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Morphological Study of Suprascapular Notch of Adult Scapula

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Abstract

Background: One of the common etiology for shoulder pain is suprascapular nerve entrapment. The suprascapular notch is a depression present on the lateral part of superior border of scapula, which is bridged by superior transverse scapular ligament. It transmits the suprascapular nerve to supraspinatus fossa. Variations in the morphology of suprascapular notch is one of the cause for suprascapular nerve entrapment syndrome. It also forms an important landmark for suprascapular nerve in arthroscopic shoulder surgeries. The aim of the present study is to note the various shapes of suprascapular notch and its clinical implications. *Materials and Methods:* One hundred and ten dry adult scapulae of both sides were examined for variations in shapes of suprascapular notch. We classified suprascapular notch in to six types based on study done be Rengacahry et al. *Results:* In the present study, out of 110 scapulae, we observed Type I (without discrete notch) in 12 scapulae. Type III was the commonest with fifty-seven scapulae. The incidence of Type VI (complete ossified notch) was seen in 10 scapulae. *Conclusion:* The knowledge of anatomical variations in the shapes of suprascapular notch will be helpful in understanding the etiology of suprascapular nerve entrapment. The determination of type of notch helps the clinicians in screening the high risk population in patients with shoulder pain. Anatomical knowledge of such variations should be kept in mind by a radiologist, Orthopaedicians and neurosurgeons as these variations may alter the technique of surgery.

Keywords: Suprascapular Notch; Morphology; Suprascapular Nerve; Entrapment.

Introduction

The scapula is a triangular, flat bone of pectoral girdle which lies on posterolateral aspect of the thorax, between second to seventh ribs. The posterior convex surface of scapula is unevenly divided by the spinous process into larger infraspinous fossa and a smaller supraspinaous fossa. The suprascapular notch (SSN) is a depression present on the lateral part of superior border of the scapula just medial to the root of coracoid process. This notch is converted into a foramen by the superior transverse scapular ligament and serves as a passage for suprascapular nerve, whereas suprascapular vessels pass backwards above the ligament. Suprascapular nerve supplies motor branches to the supraspinatus and infraspinatus muscles and sensory branches to rotator cuff muscles, shoulder joint, coracoacromial and coracohumeral ligament [1]. The morphology of suprascapular notch is considered to be a risk factor for suprascapular nerve entrapment either in combination with an anomalous superior transverse scapular ligament (STSL) or as a narrowed notch [2].

The etiology in 1-2% of patients with shoulder pain is considered to be suprascapular nerve entrapment [3]. Koepell and Thompson 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 [4]. Suprascapular notch forms an important landmark during arthroscopic shoulder operation [5]. The morphological variation of the SSN can be correlated to the individual's predisposition to the

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suprascapular nerve entrapment [6]. The partial or complete ossification of the STSL is considered to be a most common predisposing factor for suprascapular nerve entrapment, as the ossified ligament further decreases the size of the notch thus increasing the chances for suprascapular nerve entrapment [7]. The suprascapular nerve entrapment leads to the weakness of arm, difficulty in external rotation and abduction, atrophy of the infraspinatus and supraspinatus muscles. This entrapment syndrome is most frequently found in volleyball players and athletes who repeatedly experience stress on their shoulder [8,9,10].

Suprascapular notch has been varyingly classified by many researchers based on morphometric measurements. Rengachary et al has classified the suprascapular notch into six types based on its morphology [11]. The purpose of the present study was to document the incidence of the various morphological types of the suprascapular notch in South Indian population and to compare the observations with its prevalence in other ethnic populations.

Materials and Methods

The present study was carried out on 110 dried, human scapulae (60 right and 50 left) obtained from osteology collection in department of Anatomy of MES Medical college, Perinthalmanna, Kerala. The obtained bones were grossly examined irrespective of age, gender and race for the different shapes of suprascapular notch based on Rengachary et al, absence of suprascapular notch and for the degree of ossification of STSL. Damaged and broken scapulae were excluded from this study.

Rengachary et al [11]assified suprascapular notch into six types:

Type-I –wide depression in the superior border of the scapula

Type-II - wide blunted V-shaped notch

Type-III - symmetrical and U-shaped notch

Type-IV - very small narrow V-shaped notch

Type-V - partially ossified medial portion of STSL, notch minimal & U-shaped,

Type-VI - completely ossified STSL.

The type of suprascapular notch was noted and the findings were compared with other morphological studies in various populations based on Rengachary et al classification.

Results

One hundred and ten scapulae (sixty – right side and fifty - left side) were analyzed, out of which suprascapular notch was absent in twelve scapulae. The incidence of various types of suprascapular notch was classified into six types based on Rengachary et al is represented in Table 1. Type III was the commonest one with fifty-seven scapulae and type V with partial ossification was the least one with five scapulae.

Table 1: Different types of suprascapular notch

Type	Right	Left	Total (%)
Type 1	8	4	12 (10.9%)
Type 2	10	8	18 (16.4%)
Type 3	31	26	57 (51.9%)
Type 4	5	3	8 (7.2%)
Type 5	2	3	5 (4.5%)
Type 6	4	6	10 (9.1%)

Table 2: Comparison of types of notch with other studies

Authors	Types of notch					
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
Rengachary et al[11]	8%	31%	48%	3%	6%	4%
Paolo Albino et al[16]	12.4%	19.8%	22.8%	31.2%	10.2%	3.6%
Sinkeet et.al[7]	22%	21%	29%	5%	18%	4%
Ushakannan et al[17]	20%	10%	52%	4%	4%	10%
Sumathi et al[15]	11.7%	23.2%	43%	3.5%	5.8%	12.8%
Present study	10.9%	16.4%	51.9%	7.2%	4.5%	9.1%

Fig. 1: Type 1: Absent Notch

Fig. 2: Type 2: Shallow V notch

Fig. 3: Type 3: Symmetrical U notch

Fig. 4: Type 4: Deep V notch

Fig. 5: Type 5: Partial Ossification

Fig. 6: Type 6: Complete Ossification

Discussion

The suprascapular nerve entrapment is an acquired neuropathy, most commonly at the level of suprascapular notch due to the narrow dimensions of notch or ossification of suprascapular ligament. Several morphological variations and classifications of suprascapular notch have been reported in various populations. Rengachary et al [11] done a study on 211 American scapulae and classified suprascapular notch into six types (Type I – Type VI) based on the width at superior border of the notch, the widest point within the notch, and the depth of the notch. Joe De Beer [12] stated that the shape of the notch and calcified STSL has been associated with increased risk of suprascapular nerve entrapment, resulting in weakness and wasting of supraspinatus and infraspinatus muscles. Sinkeet et al [7] in their study classified 6 types of SSN with description, which also includes degree of STSL ossification. According to their study Type I represent wide 'U', Type II represents 'J' shape, Type III, which has explained has most common, represents symmetrical, Type IV represents 'V' shape, Type V&VI are related to the

degree of ossification of STSL. Iqbal et al in their two different studies in Pakistani population showed four types of notches, with 10% without notch (type 1), 14% symmetrical (type 2), 68% 'V' shape (type 3) and 8% inverted 'V' (type 4) which is having a greater inferior maximum length as compared to superior length [13,14].

The comparison of different shapes of suprascapular notch depending upon size and shapes by various authorswith the present study are illustrated in Table 2. These various shapes are thought to play a part in predisposition for suprascapular nerve entrapment, assuming that a small notch gives a larger chance of nerve impingement than a large notch. The incidence of complete absence of suprascapular notch in present study was found in 10.9% and in the study by Rengachary et al [11] it was 8%. The prevalence of type I notch as per study by Sumathi et al [15] and Paolo Albino et al [16] was 11.7% & 12.4% respectively. In the current study the predominant type was type III which correlates with study conducted by Rengachary et al in American population and by Sinkeet et al in Kenyan population. The partial or complete ossification of the STSL has been identified as a predisposing factor for suprascapular nerve entrapment.

The incidence of type 6 which is complete ossification of STSL in present study is 9.1% which is similar to the values got by Usha et al [17] and Sumathi et al [15], which is 10% and 12.8% respectively. The tendency of STSL to ossify suggests that the ligament responds to changes in the mechanical load [18]. The variations in the thickness and length of STSL are also considered to have an effect on the suprascapular nerve as it traversesthrough the suprascapular notch. Such cases are more prone for suprascapular nerve entrapment as the ossified ligament further decreases the size of the notch and decreases the space available for the suprascapular nerve. Overhead athletes continually put their arms in the extremes of motion which creates large torques on the shoulder. This causes traction on the suprascapular nerve at the SSN through which it traverses.

This is called the sling effect which proposes that in certain functional positions the suprascapular nerve is exposed to damaging sheer stress in the notch [9,19]. The investigations like nerve conduction velocity and electromyography studies, X-ray, CT Scan and MRI may be helpful in correct diagnosis. The electrophysiological studies and MRI should always be used when clinical findings are suggestive of suprascapular nerve entrapment.

Conclusion

The present study showed various types of suprascapular notches. Out of these type III was most predominant. The suprascapular nerve is very intimately related to the suprascapular notch while passing through it. Variations in shape and size can be considered as a possible causative factor in nerve impingement. The knowledge about the classification and the anatomical variations ofthe suprascapular notch will help the clinicianto easily define the type of notch and correlate the suprascapular nerve entrapment with aspecific type of notch. This should also be taken into consideration during surgical or arthroscopic shoulder procedures. This can further be helpful in avoiding iatrogenic suprascapular nerve injuries during shoulder arthroscopies.

Abbreviations

SSN - Suprascapular notch

STSL - Superior transverse scapular ligament

Conflicts of Interest: None

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