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Morphology and Morphometric Study of Dry Scapula, with Emphasis on the Glenoid Fossa in BIDAR

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ABSTRACT

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 morphology and morphometry of the scapula , its glenoid fossa and acromion process play a significant role in the mechanics of shoulder joint. A variable morphology is found in glenoid fossa that has clinical implications. The Aims of the study was to evaluate the morphology and morphometry of dry scapula with emphasis on clinical correlation of glenoid fossa. An Observational cross-sectional study was conducted in the department of anatomy, BRIMS BIDAR for a period of 6 months from March 2019 to August 2019. A total of 110 adult dry scapula were included in the study. The morphology and dimensions were measured. The dimensions were summarized as mean and standard deviation. Statistical analysis was done Chi-square test and student's t-test based on the variable types. Out of 110 scapulae studied, 44 were right sided and 66 were left sided. The mean of maximum length of the right scapula was 12.7±0.9 cm and the left side was 12.5±1.1 cm. Among the glenoid cavities, among glenoid cavities,36 was kidney shaped, 46 were pear shaped,28 was oval shaped. In one right-sided scapula Bony Spur Extends from Base of coracoid process to supra–Scapular Notch. Size and shape of the glenoid cavity are directly related to the dislocation of shoulder joint and may affect the results of total shoulder arthroplasty and rotator cuff surgeries. The present study analyzed the morphological types and diameters of the glenoid cavity in adult scapulae to improve the efficacy and minimize the failure rates in shoulder arthroplasty particularly those involving the glenoid component of the shoulder joint.

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Key Words
Acromion process, Coracoid process, Glenoid cavity, Morphology, Morphometry, Scapula

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INTRODUCTION

The scapula (shoulder blade) is a triangular flat bone that lies on the posterolateral aspect of the thorax, overlying the 2nd-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. It has costal and dorsal surfaces, superior, lateral and medial borders and is obscured by the muscles which cover it. The lateral angle is truncated and broadened. On its free surface it bears the glenoid cavity for articulation with the head of the humerus in the shoulder joint. The glenoid forms a poor socket for the humeral head. It is narrow above and wider below, and is pear shaped in outline. The neck of the scapula is the constriction immediately adjoining the head[1]. There is a notch present on its Antero superior part, that is, on the anterior glenoid rim which gives its different shape. When this glenoid notch is indistinct its shape is piriform or pear or tear drop, when it is distinct it looks like inverted comma shape and when it is absent its oval shape[2]. Variations in the superior transverse scapular ligament and the suprascapular notch are the most recognized possible predisposing factors for suprascapular notch (SSN) entrapment[3]. The disproportionate sizes of the head of the humerus and the small, shallow glenoid cavity combined with a lax articular capsule give this joint a wide range of movements but make the joint inherently unstable. The shoulder joint is the most frequently dislocated joint in the body. Dynamic factors of the rotator cuff muscles and the static factors of the glenohumeral ligaments, the labrum and the joint capsule play a role in gleno-humeral joint stability. Alignment of the humerus and the glenoid articular surfaces is one of the predisposing factors for glenohumeral joint instability, which is one of the predisposing factors for rotator cuff pathology. Dislocations may also be associated with fracture of the glenoid cavity, for the management of this, prostheses and arthroplasty are required[4]. The knowledge of variations in shape and size of the glenoid fossa are required for better understanding of shoulder joint arthroplasty. These are prerequisites for complete understanding of the mechanics of shoulder joint. This information has clinical application in shoulder arthroplasty, gleno-humeral instability and rotator cuff tear management[5]. The variations in the morphology of glenoid fossa are influenced by genetic and environmental factors[6]. The shoulder joint is the third most common joint that requires reconstruction following knee and hip[7]. Therefore, it is mandatory to understand its complex anatomy, which in turn facilitates prompt fabrication of Glenoid implants and screws. Thorough knowledge on the morphometry and morphology of the glenoid fossa is essential in the understanding, investigation and management of demographic diseases pertaining to shoulder such as glenohumeral arthritis, rotator cuff disorders, shoulder dislocations, and fractures. Therefore, it is mandatory to understand its complex anatomy, which, in turn, facilitates prompt fabrication of Glenoid implants and screws[8]. Thorough knowledge on the morphometry and morphology of the glenoid fossa is essential in the understanding, investigation and management of demographic diseases pertaining to shoulder such as glenohumeral arthritis, rotator cuff disorders, shoulder dislocations and fractures[9]. The knowledge of the shape and dimensions of the glenoid cavity are important in the design and fitting of glenoid component for total shoulder arthroplasty. So deep understanding of variations in normal anatomy of glenoid cavity is essential while dealing with its clinical correlation.

Aims and Objectives: The Aims of the study was to evaluate the morphology and morphometry of dry scapula with emphasis on clinical correlation glenoid fossa.

MATERIALS AND METHODS

An observational cross-sectional study was conducted in the department of anatomy, BRIMS BIDAR, during MARCH 2019-AUGUST 2019, after taking approval from the Institutional Ethical committee.

A morphometric and morphological analysis of 110 adult dry and undamaged human scapulae (44 right side and 66 left sides) was conducted in SOUTH INDIAN POPULATION (BIDAR region of KARNATAKA) to evaluate the parameters of the Glenoid fossa and its relevant clinical significance.

The morphological evaluation was done, and the linear measurements were taken using a Vernier Calliper and recorded in centimetre. The age and sex of the scapulae are unknown.

The Following Parameters Were Assessed in the Study: Various shapes of the Glenoid Fossa were observed (Pear, Oval and Notch type).

Maximum Length of Scapula: maximum distance between the superior angle of scapula to inferior angle of scapula

Maximum Breath of Scapula: maximum distance between the middle of dorsal border of glenoid fossa to end of spinal axis at vertebral border

Maximum Length of the Glenoid Fossa: maximum distance between the superior and inferior borders of glenoid fossa.

Maximum Breadth of the Glenoid Fossa: maximum distance between the anterior and posterior borders of glenoid. fossa.

The mean, standard deviation and the p-value correlating the shape and morphometry were calculated separately for the right and the left glenoid cavity. The comparisons in the morphology of the right and left sides were made using statistical analysis

Inclusion Criteria: Dry, complete and both right- and left-sided adult scapulae will be included in the study.

Exclusion Criteria:

- The specimens which are partially broken or have any deformity will be excluded from the study
- Specimens with osteoarthritic changes, showing any previous trauma sign or skeletal disorders will be excluded from the study
- Children scapula is excluded from the study

Statistical Analysis: In the present study, data were analysed in Microsoft Excel to determine the incidence as percentages.

For each morphology and morphometric parameters, maximum; mean and standard deviation were also calculated.

Although it was a descriptive type of analysis, so test of significance was done using Chi-square test and Student's t-test based on the variable types.

RESULTS AND DISCUSSIONS

Out of 110 scapulae studied, 44 were right sided and 66 were left sided.

Among glenoid cavities, 36 were kidney shaped, 46 were pear shaped,28 was oval shaped.

The mean of maximum length of the left scapula was 12.5±1.1 cm and right side was 12.7±0.9 cm, difference was not statistically significant.

The mean of maximum breadth of the left scapula was 8.9±0.7 cm and the right side was 9.0±0.5 cm, the difference was not statistically significant.

The mean of maximum length of the left glenoid cavity was 3.1 ± 0.4 cm and the right side was 3.2 ± 0.5 cm, the difference was not statistically significant.

The mean of maximum breadth of the left glenoid cavity was 2.0±0.3cm&right side was2.1±0.3 cm, the difference was not statistically significant.

In the present study, the sex of the scapulae was not known therefore, male and female bones could not be measured separately.

In the present study, findings show that the most commonly occurring glenoid shape is pear followed by kidney shaped and oval shape on both the side.

Similar to this study, many other authors reported Pear shaped glenoid cavity as common shape, Akhtar *et al.,*[9] and Ankush Rao and Dombe,[10] Singh[11] observed Pear shaped glenoid cavity as a common shape followed by inverted comma and oval shape in Indian scapulae, Singh *et al*.[12] and Sinha *et al*.[13] also reported pear shape as common shape followed oval shape and inverted comma.

Fig. 1: Sliding vernier calliper

Fig 2: Measuring scapular length

Fig. 3: Measuring scapular breadth

Fig. 4: Measuring length of glenoid fossa

Fig. 5: Measuring breadth of glenoid

In the present study, the mean of maximum length of the right glenoid cavity was 3.2+0.5cm and the left side was 3.1+0.4cm, the values of glenoid cavity diameter of the right side were higher then left side. Similarly, Singh *et al.*[12] measured that the values of glenoid cavity length were 34.84 mm on the right side and on the left side were 33.48 mm followed by other authors Sinha *et al.*[13] were almost similar with the present study.

Table 1:The mean of maximum length of the left glenoid cavity

Whole Scapula	Side of the Scapula	Mean	p-value
Maximum length	RIGHT	12.7±0.9 cm	0.63
	LEFT	12.5±1.1 cm	
Maximum breadth	RIGHT	9.0±0.5 cm	0.62
	LEFT	8.9±0.7 cm	

Table 2:The mean of maximum breadth of the left scapula

Glenoid Cavity	Side of the Scapula	Mean	p-value
Maximum length	RIGHT	3.2±0.5 cm	0.63
	LEFT	3.1±0.4 cm	
Maximum breadth	RIGHT	2.1±0.3 cm	0.64
	LEFT	2.0±0.3 cm	

While Akhtar *et al*.[8] and Mahto and Omar[14] reported higher values 36.03 mm, 37.03 mm and 36.2 mm, respectively, in comparison to the present study. Values of glenoid cavity diameter of the left side were reported higher then right side in the study by Mamatha *et al.*[15] and Sinha *et al*.2014.

In the present study, the mean of maximum length of the right scapula was 12.7+0.9 cm and the left side was 12.5±1.1cm, which was close to the findings observed in BIDAR population by Rajeswari and Ramalingam[16] owed that the mean length of scapula was 141.34 mm with a SD of 8.5 mm.

However, studies in European, Turkish and Egyptian population had slightly different morphometry. El-Din andAli,7 Coskun *et al.,*[17] and Flower and Garson,[18] the present study findings were similar to studies done by various Indian studies morphometry such as breadth scapular morphometry 99.32 mm) and Krishnaiah[19] showed (length scapular morphometry 143.25 mm and breadth scapular morphometry 105.59 mm).

CONCLUSION

A definite knowledge regarding the normal morphology is needed. The significant finding of this study suggests the both right and left bone parameters should be measured. Study of morphology and measurement of scapulae plays an important role in clinical significance for proper maintenance of posture and functioning of shoulder.

Size and shape of the glenoid cavity are directly related to the dislocation of shoulder joint and may affect the results of total shoulder arthroplasty and rotator cuff-surgeries. The present study analysed the morphological types and diameters of the glenoid cavity in adult scapulae to improve the efficacy and minimize the failure rates in shoulder arthroplasty particularly those involving the glenoid component of the shoulder joint.

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