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Research article

MORPHOLOGICAL STUDY ON SUPRASCAPULAR NOTCH AND SUPERIOR TRANSVERSE SCAPULAR LIGAMENTS IN HUMAN SCAPULAE

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ABSTRACT

Background: The scapula is a flat triangular bone situated on the posteroleteral aspect of thoracic wall between second and seventh rib. The coracoid process of scapula projects upward and, medial to the base of coracoid process is the Suprascapular Notch (SSN). Morphology of SSN is considered to be a risk factor for Suprascapular Nerve (SN) entrapment in combination with an anomalous Superior Transverse Scapular Ligament (STSL). **Aim**: To review and document the morphology of suprascapular notch, degree of ossification of superior transverse scapular ligament and its clinical correlation. **Materials and Methods**: The study was carried out by visual observation on 115 dried human scapulae. **Result**: It was observed that 115 scapulae showed different shapes with symmetrical 'U', the most common type (34.78%). There was a unique variation in one left scapula, where SSN was replaced by a narrow groove (0.86%). **Conclusion**: This study will help to correlate suprascapular nerve entrapment with a specific type of SSN.

Keywords: Suprascapular notch, Superior transverse scapular ligament, suprascapular nerve entrapment.

INTRODUCTION

Suprascapular notch is situated at anterolateral end of the superior border of scapula, separating the root of coracoid process from superior border of scapula. The notch is bridged by the STSL, which is attached laterally to root of coracoid process and medially to the limit of the notch. This ligament converting the notch into the foramen, transmits suprascapular nerve to supraspinous fossa, whereas the suprascapular vessels pass backwards above the ligament[1].The morphology of the suprascapular notch is considered to be a risk factor for suprascapular nerve entrapment either in combination with an anomalous STSL or as a narrowed notch[2]. Accordingly this notch is an important landmark of the suprascapular nerve during arthroscopic

shoulder operation[3]. Previously SSN has been classified by many researchers based on complex geometrical calculations. Studies reveals, 6 different types of anatomical variations of the suprascapular notch, including complete absence of notch have been reported in Nigerian population[4,5]. Koepell and Thompson (1959) were the first to describe the SN entrapment syndrome[6] .They reported that abduction or horizontal adduction of the shoulder exerted traction on the SN, which led to its compression against the STSL. The anatomical variation of the SSN includes the variation in shape, complete or partial ossification of STSL. Rengachary et al observed 6 basic types of SSN in 2011 scapulae[7]. The purpose of this study was to document the incidence, morphology and clinical significance of SSN and the existence of ossified STSL.

MATERIALS AND METHODS

The study was conducted on 115 dried human scapulae (54 right and 61 left) obtained from bone library, Department of Anatomy, Subbaiah Institute of Medical Sciences and Research Centre, after obtaining clearance from the Institutional Ethics Committee. This is an observational study, conducted from January 2012 to February 2013. Scapulae were analyzed for morphology of SSN and degree of ossification of STSL, irrespective of age, sex and race. Scapulae with damaged SSN were excluded from the study. The results were documented by photographs.

RESULTS

In the present study different shapes of SSN and degree of ossification of STSL were documented in Table 1 and Table 2. Table 1 shows different types of SSN. Among different types symmetrical 'U' shape is most common followed by 'J' shaped notch. In one of 115 dry human scapulae, SSN was replaced by a narrow groove, which extended from lateral end of superior border to the spinoglenoidal notch. Table 2 shows different degrees of ossification of STSL, which includes both complete and partial ossification. In one left scapulae out of 115, there was notch with foramen.

Table.1: Different types Suprascapular Notch

Shape of SSN	No. of Scapulae [Right & Left]	Percentage (%)
Symmetrical U shaped	39 [22 & 07]	34.78
Shallow U	07 [03 & 04]	6.08
J shape	22 [10 & 12]	19.13
Wide notch	08 [04 & 04]	6.95
Indented	09 [04 & 05]	7.82
Hockey stick	06 [04 & 02]	5.21
Deep U	07 [04 & 03]	6.08
Absence	07 [05 & 02]	6.08
Groove	01 [00 & 01]	0.88

Table.2: Types of different degrees of ossification

Degree of Ossification	No. of Scapulae [Right & left]	Percentage (%)
Complete	05 [02 & 03]	4.34
Partial	02 [01 & 01]	1.73
Notch with foramen	01 [00 & 01]	0.86

Table.3: Comparison of different shapes of SSN and degree of ossification of STS of previous studies with present study.

Shapes of SSN	Previous studies (%)				Present study (%)
	Sinkeet et al 2010	Polguj et al 2010	Iqbal et al 2010/11	Soni et al 2012	
Symmetrical	29	2.3	14/13.2	58	34.78
Shallow U	21	-	-	-	6.08
J shape	-	-	00/22	27	19.13
Wide notch	-	57.7	-	-	6.95
Indented	-	-	00/27.5	03	7.82
Hockey stick	22	-	-	-	5.21
Deep U	-	24.4	-	-	6.08
Absence	2.12	-	10/23	02	6.08
Groove	-	-	-	-	0.88
V shape	5.18	-	68/20	07	-

SSN: Suprascapular Notch, STS: Superior Transverse Scapular Ligament.

Fig 1: **Different Shapes of SSN.** a) Width and breadth of SSN equal, b) Width is greater than breadth, c) One edge of SSN was longer, d) Width is more wider, e) Almost like a shape of hockey stick, f) SSN was absent, g) slight notch was present, h) a groove replacing SSN, i) breadth is greater than the width.

a) Complete **b) Partial** **c) Notch with foramen**

Fig 2: Different degrees of ossification of STSL a) STSL was completely calcified, b) partially calcified STSL c) Ossified band of STSL dividing the SSN into foramen below and notch above

DISCUSSION

Study on morphology of SSN and degree of ossification of STSL, is done by many researchers. Joe De Beer, in his study stated that, the shape of the notch and calcified STSL has been shown to be associated with increased risk of SN entrapment, resulting in weakness and wasting of supraspinatus and infraspinatus muscles[8]. Dunkelgrun et al stated that 'U' shaped notches had a larger area than the 'V' shaped notches, leading to the assumption that a 'V' shaped notch is more likely to be connected with nerve entrapment[9].

A study by Sinkeet et al (2010, in Kenyan population)[10] classified 6 types of SSN with description, which also includes degree of STSL ossification. According to their study Type I represent wide 'U', Type II represents 'J' shape, Type III, which has explained has most common, represents symmetrical, Type IV represents 'V' shape, Type V&VI are related to the degree of ossification of STSL, to the present study.

Polguj et al (2010)[11] found that, in 21 (24.4%) scapulae the maximal depth(MD) of notch is more than superior transverse diameter (STD),which represents deep 'U' of present study. Two scapulae (2.3%) had equal MD and STD, represents symmetrical of present, in 47 (57.7%) scapulae the STD was longer than MD, represents wide 'U' of present.

In a study by Iqbal et al[12, 13] 2011-12 in Pakistani population, in their two different studies showed that 4 types of notches, with 10% without notch (type 1), 14% symmetrical (type 2), 68% 'V' shape (type 3) and 8% inverted 'V' (type 4) which is having a greater inferior maximum length as compared to superior length. Soni Garg et al (2012) reported that, symmetrical is most common type, with 'V' shape least common[14].

Regarding degree of ossification, complete ossification of STSL was reported, 30.76%, 3%, 7%, and 3% by Silva et al 2007[15], Sinkeet et al 2010[10], polguj et al 2010[11], and Soni Garg et al 2012[14], respectively. Partially ossified STSL is reported by Sinkeet et al 18% and G. Soni et al 11%.

Notch with foramen is described by Natsis et al as bony bridge, which limit the area of SSN and divide it into a bony foramen inferiorly and a notch superiorly[16]. He found such type of variation in 2 scapulae out of 204 scapulae (0.98%).

In the present study we have explained different shapes of notch depending on size and shape and also different degrees of ossification which are illustrated in Table 1and Table 2, and compared with previous studies in Table 3. These various shapes are thought to play a part in the predisposition for SN entrapment, assuming that a small notch gives a larger chance of nerve impingement than a large notch.

Our study also showed a unique variation found in one left scapulae that, presence of groove extending from lateral end of superior border to its spinoglenoidal notch, where SSN was absent. Assuming this groove in living bridged by ligament, converting groove into osseofibrous

tunnel which may cause increased risk of SN 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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