Morphology and morphometric analysis of suprascapular notch

Lajja K. Sutaria*1, Tushar V. Nayak2, Sejal V. Patel3, H. R. Jadav4, C. A. Pensi5

1-3 3rd year Resident Doctor, Department of Anatomy, B. J. Medical College, Ahmedabad, India
4 Professor and Head of Anatomy, GMERS Medical College, Sola, India
5 Professor and Head, Department of Anatomy, B. J. Medical College, Ahmedabad, Gujarat, India

*Correspondence Info:
Resident Doctor
Department of Anatomy, B. J. Medical College,
Ahmedabad (India)
Email: -lajja.sutaria@gmail.com

Abstract

The morphology of the suprascapular notch (SSN) has been associated with suprascapular entrapment neuropathy, and injury to the suprascapular nerve in arthroscopic shoulder procedures. This study aimed to describe the morphology and morphometry of the suprascapular notch in dry scapulae. The present study was done in 314 dry scapulae obtained from B. J. Medical College, Ahmedabad. In the present study the suprascapular notch is classified on the basis of two classifications. According to one classification, SSN was classified into five types, type I without a discrete notch; type II a notch that was longest in transverse diameter; type III a notch that was longest in vertical diameter; type IV a bony foramen; type V a notch and a bony foramen. Based on gross appearance, SSN was classified as ‘U’ shaped, ‘V’ shaped, ‘J’ shaped, absent notch and indentation instead of a notch. The complete and partial ossification of the superior transverse scapular ligament was also noted. According to first classification following observations were made in the present study: type I-29%; type II-52%; type III-16%; type IV-2%; type V-1%. According to another classification, following observations were made: ‘U’ shaped notch 38%, ‘V’ shaped notch 7%, ‘J’ shaped notch 22%, absent notch 18%, and indentation instead of a notch 12%. The complete ossification was seen in 3% and partial ossification of the superior transverse scapular ligament in 2% of cases. This anatomic information is important in the management of entrapment neuropathy or interventional procedure of the SSN.

Keywords: Morphology, Morphometry, Suprascapular notch

1. Introduction

The scapula (shoulder blade) is a triangular flat bone that lies on the posterolateral aspect of the thorax, overlying the 2nd to 7th ribs. The convex posterior surface of the scapula is unevenly divided by the spine of the scapula into a small supraspinous fossa and a much larger infraspinous fossa. The concave costal surface of the scapula has a large subscapular fossa. The supraspinous fossa is situated in the lateral part of the superior border of the scapula, just adjacent to the base of the coracoid process. This notch is converted into a foramen by the superior transverse scapular ligament and serves as a passage for the suprascapular nerve. The variations in the morphology of SSN are well known. Koepell and Thompson (1959) were the first to describe the suprascapular nerve entrapment syndrome. They reported that abduction or horizontal adduction of the shoulder exerted traction on the suprascapular nerve, which led to its compression against the superior transverse scapular ligament. The anatomical variation of the SSN, which includes the variation in shape, complete or partial ossification of the STSL, is recognized as one of the causes of suprascapular nerve entrapment. SSN has been classified by various workers in different populations on the basis of parameters such as vertical length of the notch, transverse diameter of the notch and shape of the notch. Knowing the anatomical variations in detail is better for understanding of location and source of the entrapment syndrome. However, the literature focusing on SSN and SN
entrapment in Indian population is scarce. Therefore, the present study was done to obtain the morphological data regarding SSN in the population of Gujarat of India.

2. Material and Methods

The present study was conducted on 314 dry scapulae obtained from the bone store of the B. J. Medical College, Ahmedabad. Each scapula was observed carefully by two investigators, the scapulae with indentation, absence (type I) or complete ossification of SSN (type IV) were separated. In the remaining scapulae the vertical length (VL) and transverse diameter (TD) of the SSN were measured using digital vernier caliper. Based on the above parameters the suprascapular notch is classified into two classifications. According to one classification, SSN was classified into five types, type I without a discrete notch; type II a notch that was longest in transverse diameter; type III a notch that was longest in vertical diameter; type IV a bony foramen; type V a notch and a bony foramen. Based on gross appearance, SSN was classified as ‘U’ shaped, ‘V’ shaped, ‘J’ shaped, absent notch and indentation instead of a notch. The complete and partial ossification of the superior transverse scapular ligament was also noted. For VL, 2 points were taken; the first point was the midpoint of the imaginary line joining the superior corners of the notch, the second point was at the maximal depth of the notch. For TD the diameter perpendicular to the midpoint of VL was taken [figure 1].

![Fig 1 showing measurements of suprascapular notch](image)

An imaginary line joining the superior corners of the notch

Vertical length of the notch

Transverse diameter of the notch

3. Results

| Classification                                | Percentage (%) |
|----------------------------------------------|----------------|
| type I without a discrete notch              | 29             |
| type II (TD>VL)                              | 52             |
| type III (VL>TD)                             | 16             |
| type IV a bony foramen                       | 2              |
| type V a notch and a bony foramen            | 1              |
Table I shows that the most common type of SSN observed in the present study is type II- a notch that was longest in its transverse diameter, the least common is type V where a notch and a bony foramen are present. (TD; transverse diameter, VL; vertical length)

**Table 2 showing the classification of suprascapular notch on the basis of its shape [Fig.2]**

| Shape of the notch                                      | Percentage (%) |
|---------------------------------------------------------|----------------|
| U                                                       | 38             |
| J                                                       | 22             |
| V                                                       | 7              |
| Indentation                                             | 12             |
| Absent notch                                            | 18             |
| Partial ossification of the superior transverse scapular ligament | 7              |
| Complete ossification of the superior transverse scapular ligament | 3              |

Table II shows that the U shaped notch is most common, V shaped is least common. The partial ossification of the STSL was seen in 3 ‘U’ Shaped SSN, 1 ‘V’ Shaped SSN and 3 ‘J’ shaped SSN.

**Figure 2. Scapulae showing different shape of notches**
4. Discussion

Rengachary et al classified the SSN into six types based on the inferior shape of the SSN as well as the degree of ossification of STSL. This classification was difficult to use when transition between these types is being found. The classification given by Natsis et al seems to be simple and includes all the anatomical variations based on the vertical and transverse diameters of the SSN. The classification by Iqbal et al also provides an easy method of distinction of SSN based on its shape (U, V, and J) without involving any measurements. The results of the present study show that the most common type of SSN is type II - a notch that is longest in its transverse diameter (52%) and the least common is Type V where both notch and foramen present are present (1%). This corresponds with the results of Wang et al (Chinese population) where also the most common type of SSN reported is Type II (58.6%) , where the notch is longest in transverse diameter and the least common is Type V where both notch and foramen are present (none). Natsis et al in their study reported an equal incidence of types II and III SSN.

Table 3 showing the comparison of the results of present study with previous studies

|       | Natsis et al (%)[Greek] | Wang et al (%)[Chinese] | Present study (%)[Indian] |
|-------|------------------------|------------------------|---------------------------|
| Type I | 8.3                    | 28                     | 29                        |
| Type II| 41.85                  | 58.16                  | 52                        |
| Type III| 41.85                  | 28.23                  | 16                        |
| Type IV | 7.3                    | 3                      | 2                         |
| Type V | 0.7                    | None                   | 1                         |

On gross examination without involving any measurements, the results of the present study correspond with that of Sinkeet et al who also reported the U shaped notch as most common (29%) and the complete ossification of STSL as least common (4%) in Kenyan population. Iqbal et al reported the J shaped notch the commonest (22%) in their study in the population of Pakistan. Variation in the morphology of the STSL which include their partial or complete ossification have been identified to be one of the predisposing factor in cases of suprascapular nerve entrapment in various case reports. The incidence of complete ossification of STSL varies widely in different populations. In Brazilian population its incidence is reported to be 30.76% as compared to Vallios who reported the incidence to be 6.5% in Italian population and Kajava who reported the incidence of complete ossification of STSL to be 1.5% in Finish Scapulae. In the present study the incidence of complete ossification of STSL was observed in 3% of cases. This indicates that there are differences in different populations, therefore population specific studies are required to know the incidence of complete ossification of the STSL. The differences in morphology of the SSN can be explained by the fact that the shape of the SSN is influenced by the ossification of coracoid process. Odita et al reported that epiphyseal centers of coracoids process appear earlier in Nigerian infants than Caucasians. Although it has been hypothesized that suprascapular nerve entrapment is more likely to be associated with a narrow ‘V’ shaped notch, no direct correlation between notch type and suprascapular nerve entrapment has been shown clinically. Therefore, rather than the shape and diameter of the notch, the morphology of the STSL has been identified to be associated with suprascapular nerve entrapment.

References
1. Moore, KL., Dalley, AF. Clinically oriented anatomy. 4th ed. Philadelphia, USA: Lippincot Williams and Wilkins, 1999. p. 668-9.
2. Williams, PL., Bannister, LH., Bery, MM., Collins, P., Dyson, M. and Dussek, JE. MWJ Gray’s Anatomy. 38th ed. London: Churchill-Livingstone, 2004.
3. Kopell HP, Thompson WA. Pain and frozen shoulder. Surg Gynecol Obstet 1959; 109:92-96.
4. Iqbal K, Iqbal R, Khan SG. Anatomical variations in shape of suprascapular notch of scapula. J. Morphol. Sci. 2010;
5. Natsis K, Totlis T, Tsikaras P, Appell HJ, Skandalakis K. Proposal for classification of the suprascapular notch: a study on 423 dried scapulas. Clin.Anat. 2007; 20:135-139.

6. Rengachary SS, Neff JP, Singer PA, Brackett CF. Suprascapular nerve entrapment neuropathy: A clinical, anatomical and comparative study. Part 1: Clinical study. Neurosurg. 1979; 5:441-6.

7. Sinkeet SR, Awori KO, Odula PO, Ogeng’o JA, Mwachaka PM. The Suprascapular notch: its Morphology and distance from the glenoid cavity in a Kenyan population. Folia Morphol. 2010; 69:241-245.

8. Wang HJ, Chen C, Wu LP, Pan CQ, Zhang WJ, Li YK. Variable Morphology of the Suprascapular Notch: An investigation and Quantitative Measurements in Chinese Population. Clin. Anat. 2011; 24:47-55.

9. Alon M, Weiss S, Fischel B, Dekel S. Bilateral suprascapular nerve entrapment syndrome due to an anomalous transverse scapular ligament. ClinOrthop 1998; 234:31-33.

10. Cohen SB, Dines DM, Moorman CT. Familial calcification of the superior transverse scapular ligament causing neuropathy. ClinOrthop 1997; 334:131-135.

11. Ticker JB, Djurasovic M, Strauch RJ, April EW, Pollock RG, Flatow EL et al. The incidence of ganglion cysts and variations in anatomy along the course of the suprascapular nerve. J. Shoulder Elbow Surg. 1998; 7(5):472-8.

12. Silva JG, Abidu-Figueiredo M, Fernandes RMP, Aureliano-Rafael F, Sgrott EA, Silva SF, Babinski MA. High incidence of complete ossification of the superior transverse scapular ligament in Brazilians and its clinical implications. Int. J. Morphology http://findarticles.com/p/articles/mi_m5EOM/is_4_25/ai_n30962096/

13. Vallois H. V. L’os acromial dans les races humaine. L’ Anthropologie. 0. 1925; 35:977-1022.

14. Kajava Y. Uber den Schultergiirtel der Finen. Ann. Acad. Sci. Fenn, Series A. 1924; 21(5):1-69.

15. Odita JC, Ugbodaga VI, Omene JA, Okolo AA. Humeral head and coracoid ossification in Nigerian newborn infants. Paediatric Radiol. 1983; 13:276-278.

16. Cummins CA, Messer TM, Nuber GW. Suprascapular nerve entrapment. J Bone Joint Surg 2000; 82A:415-424.