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A Study of the Anatomical Variations in the Shape and Diameter of the Suprascapular Notch and Spinoglenoid Notch in Dried Human Scapulae

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Abstract

Background: The suprascapular notch is a depression on the superior border of scapula which gives passage to the suprascapular nerve to enter the supraspinous fossa. During its course there is a possibility of entrapment of the nerve while in the notch due to its variant shapes and dimensions which leads to suprascapular nerve entrapment syndrome. Also the spinoglenoid notch with its ligament is affected by the position of the glenohumeral joint. These pressure changes in combination with repetitive shoulder movement are likely components that cause repeated trauma or compression on the distal suprascapular nerve.

Aim of Study: The present work was designed to study the variation of the shape and diameter of the suprascapular notch and spinoglenoid notch of the scapula.

Material and Methods: The study will be carried out on 100 dried human scapula obtained from Anatomy department, Faculty of Medicine, Cairo University. The shape of the suprascapular notch was determined and recorded as follow U shaped, V shaped, flat or absent at all. Out of 100 scapulae 56 were right sided and 44 were left sided. Also the mean values for suprascapula notch was measured.

Results: The most common shape was V- shaped, followed by U-shaped, then the least common one is the flat one. About 14 % scapulae showing absent foramen. Regarding the side of scapulae, V shaped suprascapular notch were recorded in 44.2% scapulae (22 left side, 16 right side), while 39.5% were U shaped (12 left side, 22 right side). Only 16.3% scapulae showed flat suprascapular notch (8 left side, 6 right side).

Conclusion: This study may help the clinicians to have precise anatomical knowledge of the suprascapular notch before making proper diagnosis and surgical interventions of suprascapular nerve entrapment syndrome.

Key Words: *Suprascapular – Notch – Spinoglenoid – Suprascapular nerve.*

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Introduction

THE Scapula is a flat triangular bone that lies on the posterior chest wall between the second and seventh rib and has three borders (superior, medial, and lateral) and three angles (superior, inferior, and lateral). The superior border extends from the superior angle to the lateral angle. It is the thinnest and the shortest of the three borders. Near the root of the coracoid process, the superior border presents a notch called the suprascapular notch (SSN). This notch is converted into a foramen, called the suprascapular foramen, by the attachment of the superior transverse scapular ligament to its edges **[1]**.

After arising from the upper trunk of the brachial plexus, the suprascapular nerve passes through this foramen and supplies the supraspinatus muscle. As the nerve travels laterally along the supraspinous fossa, it approaches the posterior glenoid rim, around the scapular spine, and descends into the infraspinous fossa and passes under the spinoglenoid ligament (inferior transverse scapular ligament) along with the suprascapular vessels to supply the infraspinatus muscle. It also gives a twig to the shoulder joint **[2]**. Overhead abduction of the shoulder joint exerts traction on the suprascapular nerve and leads to its compression **[3]**.

SSN was described as a depression present on the lateral aspect of superior border of the scapula just medial to the coracoid process **[4,5]**. They added that in few cases, this notch may be transformed into a foramen due to ossification of suprascapular ligament (STSL) and serves as a bony tunnel for suprascapular nerve. So the authors concluded that the shape and size of the SSN is the most important causal factor in the pathogenesis of suprascapular nerve entrapment syndrome.

The suprascapular nerve compression may result in significant dysfunction of rotator cuff [6]. This disease is characterized by dull aching pain over the posterolateral region of the shoulder, atrophy of the supraspinatus and infraspinatus muscles and weakness during external rotation and initiation of shoulder abduction [2,7]. The anatomical variations of the suprascapular notch in combination with superior transverse scapular ligament are responsible for suprascapular nerve entrapment syndrome [8,9].

Previously, cadaveric study was performed and found that the spinoglenoid ligament was present in 100% of specimens [10]. The authors also found that it had attachments to the glenohumeral joint, which contributed to compression of the suprascapular nerve at the spinoglenoid ligament on internal rotation of the shoulder.

Although the usual site of suprascapular entrapment neuropathy is at the transverse scapular ligament in the suprascapular foramen, clinical presentation and diagnosis of compression have been recorded [11]. Most commonly in overhead athletes, injury to this nerve may occur from repetitive traction and microtrauma [12].

The spinoglenoid ligament has also been demonstrated to tighten when the shoulder is in a position for overhead throwing, resulting in increased pressure on the suprascapular nerve [13]. A stenotic notch, ossified spinoglenoid ligament, or even superiorly oriented fibers of the subscapularis muscle may cause suprascapular neuropathy [14].

The aim of this study is study the variations in the shape of the suprascapular notch.

Patients and Methods

The present study was done on 100 dry adult human scapulae of both sex obtained from Anatomy Department, Cairo University, 2018. The shape of suprascapular notch was determined and recorded. Out of 100 scapulae 56 were right sided and 44 were left sided. But exact age and gender were not known.

Inclusion criteria: All the scapulae were completely ossified and without any deformity.

Exclusion criteria: Scapulae with deformity, pathology or with any fracture.

The following parameters were measured for suprascapular notch using vernier sliding caliper [15] as follow:

1- Superior transverse diameter (STD) the maximum value of the horizontal measurements taken in the horizontal plane between the corners of the SSN on the superior border of the scapula (Fig. 1).
2- Middle transverse diameter (MTD) the maximum horizontal distance between the margins of the notch, perpendicular to the midpoint of the vertical diameter. (Fig. 1).
3- Spinoglenoid notch diameter (Fig. 2).

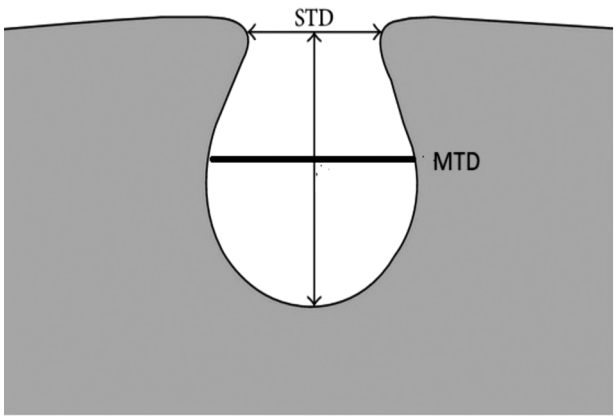

Fig. (1): Diagramtic picture showing how to measure STD and MTD.

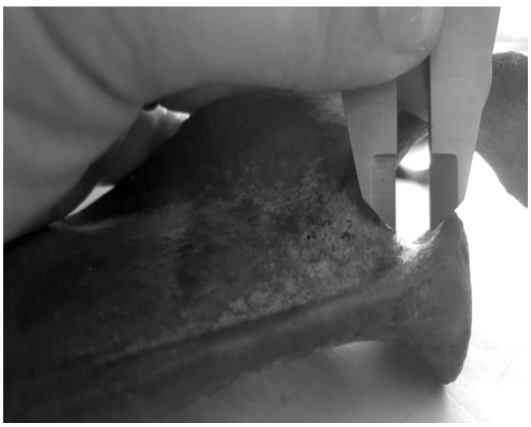

Fig. (2): Showing how to measure spinoglenoid notch.

Results

The present study was done on 100 dry human scapulae obtained from Anatomy Department, Cairo University. The shape of suprascapular notch was determined and recorded as follow U shaped, V shaped, flat or absent at all (Figs. 3-7). Out of 100 scapulae 56 were right sided and 44 were left sided. (Fig. 8, Table 1).

The most common shape was V shaped which constitutes 38%, followed by U shaped in 34%, then the least common one is the flat one 14%. About 14 scapulae (14%) showing absent foramen (Table 2, Fig. 11). Regarding the side of scapulae V shaped suprascapular notch were recorded in 38 scapulae (22 left side, 16 right side), while 34 were U shaped (12 left side, 22 right side). Only 8 scapulae showed flat suprascapular notch (8 left side, 6 right side) (Fig.9, Table 2). Also suprascapular foramen was noticed (Fig. 10).

The following parameters were measured for suprascapular notch using vernier sliding caliper as follow:

1- Superior transverse diameter.

2- Middle transverse diameter.

The mean value of each was measured and subjected statistically as the mean value for superior tranverse diameter was 4.44mm, and for middle transverse diameter were 2.69mm.

Also the mean value for spinoglenoid notch was measured and tabulated (Table 3).

In respect to scapula side, mean value of superior transverse diameter on right side was 4 and 4.9 on left side. While mean value of middle transverse diameter 2.26 on right side and 3. 15 on left side. Mean value for spinoglenoid notch was 4.18 on right side and 4.96 on left side (Table 4).

Superior transverse diameter was found to be greater than middle transverse diameter in 8 scapulae (9.3%), while middle diameter was greater in 76 scapulae (88.4%) and both diameters were equal in two scapulae (2.35) (Table 5, Fig. 11).

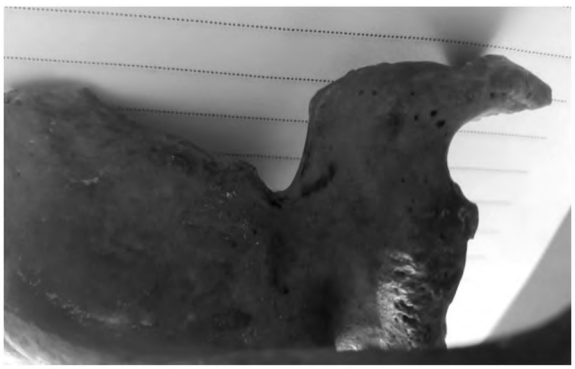

Fig. (4): Showing V-shaped suprascapular notch.

Fig. (5): Showing U-shaped suprascapular notch.

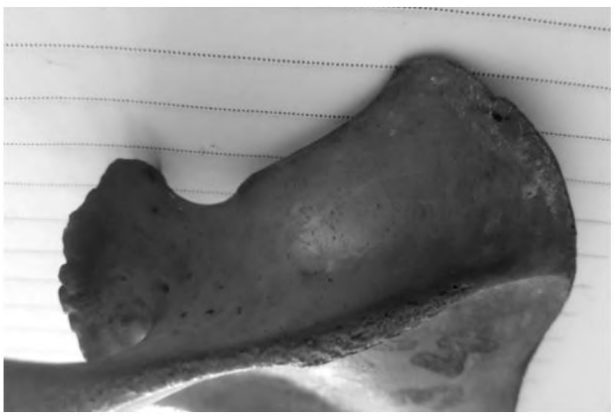

Fig. (6): Showing flat suprascapular notch.

Fig. (3): Showing absence of suprascapular notch.

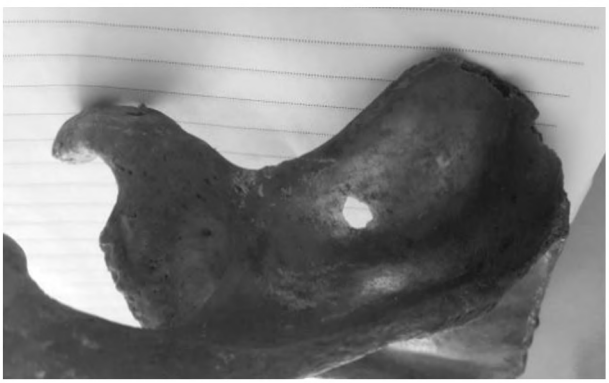

Fig. (7): Showing suprascapular foramen.

Table (1): Showing percentage of side of scapulae.

Side	Frequency	Percent
Right	56	56.0
Left	44	44.0
Total	100	100.0

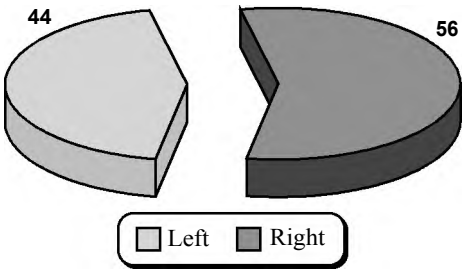

Fig. (8): Pie chart showing percentage of side of scapulae.

Table (2): Showing percentage of suprascapular shape.

	Frequency	Percent
V shape	38	38.0
U shape	34	34.0
Absent	14	14.0
Flat	14	14.0
Total	100	100.0

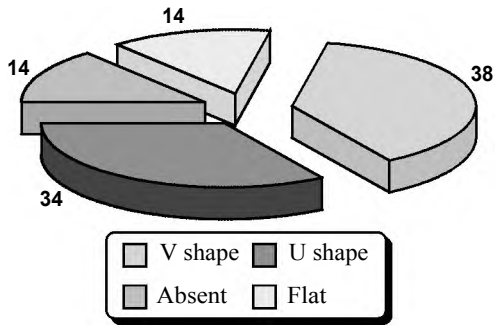

Fig. (9): Pie chart showing percentage of suprascapular shape.

Table (3): Showing side of scapulae and shape of suprascapular notch

	Side		Total
	Right	Left	
Shape:			
V shape:			
Count	16	22	38
% within shape	42.1%	57.9%	100.0%
U shape:			
Count	22	12	34
% within shape	64.7%	35.3%	100.0%
Flat:			
Count	6	8	14
% within shape	42.9%	57.1%	100.0%
Total			
Count	44	42	86
% within shape	51.2%	48.8%	100.0%

p-value=0.127

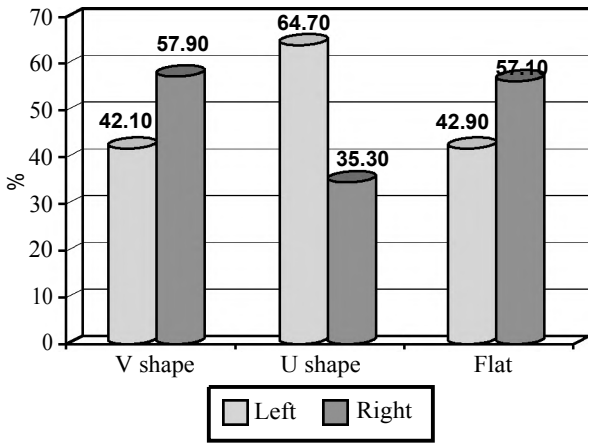

Fig. (10): Bar chart showing side and shape of suprascapular notch.

Table (4): Showing the mean values of measurement of scapulae (mm).

	N	Range	Mini-mum	Maxi-mum	Mean	Std. Deviation
STD	86	13.95	0.48	14.43	4.4458	3.19793
MTD	86	9.32	.0.01	9.33	2.6986	2.47963
Spinog-lenoid	86	12.73	0.20	12.93	4.5686	3.50238

STD : Superior transverse diameter.
MTD: Middle transverse diameter.

Table (5): Showing diameters measurement in respect to side.

	Side	N	Mean	Std. Deviation	p-value
STD	Right	44	4.0032	2.64672	.191
	Left	42	4.9095	3.66394	
MTD	Right	44	2.2659	1.83797	.098
	Left	42	3. 15 19	2.96524	
Spinoglenoid	Right	44	4.1877	2.70680	.305
	Left	42	4.9676	4.17468	

Table (6): Relation between superior and middle tranverse diameter.

	Frequency	Percent
Valid:		
Std more	8	9.3
Equal	2	2.3
Mtd more	76	88.4
Total	86	100.0

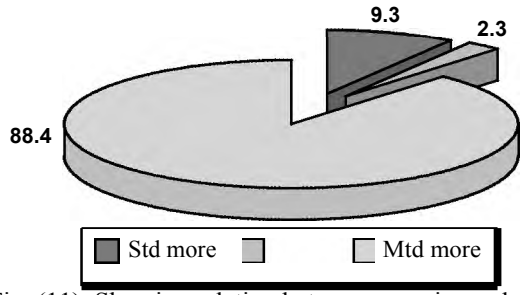

Fig. (11): Showing relation between superior and middle transverse diameter.

Discussion

Knowledge of detail anatomy of suprascapular notch (SSN) is necessary for proper diagnosis and treatment of shoulder girdle problems that might be related to the nerve. In the present study, an effort has been made to classify suprascapular notch based on its shape and dimensions. Various authors have classified SSN based on certain parameters and gross examination of its shape.

SSN have been classified on the basis of morphological appearance into two types U&V and found U-shaped notch to be the most common type **[16,17]**. Moreover, another classification of SSN into three types U,V,J based on their shapes on gross examination **[18]**. Five types of SSN were reported as U,V,J, indentation and absence of the notch **[13]**.

The current study predominately showed four types V, U, flat and absent notch. The most common type was V-shaped one which constitutes 44.2%, followed by U-shaped in 39.5%, then the least common one is the flat one 16.3%. About 14 scapulae (14%) showing absent foramen.

The highest incidence of V-shaped suprascapular notch, thus having a higher predisposition to suprascapular nerve entrapment neuropathy **[19]**. The authors added that the U-shaped suprascapular notch, defined as having approximately parallel sides with a rounded base, and the V-shaped suprascapular notch, defined as having medial and lateral sides which converge toward a narrow base. Suprascapular nerve entrapment is more likely to be associated with a narrow V-shaped notch. They noticed also that a reduction in the height of the suprascapular foramen may predispose to entrapment of the suprascapular nerve and it should be considered as a possible etiologic factor in suprascapular nerve entrapment.

Suprascapular nerve entrapment is an acquired neuropathy secondary to compression of the nerve in the bony suprascapular notch. The suprascapular notch is frequently bridged by bone rather than a ligament, converting it into foramen in some animals but incidence is much less in humans **[20]**.

Also compression of the nerve may occur at the spinoglenoid ligament and that has been noted by many authors to be caused by a soft tissue mass or ganglion cyst as a result of some form of a labral or capsule injury **[21]**.

Compression by a ganglion cyst or soft tissue mass has known to occur because of the relatively fixed position of the suprascapular nerve combined with the close proximity of the infraspinatus muscle to the glenohumeral joint. These ganglia may form when the capsule or labrum tears and synovial fluid is forced into the tissues as a 1-way valve, similar to meniscal cysts that occur in the knee **[21]**.

Irrespective of the mechanism, compression or injury to the suprascapular nerve at the spinoglenoid ligament results in weakness and, if long term, atrophy of the infraspinatus muscle, with little, if any, probability of return to normal muscle strength.

Using the present study, the clinician will be able to define easily and quickly the notch type on a plain radiograph and perhaps is able to correlate suprascapular nerve entrapment.

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دراسة للأختلافات التشريحية فى شكل وقطر الثلمة فوق الكتفية و الثلمة الشوكية فوق الكتف فى عظام الألواح البشرية الكتفية

مقدمة: الثلمة فوق الكتفية هى الإنخفاض البائن على الحرف العلوى من الكتف والذى يسمح بمرور العصب فوق الكتف للدخول فى الحفرة فوق الشوكية. وفى خلال هذا المسار هناك يكون عرضة للإنحباس للعصب بسبب الأشكال والأبعاد المختلفة التى تؤدى إلى متلازمة إنحباس العصب فوق الكتف.

الهدف من البحث: تم تصميم هذا البحث لدراسة الإحتلافات فى تغير الشكل والمقاسات الثلمة فوقالكتفية.

المواد والطرق: إستخدم فى هذه الدراسة ١٠٠ من الألواح الكتفية (٥٦ يمنى و ٤٤يسرى) والتى تمالحصول عليها من قسم التشريح كلية طب جامعة القاهرة. تم تحديد شكل الثلمة فوق الكتفية و تسجيله على النحو التالى إما على شكل حرف أو سطحية أو غائبة U أو V.

النتائج: أظهرت النتائج أن الشكل الأكثر شيوعاً للثلمة الفوق كتفية على شكل حرف Vفى ٤٤.٢٪ يليه شكل حرف U فى ٣٩.٥٪ ثم الأقل شيوعاً الثلمة السطحية ١٦.٣٪ و١٤٪ من عظام اللوح كتفية لا تظهر فيها الثلمة. وفيما يتعلق بالجانب الكتفى، تم تسجيل الثلمة فوق الكتفية على شكل V فى ٣٨ لوح كتف (٢٢ يسرى، ١٦ يمنى)، فى حين كان ٣٤ على شكل حرف U (١٢ يسرى، ٢٢ يمنى) ٨ عظمات لوح الكتف أظهرت ثلمة مسطحة ٢ يسرى و ٦يمنى.

الخلاصة: من الممكن مساعدة الأخصائيين على أن يكون لديهم معرفة تشريحية دقيقة على الثلمة فوق الكتف قبل إجراء التشخيص المناسب والتدخلات الجراحية من متلازمة إنحباس العصب فوق الكتف.