

Morphometric Study of Glenoid Cavity in South Indian Population

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Abstract

Background: The glenoid cavity is a shallow pyriform articular surface on the lateral angle of scapula. The shape and dimensions of glenoid cavity are important in the design and fitting of glenoid component for total shoulder arthroplasty. The shoulder arthroplasty is a common orthopedic intervention in the clinical management of shoulder arthritis. Appropriate fixation of glenoid component is essential to evade loosening which is the common indication for revision surgery. **Aims and Objectives:** To determine the morphometry of glenoid cavity of scapula bones belonging to South Indian population. To assess the incidence of different shapes of glenoid cavity. **Methodology:** The present study was carried out on 182 dry adult scapulae of unknown sex belonging to South Indian population. Three glenoid diameters were measured using Vernier caliper. The shape of glenoid cavity was classified as inverted comma, pear and oval shape based on a notch present on anterior glenoid rim. **Results:** The mean superior-inferior diameter was 34.70 ± 3.64 mm. The mean anterior-posterior diameter of lower half of glenoid cavity was 23.59 ± 2.33 mm. The average anterior-posterior of upper half was 15.50 ± 1.55 mm. **Conclusion:** The left glenoid cavity was slightly longer in length. This fact may be taken into consideration while designing glenoid prosthesis for south Indian population. The morphometric data regarding the glenoid cavity will be helpful in evaluating the defects or lesions of glenoid cavity and is important in the diagnosis and management of diseases of shoulder joint.

Keywords: Glenoid Cavity; Morphometry; Scapula; Glenoid Notch.

Introduction

The scapula is a pair of triangular large flat bones that are situated dorsally in the rib cage in relation to second to seventh ribs. The glenoid fossa is oriented at lateral angle of scapula. The vertical diameter of glenoid cavity is the longest and is broader below than above. The shoulder joint is a synovial joint of ball and socket variety. It has gained mobility at the cost of stability [1]. The two articular surfaces of shoulder joint are hemispherical head of humerus and glenoid cavity of scapula.

The shoulder joint is the most frequently dislocated joint of body. Dislocation with fracture of glenoid are quite common in trauma [2]. Along with repair of labrum and rearrange of anterior muscles, total shoulder replacement is also being used as treatment [3]. The glenoid cavity regarded as head of scapula. The morphology of glenoid cavity is highly variable. The shape of glenoid cavity varies from pear shape, inverted comma and oval depend on the presence or absence of a notch on anterior glenoid rim [4]. The studies have reported that the glenoid inclination is associated with full thickness rotator cuff tears [5]. The glenoid morphology has a prognostic implication on primary gleno-humeral osteo arthritis [6]. The morphometry of glenoid cavity has clinical application in orthopedic joint replacement, gleno humeral instability and rotator cuff tear management [7]. The purpose of present study is to obtain the morphometric data of glenoid cavity, to study the various shapes of glenoid cavity relevant to south Indian population and to compare the data obtained from present study with earlier studies.

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Materials and Methods

The present study was carried out on 182 dry adult scapula of unknown sex obtained from department of anatomy of various medical colleges in and around Bangalore and Kerala. Of the 182 scapulae 96 were right side and 86 were from left side. All the measurements were manually performed with the help of Vernier caliper and were performed directly by placing the calipers on the glenoid surface.

Scapulae having clear and intact glenoid cavity were selected for the study. Damaged and broken scapulae were excluded. All the measurement was taken in millimeters (mm) using Vernier caliper. Data was analyzed using SPSS software and presented in tables.

The following parameters were studied in glenoid cavity.

1. Superior-Inferior glenoid diameter (SI): maximum distance from the inferior point on the glenoid margin to the most prominent point of the supraglenoid tubercle.
2. Anterior-Posterior glenoid diameter (AP-1): maximum breadth of the articular margin of the glenoid cavity perpendicular to the glenoid cavity height.
3. Anterior-Posterior glenoid diameter (AP-2): the anterior-posterior diameter (breadth) of the upper half of glenoid cavity at the mid-point between the superior rim and the mid equator.
4. Shape of glenoid cavity: a piece of white sheet was

placed on the glenoid cavity and held firmly in position to trace the shape of glenoid cavity. The side of the point of a lead pencil was rubbed along the rim of glenoid cavity to get a tracing of the shape of glenoid cavity on the paper. 3 types were classified – oval, pear and inverted comma shape.

Results

In the present study the superior-inferior (SI) diameter of glenoid cavity on the right side varied from 27 mm to 48 mm. with an average of 34.39 ± 3.55 mm and on the left side superior-inferior diameter varies from 28 mm to 48 mm, with a mean of 35.05 ± 3.73 mm.

The Anterior-Posterior (AP-1) glenoid diameter of right and left side varies from 16 mm to 30 mm and 16 mm to 29 mm respectively. The mean AP-1 diameter of right glenoid was 23.54 ± 2.39 mm and of left glenoid was 23.56 ± 2.27 mm.

The range of AP-2 diameter of right glenoid cavity was 11 to 19 mm and the mean was for the same was 15.40 ± 1.45 mm. the AP-2 diameter for left glenoid varied from 11 to 20 mm, while the mean for left glenoid was 15.61 ± 1.66 mm.

A total of 96 glenoid on the right side were looked, out of them 11 were inverted comma shaped, 53 were pear shaped and 32 were oval shaped. 86 glenoid belongs to the left side out of them inverted comma shaped glenoid were 12, pear shaped were 39 and oval shaped were 35 in number.

Table 1: Comparison of measurements of right and left glenoid

Parameters	Range		Mean		Standard deviation		P value
	Right	Left	Right	Left	Right	Left	
SI diameter	27 - 48 mm	28 - 48 mm	34.39 mm	35.05 mm	3.55	3.73	0.22
AP-1 diameter	16 - 30 mm	16 - 29 mm	23.54 mm	23.56 mm	2.39	2.27	0.74
AP-2 diameter	11 - 19 mm	11 - 20 mm	15.40 mm	15.61 mm	1.45	1.66	0.36

Table 2: Comparison between shape of right and left glenoid

Shape of Glenoid	Incidence of shape		Total
	Right glenoid (96)	Left glenoid (86)	
Oval	32 (33.3%)	35 (40.69%)	67
Pear	53 (55.20%)	39 (45.34%)	92
Inverted comma	11 (11.45%)	12 (13.95%)	23

Table 3: Comparison of superior-inferior (SI) diameter and anterior-posterior (AP-1) diameter by various authors

Observers	No of specimens	Mean SI diameter	Mean AP-1 diameter
Iannotti et al ¹¹	140	39 ± 3.5 mm	29 ± 3.2 mm
Luis Rios Frutos ¹²	Male - 65	36.08 ± 2.0 mm	26.31 ± 1.5 mm
	Female - 38	31.17 ± 1.7 mm	22.31 ± 1.4 mm
Ozer et al ⁸	Male - 94	38.71 ± 2.71 mm	27.33 ± 2.4 mm
	Female - 92	33.79 ± 3.08 mm	22.72 ± 1.72 mm
Mamatha et al ²	Right - 98	33.67 ± 2.82 mm	23.35 ± 2.04 mm
	Left - 104	33.92 ± 2.87 mm	23.02 ± 2.30 mm
Present study	Right - 96	34.39 ± 3.55 mm	23.54 ± 2.39 mm
	Left - 86	35.05 ± 3.73 mm	23.56 ± 2.27 mm

Discussion

Anterior dislocation of the shoulder joint is the commonest dislocation and is more common in adults than in children. It results due to a direct force pushing the head of humerus out of the glenoid cavity and thereby injuring the later consequently. In the present study the various diameters of glenoid cavity and various shapes of glenoid cavity were measured and compared with similar studies. Several studies have been conducted on different population by various authors. The SI diameter of right glenoid was 34.39 ± 3.55 mm and of left was 35.05 ± 3.73 mm, the right glenoid value was slight lower than the left. Mamatha et al [1] worked on 202 dry scapulae out of which 98 were right and 104 belongs to left, SI diameter of glenoid on right side is 33.67 ± 2.82 mm and on left side was 33.92 ± 2.87 mm which were slightly lower than the values got in present study. Ozer et al [8] studied 186 scapulae, SI diameter of male glenoid was 38.71 ± 2.71 mm. and of female was 33.79 ± 3.08 mm. Hina BR et al [9] studied 100 scapulae of which 43 belongs to right and 57 belongs to left side. The mean SI diameter on right side was 34.76 ± 3.0 mm and on left side was 34.43 ± 3.21 mm, which is similar to the values of present study.

The average anterior-posterior of lower half of glenoid (AP-1) of right side was 23.54 ± 2.39 mm and that of left was 23.56 ± 2.27 mm in the present study. In the study of Mamatha et al, the average anterior-posterior diameter (AP-1) of lower half of the glenoid of the right side was 23.35 ± 2.04 mm and that of left side was 23.02 ± 2.30 mm. the values were similar to the values of present study. The AP-1 diameter recorded by Karelse et al [10], was 27.2 ± 3.0 mm which is higher than the current study. The average AP-1

diameter of right side is 23.31 ± 3.0 mm and on left side is 22.92 ± 2.8 mm as per study done by Hina BR et al, which is similar to the present study.

The mean anterior-posterior of upper half (AP-2) of right glenoid was 15.40 ± 1.45 mm and that of left glenoid was 15.61 ± 1.66 mm in current study. In the study of Mamatha et al, the average anterior-posterior diameter (AP-2) of upper half of the glenoid of the right side was 16.27 ± 2.01 mm and that of left side was 15.77 ± 1.96 mm. the values were slightly larger than the values of present study. Hina BR et al studied 100 scapulae, the AP-2 of right was 15.10 ± 2.54 mm and that of left was 13.83 ± 2.45 mm.

In the current study, incidence in percentage of various shapes of glenoid cavity were recorded. 11.45% of right and 13.95 % of left glenoid were inverted comma shape with a distinct notch. The pear shaped glenoid were 55.2 % on right side and 45.34 % on left side. The right side 33.3 % were oval and on left side 40.69 % were oval. Hira BR et al found out that 35% of right and 39% of left glenoid were inverted comma shape. The oval glenoid were found on 16 % on right and 15% on left side and in Mamatha et al 20% on right side and 24% on left side. In present study the percentage of pear shape and oval shape are more prevalent than previous studies.

Conclusion

The knowledge of size and shape of glenoid will be helpful for the surgeons in the design and fitting of glenoid components for total shoulder arthroplasty. An understanding in variation in normal anatomy of glenoid is essential while evaluating pathological conditions like osseous lesions and osteochondral

defects related to shoulder joint. Dimensions of glenoid fossa exhibit racial variations hence the important parameters for selecting appropriate shoulder implants. Since the present study was performed on a limited number of scapulae, further cadaveric, radiological and clinical studies are indicated.

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