Original article

Analysis of Variant Morphology of Suprascapular Notch in Human Cadaveric Scapulae

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ABSTRACT

Background: Suprascapular notch (SSN) is present along the superior border of scapula. Superior transverse scapular ligament converts the notch into an osteo-fibrous foramen. Suprascapular nerve passes below the superior transverse scapular ligament which may undergo calcification resulting in suprascapular nerve entrapment syndrome. This results in shoulder pain with limitation of movement involving muscles supplied by this nerve. The purpose of this study was to analyze the morphology of suprascapular notch in cadaveric scapulae to establish its clinical relevance.

Materials and methods: It was an observational study conducted in the cadaveric bone museum of Anatomy Department at Combined Military Hospital, Lahore Medical College and Institute of Dentistry (CMH LMC&IOD).

Results: A total of 75 human cadaveric scapulae were observed. Thirty-six scapulae belonged to the right side and 39 to the left side. Overall type-1(28%), type-II (8%), type-III (35%), type-IV (24%), type-V (2.6%) and type-VI (2.6%) were observed. Out of 75 scapulae only 2 (3%) had completely ossified suprascapular ligament and both were on left side. Independent Samples t-test showed statistically significant difference between superior transverse (p-value=0.001), middle transverse (p-value=0.002) and vertical diameters (p-value=0.048) of type-III and type-IV suprascapular notches.

Conclusion: This study showed an overall predominance of types III and IV suprascapular notches. This finding is important for surgeons as ossification of suprascapular ligament may predispose patients to nerve entrapment.

Keywords:

Morphology, suprascapular notch, cadaveric scapulae

INTRODUCTION

Scapula serves to connect free upper limb with the axial skeleton. It has three borders and suprascapular notch (SSN) is present on the superior border of the scapula, just medial to the coracoid process.[1] In life, the superior transverse scapular ligament bridges the edges of notch and converts it into an osseo-fibrous suprascapular foramen which allows the suprascapular nerve to pass beneath it. The suprascapular notch has been observed to vary in its shape and configuration, and sometimes superior transverse scapular ligament gets partially or completely ossified, thus converting it into a suprascapular foramen.[2] The suprascapular nerve is a branch of superior trunk of brachial plexus with C5, 6 roots. It supplies supraspinatus and infraspinatus muscles and articular branches to shoulder joint. It passes beneath the superior transverse scapular ligament to pass from supraspinous fossa to infraspinous fossa.[3] A narrow notch or excessively ossified ligament may have a greater chance of nerve impingement in the suprascapular foramen.[4] Compression of the suprascapular nerve results in shoulder pain, weakness and/or paralysis of supraspinatus and infraspinatus muscles which bring about abduction and external rotation of scapula respectively. This is called suprascapular nerve entrapment syndrome, which is the reason behind many cases of shoulder pain and limitation of movement due to atrophy of supraspinatus and infraspinatus muscles thus affecting the abduction and external rotation at shoulder joint.[5]

It is important for anatomists, radiologists, orthopedic surgeons and chiropractitioners to know the possible shapes and dimensions of suprascapular notch and their likely influence on the clinical presentation of patients with shoulder pain and its management. The objective of this study is to observe the morphology of cadaveric scapulae to assess the morphometric dimensions of suprascapular notch in the local population.

MATERIALS AND METHODS

This was an observational study carried out at the Department of anatomy, bone museum, CMH LMC & IOD, from November to December 2022 after the ethical approval.

Conflict of interest: The authors declared no conflict of interest exists.
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Ethical review certificate was obtained from the Institutional Ethical Review Committee as Case # .745/ERC/CMH/LMC. All available human cadaveric scapulae of indetermined sex of both right and left side were included. Scapulae with broken superior border or any structural deformity were not included.

Seventy-five scapulae, 36 on the right side, and 39 on the left side were studied. These scapulae were retrieved and saved from cadavers that could not be used for study purpose any longer. The shape of suprascapular notch was observed, and they were categorized according to Rengachary, I to VI types.[6]

- Type-I: No defined suprascapular notch
- Type-II: Wide indentation as suprascapular notch
- Type-III: A 'U' shaped suprascapular notch
- Type-IV: Narrow V shaped notch
- Type-V: With a partially ossified ligament
- Type-VI: Complete foramen formed as transverse scapular ligament is completely ossified.

Statistical analysis was done using SPSS ver. 26. Frequencies of different types of suprascapular notches on two sides were calculated. As the data was normally distributed on analysis by Shapiro wilks test, Independent Samples t-test was applied to look for statistically significant differences between type-III and type-IV notches belonging to right and left sides and differences between the morphological parameters of type-III & IV notches (two independent groups).

RESULTS

Figure 1 shows the scapulae of six different types observed in the current study. Scapulae belonging to types III, IV were measured for superior transverse, mid transverse and maximum vertical diameter of notches (Figure below [7]) with the help of vernier caliper as shown in Figure 2. The proportionate occurrence of various types of suprascapular notch on the two sides are given in Figure 3.

Twenty eight percent of total scapulae showed no notch, 24% of notches were of type-IV (V-shaped), Figure 3. While 35% were of type-III (U-shaped), 2.6% showed partial ossification of superior scapular ligament with narrowing of superior transverse diameter of notch. Only 2.6% of the total scapulae showed calcified transverse scapular ligament with complete formation of suprascapular foramen. The frequency of different types of notches observed on right and left scapulae are shown in Figure 4.

Independent Samples t-test revealed statistically significant differences between the morphometric parameters, as shown in Table 1.

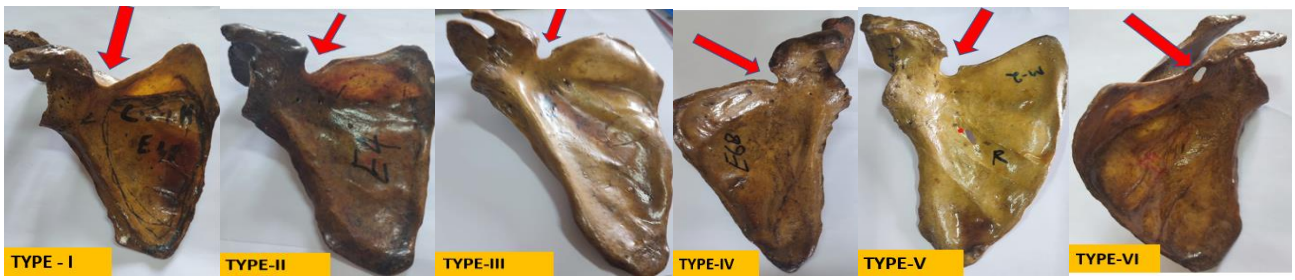

Figure 1: Types of suprascapular notches according to Rengachary classification.

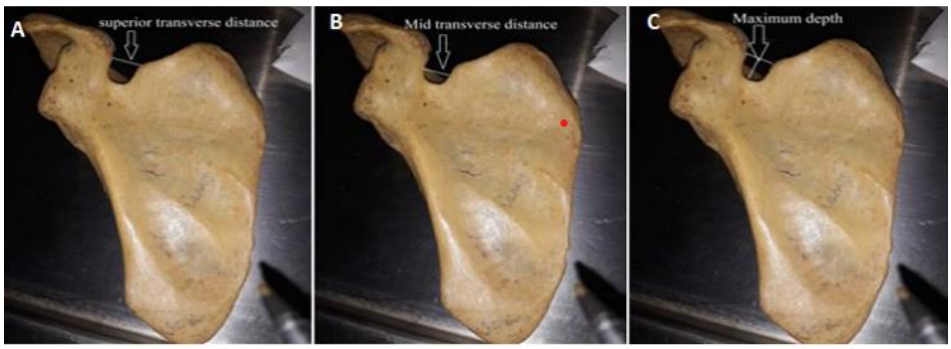

Figure 2: Showing morphometric parameters for suprascapular notch

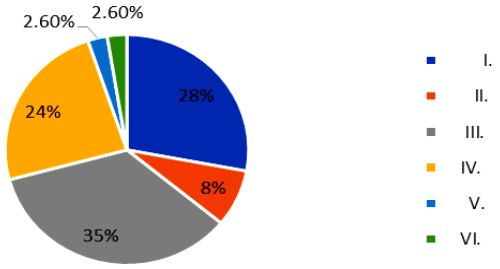

Figure 3: Overall distribution of various types of suprascapular notches.

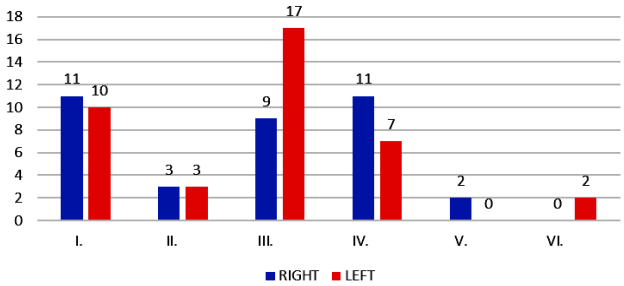

Figure 4. Graph showing percentages of different types of suprascapular notches on right and left sided scapulae.

Table 1: Showing differences between morphological parameters of types III and IV suprascapular notches using independent samples t-test

Morphological parameters	Mean ± SD	p-value
Superior Transverse Diameter (STD)		
Type-III	1.52 ± 0.38	0.001*
Type- IV	1.04 ± 0.39	
Mid Transverse Diameter (MTD)		
Type-III	1.31 ± 0.40	0.002*
Type- IV	0.91 ± 0.37	
Vertical Diameter (VD)		
Type-III	1 ± 0.36	0.048*
Type- IV	0.8 ± 0.06	

*p-value < 0.05 was considered statistically significant

DISCUSSION

Anatomical variations and anomalies along the course of the suprascapular nerve are critical in the management of suprascapular neuropathy and individuals show considerable differences in the dimensions of the suprascapular notch across populations.[8] The morphology of the suprascapular notch region is important to evaluate from a clinical point of view because it is the most common site of suprascapular nerve compression and injury.[9]

In our study, the most prevalent suprascapular notch class was type III (U-shaped notch), followed by type-IV (narrow V-shaped notch) while types V and VI (notches with partially and completely ossified ligaments) were the least common ones. Another study compared the frequency of their most common SSN with that of other populations and reported that type-III SSN was the commonest type in all reported populations, while types V and VI were the least common ones among different ethnicities. [10] These findings are in accordance with our study. Similarly, maximum number of scapulae (35%) in a study had U-shaped suprascapular notches.[11]

Our study also analysed the morphometric measurements of the SSNs. This is particularly important because the dimensions of SSN can be good predictor of Suprascapular nerve entrapment syndrome (SNES). [12] Our study recognized that type-III SSNs were larger and more symmetrical than type-IV notches and these differences were statistically significant. Similar finding was reported in another study that determined symmetry of the SSNs radiologically: U-shaped (type-III) notches showed more symmetry than other types.[13] The morphology of the SSN is significant because its shape is the most important risk factor in the etiopathology of suprascapular nerve entrapment formation and can help in identifying the cause and association of nerve entrapment with type of notch. [14] A shallow notch can be a predisposing factor for nerve entrapment, particularly in case of ossification of transverse scapular ligament. However, even though there were variations in the dimensions of the type-III and IV notches in our study, the differences between right and left scapulae were not statistically significant.

The low occurrence of type-V and type-VI notch accounts for the fact that suprascapular nerve entrapment syndrome is an uncommon disorder affecting the nerve and subsequently the muscles supplied by it. However, this low incidence can be the reason why nerve entrapment due to small sized notches and ossified ligament may be overlooked as the cause of nerve injury.

There is little data available from local population regarding the variation in morphology of SSN. This study could help in contributing to identifying the predominant notch type in Pakistani population, thus

aiding the surgeons in surgical procedures, diagnosis and correct management of patients presenting with shoulder pain. The study was conducted on a limited number of cadaveric specimens. Conducting a multicenter study to increase sample size can provide more conclusive evidence. Use of radiological data along with biochemical markers will give a better insight into pathogenesis and progression of disease.

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