Original Research Paper



MORPHOMETRIC STUDY OF SUPRASCAPULAR NOTCH AND ITS CLINICAL SIGNIFICANCE

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Introduction: The Scapula is flat triangular bone situated on the posterolateral aspect of thoracic wall ABSTRACT between 2nd to 7th ribs. Medial to the base of coracoid process on the superior border of scapula lies the suprascapular notch. The notch is bridged by transverse scapular ligament which converts it into a foramen. Through this foramen suprascapular nerve enters the supraspinous fossa. Various types of suprascapular notches were identified by many authors. The suprascapular notch is the commonest site where suprascapular nerve is compressed and results in suprascapular nerve entrapment syndrome. The notch is important site of identification of nerve during arthroscopic shoulder surgeries. Materials & Methods: The study was carried out on 100 dry scapula bones of unknown age and sex in the department of Anatomy, PSG Institute of Medical Sciences and research, Coimbatore after getting Institutional ethical committee clearance. Variations in the shape of suprascapular notch were noted. Dimensions of suprascapular notch were noted with digital Vernier caliper as Maximum depth, Maximum transverse diameter, Middle transverse diameter were taken. Degree of ossification of transverse scapular ligament - complete, partial or notch with foramen was identified and noted. Results: We observed 'U' shaped suprascapular notch (22%) was the commonest shape on gross examination. In our study, partial ossification of transverse scapular ligament was present in 32% of scapula. Complete ossification of transverse scapular ligament converting into foramen was found in 4% of scapula. In the present study, vertical depth was found to be higher than the transverse diameter (Type III) in 54% of scapula according to Natsis et al classification. Conclusion: In the present study, we observed the various shapes of suprascapular notch. The completely ossified superior transverse scapular ligament produces nerve impingement at higher rate. Hence there is a need to have precise anatomical knowledge of suprascapular notch before making proper diagnosis and planning for surgical interventions of suprascapular nerve entrapment syndrome.

KEYWORDS : Suprascapular nerve, impingement syndrome, suprascapular foramen and ossification

INTRODUCTION

The Scapula is a large triangular bone that lies over the posterolateral chest wall, covering parts of the second to seventh ribs in the vertical axis. It has costal and dorsal surfaces; superior, lateral and medial borders; inferior, superior and lateral angles; three processes; the spine, the acromion and the coracoid process.

The superior and lateral borders and the supraspinous and infraspinous fossae converge laterally at the lateral angle of the scapula. This region comprises the glenoid fossa, the coracoid process and the neck of the scapula. Thus, three robust columns of bone converge at the neck region. Scapula has costal and dorsal surfaces. Dorsal surface is divided by the transverse, shelf like spine of the scapula into two unequal parts: a smaller supraspinous fossa above and infraspinous fossa below. The fossa are confluent at the spinoglenoid notch between the lateral border of the spine and the dorsal aspect of the neck; the central parts may be very thin. The supraspinous fossa is bounded superiorly and anteriorly by the superior border, from the suprascapular notch and dorsal aspect of the root of the coracoid laterally, to the superior angle medially. The infraspinous fossa is bounded by the medial and lateral borders and the inferior angle.

The superior border, thin and sharp, is the shortest. At its anterolateral end, it is separated from the root of coracoid process by the suprascapular notch, which can vary in shape and size. The suparscapular notch is bridged by the superior transverse ligament or suprascapular ligament, which is laterally attached to the root of the coracoid process and medially to the limit of the notch. The ligament is sometimes ossified. The foramen, thus completed, transmits the suprascapular nerve to the supraspinous fossa, whereas the suprascapular vessels pass backwards above the ligament¹.

Knowledge regarding various shapes of suprascapular notch and ossification of suprascapular ligament is important to identify the suprascapular nerve entrapment syndrome. This study may be helpful before planning for surgeries and arthroscopic procedures.

AIM OF THE STUDY

- 1. To identify the different shapes of Suprascapular notch
- 2. To measure various dimensions of the notch Superior transverse diameter, Middle transverse diameter & Vertical depth
- 3. To compare our results with the previous authors

MATERIALS & METHODS

We conducted this study on one hundred dry Scapulae of unknown sex and age in the department of Anatomy, PSG Institute of Medical Sciences & Research, Coimbatore after getting clearance from Institutional ethical committee. Broken and defective scapulae were excluded from the study. Variations in the shape of suprascapular notch were identified and noted. Ligament ossification if present, whether partial or complete with foramen were observed and noted. Various dimensions (Superior transverse diameter, Middle transverse diameter & vertical depth) were noted using digital vernier caliper. Superior transverse diameter (STD) – It is the horizontal distance between superior corners of the suprascapular notch on the superior border of the scapula.

Middle transverse diameter (MTD) – It is the horizontal distance between the opposite walls of the suprascapular notch at a midpoint of the maximum depth and perpendicular to it.

Maximum depth (MD) – It is the distance between the superior corners of the notch to the deepest point of suprascapular notch.

RESULTS

In this study, one hundred scapulae (Fifty on the right side & Fifty on the left side) were analyzed for various shapes. Various measurements (Superior transverse diameter, Middle transverse diameter & vertical depth) were taken and analysed.

On gross examination, the suprascapular notch was classified as U shaped notch in which the notch has approximately parallel sides with a rounded base, V shaped notch in which both medial and lateral walls of the notch converged into a narrow base and J shaped notch in which one wall (medial or lateral wall) may be larger than the other and indentation in which the notch may have the broad base.

Ticker et al², Nayramoglu et al³ and Sinkeet et al⁴ have classified suprascapular notch on the basis of morphological appearance into two types – 'U' and 'V'and found that U shaped notch was the commonest type. Iqbal et al⁵ classified suprascapular notch into three types –'U', 'V' and 'J' based on their shapes on their gross examination. Soni et al⁶ reported five types as 'U', 'V', J', indentation and absence of notch.

Table -1 & (Figure 1 to Figure 7) Show Classification Of Suprascapular Notch According To Shapes. In Our Study, We Observed J Shaped Notch Was The Commonest Shape (22%) And Partial Ossification Of Superior Transverse Suprascapular Ligament Was Found To Be Higher (32%)

Serial	Shape	Number of	Number of	Total Number
Number		Scapulae	Scapulae	of Scapulae
		on the right	on the right	on the both
		side	side	sides
1.	J shape	10(20%)	9(18%)	19(19%)
2.	U shape	12(24%)	10(2)%)	22(22%)
3.	V shape	5(10%)	3(6%)	8(8%)
4.	Indentation	4(8%)	4(8%)	8(8%)
5.	Absent	5(10%)	2(4%)	7(7%)
6.	Partial	16(32%)	16(32%)	32(32%)
	ossification of STSL			
7.	Complete	1(2%)	3(6%)	4(4%)
	ossification			
	of STSL			
	converting			
	into			
	foramen			



Figure 1-U shaped Suprascapular notch



Figure 2-V shaped Suprascapular notch



Figure 3 – J shaped Suprascapular notch



Figure 4-Absence of Suprascapular notch GJRA - GLOBAL JOURNAL FOR RESEARCH ANALYSIS 👁 53

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Figure 5-Indentation of Suprascapular notch



Figure 6 - Partial ossification of suprascapular Ligament



Figure 7 – Complete ossification of ligament converting the notch into foramen

Table – 2 & Figure 8 to Figure 10 show distribution of suprascapular notch according to Natsis et al 7 classification.

Serial	Туре	Number of	Number of	Total
number		scapula on	scapula on	Number of
		the right side	the left side	scapula
1.	TypeI (Absence)	5(10%)	2(4%)	7
2.	Type II (Transverse diameter>Ve rtical depth)	15(30%)	18(36%)	33
3.	Type III (Transverse diameter <ve rtical depth)</ve 	29(58%)	25(50%)	54
4.	Type IV (Transverse diameter=Ve rtical depth)	0(0%)	2(4%)	2
5.	Type V (Bony foramen)	1(2%)	3(6%)	4
6.	Type VI (Notch with Foramen)	0(0%)	0(0%)	0



 $Figure\,8-To\,measure\,Superior\,transverse\,diameter$



Figure 9 - To measure middle transverse diameter

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Figure 10 - To measure vertical depth

In our study, we found scapula with vertical depth was higher than transverse diameter (Type III) was the commonest presentation. vertical depth in two scapula in their study. They excluded Type VI – Notch with foramen. We found Transverse diameter = vertical depth in two scapula.

Table – 3 shows different degrees of ossification of superior transverse suprascapular ligament. We observed partial ossification of ligament (32%) was the commonest finding. In our study, we did not find suprascapular notch with foramen in scapula.

Serial Degree of		Number of	Number of	Total
number	ossification	scapula on	scapula on	Number of
		the right side	the left side	scapula
1.	Complete	1(2%)	3(6%)	4
2.	Partial	16(32%)	16(32%)	32
3.	Notch with	0(0%)	0(0%)	0
	foramen			

DISCUSSION

Study on Morphology of suprascapular notch and degree of ossification of superior transverse scapular ligament with or without foramen was performed by many authors.

Rengachary et al⁹ performed a study on 211 adult scapulae and classified the notch into six types. Type I - Absence of notch, Type –II - V shaped notch, Type III – U shaped notch, Type IV – Small V shaped notch, Type V – U shaped notch with partial ossification of suprascapular ligament and Type VI – Complete ossification of suprascapular ligament. He found Type III was the commonest type followed by Type II in his study. We observed Type V - U shaped notch with partial ossification of suprascapular ligament was the commonest type followed by Type III. Complete ossification of the ligament was observed in 4% in our study. This was compared with various author's studies in Table -4.

Polguj M et al[®]found scapula with Transverse diameter = with various author's studies in Table -4. Table – 4 shows comparison of percentage of distribution of suprascapular notch according to the shape of present study with previous studies.

Serial	Author	J shaped	U shaped	V shaped	Indent-	Absence	Partial	Complete
number		notch	notch	notch	ation	of notch	ossification	ossification
1.	Sinkeet et al4	-	21	5.18	-	2.12	-	-
2.	Iqbal et al5	22	13.2	20	26.8	18	-	-
3.	Soni et al6	27	58	7	-	2	11	3
4.	Natsis et al7	-	-	-	-	8.3	-	7.3
5.	Rengachary et al9	-	58	7	-	8	6	4
6.	Vasudha et all0	19.13	12.16	-	7.82	6.08	1.73	4.34
7.	Apurba patra et all1	39.09	31.81	9.09	7.27	4.54	3.63	4.54
8.	Vedha et all2	5.2	53.2	5.6	-	21.2	5.2	9.2
9.	Manmeet Kour et	28.33	46.67	8.33	-	13.3	-	3.33
10		04.0	05	5.0	4.5	4 5	0	10.0
10.	vananana et all4	34.3	30	5.2	4.5	4.5	3	12.6
11.	Present study	22	19	8	8	7	32	4

The Superior transverse diameter and Vertical depth were measured. The scapulae with indentation, absence of notch and partial ossification of ligament were excluded from the measurement. Natsis et al classified suprascapular notch into six types. Type I - Absence of notch, Type II - Transverse Table 5 shows comparison of percentage of distribution of si

diameter>Vertical depth, Type III - Transverse diameter<Vertical depth, Type IV - Transverse diameter=Vertical depth, Type V-Bony foramen and Type VI -Notch with Foramen. Type III was the commonest in our study which was similar to Natsis et al study and was compared with various author's studies in Table -5.

Table -5 shows comparison of percentage of distribution of suprascapular notch according to Natsis classification of present study with previous studies.

Serial	Author	Type I -	Type II - (Transverse	Type III - (Transverse	Type IV - (Transverse	Type V-	Type VI -
number		(Absence	diameter	diameter	diameter=	With Bony	Notch with
		of notch)	>Vertical depth)I	<vertical depth)<="" td=""><td>Vertical depth)</td><td>foramen</td><td>Foramen</td></vertical>	Vertical depth)	foramen	Foramen
1.	Sinkeet et al4	22	21	29	5	18	4
2.	Natsis et al7	8.3	41.85	41.85	3	7.3	0.7
3.	Polguj M et al8	-	57.7	48	2.3	4	-
4.	Rengachary et al9	6	24	40	13	11	6
5.	Vandana et all4	4.8	70.1	8	3.2	13.7	0
6.	Shiva leela et al15	14.7	70.58	12.78	0	1.96	0
7.	Sharma et al16	20	39	34	0	5	2
8.	Shalom Elsy Philip	9	36	38	8	6	3
	et all7						
9.	Present study	7	33	54	2	4	0

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Table -6 shows comparison of percentage of distribution of suprascapular foramen of present study with previous studies. We found suprascapular foramen in 4(4%) of scapula which was similar to Vasudha et al¹⁰ & Apurba patra et al¹¹ studies.

Serial	Author	Number	Number of
number		of	scapula with
		scapula	suprascapular
		studied	foramen
1.	Soni et al6	100	3(3%)
2.	Natsis et al7	204	2(0.75%)
3.	Rengachary et al9	211	9(4%)
4.	Vasudha et all0	115	5(4.34%)
5.	Apurba patra et all1	110	5(4.54%)
6.	Vedha et all2	250	21(9.4%)
7.	Manmeet Kour et al13	60	2(3.33%)
8.	Vandana et all4	134	17(12.6%)
9.	Shalom Elsy Philip et al17	100	3(3%)
10.	Present study	100	4(4%)

CONCLUSION

Suprascapular notch is the most common site of compression and injury to suprascapular nerve. Hence thorough knowledge regarding suprascapular notch and its variations in shape and various dimensions of the notch – Superior transverse diameter, Middle transverse diameter & Vertical depth are important for orthopedic surgeons while performing suprascapular nerve decompression especially by endoscopic technique.

The suprascapular nerve is very closely related to the suprascapular notch while passing through it. Variations in shape can be considered as a possible etiological factor in nerve entrapment syndrome. Reduction in height of suprascapular notch narrows the foramen and increases the risk of nerve entrapment. Ossification of superior transverse suprascapular ligament converts the notch into foramen and reduces the space which results in nerve entrapment syndrome.

The presence of suprascapular foramen clearly indicates the presence of ossified superior transverse suprascapular ligament. One of the most important risk factors for the suprascapular nerve entrapment is a completely ossified superior transverse suprascapular ligament.

Overhead abduction of shoulder joint exerts traction on the suprascapular nerve, which leads to its compression against superior border of scapula. Narrow or absent notch is prone to have nerve entrapment resulting in weakness and wasting of supraspinatus and infraspinatus.

This study may be helpful in avoiding iatrogenic suprascapular nerve injury in different arthroscopic procedures. Anatomical knowledge of such variations is important for Radiologists, Orthopedicians and Neurosurgeons before making diagnosis and performing surgeries in these regions.

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