgeons, radiologist for better diagnosis and management of entrapment syndrome.

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