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Anatomy

MORPHOLOGY AND MORPHOMETRY OF GLENOID CAVITY AND IT'S CLINICAL SIGNIFICANCE

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ABSTRACT Shapes of gelenoid cavity may be pear-shaped or teardrop, round, oval and an inverted comma-shape depending on the presence or absence of a glenoid notch. Study of glenoid cavity is important for clinician or orthropaedician to treat medical and surgical problems of shoulder joint. Aim is to observe shape and to measure various diameters of gelenoid cavity in adult dry scapula.

Materials And Methods: Study was done on 222 dry, unpaired human scapulae. We measured length, breadth and observed shape of the glenoid cavity.

Results: Mean superior-inferior diameter on right and the left sides were 33.20±2.72 mm and 32.73±2.83 mm respectively. Mean anterior-posterior diameter of the lower half of the right glenoid was 23.33±2.04 mm and that of the left was 22.82±2.30 mm. Present study observed pear, oval, inneverted comma and round shape glenoid cavities.

Conclusion: Knowledge is important in better understanding of the shoulder pathology as well as in designing and fitting of glenoid components for total shoulder arthroplasty.

KEYWORDS : Gelenoid Cavity, Shoulder Joint, Glenoid Notch, Dislocation, Arthroplasty.

INTRODUCTION:

The glenoid cavity (GC) is present on the lateral angle of the scapula which is a shallow, pyriform articular surface. It is also known as glenoid fossa of the scapula. The vertical diameter of the GC is the longest and it is broader below than above. Supra-glenoid tubercle is present at the upper margin of GC and an infra-glenoid tubercle at the lower margin. Supra-glenoid tubercle lies inside the joint capsule of shoulder joint and the infra-glenoid tubercle lies outside the capsule. GC articulates with the head of humerus and forms the shoulder joint. [1] The articular surface of GC is usually pear shaped and its inferior half is 20% larger than the superior half. [2]

GC is much smaller than the articular surface of head of humerus. The glenoid labrum (fibro-cartilaginous rim) which is attached to the margin of fossa deepens the concavity of GC but in spite of this both the articulating surfaces are not well congruent in various joint movement positions therefore, the joint is loosely packed. It is probably closely packed in abduction and lateral rotation of the joint [1].

Different types of shapes of the GC have been described in literature which is based on the presence of a notch on the anterior glenoid rim. It has been found that when the notch is distinct, then the glenoid labrum bridges the notch itself which could make the shoulder joint more prone for dislocation and other pathologies.[3] The shape of the glenoid cavity is highly variable. The shape of the GC may be pear-shaped or teardrop, round, oval and an inverted comma-shape depending on the presence or absence of a glenoid notch. Glenoid notch is better marked in the early state of the bone which indicate the junction of "coracoid" and "scapular" parts and part above glenoid notch has a separate centre of ossification.[4]

Most frequently dislocated joint in the body is the shoulder joint and along with it fractures of the glenoid are also very common in trauma. Repair of the labrum done along with reinforcing the capsule by an overlapping repair and rearrangement of anterior muscles and total shoulder joint replacement is also being used as a treatment.[5] Diseases of rotator cuff and tear are found to be associated with the degree of inclination of the glenoid fossa [6]

Prostheses and arthroplasty are required for management of dislocation with fracture. Knoweldge of normal anatomy and variations of shape and size of GC is of fundamental importance in understanding of rotator cuff disease, shoulder dislocation and to choose the proper size of the glenoid component in the shoulder arthroplasty. [7, 8]

The sound knowledge of normal anatomical features, variation in shape and morphometric dimensions of GC is essential for the clinician or orthropaedician to treat various medical and surgical problems associated with the shoulder joint such as; dislocation, osteoarthritis, unstable joint and osseous Bankart's lesion. Considering the clinical importance of glenoid cavity, the present study was conducted to observe the shape of GC and to measure the various diameters of it in adult dry human scapula.

MATERIALS AND METHODS:

This study was done on 222 (Rt.- 111; Lt.- 111) dry, unpaired adult human scapulae of unknown sex. The scapulae with clear and intact glenoid cavity were used for the study. The following parameters of the glenoid cavity were studied. (Fig.1)

a.Superior-Inferior glenoid diameter (SI): The maximum distance from the inferior point on the glenoid margin to the most prominent point of the supraglenoid tubercle, i.e. is the maximum height of the glenoid cavity (Fig.1).

b. Anterior-Posterior glenoid diameter (AP-a): The maximum breadth of the lower half of the glenoid cavity perpendicular to the glenoid cavity height (Fig.1).

c. Anterior-Posterior glenoid diameter (AP-b): The anterior-posterior diameter (breadth) was measured as maximum breadth of upper half of glenoid cavity (Fig. 1).

d.Shape of the glenoid cavity: Shapes of glenoid cavity were classified described by Schrmpf M et al. They classified shapes on the basis of presence or absence of notch on the anterior margin of fossa [9]. These are: Oval shape- absence of notch, Pear shape- presence of indistinct notch and Inverted comma shape- presence of distinct notch. Slightly raised margin around the glenoid fossa was used to define the border of fossa.

All morphometric parameters were measured by using digital Vernier caliper in millimeter with accuracy of 0.01mm. Different measured parameters of glenoid fossa were measured as by Akhtar MJ et al.[10]

Statistical Analysis:

All the measurement were tabulated and analysed by using SPSS version 22.0. Mean, minimum and maximum values were derived with Standard deviation. The values of right and left side were analyzed and compare by using unpaired t-test. The p-value ≤0.05

was taken as statistically significant.

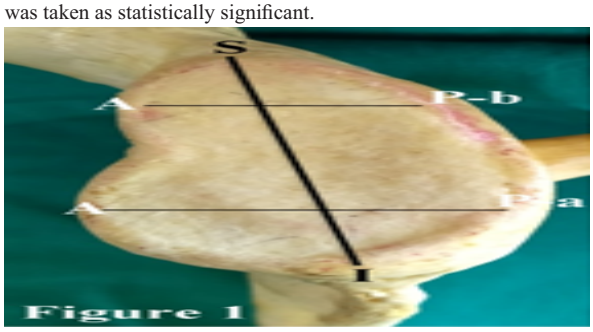

Figure 1: Showing various diameters of the glenoid cavity. S- I: Superior-Inferior diameter, A-Pa: Anterior- Posterior diameter in lower half of glenoid cavity, A-Pb: Anterior-Posterior diameter in upper half of glenoid cavity

RESULTS:

The mean superior-inferior diameter on right and the left sides were 33.20±2.72 mm and 32.73±2.83 mm respectively. The mean anterior-posterior diameter of the lower half of the right glenoid was 23.33±2.04 mm and that of the left was 22.82±2.30 mm. The mean diameter of the upper half of the right glenoid was 16.14±2.00 mm and that of the left was 15.90±1.96 mm. We observed that the right glenoid value was slightly more than the left but it was not statistically significant (Table 1).

Table 1: Comparison Of Measurements Of Right And Left Glenoid Cavity

Parameter	Mean +SD		P value
	Right	Left	
Superior-inferior diameter	33.20±2.72	32.73±2.83	0.765
Anterior-posterior diameter lower half of glenoid	23.33±2.04	22.82±2.30	0.569
Anterior-posterior diameter upper half of glenoid	16.14±2.00	15.90±1.96	0.501

Present study observed four different types of shape of the glenoid cavity as shown in table 2.

Table 2:Comparison Between Shape Of Right And Left Glenoid Cavity

Types of Shape	Incidence of shape		
	Right	Left	Total (n=222)
Pear	47	51	98(44.14%)
Oval	38	34	72(32.43%)
Inverted comma	20	24	42(19.81%)
Round	05	05	10(3.60%)

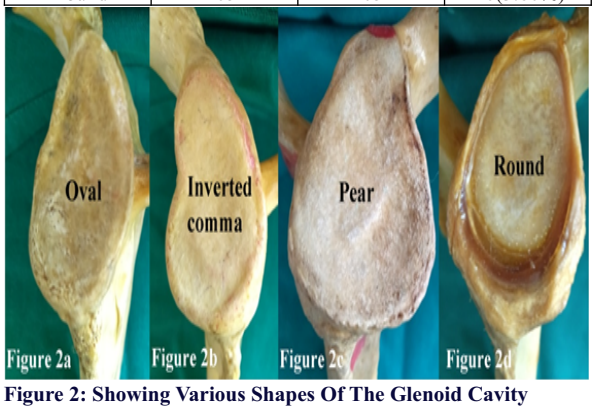

Figure 2: Showing Various Shapes Of The Glenoid Cavity

DISCUSSION

Many researchers studied the GC diameters which were measured in a variety of ways, including direct measurement of dry scapulae, direct measurement of fresh or embalmed cadavers, radiographic measurement of scapulae which were collected from cadavers and radiographic measurement in living patients. These studies were performed on different populations in different regions with variation in sample size. Present study observed the average superior-inferior diameter of the right glenoid was 33.20 ± 2.82 mm and the average superior-inferior diameter of the left glenoid was 32.73 ± 2.83 mm. Though the right GC value was slightly more, it was not statistically significant. This shows that the length of the right glenoid was slightly more than that of the left. The averages were compared to the values recorded in other studies (Table 3).

Table 3-Showing The Comparision Of Different Parameters In Indian Scapulae

Author	Number of Specimens	Mean S-I diameter (mm)	Mean APa diameter (mm)	Mean APb diameter (mm)
Mamatha T et al., [11]	R:98,L:104	33.79	23.2	16.02
Rajput HB et al., [8]	R: 43,L:57	34.59	23.11	14.46
Kavita et al (2013) [12]	R: 67, L: 62	34.66	24.95	-
Mahto AK et al., [13]	R:40,L:40	34.7	23.35	
Akhtar MJ et al., [10]	R:126, L:102	35.77	23.63	16.15
Sinha P et al., [14]	R:21, L:32	34.4	23.26	18.04
Ankushrao et al., [15]	R:53, L:54	36.77	24.58	16.25
Singh A et al. [16]	R:56, L:44	34.16	24.88	12.85
Present study	R:111, L:111	32.96	23.07	16.02

Different types of the shape, size of GC and attachment of glenoid labrum at the glenoid notch are important for normal functioning of this multiaxial shoulder joint of the human body. We observed that the Pear shape was common shape of glenoid cavity followed by oval, inverted comma shape and round on both the side (Table 2; Fig.2). We noted 4th type of shape of glenoid cavity ie. Round (Fig.2- d). Most of researchers observed Pear shaped GC as a common shape in Indian scapula. [8, 10, 11, 15] Prescher A,and Klumpen T [3] observed in German scapulae, Sinha P et al. [14], Sing A et al. [16] and present study in Indian scapulae reported pear shape as common shape followed oval shape.

Wael Amin Nasr EL-DIN and Mona Hassan MA in Egyptian population [17] and Coskun N et al. [18] in Turkish reported oval shape of GC as a common shape followed by pear shape while Gamal Hamed ESM et al., [19] reported pear shape as a common followed by inverted comma and oval shape in Egyptian scapulae.

By observing the table no3 in the discussion it can be observed that in the present study, though our results are nearby with that of some of the studies are less than that recorded by many of the researchers. This should be to be taken into consideration while designing and fitting glenoid components during shoulder arthroplasty.

We found a distinct notch 19.81% (inverted comma-shaped) and this arrangement may mimic as sublabrum foramen, Buford complex or labral tear during arthroscopy [20]. An indistinct notch present in 44.14% (pear-shaped), 32.43% were oval and 3.60 % round without any recognizable notch. Prescher A and Klumpen T [3] studied soft tissue specimens and concluded that when the glenoid notch is distinct, the glenoid labrum is usually not attached to the rim of the GC at the site of the notch which can be an important predisposing factor in anterior dislocation of shoulder joint.

The difference in morphometric values of glenoid fossa of present study with other Indian as well as of other countries could be explained on the basis of ethnic, racial and sample size variations. Precise knowledge of the variation in the shape and dimensions of the GC are important in better understanding of the shoulder pathology as well as in designing and fitting of glenoid components for total shoulder arthroplasty.

Limitation:

The present study was performed on a limited number of dry scapulae but the morphological and morphometric values of GC of present study may add some valuable data. The sex of scapula was unknown to us therefore we could not compare male and female scapulae.

CONCLUSION

The observations in this study will be helpful to the orthopaedician for the better understanding of the anatomy of shoulder joint and

they can use this information for surgical corrections of the pathology of this joint. Also, this dada will be helpful in choosing the proper size prosthesis in shoulder arthroplasty. Further the cadaveric, radiological and clinical studies should be done on large number of scapulae.

REFERENCES:

1. Standarding S. Gray's anatomy. The anatomical basis of clinical practice. 41th ed. London: Elsevier Churchill Livingstone; 2016; 803,813.
2. Wilk KE, Arrigo CA, Andrew JR. Current concepts: The stabilizing structures of Glenohumeral joint. Journal of Othropaedic and Sports physical therapy.1997; 25(6):364- 79.
3. Prescher A, Klumpen T. The glenoid notch and its relation to the shape of the glenoid cavity of the scapula. J Anat. 1997;190:457-460.
4. Breathnach AS. Frazer's Anatomy of the Human Skeleton. 6th ed. London: J and A Churchill Ltd; 1965. p. 63-70.
5. Sinnatamby CS. Last's Anatomy, Regional and Applied. 11th ed. London: Churchill Livingstone; 2006. p. 50-52.
6. Hughes RE, Bryant CR, Hall JM, Wening J, Hutson LJ, Kuhn JE et al. Glenoid inclination is associated with full thickness rotator cuff tears. Clin Orthop Related Res. 2003;407:86-91.
7. Vaishnani H, Jethva K, A Rathwa A, Sharma P. Morphometry and morphology of glenoid cavity of scapula. Int J Anat Res 2018; 6(1.1): 4798-4802.
8. Rajput HB, Vyas KK, Shroff BD. A study of morphological patterns of glenoid cavity of scapula. National J Med Res. 2012;2(4):504-07.
9. Schrumpf M, Maak T, Hammoud S, Craig EV. The glenoid in total shoulder arthroplasty. Curr Rev Musculoskelet Med. 2011;4(4):191-99.
10. Akhtar MJ, Kumar B, Fatima N, Kumar V. Morphometric analysis of glenoid cavity of dry scapulae and its role in shoulder prosthesis. Int J Res Med Sci. 2016;4(7):2770-76.
11. Mamatha T, Pai SR, Murlimanju BV, Kalthur SG, Pai MM, Kumar B. Morphometry of glenoid cavity. Online J Health Allied Sci. 2011;10(3):01-04.
12. Kavita P, Singh J, Geeta. Morphology of Coracoid process and Glenoid cavity in adult human Scapulae. International Journal of Analytical, Pharmaceutical and Biomedical Sciences 2013; 2(2): 19- 22.
13. Mahto AK, Omar S. Dimensions of glenoid fossa of scapula: implications in the Biomechanics of an implant design. Int J Sci Stud. 2015;3(4):146-48.
14. Sinha P, Bhutia KL, Tamang B, Sarda RK. Morphometric study of glenoid cavity of dry human scapula. Int J Med Res Prof. 2016;2(3):86-90.
15. Ankushrao SD, Dombe DD. Morphological and Morphometrical study of scapulae in Western Indian Population. Ind J Clin Anat Physiol. 2017; 4(3):298-303.
16. Singh A, Singh A, Agarwal P, Gupta R. A Morphological and Morphometric Study of Glenoid Fossa of Scapula and its Implication in Shoulder Arthroplasty. International Journal of Anatomy, Radiology and Surgery. 2019; 8(3):6-9.
17. Wael Amin Nasr EL-DIN, Mona Hassan MA. A morphometric study of the patterns and variations of the acromion and glenoid cavity of the scapulae in Egyptian Population. J Clin Diagn Res. 2015;9(8):8-11.]
18. Coskun N, Karaali K, Cevikol C, Demirel BM, Sindel M. Anatomical basics and variations of the scapula in Turkish adults. Saudi Med J. 2006;27(9):1320-25.
19. Gamal Hamed ESH. Morphometry of Glenoid fossa in Adult Egyptian Scapulae. Int J Anat Res. 2015;3(2):1138-42.
20. Tulte JM, Blankenbaker DG, Selfert M, Zlegert AJ, Orwin JF. Sublabral foramen and Buford complex: Inferior extent of unattached or absent labrum in 50 patients. Radiology.2002; 223(1): 137-142