Original Article

Glenoid Cavity And Its Clinical Significance In The Region Of Bihar: A Morphological And Morphometric Study

Dr. Md. Zahid Hussain[1], Dr. Rajesh Kumar[2], Dr. Rakesh Ranjan[3*], Dr. Rashmi Prasad[4]

[1]Tutor, Department of Anatomy, Nalanda Medical College & Hospital, Patna, Bihar (India)
[2]Tutor, Department of Anatomy, Nalanda Medical College & Hospital, Patna, Bihar (India)
[3*]Assistant Professor, Department of Anatomy, Sri krishna Medical College & Hospital, Muzaffarpur, Bihar (India)
[4]Professor, Department of Anatomy, Nalanda Medical College & Hospital, Patna, Bihar (India)

***Corresponding author:** Dr. Rakesh Ranjan

*Assistant Professor, Department of Anatomy, Sri krishna Medical College & Hospital, Muzaffarpur, Bihar (India)
Email- rakeshranjan73@yahoo.com
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Abstract

Background: The articular surface of the head of the humerus is much larger than the glenoid cavity (GC). The joint's concavity is deepened by the glenoid labrum (fibro-cartilaginous rim), which is attached to the fossa's margin. However, despite this, both articulating surfaces are not perfectly congruent in various joint movement positions, leaving the joint with a loose packing. During lateral rotation and abduction of the joint, it is probably closely packed.

Aim and Objectives: The current study's aim was to observe and quantitatively measure the dimensions of the glenoid cavity in an adult, dry human scapula.

Materials and Methods: 130 dry (right side: 65 and left side: 65), unpaired, fully ossified adult human scapulae of unknown sex and age were represented as the study's subjects in this prospective cross-sectional study.

Results: We observed that pear-shaped glenoid cavities in the scapula were the most common (43.8%), followed by oval-shaped glenoid cavities (34.62%), while inverted comma-shaped glenoid cavities (21.53%) were the least common.

Conclusion: Any variation from the shoulder joint's normal anatomy will give orthopaedic surgeons a better understand- ing of the anatomy of the joint, which they can use to correct the joint's pathology surgically. Also, using this information will make it easier to select the proper prosthesis size for a shoulder arthroplasty.

Keywords: Gelenoid Cavity, Glenoid Labrum, Shoulder Joint, Glenoid Notch, Dislocation, Arthroplasty

INTRODUCTION

The articular surface of the head of the humerus is much larger than the glenoid cavity (GC). The joint's concavity is deepened by the glenoid labrum (fibro-cartilaginous rim), which is attached to the fossa's margin. However, despite this, both articulating surfaces are not perfectly congruent in various joint movement positions, leaving the joint with a loose packing. During lateral rotation and abduction of the joint, it is probably closely packed.[1] The glenoid cavity's shape and the glenoid labrum, which deepen it and allow a wide range of movements while precisely stabilising the humeral head in its centre, give it its most remarkable feature.[2] The shoulder joint is the most often dislocated joint in the body, and trauma very frequently causes glenoid fractures along with it. Treatments available include total shoulder replacement, labrum repair, and capsule reinforcement through overlapping tissue repair and realignment of anterior muscles.[3,4,5] Management of dislocations with fractures required prosthesis and arthroplasty. Understanding rotator cuff disease, shoulder dislocation, and how to select the proper size of the glenoid component in the shoulder arthroplasty are fundamentally dependent on knowledge of normal anatomy and variations in the shape and size of the glenoid.[4,6]
In different regions of our country, various studies on the morphometry of the glenoid cavity have been conducted. On the morphometry of the glenoid cavity in the eastern Indian population, there is still relatively little data available.

AIM AND OBJECTIVES:

The current study's aim was to observe and quantitatively measure the dimensions of the glenoid cavity in an adult, dry human scapula.

METHODS AND MATERIALS

130 dry (right side: 65 and left side: 65), unpaired, fully ossified adult human scapulae of unknown sex and age were represented as the study's subjects in this prospective cross-sectional study. These samples were collected from the anatomy departments at the Nalanda Medical College and Hospital in Patna, Bihar, India, and the Shri Krishna Medical College and Hospital in Muzaffarpur, Bihar, India. The institution's institutional ethics committee reviewed the study protocol's ethical clearance and granted its approval. The study was conducted from September 2019 to December 2021.

Inclusion criteria

- Only clean, dried scapulae with anatomical features should be used.

Exclusion criteria

- glenoid fossa damage, a partially broken scapula, or any pathologically damaged scapula
- Scapula of a child

As previously described by Schrmpf M et al., morphological parameters such as the shape of the glenoid fossa were divided into three groups depending on the presence or absence of a notch on the anterior margin of the fossa.[7]

Various shapes include:

a. an inverted comma shape with a distinct notch
b. an oval shape without a notch, and
c. a pear shape with an indistinct notch.

Using a digital vernier calliper with a precision of 0.01 mm, morphometric Parameters-as previously described by Sinha P et al.[8] and Akhtar MJ et al.[9]- were calculated in millimetres (mm).

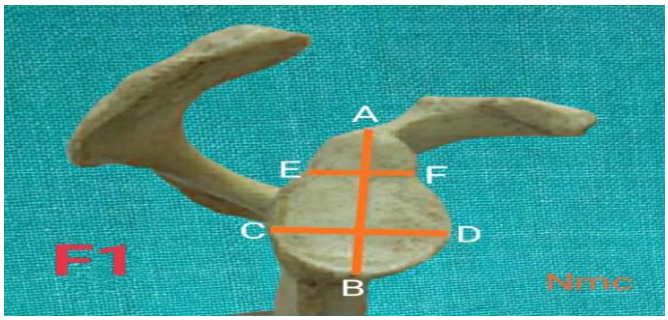


Figure F1: showing parameter measurements in the Glenoid cavity

For both the right and left sides of the scapula, the glenoid cavity's following parameters were calculated (Fig. F1).

a. Superior-inferior glenoid diameter (SI): The maximum distance between the inferior point on the glenoid margin and the most prominent point of the supraglenoid tubercle, or the maximum height of the glenoid cavity (between points A and B).
b. Anterior-posterior glenoid diameter (AP-a): The maximum breadth of the lower half of the glenoid cavity, as measured perpendicular to the glenoid cavity height (from point C to point D).
c. Anterior-posterior glenoid diameter (AP-b): The anterior-posterior diameter (breadth) was measured as the maximal breadth of the upper half of the glenoid cavity (from points E to F).
d. The shapes of the glenoid cavities: were classified and described by Schrmpf M et al.[7]
e. Glenoid cavity index (GCI): Glenoid Cavity Index (GCI) was calculated by the formula[9] :- (Antero-posterior diameter-1 /Supero-inferior diameter) × 100

Statistic analysis: Using Microsoft Excel 16 and SPSS version 22.0, all the measurements data were analyzed and tabulated. The mean value and standard deviation were computed. An unpaired t-test was used to analyse and compare the values on the right and left sides. Statistical significance is defined as a p-value of 0.05 or less.

RESULTS

The current study included 130 dry adult human scapulae (65 on the right and 65 on the left side).

Table 1: showing the distribution of the scapulae based on the glenoid's shape.

Total bones= 130 (65 right & 65 left side)		
Glenoid cavity's shape	Frequency	Percentage (%)

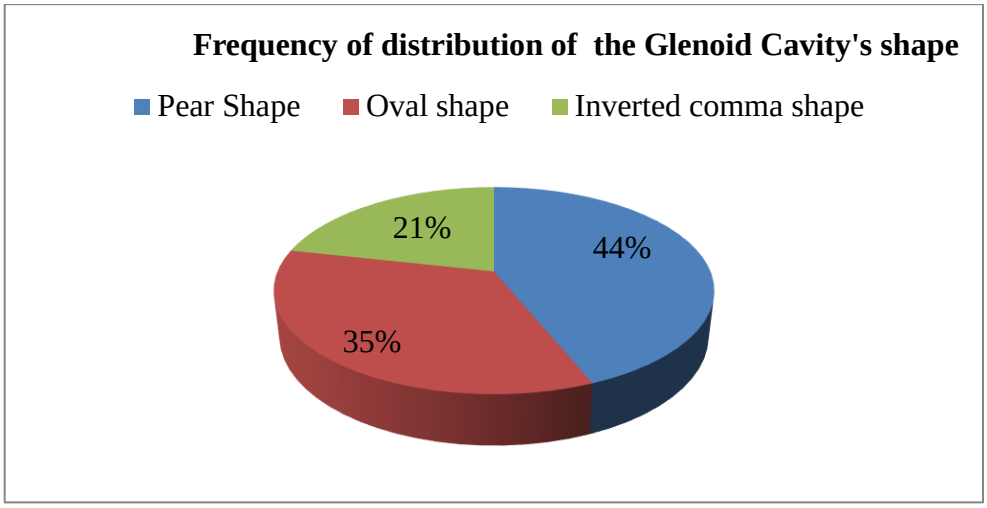
	Right side	Left side	
Pear	27	30	43.85%
Oval	24	21	34.62%
Inverted comma	13	15	21.53%

We observed that pear-shaped glenoid cavities in the scapula were the most common (43.8%), followed by oval-shaped glenoid cavities (34.62%), while inverted comma-shaped glenoid cavities (21.53%) were the least common.

Figure F2: showing the glenoid cavity's pear shape.

Figure F3: showing the glenoid cavity's oval shape.

Figure F4: showing the glenoid cavity's inverted comma shape.



Graph 1: showing the frequency of distribution of the Glenoid cavity's shape

Table 2: Showing glenoid Cavity measurements on the right and left sides are compared

Parameters	Mean ± SD (In mm)		P value	't' value
	Right side	Left side		
Superior-inferior diameter (SI)	34.52±3.96	33.30±2.74	0.673	2.162
Anterior-posterior diameter- lower half of glenoid (AP-a)	22.43±2.30	23.64±2.90	0.526	1.416
Anterior-posterior diameter- upper half of glenoid (AP-b)	17.21±2.86	16.37±2.64	0.531	3.652
Glenoid Cavity Index (GCI)	65.72±5.82	67.43±5.72	0.002	2.531

We found that the mean± SD values of superior-inferior diameter (SI) on the right and left sides of the glenoid cavity were 34.52±3.96 mm, and 33.30±2.74 mm, respectively.
The mean±SD value of the lower half of the right glenoid cavity's anterior-posterior diameter (AP-a) was 22.43 ±2.30 mm, whereas the left was 23.64 ±2.90 mm, respectively. P value was non-significant because in the current study, the observed P value was >0.05.
In the current study, the mean± SD values of the GCI for the right side were 65.72 ± 5.82 mm, and those for the left side were 63.43± 5.72 mm.
In the upper half of the glenoid, we found that the right glenoid's superior-inferior diameter and anterior-posterior diameter values were slightly higher compared to the left. The Glenoid Cavity Index (GCI), P value was significant (P = 0.002) in this study (Table 2).

OBSERVATION

To design and fit glenoid components for a total shoulder arthroplasty, as well as for a better understanding of shoulder pathology, it's necessary to have a precise understanding of the variations in the glenoid's shape and dimensions. Therefore, for the multiaxial shoulder joint of the human body to function normally, different types of glenoid labrum shape, size, and attachment at the glenoid notch are important. On the basis of ethnic, racial, and sample size variations, the differences between the morphometric values of the glenoid fossa in the present study and those of other Indians and people from other nations may be explained.

Table 3: Showing the various glenoid cavity shapes that have been observed by different authors

Authors	**Year of study**	**Sample size**	**Shape of Glenoid Cavity**		
			Pear	Oval	Inverted comma
Murli manju BV et al[10]	2011	202	90	45	67
Philip SE et al[11]	2018	100	64	28	8
Singh A et al[12]	2019	100	44	34	22
Present study	2021	130	57	45	28

We found that the pear shape (43.8%), the oval (34.62%), and the inverted comma (21.54%) were the three most common glenoid cavity shapes on both sides (Table 3). The majority of researchers found that the most common shape of Indian scapulae appeared to be a pear-shaped scapula.[10,11,12,15,16]

The inverted comma form was found to be the least frequent shape in the current study, which is consistent with findings by Philip SE et al.[11], Singh A et al.[12], Tiwari Vandanaet al.[15] and Murli manju BV et al.[10], who found the inverted comma shape as the second most common shape.

Table 4: The superior-inferior diameter (SI), the anterior-posterior diameter (AP-a), and the posterior-posterior diameter (AP-b) have been compared by various authors

Authors	Year of study	Sample size		Glenoid Cavity measurements of the right and left sides' Mean± SD (in mm)		
				SI	AP-a	AP-b
Neeta Chhabra et al[13]	2015	Right	55	38.46±2.81	25.04±2.69	18.70±2.22
		Left	71	39.03±3.18	24.85±2.46	18.6±2.07
Sinha Pranoti et al[14]	2016	Right	21	33.6± 3.01	23.22±2.85	18.07±2.64
		Left	32	34.44±3.27	23.31±3.12	18.01±2.56
Akhtar J et al[9]	2016	Right	126	36.03±3.15	23.67±2.53	16.30±2.16
		Left	102	35.52±3.12	23.59±2.47	16±2.34
Current study	2021	Right	65	34.52±3.96	22.43±2.30	17.21±2.86
		Left	65	33.30±2.74	23.64±2.90	16.37±2.64

We found that the mean± SD values of superior-inferior diameter (SI) on the right and left sides of the glenoid cavity were 34.52±3.96 mm, and 33.30±2.74 mm, respectively.

The mean±SD value of the lower half of the right glenoid cavity's anterior-posterior diameter (AP-a) was 22.43 ±2.30 mm, whereas the left was 23.64 ±2.90 mm, respectively. The findings presented above were closed to Sinha Pranoti et al.[14] and Akhtar J et al[9]. The mean±SD of the anterior-posterior diameter (AP-b) of the upper part of the right glenoid cavity were 17.21 mm and 16.37 mm, respectively. These values are very similar to those found by Akhtar J. et al.[9]

In the current study, the mean± SD values of the GCI for the right side were 65.72 ±5.82 mm, and those for the left side were 63.43± 5.72 mm, which was very similar to Neeta Chhabra et al.[13] finding. The GCI on the right side was 65.11±5.11 mm and the GCI on the left side was 63.67±3.76 mm, respectively, according to research conducted in 2015 by Neeta Chhabra et al.[13] on 126 dry human scapulae.

LIMITATION OF STUDY

This study has a small sample size. We could not compare male and female scapulae since we did not know the gender of the scapula. A radiological study conducted over a short time period may improve data collection for glenoid cavity (GC) measurement and shape.

CONCLUSION

In the upper half of the glenoid, we found that the right glenoid's superior-inferior diameter and anterior-posterior diameter values were slightly higher compared to the left.

Any variation from the shoulder joint's normal anatomy will give orthopaedic surgeons a better understanding of the anatomy of the joint, which they can use to correct the joint's pathology surgically. Also, using this information will make it easier to select the proper prosthesis size for a shoulder arthroplasty.

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