Morphometric Study of Suprascapular Notch and Its Variations in Dried Human Scapulae

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ABSTRACT

The study was undertaken to see the variation of the suprascapular notch. The notch is present on the superior border of the scapula near the root of coracoid process. It is roofed by the superior transverse ligament and is converted into foramen for the passage of suprascapular nerve. The study was carried out on 121 scapulae in the department of Anatomy RMC Loni, Ahmednagar. The parameters included in the study were presence of notch, shape of notch, transvers length of notch, edge of notch, ossification of transverse ligament and other finding were also noted. The parameters were measured by Vernier calliper and appropriate statistical tests were applied.

The supra-scapular notch was present in 82.64% of scapulae. U Deep shaped notch was most common shape followed by J shallow shaped notch. Round edge at the depth of the notch was more common.

The knowledge of suprascapular notch variations is of great importance for surgeons performing suprascapular nerve decompression especially by means of endoscopic techniques. Our anatomical study helps the clinicians before planning a surgery.

Keywords: Suprascapular notch, superior transverse scapular ligament, suprascapular foramen, suprascapular nerve.

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I. INTRODUCTION

The scapula is a flat triangular bone that lies on the posterolateral aspect of chest wall between the second and the seventh ribs. The suprascapular notch (SSN) is present at the root of coracoid process and at the lateral end of superior border. This notch is converted into a foramen by the superior transverse scapular ligament and serves as a passage for the suprascapular nerve [1].

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 [2]. This suprascapular nerve entrapment syndrome was first described by Kopell and Thompson in 1959 and mentioned that smaller the size of the notch, greater the chance of nerve entrapment [3]. Abduction of the shoulder joint beyond 90 °C may exert traction on the suprascapular nerve, which leads to its compression against transverse scapular ligament.

The narrow suprascapular notches have been reported in patients with the nerve entrapment. Suprascapular nerve compression may present with vague pain radiating across the scapula, dull shoulder ache, limitations of shoulder joint movements and wasting of supraspinatus and infraspinatus [4]. The suprascapular notch serves as an important landmark during arthroscopic procedures [5]. So, we have decided to study the "Morphometric study of suprascapular notch and its variations in dried human scapulae." which

may have an immense help to anatomists, osteologists, anthropologists and orthopedic.

II. MATERIAL AND METHODS

The presence of suprascapular notch was studied in 150 dried scapulae of unknown age sex and race, which were collected from the Department of Anatomy Rural medical college Loni. Damaged superior border and decayed scapulae were excluded. The scapulae were divided into right and left (right 65 and left 56). Morphological features of SSN and its variation was observed according to the shape of SSN. The non-metrical parameters of the notch were as follows: Presence or Absence of notch, Shape of the notch, Nature of edge at the depth of the notch and ossification of the transverse scapular ligament. Metrical parameters were transverse width at the upper and middle part of the notch, depth of notch was measured by Vernier calliper in mm. (Fig. 1). Also, transverse, and vertical diameter of the suprascapular foramen with ossified transverse scapular ligament was measured.

Fig.1. Diameters of notch STD –superior transverse diameter, MTD- middle transverse diameter, VD- vertical depth.

III. OBSERVATIONS AND RESULTS

It is evident from Table I that supra-scapular notch was present in 82.65% of scapulae.

The supra-scapular notch was present more on right scapulae as compared to left.

TABLE I: PRESENCE OF SUPRA-SCAPULAR NOTCH

Particulars	Side		No of [Scapulae (121)	Percentage %
	Rt (65)	Lt (56)		
Presence of Notch	55	45	100	82.65%
Absence of Notch	10	11	21	17.35%

It is evident from Table 2 that U Deep shaped notch was most common shape followed by J shallow shaped notch. V Shallow shaped notch was seen in 14.87% of scapulae.

TABLE II: SHAPE OF THE NOTCH

Shape of the notch	Side		No. of Scapulae	Percentage%
	Rt	Lt		
U Deep	28	22	50	41.32%
V Shallow	11	07	18	14.87%
J Shallow	16	15	31	25.61%
W Double Notch	0	1	01	0.86%

Round edge at the depth of the notch was more common as compared to sharp edge (Table III).

TABLE III: NATURE OF EDGE AT THE DEPTH OF THE NOTCH

Edges	Side		No of Scapula	Percentage %
	Rt	Lt		
Sharp	27	26	53	43.80%
Round	29	28	57	47.10%

Transverse scapular ligament was fully and partially ossified in 16.52% of scapulae while fully ossified in 9.09% of scapulae.

TABLE IV: OSSIFICATION OF THE TRANSVERSE SCAPULAR LIGAMENT

Ossification	Side		No of Scapulae	Percentage %
	RT	Lt		
Partially ossified	5	4	9	7.43%
Fully Ossified	6	5	11	9.09%
Total = Partially ossified + fully Ossified	11	9	20	16.52%

It can be seen from Table V that Mean upper transverse diameter of suprascapular 8 notch was 12.83 mm (12-22 mm) while Middle Transverse diameter was 7.94 mm (10-16 mm). The depth of suprascapular notch was 9.41 mm (10-18 mm).

TABLE V: SHOWING TRANSVERSE DIAMETER AT UPPER AND MIDDLE PART OF THE NOTCH AND DEPTH OF THE NOTCH

Diameter	Range(mm)	Mean(mm)
Upper Transverse diameter	12 – 22	12.83
Middle Transverse Diameter	10-16	07.94
Depth of the notch	10 -18	09.41

Mean Transverse Diameter of ossified foramen was 9.18 mm while vertical diameter was 9.63 mm. (Table VI).

TABLE VI: OSSIFIED FORAMEN: TRANSVERSE AND VERTICAL DIAMETER

Ossified foramen	Range(mm)	Mean(mm)
Transverse Diameter	9 – 15	9.18
Vertical Diameter	10 - 15	9.63

Fig. 2. Absence of notch.

Different shapes of suprascapular notch:

Fig.3. U shaped notch.

Fig.4. J shaped notch.

Fig.5. V shaped notch.

Fig. 6. W shaped notch.

Fig.7. Fully ossified superior transverse scapular ligament.

Fig.8.Partiallyossified superior transverse scapular ligament.

Fig. 9. suprascapular foramen showing vertical ligamentous band extending from one end of the transverse scapular ligament to the depth of the notch.

In one specimen suprascapular foramen was further narrowed by presence of vertical ligamentous band extending from one end of the transverse scapular ligament to the depth of the notch.

IV. DISCUSSION

Previous researchers like Rangachari [4] classified the supra scapular notch into six types as well as the degree of ossification of superior scapular transverse ligament.

Type I [8%]: Notch is absent. The superior border makes a wide depression from the medial angle to the coracoid process.

Type II [31%]: Notch is blunted V-shape.

Type III [48%]: Notch is U-shaped with nearly parallel margins.

Type IV [3%]: Notch is V shaped and very small. A shallow notch is formed for the suprascapular nerve near to the notch.

Type V [6%]: Notch is minimal and U- shaped with a partially ossified ligament.

Type VI [4%]: Notch is a foramen as the ligament is completely ossified 4

Presence of suprascapular notch in present study was 82.65%, U Kannan reported 80%, Rubi Saika 82.56%, Roopali et al. 73.6% Jadhav SD et al. 92.35% K Santosh et al. 97.4% so this is similar to the previous workers [11]-[15].

Different authors have observed different shapes of suprascapular notch in scapulae. In present study (Fig 3) U

shaped notch was found in 41.32% the study was close to U Kannan et al. 52% Rube et al 40.3% Roopaliet al. 40.6% Jadhav et. al. 39.79% and Kumar Santosh et. al 37.5%. But Khadija Iqbal and Rameez Iqbal found less incidence

i.e.,14% [11]-[15], [6].

TABLE VII: COMPARISON OF NON-METRICAL PARAMETERS OF SCAPULA IN PERCENTAGE

Shape of notch	U Kannan et al (2014)	Rubi Saikiaet.al. (2017)	Roopaliet al. (2017)	Jadhav S.D. et.al(2012)	Kumar Santosh et.al(2020)	Present study
Absence of notch	20%	17.44%	26.4%	7.76%	2.6%	17.35%
Presence of notch	80%	82.56%	73.6%	92.35%	97.4%	82.65%
U Shaped	52%	40.3%	40.6%	39.79%	37.5%	41.32%
V shaped	10%	0	17%	19.38%	29.4%	14.87%
J shaped	0	21.31%	0	20.66%	18.75%	25.61%
W shaped	0	0	0	0	0	0.86%
Sharp edge	0	0	0	0	0	43.80%
Rounded edge	0	0	0	0	0	47.10%
Partially ossified	4.1%	0	2.8%	4.84%	0	7.43%
Fully ossified	10.1%	3.1%	8.5	0	5.3%	9.09%

In present study (Fig. 5) V shaped notch was observed in 14.87% U Kannan et, al reported 10%, Roopali et, al 17% Jadhav SD 19.38% Kumar Santosh et al. 29.4% [13]-[15]. The V shaped suprascapular notch is vulnerable to the abrasion and entrapment of suprascapular nerve due to the narrow base.

In present study (Fig. 4) J shaped notch was observed in 25.61% similar to this study Rubi Saikia et. al 21.31% Jadhav et. al 20.66% and Kumar Santosh et, al 18.75% was noticed above findings. So, the J shaped notch was second common type [12], [14], [15].

One unique variation of shape of scapula was W shaped found in 0.86% (Fig. 6).

It is evident from Table III nature of edge at the depth of the notch was (i) sharp edged notch 43.80% and (ii) rounded edge was 47.10% No one observed the edge of the notch. The narrow sharp edge of notch at the bottom of the suprascapular notch may predispose to the symptoms of entrapment of supra scapular nerve syndrome.

It is noticed from Table IV that partially ossified superior transverse scapular ligament was 7.43% (Fig. 8) similar to this U Kannan et al reported 4.1%, Jadhav et al. 4.84%, Desai R. R. et al. 5.82% [11], [14], [7].

It is observed from Table IV fully ossified superior transverse scapular ligament was 9.09%. (Fig. 7). similar to this U kannan reported 10%, Rubi Saikia et al 3.1%, Roopali et al 8.5% and Kumar Santosh et al 5.3%. This was close to U Kannan et al. Roopali et.al. [11]-[13], [15]. Zahid A et al. found 1.96% [8]. Saikia et al and Zahid A et al. found less incidence. In present study the diameter of suprascapular notch varied in the upper part 12.83mm (range 12-22 mm), middle part 07.94 mm (10-16 mm) and depth of notch 09.41 mm (range 10-18 mm (Fig. 1) (Table V). M. Polguy et al. did the retrospective study of CT scan of the shoulders. They analyzed the suprascapular region and mentioned the types of suprascapular notch by measuring diameter at upper

part, middle part, and vertical diameter. They observed the transverse diameter at the upper and middle part of notch was 8.62 mm and 10.03 mm respectively. The vertical diameter was 7.53 mm [20].

Kothandaraman U and Lokanadha S found bony prominence within the suprascapular notch and its percentage was 3.5% [10].

Measurement of the ossified foramen was transverse diameter 9.18 mm (range 9-15 mm).

In fully ossified and partially ossified suprascapular notch converted into foramen and reduced all diameter which may compress the suprascapular nerve and gives rise to suprascapular nerve entrapment syndrome. Suprascapular nerve entrapment neuropathy may occur in the supra scapular notch. The sharp edge at the bottom of the notch may be contributing factor. The suprascapular nerve may be damaged due to the trauma to the scapula and shoulder there is pain in shoulder and wasting and weakness of supraspinatus and infraspinatus [16]. suprascapular nerve arises from the upper trunk of brachial plexus. It lies in the posterior triangle of neck; it passes under the omohyoid muscle and anterior border of trapezius to enter scapular notch and passes below the superior scapular transvers ligament it enters supraspinous fossa and supply the supraspinatus muscle. Then it enters infraspinous fossa through spino-glenoid notch, here it supplies the infraspinatus muscle. It also gives the branches to the shoulder joints. The nerve may entrap at suprascapular notch due to the narrowing of neck by cyst. Ossification of superior scapular transverse ligament, fracture of scapula at spino-glenoid notch, due to this reason vague pain radiating across the scapula, dull shoulder ache, limited movement of shoulder joint wasting of supraspinatus and infraspinatus muscles [19].

Suprascapular neuropathy is a big problem in individual who have been involved in overhead abduction [14] the

morphological variation of suprascapular notch is not clear but Odita J. C. et. al. [18] stated that the ossification of the coracoid process epiphysis influences the shape of suprascapular notch. The variation of the notch gives rise the suprascapular nerve entrapment syndrome [17].

V. CONCLUSION

The knowledge of suprascapular notch variations is of great importance for surgeons performing suprascapular nerve decompression especially by means of endoscopic techniques. Our anatomical study helps the clinicians before planning a surgery.

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