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Original Research Article

MORPHOLOGICAL VARIATIONS OF THE SUPRASCAPULAR NOTCH: CLINICAL RELEVANCE IN SUPRASCAPULAR NEUROPATHY VIS-A-VIS OSSIFIED SUPERIOR TRANSVERSE SCAPULAR LIGAMENT

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ABSTRACT

Background: Suprascapular notch is an indentation in the superior border of the scapula which is just medical to base of the coracoid process. The superior transverse scapular ligament (STSL) ossifies to form suprascapular foramen and serves as passage for suprascapular nerve. Morphological variations of SSN play a crucial role in the suprascapular neuropathy due to nerve entrapment.

Objective: To study variations of suprascapular notch in dry scapulae and to find out and compare the incidence of ossified STSL/ suprascapular foramina with previous studies from different regions.

Materials and Methods: The present study was conducted on 106 dry human scapulae of unknown age and sex in the Department of Anatomy, ACPM Medical College, Dhule. This was an observational study over a period of nine months from July 2016 to March 2017.The scapulae were examined to assess morphological variations of SSN and various types were classified as per Rengachary et al. The results of present work were compared with previous studies.

Result: Complete ossification of STSL leading to foramina (Type VI) was observed in 09(8.5%) out of 106 scapulae. The most frequent type seen was Type III in 43(40.6%) scapulae, second most common- Type I-26.4%, and rest were Type II-17%,Type IV-4.7%, and Type V-2.8% .

Conclusion: Better understanding and thorough knowledge of variations of suprascapular notch vis-à-vis ossified STSL leading to foramina is important for anatomists and clinicians (surgeons and orthopedics) for making proper diagnosis of suprascapular neuropathy and planning the most suitable surgical corrections.

KEY WORDS: Suprascapular Notch, Foramina, Superior Transverse Scapular Ligament, Neuropathy, Scapula.

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INTRODUCTION

Shoulder blade or scapula is a point of attraction to many anatomists due to its characteristic triangular shape having 3 borders, 3 angles, 3 processess and 2 surfaces [1]. The action of scapula is like fulcrum and important for the motions of humerus. Scapula has three borders; superior border is thin, sharp and shortest while

it is interrupted by semicircular indentation just medial to coracoid process known as suprascapular notch (SSN) [2]. The superior transverse scapular ligament (STSL) is a fibrous band connecting two borders of notch forming suprascapular foramina (SSF), transmitting suprascapular nerve to supraspinatus fossa [2].

The suprascapular nerve, a branch from upper trunk of branchial plexus gives motor branch to supraspinatus and infraspinatus muscle and sensory branch to rotator cuff muscles, ligaments of shoulder and acromioclavicular joint [2].

The most common risk factor for the suprascapular nerve entrapment is a completely ossified STSL [3]. The main manifestations of neuropathy are dull, diffuse pain in posterior and lateral aspect of shoulder, weak abduction and rotation of upper extremity at joint and atrophy of supra and infraspinatus muscle [4]. Such injuries are more common in sport personals due to repeated stress on shoulder. Hence SCN is an important landmark of suprascapular nerve during arthroscopic ligament repairs.

Rengachary SS et al [5,6] classified SCN into six different types on morphological features and stated that size of SCN played a important role in predisposition of suprascapular nerve entrapment.

In the present study, we studied all six morphological variants of suprascapular notch (Type I to VI) as per Rengachary SS et al. [5,6]. We correlated our findings with previous Indian studies and various ethnic population from available literature.

MATERIALS AND METHODS

In the present study, 106 dry human scapulae of unknown age/sex were collected from the Department of Anatomy, ACPM Medical College, Dhule. This was an observational study of morphological variants of suprascapular notch over a period of nine months from July 2016 to March 2017.

The scapulae available in the department with intact or unbroken superior border were included whereas the scapulae with broken superior border were excluded from the study. The scapulae were examined for the morphological variation of SCN and its types as classified by Rengachary SS et al.[5,6] The results of present study vis-à-vis superior transverse scapular ligament were tabulated and compared with various Indian and other ethnic studies available from the literature.

We classified the morphology of SCN into six types as per Rengachary SS et al [5,6] based on shape as well as ossification of STSL, as follows:

Type I- Complete absence of notch, wide depression from the superior angle to base of coracoid process.

Type II- Wide blunted V-shaped notch occupying a third of superior border of scapula.
Type III- Symmetrical U-shaped notch with parallel margins.

Type IV- Small ,narrow V-shaped notch.

Type V- U-shaped notch with partial ossification of medial part of STSL.

Type VI – Completely ossified ligament forming a foramen of variable size.

RESULTS

In the present study on 106 dried human scapulae, we found all the six types of suprascapular notch as per classification [5,6]. We found 09(8.5%) scapulae with completely ossified STSL forming SSF (Type VI).After observation and analysis of morphological variants of suprascapular notch, we noted: Type I-26.4%,Type II-17%, Type III-40.6%,Type IV-4.7%,Type V-2.8% and Type VI-8.5% (Table 1) The gross photographs of various notch types were shown in Figure no.1as type I to type VI highlighting superior border of scapulae with notch variant.

Table 1: Morphological variants of suprascapular notch as per Rengachary SS et al[5,6] in our study.

Type	I	II	III	IV	V	VI	Total
Number of scapulae	28	18	43	5	3	9	106
Percentage (%)	26.4	17	40.6	4.7	2.8	8.5	100

In our study, we observed type III (40.6%) as the most common type of suprascapular notch as per Rengachary SS et al. [5,6] We noted various forms of type III in Figure no.2. Second most common type was type I (26.4%) after type III. We found 3(2.8%) scapulae of type V (partially ossified STSL forming incomplete foramina) highlighted in figure no.3a,b.

Characteristically we noted 09(8.5%) scapulae

with type VI (completely ossified STSL forming suprascapular foramina) and the photographs were highlighted in figure no.4 as 4a,4b,4c (ventral/anterior aspect) and 4d,4e,4f (dorsal/ posterior aspect).

Fig. 1: Showing various notch types (type I to type VI) as per Rengachary's classification.

Fig. 2: Most common type of notch in our study (type III) with various forms.

Fig. 3: Showing type V notch with partial ossification of STSL:3a –ventral aspect and 3b-dorsal aspect.

Fig. 4: Type VI notch with completely ossified STSL forming suprascapular foramina on ventral aspect (a,b,c) and dorsal aspect(d,e,f)

DISCUSSION

In the present study, the incidence of completely ossified scapular ligament leading to type VI was 8.5%.This is the characteristic finding in our study in view of clinical importance leading to neuropathy. The incidence of type VI by various Indian researchers in chronological order was shown in Table 2 ranges from lesser incidence as 1 to 3% with an average of 10 to 12%.

Table 2: Incidence of type VI by various Indian authors as per chronological order.

Serial number	Author/Year of study	n (Sample size-no of scapulae)	Percentage (%) of type VI
1	Iqbal K et al [7] 2010	250	0
2	Malik G E et al [8] 2012	100	3
3	Jadhav S et al [9] 2012	350	10.57
4	Reddy M [10] 2013	104	1.93
5	Karam K [11] 2013	100	2
6	Vandana Ret al [12] 2013	134	12.6
7	Kannan U et al [13] 2014	400	10
8	Neeta Chhabra et al [14] 2016	126	2.4
9	Shalom Elsy Philip el al [15] 2017	100	3
10	Present study 2017	106	8.5

The incidence of suprascapular foramen in our study is comparable and in concordance with various ethnic population based studies. After going through available literature of study on completely ossified STSL, we found concordance of our incidence with Polguj M et al [16] (Poland) and Grey DJ et al [17] (America and Europeans) as shown in Table no.3

Table 3: Incidence of suprascapular foramina by different ethnic population studies.

Serial no	Author	Race /sample size(n)	Percentage(%) of type VI
1	Polguj M et al [16]	Poland (86)	7.00%
2	Grey DJ et al [17]	Americans &Europeans(1151)	6.34
3	Natsis K et al [18]	Greek(423)	6
4	Vallois HV [19]	French (200)	6.5
5	Olliver G et al [20]	French (133)	5-6.5
6	Present study	India (106)	8.5

In our morphological study on 106 scapulae, we found most common type of SCN is type III (40.6%) and this observation is in accordance with previous cited studies by Jadhav S et al [9] (39.79%)and Agrawal D et al [21](45.0%).Second most common finding regarding our study is type I (26.4%) of suprascapular notch variation and this finding is similar with previous studies by Iqbal K et al [7] (22.5%), Kannan U et al [13] (20.0%) and Nagraj S et al [22](23%).

There is lack of standard classification regarding morphological study on SCN of scapula. Different authors followed different classification as by Rengachary SS et al [5,6], Iqbal K et al [7] and Natsis K et al [17] depending upon morphology, shape (J,U,V) and morphometry respectively. Due to several classifications, it is difficult to compare the morphological findings and draw conclusion. In the present study, we followed Rengachary SS el al [5,6] classification of six types on morphology, and correlated and compared the results from different studies across the globe who followed the Rengachary classification as shown in Table 4.

Table 4: Incidence of different types of suprascapular notch in different ethnic groups.

Authors	Ethnicity (n)	Type I(%)	II(%)	III(%)	IV(%)	V(%)	VI(%)
Rengachary SS et al [5,6]	Americans(211)	8	31	48	3	6	4
Sinket SR et al [23]	Kenyan (138)	22	21	29	5	18	4
Albino P et al [24]	Italian (500)	12.4	14.8	22.8	31.1	10.2	3.6
Reddy M et al [10]	Indian (104)	21.15	8.65	59.61	2.88	5.76	1.93
Kinnan U et al [13]	Indian (400)	20	10	52	4	4	10
Sumathi Shanmugam et al [25]	Indian (176)	11.63	23.26	43.03	3.48	4.81	12.79
Shalom Elsy Philipe el al [15]	Indian (100)	9	36	38	8	6	3
Present study	Indian (106)	26.4	17	40.6	4.7	2.8	8.5

From the above table , our results were in accordance with study by Kinnan U et al [13] from Indian population and by Rengachary SS et al [6,7] in Americans and Sinket SR et al [23] (Kenyan).Albino P et al [24] (Italian)and Reddy M et al [10](India) and the latest references in 2016 and 2017 like Sumathi Shanmugam et al [25] and Shalom Elsy Philip el al [15] showed lesser incidence of type VI and remaining types of SCN were comparable with present study.

The exact etiology of morphological variation of SCN is not clear but Odita JC et al [26] hypothesized that the ossification of the coracoid process epiphysis influence the shape of the notch and give rise to different morphologies in various populations. The varied size and shape of SCN may predispose to suprascapular nerve entrapment and neuropathy [14].

CONCLUSION

The thorough knowledge of morphological variations of suprascapular notch and ossified STSL is important for anatomists, operating surgeons ,orthopedicians and neurophysicians and radiologists for better understanding of suprascapular nerve entrapment neuropathy. In the present study, we analyzed six morphological variant of suprascapular notch and suprascapular foramina due to ossified STSL.

In recent advances, the present topic includes screening of sport personalities for suprascapular neuropathy, diagnosis of the suprascapular nerve entrapment syndrome with the help of CT, MRI and USG, laparoscopic repair of SCN by orthopedicians and histopathological analysis of SCN by pathologists.

Conflicts of Interests: None

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