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Original Research Article

A STUDY OF MORPHOMETRY OF GLENOID FOSSA TO DECIDE THE SIZE OF GLENOID COMPONENT IN SHOULDER ARTHROPLASTY AMONG SOUTH INDIANS

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ABSTRACT

Introduction: The detail understanding about discrepancy in anatomy of glenoid cavity like different shape, size and dimensions are important for orthopaedicians and prosthetic designers. Studies concerning glenoid morphometry among south Indians are scarce. Present study aims at obtaining anthropometric data of glenoid cavity in south Indian scapulae.

Materials and Methods: A total of 72 dry adult unpaired scapulae of unknown age and sex were used in the study. Shape and diameters of glenoid fossa in each scapula were recorded and analysed statistically.

Results: The average vertical diameter of glenoid fossa was 37.1mm on right side and 37.3mm on left side. The average transverse I and II diameter was 23.3mm and 17.4mm on right side, 23.3mm and 17.7mm on the left side. The average spino-glenoid depth was 16.9 and 16.3mm on right and left side. The average Coraco-glenoid distance was 25.1mm on both sides. The average acromio-glenoid distance was 32.2 and 32.6mm on right and left side. Glenoid index was 63.2% on the right side and 62.4% on the left side.

Conclusion: The findings of this study would assist to design proper size of glenoid component to be used in total shoulder arthroplasty among south Indians.

KEY WORDS: Glenoid Fossa, Arthroplasty, Glenoid Index.

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INTRODUCTION

The lateral angle of scapula becomes truncated and broadened to form the glenoid cavity also known as glenoid fossa. Head of humerus articulates with the glenoid fossa to form the shoulder joint. The glenoid rim presents a notch in its antero-superior part, due to which various shapes of glenoid fossa are described like pear, oval and inverted comma [1]. Glenoid with its variable anatomy, minimal bone stock and inherent instability makes addressing the glenoid one of the most difficult procedures in

orthopaedics [2].

Shoulder joint is the most commonly dislocated joint in the body, dislocations can be coupled with the fracture of glenoid in case of trauma. Along with repair of the labrum and reinforcing the capsule by an overlapping repair and rearrangement of anterior muscles, total shoulder replacement is also being used as a treatment [3]. Total shoulder arthroplasty is a common treatment for glenohumeral arthritis but glenoid loosening causing pain, limitation of function and need for revision surgery, is one of the most common failure modes of total shoulder arthroplasty [2]. Today's gold standard for primary glenoid replacement is cemented all-polythylene component [4].

The objective of this study was to obtain anthropometric statistics of scapulae particularly the diameters and shape of glenoid fossa in the south Indian population which is important during designing and fitting of glenoid component for total shoulder arthroplasty to curtail failure rate.

MATERIALS AND METHODS

This study was done on 72 unpaired adult human scapulae, exact age and sex of which were not known. 38 scapulae belonged to right side and 34 to the left side. Bones which were damaged were excluded from the study. The following parameters of scapula were recorded with a digital calliper. All the measurements were in millimetre.

Maximum scapular length: Measured from superior angle to inferior angle of scapula

Maximum scapular width: Maximum transverse diameter between the medial border of the scapula, where spine meets the body of scapula, and the anterior lip of glenoid

Vertical diameter of the glenoid fossa:

Maximum distance between supraglenoid tubercle and inferior point on the glenoidal margin

Transverse diameter of glenoid fossa- I:

Maximum diameter between the articular margins of glenoid fossa

Transverse diameter of glenoid fossa- II:

Diameter between the upper half of the glenoid fossa (at the mid-point between the superior rim and the mid-point on the vertical diameter)

Spino- glenoid depth: Measured from the posterior rim of the glenoid fossa to the maximum concavity of the lateral border of the spine of scapula

oraco- glenoid distance: Minimum distance from the anterior rim of glenoid fossa to the tip of the coracoid process

Acromio- glenoidal distance: Distance between tip of acromion process and supraglenoid tubercle

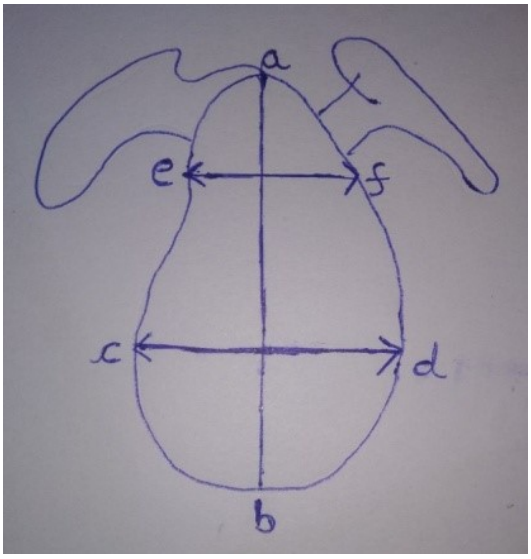
Glenoid index:

$$\frac{\text{Transverse diameter of glenoid fossa I X 100}}{\text{Vertical diameter of the glenoid fossa}}$$

Shape of the glenoid fossa: A piece of white sheet was placed on the glenoid cavity and held firmly in position to trace the shape of the glenoid fossa. A lead pencil was rubbed along the rim of glenoid fossa to get a tracing of the shape of the glenoid cavity on the paper. Three types were classified, type-1 oval, type-2 pear shaped and type-3 inverted coma shaped.

Microsoft office excel 2007 was used to calculate the range, mean, standard deviation of Glenoid diameters and glenoid index.

Fig. 1: Schematic representation of vertical diameter (a-b), transverse diameter I (c-d) and transverse diameter II (e-f) of glenoid fossa.



RESULTS

In the present study vertical diameter of glenoid fossa on the right side varied from 31.8mm to 40.5mm, with an average of 37.1mm. Vertical

Transverse diameter I of glenoid fossa on right and left side varied from 18.4mm to 26.8mm and 20.3mm to 26.2mm. The average transverse diameter I on right and left side was same i.e 23.3mm. Transverse diameter II of glenoid fossa on right and left side varied from 13.1mm to 19.7mm and 16.1mm to 19.8mm. The average transverse diameter II on right and left side was 17.4mm and 17.7mm.

Spino-glenoid depth on right and left side varied from 15.03mm to18.9mm and 14.1mm to 18.7mm. Average of spino-glenoid depth was 16.9mm and 16.3mm on right and left side respectively. The average Coraco-glenoid distance on right and left side was 25.1mm. The average acromio-glenoid distance on right was 32.2mm and left was 32.6mm. The average glenoid Index on the right side was 63.2% and left side was 62.4%.

Table1: Range, mean and standard deviation of dimensions of scapula and glenoid fossa.

Parameter		Range	Mean	Standard Deviation
Scapular length	Right	120.9-148.8 mm	134.3 mm	8.97
	Left	121.4-162.2 mm	137.4 mm	8.97
Scapular Width	Right	88.1-103.1 mm	93.7 mm	4.78
	Left	90.7-109.7 mm	98.5 mm	4.14
Vertical diameter of glenoid fossa	Right	31.8-40.5 mm	37.1 mm	1.95
	Left	33.8-40.7 mm	37.3 mm	1.55
Transverse diameter- I of glenoid fossa	Right	18.4-26.8 mm	23.3 mm	2.04
	Left	20.3-26.2 mm	23.3 mm	1.91
Transverse diameter- II of glenoid fossa	Right	13.1-19.7 mm	17.4 mm	1.43
	Left	16.1-19.8 mm	17.7 mm	1.05
Spino-glenoid depth	Right	15.03-18.9 mm	16.9 mm	0.91
	Left	14.1-18.7 mm	16.3 mm	1.2
Coraco-glenoid distance	Right	21-28.9 mm	25.1 mm	2.77
	Left	21.8-27.4 mm	25.1 mm	1.76
Acromio-glenoidal distance	Right	28.9-35.8 mm	32.2 mm	1.91
	Left	28.9-36.03 mm	32.6 mm	1.88
Glenoid index	Right	50.6-77.1%	63.20%	5.56
	Left	54.8-70.7%	62.40%	4.53

The incidence of pear shaped glenoid fossa on right and left side was 55% and 50%. The incidence of inverted comma shaped glenoid fossa on right and left side was 24% 35%. The incidence of oval shaped glenoid fossa on right and left side was 21% and 15% respectively.

Fig. 2: Various morphological shaped glenoid fossa.

Pear Inverted comma Oval

Table 2: Different shapes of glenoid fossa.

Shape of the glenoid cavity	Incidence (%)		
	Total	Right	Left
Pear shaped	38 (52.78%)	21 (55.26%)	17 (50%)
Inverted comma shaped	21 (29.17%)	9 (23.68%)	12 (35.29%)
Oval shaped	13 (18.05%)	8 (21.05%)	5 (14.70%)

Chart 1: Incidence of morphological types of glenoid fossa.

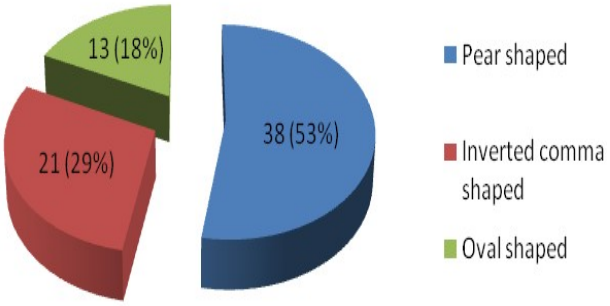
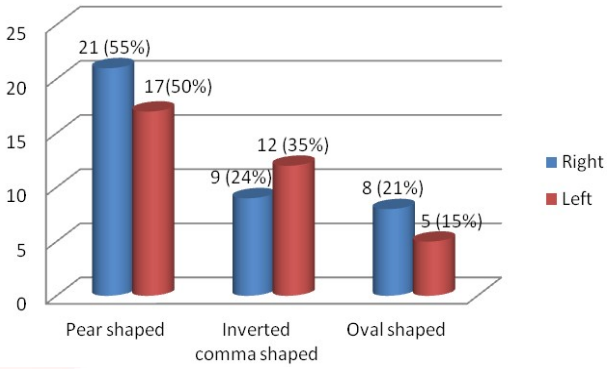


Chart 2: Incidence of morphological types of glenoid fossa in right and left scapulae.



DISCUSSION

In the present study mean vertical diameter of glenoid fossa was 37.1mm and 37.3mm on right and left side. Left glenoid value was slightly higher than the right. In a study done by Gupta et al in north India the vertical diameter of glenoid fossa were 3.49cms and 3.30cms on right and left side [5]. Gamal et al studied 68 dry Egyptian scapulae and reported the mean of vertical diameter of glenoid fossa as 3.31cms on right side and 2.87cms on left side. In study done by Gupta et al and Gamal et al [2], the right values are higher than the left. Mamtha et al [4] reported the mean vertical diameter of glenoid fossa of south Indian scapulae as 33.67mm and 33.92mm on the right and left side, vertical diameter on the left side is higher than right which is similar to our study.

Mean of transverse diameter I and II in our study

was 23.3 (both on left and right side) and 17.4 mm (right) and 17.7 (left). Gupta et al [5] recorded mean transverse diameter I of 2.31 cms and 2.06 cms on right and left side. Gamal et al [2] recorded mean transverse diameter I of 2.44 cms and 2.21 cms on right and left side. Mamtha et [4] al recorded mean transverse diameter I of 23.35mm and 23.05mm and mean transverse diameter II of 16.27mm and 15.77mm on right and left side, mean transverse diameter I was found to be similar to the results of present study, whereas the value of transverse diameter II was less compared to present study.

Table 3: Comparison of vertical and transverse diameters of glenoid fossa with other studies.

Study	Vertical diameter of glenoid fossa	Transverse diameter I of glenoid fossa	Transverse diameter II of glenoid fossa
Gupta et al [5]	Right 3.49 cms	Right 2.31 cms	
	Left 3.30 cms	Left 2.06 cms	
Gamal et al [2]	Right 3.31cms	Right 2.44 cms	
	Left 2.87 cms	Left 2.21 cms	
Mamtha et al [4]	Right 33.67mm	Right 23.35 mm	Right 16.27 mm
	Left 33.92 mm	Left 23.05 mm	Left 15.77 mm
Present study	Right 37.1 mm	Right 23.3 mm	Right 17.4 mm
	Left 37.3mm	Left 23.3 mm	Left 17.7 mm

The mean of spino-glenoid depth was 16.9mm on right side and 16.3mm on the left side in our study. Pahuja et al [6] in a study done on 129 dry north Indian scapulae recorded the mean spino-glenoid depth of 17.2mm and 17.02mm on right and left side, which was higher compared to our study.

The mean of coraco-glenoid distance was 25.1 mm on right and left side in our study. In contrast lesser value of 16.23mm (total mean) was recorded by Gumina et al [7] in a study done on 204 dry scapulae in Rome.

The mean of acromio-glenoid distance was 32.2 mm on right side and 32.6mm on the left side in our study. In contrast lesser value of 31mm on right and 31.97mm was recorded by Mansur et al [8] in a study done on 68 dry scapulae in Nepal. Lesser values of 2.53cms on right and 2.43cms on right was recorded in a study done by Gupta et al [9] on 50 dry unpaired scapulae in south India.

Mean glenoid index was 63.2% on the right and 62.4% on left in our study. Gamal et al [2] reported mean glenoid index as 73.67% on right and 76.71% on left side. Chhabra et al [1] reported glenoid index of 65.11on right side and 63.67 on the left side.

Table 4: Comparison of morphological types of glenoid fossa with other studies.

Glenoid shape	Our study	Gamal et al [2]	Mamtha et al [4]	Chhabra et al [1]
Pear shaped	53%	46%	45%	51%
Inverted comma shaped	29%	31%	33%	17%
Oval shaped	18%	23%	22%	32%

Studies done by Gamal et al and Mamtha et al recorded morphological shapes of glenoid fossa wherein, pear shape > inverted comma shape > oval shape which was similar to our study. Chhabra et all recorded pear shape > oval shape > inverted comma shape.

CONCLUSION

Knowledge about the morphometry of glenoid fossa is important to design glenoid component which is used in total shoulder arthroplasty. Dimensions observed in this study were more or less similar to other studies done on other population. Studies concerning glenoid morphometry among south Indians are scarce. Anatomical, clinical and radiological studies of glenoid fossa with a larger sample size is indicated for more accurate data pertaining to dimensions of glenoid fossa in south Indian population.

Conflicts of Interests: None

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