

# Morphometric Study of Glenoid Cavity and Suprascapular Notch of Scapula

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## ABSTRACT

**Aim :** To compare morphometric differences of glenoid cavity and suprascapular notch of left and right scapula and to calculate glenoid cavity index.

**Period of Study:** July 2016-August 2018

**Materials and Methods:** The Present study was conducted on 300 dry human scapulae in the Department of Anatomy, Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar, Telangana. This study excludes any scapula having deformity or pathology.

**Results:** Present study includes 140 right and 160 left scapulae for which length of glenoid cavity, maximal depth of suprascapular notch and superior transverse diameter of suprascapular notch were more on right scapula and breadth of glenoid cavity was more on left scapula. Scapulae with longer superior transverse diameter of suprascapular notch (63.33%) were more than scapulae with longer maximal depth of suprascapular notch (36.70%). Superior transverse scapular ligament was completely ossified in 2.66% of cases.

**Conclusion:** The explanation for parameter being more on right side is on the basis of more muscular activity on right side in comparison to left. The ossification of superior transverse scapular ligament was complete in 2.66% of cases which can lead to entrapment of suprascapular nerve.

**Keywords:** Morphometric, glenoid cavity, suprascapular notch, scapula

## INTRODUCTION

The scapula is triangular flat bone that lies on posterolateral aspect of thorax overlying 2nd to 7th ribs. The convex posterior surface of scapula is unevenly divided by the spine of scapula into small supraspinous fossa and much larger infraspinous fossa. It has glenoid cavity for articulation with head of humerus to form shoulder joint. The glenoid forms poor socket for humeral head. It is narrow above and wider below.

The suprascapular notch is situated in lateral part of superior border of scapula adjacent to base of coracoid process. This notch is converted into foramen by superior

transverse scapular ligament and serves as passage for suprascapular nerve which arises from upper trunk of Brachial plexus and supplies motor branches of supraspinatus, infraspinatus and sensory branches to rotator cuff muscles and ligamentous structures of shoulder and acromioclavicular joint.

The variations in suprascapular notch is accompanied by variation in superior transverse scapular ligament. These variations have a role to play in suprascapular nerve entrapment. Injury to nerve may result in significant rotator cuff dysfunction. Suprascapular nerve entrapment causes pain and limitation of movement in shoulder.

To relieve these symptoms, suprascapular nerve decompression is performed through the resection of superior transverse scapular ligament.

The study of dimensions of suprascapular notch will help the Orthopaedicians to correlate suprascapular nerve entrapment syndrome with the specific type of suprascapular notch. Suprascapular nerve entrapment is an acquired neuropathy secondary to compression of the nerve in suprascapular notch.

Robert van Dongen 1963 investigated shoulder girdle of Australian Aborigine. Based on morphological traits such as variation of borders, suprascapular notch and glenoid cavity and metric traits such as maximum length, breadth and glenoid length, van Dongen found that same variation occurred among Australian Aborigines as in other population to which he compared his findings, He did note, however, that overall length of scapula was shorter in Australian Aborigines than other groups.<sup>[2]</sup>

The Mallon, et al 1992 measured diameters of glenoid from radiographs of scapulae harvested from cadavers. The mean maximum height height of glenoid was  $35 \pm 3.3\text{mm}$ .<sup>[3]</sup>

The purpose of study was to compare morphometric differences of glenoid cavity and suprascapular notch of left and right scapula and to calculate glenoid cavity index.

## MATERIALS AND METHODS

### Sampling

Total 300 dry human scapula collected from the department of anatomy, Chalmeda Anandrao Institute of Medical Sciences and Research Centre, Bommakal, Karimnagar.



Figure 1: Sliding vernier callipers.

### Inclusion Criteria

- All the scapula which are completely ossified and with no deformity.

### Exclusion Criteria

- Scapula which are having any deformity, any pathology or any wear and tear.

### Methods

1. Superior transverse diameter of suprascapular notch: The maximum value of the horizontal measurements taken in the horizontal plane between the corners of the suprascapular notch on the superior border of the scapulae. Each measurement was recorded in an Excel spreadsheet.
2. Maximal depth of suprascapular notch(Fig 3): The maximum value of the longitudinal measurements taken in the vertical plane from an imaginary line between the superior corners of the notch to the deepest point of the suprascapular notch.
3. Maximum length of glenoid fossa (Fig 2): maximum distance between the Supra glenoid tubercle and the infra glenoid tubercle of the glenoid fossa.
4. Maximum breadth of glenoid fossa(Fig 5): maximum distance between the ventral border and the dorsal border of the glenoid, usually around the midpoint of the glenoid fossa.
5. Width-length index: Morphological width X100/ Morphological length.
6. Glenoid cavity index: Width of the glenoid cavityX100/Length of the glenoid cavity.



Figure 2: Method of measuring length of suprascapular notch



Figure 3: Method of measuring depth of suprascapular notch



Figure 4: Method of measuring length of glenoid cavity



Figure 5: Method of measuring width of glenoid cavity



Figure 6: Showing bony foramen in scapula (Suprascapular foramen)

Table 1 : Measurement of length of suprascapular notch

Details Measurement	Right	Left
Numbers	140	160
Range	2.93 – 13.05	3.24 – 13.70
Mean	5.55	6.36

Table 2: Measurement of depth of suprascapular notch

	Right	Left
Numbers	140	160
Range	3.70 – 12.96	3.29 – 16.80
Mean	5.8	6.01

### Maximum length of glenoid cavity:

As shown in Table 3, the maximum length of glenoid cavity in right scapula varied from 25mm to 50mm with an average of  $36.05 \pm 4.33$  and that of left scapula varied from 25mm to 48mm with an average of  $35.71 \pm 4.43$ . The right scapular glenoid cavity is longer than left scapular glenoid cavity by 0.34mm which is not statistically significant.

Table 3: Difference between Length of glenoid cavity on Right and Left Side

Details Measurement	Right	Left
Numbers	140	160
Range	25 – 50	25 - 48
Mean	36.05	35.71
Standard Deviation	4.33	4.43



### Maximum Breadth of glenoid cavity:

As shown in Table 4, the maximum breadth of glenoid cavity in right scapula varied from 19mm to 35mm with an average of  $24.98 \pm 3.09$  and that of left scapula varied from 17mm to 33mm with an average of  $25.07 \pm 3.39$ . The left scapular glenoid cavity is broader than right scapular glenoid cavity by 0.09mm which is statistically not significant.

Table 4: Difference Between Right and Left scapular Breadth of glenoid cavity

Details Measurement	Right	Left
Numbers	140	160
Range	19 – 35	17 – 33
Mean	24.98	25.07
Standard Deviation	3.09	3.39

In scapulae with longer STD (STD > MD), morphological length, morphological width, maximal length of the coracoid process, width of the glenoid cavity, width length index and glenoid cavity index were higher than in bones with longer MD.

However, there was no statistically significant difference between anthropometric measurements in both groups.

## DISCUSSION

In the present study, maximum length of glenoid fossa of right scapula was  $36.05 \pm 4.33$  mm and that of left scapula was  $35.71 \pm 4.43$  mm. Right scapular glenoid cavity is longer than left scapula which was not significant. This suggested that the right glenoid cavity is longer than left glenoid cavity in this study.

As compared to the study done by other authors, Iannotti, et al (1992) reported the supero-inferior diameter (length) of the glenoid to be  $39 \pm 3.5$  mm and Mallon, et al (1992) reported the superior-inferior diameter of the glenoid to be  $35 \pm 4.1$  mm which it was when compared to our study, length of right glenoid was  $36.05 \pm 4.33$  mm and that of left glenoid was  $35.71 \pm 4.43$  mm.<sup>[1]</sup>

So, the value got in the present study is less compared to the values got by Iannotti et al but it was quite similar to the value got by Mallon et al. So our study is in accordance with the study done by Mallon et al. <sup>[2]</sup> Churchill, et al (2001) measured the average superior-inferior diameter which was  $37.5 \pm 2.2$  mm.<sup>[3]</sup>

In present study length of glenoid cavity of right glenoid was  $36.05 \pm 4.33$  mm and that of left glenoid was  $35.71 \pm 4.43$  mm which was less than the Churchill's measurements.

Coskun N, et al (2006) measured the mean vertical length of the glenoid cavity in Turkish population which was  $36.3 \pm 3$  mm and was oval in shape. In south Indians also glenoid cavity is oval in shape and is of almost same size as in Turkish population i.e. right glenoid being  $36.05 \pm 4.33$  mm and left glenoid  $35.71 \pm 4.43$  mm, which was in accordance with the present study.<sup>[6]</sup>

### Breadth of glenoid cavity

In the present study, the breadth of glenoid cavity was  $24.98 \pm 3.09$  mm on the right and  $25.07 \pm 3.39$  on the left side. Though the breadth of glenoid cavity on left side was more than the right side, it was statistically insignificant.

Churchill, et al (2001) measured the average antero-posterior diameter of glenoid cavity  $23.6 \pm 1.5$  mm which was compared with present study in which the breadth of glenoid cavity was  $24.98 \pm 3.09$  mm on the right and  $25.07 \pm 3.39$  on the left side. It showed that the breadth of glenoid is larger in south Indians compared to the study done by Churchill et al.<sup>[3]</sup>

Frutos LR, et al (2002) measured the average breadth of glenoid cavity  $22.31 \pm 1.49$  mm which was less compared to the breadth of glenoid cavity  $24.98 \pm 3.09$  mm on the right and  $25.07 \pm 3.39$  on the left side of present study.

Ozer, et al (2006) measured average antero-postero diameter  $27.33 \pm 2.4$  mm which were more than the combined average of right  $24.98 \pm 3.09$  mm and left sides  $25.07 \pm 3.39$  mm in the present study.<sup>[7]</sup>

Coskun N, et al (2006) measured the mean transverse length of the glenoid cavity in Turkish population which was  $24.6 \pm 2.5$  mm. In south Indians also breadth of glenoid of right  $24.98 \pm 3.09$  mm and left side  $25.07 \pm 3.39$  mm is almost same size as in Turkish population, which was in accordance with the present study.<sup>[6]</sup>

Gretchen R, et al (2010) studied Breadth of glenoid prominence  $41.09 \pm 3.24$  and  $27.07 \pm 2.26$  in Lexington population which was larger and oval shaped compared to South Indian population having right  $24.98 \pm 3.09$  mm and left sides  $25.07 \pm 3.39$  mm. This indicates that the Lexington population has broader glenoid compared to the south Indians.<sup>[8]</sup>

In the present study, the length of glenoid cavity measurements were more on right side compared to the left side. The increase in the value of right side can be explained on the basis of more muscular activity on right side than of left side, the difference between suprascapular notch is very minimal which is not statically significant.

## Variations

In the present study the supra scapular notch was found fused to form the foramen in 4 scapulae. Out of 300 bones 4 had variations i.e. 2.66% of scapulae had supra scapular foramen in our study compared to Von Schroeder HP, et al (2001) who found 2 scapulae (6%) having the supra scapular notch fused to form the foramen out of 30 specimens<sup>[4]</sup> and Raj Kishore M et al (2013) who found 22 scapulae (19.64%) with suprascapular foramen out of 112 specimens.<sup>[9]</sup>

## CONCLUSION

The observations in the present study were: Following parameters were more on right side compared to left

- The length of glenoid cavity.
- Maximal depth of suprascapular notch.
- Superior transverse diameter of suprascapular notch.

Following parameters were more on left side compared to right the breadth of glenoid cavity and also, there were more scapulae with longer superior transverse diameter of supra scapular notch (STD>MD) (63.33%) than scapulae with longer maximal depth of suprascapular notch(MD>STD) (36.70%). The superior transverse scapular ligament was completely ossified in 2.66% of cases to form suprascapular foramen.

## CONFLICT OF INTEREST :

The authors declared no conflict of interest.

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