

Morphology and Morphometry of Glenoid Fossa of the Adult Human Scapula and its Clinical Application

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ABSTRACT

Introduction: Surgical remodeling of glenoid cavity is used as a treatment to relieve pain in shoulder joint osteoarthritis to reduce pain. Accurate morphometry of scapular glenoid is essential in shoulder joint replacement. **Aims and Objectives:** To observe the morphology and morphometry of adult dry Human Scapular glenoids. **Methodology:** our study observed 39 right-sided and 21 left-sided human scapulae (total of 60 dry scapular specimens were used), obtained from Department of Anatomy. All scapulae were observed for morphology of scapular glenoids. The morphometric parameters (Transverse diameter (TD), Vertical diameter (VD), and Glenoid cavity index (GCI) were measured using appropriate anthropometric instruments. **Results:** In our study, pear glenoid is the most common type whereas oval glenoid is the least common. Anthropometry of glenoid cavity in our study reveals that the mean vertical diameter on both right and left sides is 36.35 mm; the mean transverse diameter on right side is 25.73 mm and on left side is 26.46 mm. The mean glenoid cavity index in right scapulae is 70.91 and left scapulae is 72.86. **Conclusion:** Thus, the accurate morphometric measurements and morphology of glenoid cavity are helpful for orthopedic surgeons in selecting appropriate shape and size of implants in total arthroplasty of shoulder joint. While selecting the appropriate size racial differences also to be considered.

Introduction

The scapula is a major bone of pectoral girdle. The glenoid fossa forms the shoulder joint by articulating with humeral head.¹ Glenoid cavity permits greater mobility, compromising stability. In athletes, glenohumeral instability is frequent cause of shoulder dislocation and pain.

Surgical remodeling of glenoid cavity is used as a treatment to relieve pain in shoulder joint osteoarthritis to reduce pain.² Accurate morphometry of scapular glenoid is essential in shoulder joint replacement. Neer et al. in 1982 reported that unconstrained type of total shoulder arthroplasty has great success.² Gristina and Webb developed a nonarticulated semi-constrained, monospherical total shoulder arthroplasty. In this the polyethylene glenoid surface is pear-shaped, and has a superior buttressing lip that resists superior subluxation of the humeral head as the deltoid abducts the shoulder.²

Material and Methods

In our study, we observed 39 right-sided and 21 left-sided human scapulae (total of 60 dry scapular specimens were used), obtained from Department of Anatomy, Sri Venkateswara Medical College Tirupati, Andhra Pradesh, India. All scapulae were observed for morphology of scapular glenoids. The shape of the glenoid cavity was studied and compared with various studies which reported pear-shaped, inverted comma-

shaped, oval shaped glenoid cavities.³ The morphometric parameters (Transverse diameter (TD), Vertical diameter (VD), and Glenoid cavity index (GCI) were measured using appropriate anthropometric instruments. The sample size of 60 scapulae was selected by simple random sampling method, excluding the damaged scapulae. Parameters included were TD (maximum distance between anterior and posterior margin of glenoid cavity), VD (maximum height of the glenoid cavity), and GCI (TD/VD x 100).

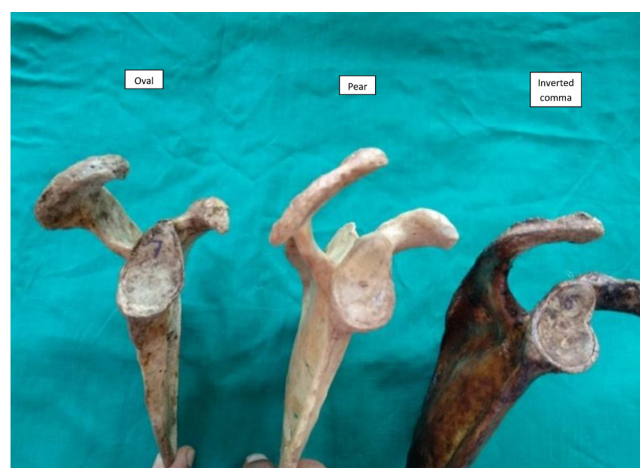


Fig. 1: Types of glenoid cavity

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Fig. 2: Measuring the vertical diameter of glenoid cavity

Result

In the present study, 60 scapulae were studied for morphology and morphometry of glenoid cavity. Out of the 60 scapulae, 39 (65%) belong to right side and 21 (35%) belong to left side (Fig. 3). Following shapes of glenoid cavity were observed in the present study – pear, oval and inverted comma. It was observed pear shape was found to be most common type whereas oval shape was least common (Table 1 and Fig. 1 and Fig. 4). Morphometry of glenoid cavity in our study reveals that the maximum VD of glenoid cavity in right scapulae was 44.28 mm and in left scapulae was 41.20 mm (Table 2). Minimum VD in right scapulae was 30.57 mm and in left scapulae was 28.99 mm (Table 2). Mean VD on both right and left sides is 36.35 mm (Table 2). Maximum TD of glenoid cavity in right scapulae was 28.82 mm and in left scapulae was 30.68 mm (Table 2). Minimum TD of glenoid cavity in right scapulae was 21.29 mm and in left scapulae was 21.61 mm (Table 2). Mean TD of glenoid cavity on right side is 25.73 mm and on left side is 26.46 mm (Table 2). Glenoid cavity index was calculated using the formula ($GCI = TD / VD \times 100$). In

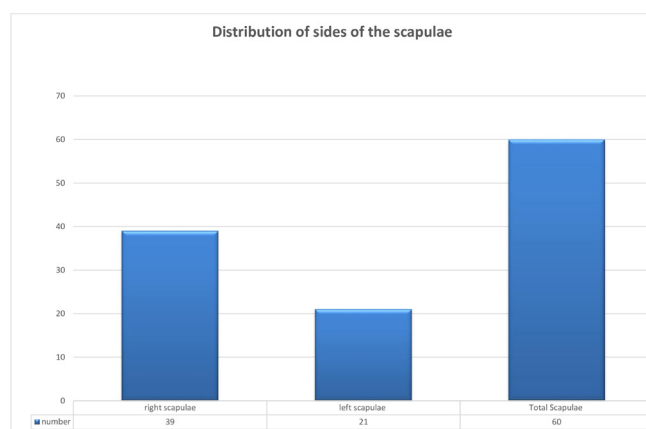


Fig. 3: Distribution of sides of scapulae used in the present study

our study, GCI on right side ranged between 62.53–78.33 and that of left side scapulae ranged between 64.03–82.79 (Table 3). Mean glenoid cavity index in right scapula was 70.91 and left scapula was 72.86 (Table 3). Table 1 depicts common type is pear shape and oval shape is relatively less common. Table 2 depicts that mean vertical diameter on both right and left sides is 36.35 mm; mean transverse diameter on right side is 25.73 mm and on left side is 26.46 mm..

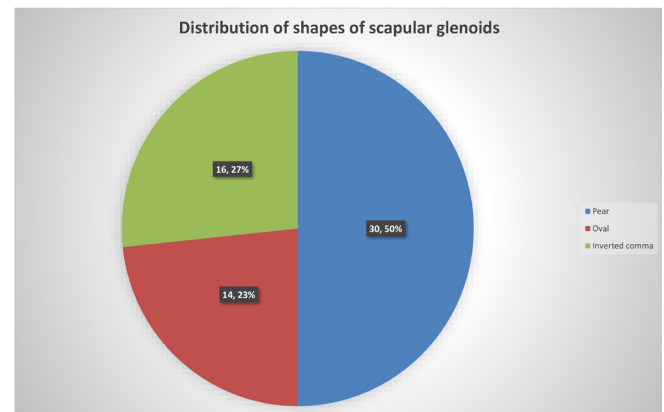


Fig. 4: Distribution of shapes of the scapular glenoids

Discussion

Morphometry of glenoid fossa is helpful in designing and properly aligning the glenoid component in total shoulder joint replacement surgeries. Mamatha et al reported in their study that glenoid cavity is pear-shaped in 44.5%, inverted comma-shaped in 33.5%, and oval-shaped in 22%.³ Rajput et al in their study stated that 47.5% were pear-shaped, 36% were inverted commas and 15.5% were oval-shaped.⁴ In the present study, it was noted most common type is pear shape (50%) and least common type is oval shape (23.33%). Gosavi SN et al also reported a greater number of pear-shaped glenoid cavities (49.91%) and least number of inverted comma-shaped glenoid cavities (12.05%).⁵ Prescher and Klumpen reported 35 percent oval glenoids and 30 percent pear glenoids.⁶ Coskun et al noted 72% oval shaped and 28% pear shaped glenoid.⁷

Gandhi et al reported a greater number of pear-shaped (56.09%) glenoid cavities but the least common type was triangular (2.4%) which is not observed in the present study.⁸ Durgesh Singh concluded that the most common shape was oval and least common shape was pear, the mean VD on right side was 37.0 mm and on left side 36.1 mm.⁹ The mean TD on the right side was 24.5 mm and on the left side 24.6 mm. In the study done by Mahto and Omar, the mean VD was 36.2 mm and 33.2 mm on right and left sides respectively.¹⁰ The mean TD was 24.2 mm on right side and 22.5 mm on left side.¹⁰ The values in the present study are – mean VD is 36.35mm on both sides and mean TD is 25.73mm on right and 26.46mm on left side, which is nearer to the values of above studies. These values are also correlating with the values of Mamatha et al, Rajput et al and Kavita et al.^{3, 4, 11}

Table 1: Distribution of various shapes of Glenoid cavity

S.No	Shape	Right (%)	Left (%)	Total (%)
1.	Pear	24 (61.54)	6 (28.57)	30 (50)
2.	Oval	8 (20.51)	6 (28.57)	14 (23.33)
3.	Inverted comma	7 (17.95)	9 (42.86)	16 (26.67)

Table 2: Anthropometric measurements of various parameters of Glenoid cavity

S.No	Parameter	Mean (mm)		Range (mm)	
		Right	Left	Right	Left
1.	VD of glenoid cavity	36.35	36.35	30.57–44.28	28.99–41.20
2.	TD of glenoid cavity	25.73	26.46	21.29–28.82	21.61–30.68

Table 3: Mean and range of glenoid cavity index

S.No	Parameter	Mean		Range	
		Right	Left	Right	Left
1.	GCI	70.91	72.86	62.53–78.33	64.03–82.79

Table 4: Comparing the mean values of diameters of glenoid cavity with other studies

Parameter	Rajput et al	Mamatha et al	Kavita et al	Present study
SI diameter				
Right (mm)	34.76	33.67	35.2	36.35
Left (mm)	34.43	33.92	34.7	36.35
AP diameter				
Right (mm)	23.31	23.35	25.07	25.73
Left (mm)	22.92	23.05	24.9	26.46

All the above studies were done in Indian population. In the study done by El-din et al in Egyptian population oval shaped glenoid cavity was found to be most common.¹² The mean vertical diameter was 38.88 mm on right side and 39.01 mm on left side; the mean transverse diameter was 28.31 mm on right side and 27.99 mm on left side. From this study, it is noticed that the racial differences in the dimensions of glenoid cavity have to be considered during shoulder joint surgeries. Polguy et al stated that the mean GCI observed was 72.35 in total samples.¹³ Dhindsa et al reported that the combined mean GCI was 69.48¹⁴ The GCI in the present study is 71.59 which is statistically correlating with the above-mentioned studies.

STUDY LIMITATIONS

In present study, we utilized scapulae of adult humans from single locality, Tirupati of Andhra Pradesh. The sample size is only 60 which is very small. Application of statistical inference derived from our study to larger population requires continuation of the study with larger sample size. Scapulae

of adult humans from different regions of country to be included to generalize the results for larger population.

Conclusion

Results from the current study are in close alignment with statistical data available in various studies from the literature. Thus, the accurate morphometric measurements and morphology of glenoid cavity are helpful for orthopedic surgeons in selecting appropriate shape and size of implants in total arthroplasty of shoulder joint. While selecting the appropriate size racial differences also to be considered. The functional capacity of the shoulder joint is critical in daily lifestyle activities of the patient being treated. The size of the prosthesis chosen for the shoulder joint arthroplasty should be similar in size to the original size of the glenoid cavity of patient who is undergoing the procedure so that functional capacity of the shoulder joint after replacement will be acceptable by the patient.

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