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A MORPHOMETRIC STUDY ON GLENOID-CAVITY OF SOUTH INDIAN POPULATION

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ABSTRACT

The shoulder joint is one of the ball and socket joint of human body, which is formed by the articulation of glenoid cavity of scapula and head of humerus. A sound knowledge of dimensions and shape of glenoid cavity are very important in the design of glenoid component for total shoulder arthroscopy. The study was done on 136 dry, unpaired adult human scapula of unknown sex in the department of anatomy, K S Hegde Medical Academy, Deralakatte, Mangalore. The dimensions were measured using digital Vernier caliper. The mean superior-inferior diameter of the glenoid cavity on the right side and of left side was observed as 34.81 ± 2.46 and 33.37 ± 2.96 . The mean antero-posterior glenoid diameter (AP-1) on right and left side was observed as 24.07 ± 2.58 and 22.75 ± 2.45 . The mean antero-posterior diameter (AP-2) right and left side was observed as 15.27 ± 1.92 and 15.19 ± 2.31 respectively. The shapes of the glenoid cavity varied from pear, oval and inverted comma. Understanding the variations in the anatomy of glenoid is very much essential while dealing with the pathological conditions.

Keywords: *Glenoid Cavity, Humerus, Arthroscopy*

INTRODUCTION

The scapula is a large, triangular bone that lies on the posterior chest wall. It has two surfaces, three borders and three angles. The three angles are inferior, superior and lateral. Out of these three angles, the lateral angle is truncated and bears the glenoid cavity for articulation with the head of humerus forming the gleno-humeral joint. The glenoid cavity is shallow, narrow above and broad below. The peripheral margin of glenoid cavity except at the supraglenoid tubercle is covered by a fibrocartilaginous rim called glenoid labrum. The floor of the glenoid cavity is covered by articular hyaline cartilage. The superior-inferior diameter of the cavity is longer than the transverse diameter and also the lower transverse diameter is more than the upper half diameter. The fibrous capsule of the shoulder joint is attached to the periphery of the glenoid cavity, outside the labrum in such a way that includes the supraglenoid tubercle but excludes the infraglenoid tubercle (Datta, 2004).

The glenoid rim presents a notch in its upper and anterior part (Breathnach AS, 2016). Due to the presence of this glenoid notch, various shapes of glenoid cavity is found like pear-shaped, oval or inverted comma (Rajput *et al.*, 1965).

Shoulder joint is one of the most commonly dislocated joint in trauma. Dislocations with fracture of the glenoid are quite common. It is not only the repair of the labrum or reinforcement of the capsule of the glenoid cavity or muscle arrangement but also a total shoulder replacement is also a treatment of choice (Sinha *et al.*, 2016)

The variations of the morphology of the glenoid cavity will be helpful for the glenoid cavity will be helpful for the surgeons to evaluate the proper size of the glenoid component in the shoulder arthroplasty (Sinnatamby, 1999).

Our present study is aimed to obtain the morphometric data of the glenoid cavity which includes different diameters of glenoid cavity and its shape. This will be helpful for better management of shoulder pathology.

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MATERIALS AND METHODS

The study was done on 136 dry, unpaired adult human scapula of unknown sex in the department of anatomy, K S Hegde Medical Academy, Deralakatte, Mangalore. Out of 136 scapulae, 74 belong to right side and 62 belong to the left side. The study was carried only on those scapulae which had intact glenoid cavity. The parameters taken for the study were:

- Superior-inferior glenoid diameter (SI): this is the maximum height of the glenoid cavity. It represents the maximum distance from the most prominent point of the supra-glenoid tubercle to the inferior point on the glenoid margin.
- Anterior-posterior glenoid diameter (AP-1): It represents the maximum breadth of the articular margin of the glenoid cavity perpendicular to the glenoid cavity height.
- Anterior-posterior glenoid diameter (AP-2): It represents the anterior posterior diameter of the upper half of glenoid cavity, at the mid-point between the upper rim and mid-equator.
- Shape of glenoid cavity: based on slightly raised rim of the glenoid cavity.

The diameters were measured in millimeters using digital Vernier calipers. The mean and standard error of the glenoid cavity in various dimensions were calculated. The morphometric values of the two sides were analyzed using an unpaired t test. These data were compared with the earlier published reports.

RESULTS

In the present study, the superior-inferior diameter of the glenoid cavity on the right side and of left side varied from 28mm to 38mm, with an average of 34.81 ± 2.46 and 33.37 ± 2.96 .

In this study, the AP-1 glenoid diameter of right and left varied from 16mm to 28mm and 18mm to 27mm respectively.

The average AP-1 glenoid diameter of right side was 24.07 ± 2.58 . The average AP-1 glenoid diameter of left side was 22.75 ± 2.45 .

The AP-2 glenoid diameter in the present study of right and left varied from 11mm to 19mm and 11mm to 20mm respectively.

The average AP-2 glenoid diameter of right and left side was 15.27 ± 1.92 and 15.19 ± 2.31 respectively.

On the right side, out of 74 glenoid cavities that were examined 49 were found to have pear shape, 14 were found to have oval shape and 11 were found to have inverted comma shape.

On the left side, out of 62 glenoid cavities that were examined 36 were found to have pear shape, 16 were found to have oval shape and 10 were found to have inverted comma shape.

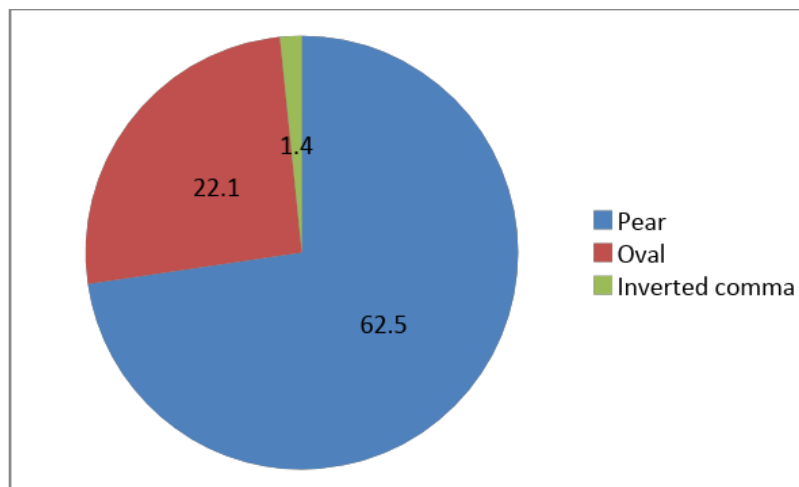


Chart1: chart indicating the various shapes of the glenoid cavity

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DISCUSSION

In the present study, an effort has been made to measure the average diameters of the glenoid cavity of the scapulae and different shapes of the glenoid cavity in the south Indian population.

Many authors have attempted to measure the diameter of glenoid cavity in many ways, which includes direct measurement of dry scapulae, direct measurement of fresh or embalmed cadavers, radiological measurement of scapulae taken from the cadavers and radiological measurement in the living patients. Various authors have performed the study in different population. The data obtained in this study has been correlated with the studies done by various authors. The comparison reveals the similarities as well as differences.

The average supero-inferior diameter of the right glenoid cavity in the present study was 34.81 ± 2.46 and the average supero-inferior diameter of the left glenoid cavity was 33.37 ± 2.96 . The length of the right glenoid cavity was slightly more than the left side glenoid cavity and it was statistically significant. The average supero-inferior diameters obtained by earlier authors were compared with the present study (Pai, 2011) (Table 1). In the study done by Iannotti et al, the supero-inferior diameter of the glenoid cavity was 39 ± 3.5 mm which was more than the value obtained in the present study. Churchill et al., Luis Rios Frutos and Ozer et al., measured the male and female supero- inferior diameter of glenoid cavity separately. The average supero-inferior diameter of the male glenoid cavity measured by Churchill et al., was 37 ± 2.2 mm, Luis Rios Frutos et al., was 36.08 ± 2.05 mm and Ozer et al., and was 38.71 ± 2.71 mm. All these measurements were higher than the values recorded in the present study. The supero-inferior diameter of the female glenoid cavity measured by Churchill et al., was 32.6 ± 1.8 mm, Luis Rios Frutos et al was 31.17 ± 0.17 mm and Ozer et al., was 33.79 ± 3.08 mm. The values obtained in the present study agree with these authors who have done the measurements in the female scapula. In our present study, the male and female scapula was not measured separately because the sex of the scapula was not known.

Table 1: Comparison of supero-inferior diameter by various authors

Observers	No. of specimens	Mean SI diameter
Mallon et al., (1992)	28	35 ± 4.1 mm
Iannotti et al., (1992)	140	39 ± 3.5 mm
Von Schroeder et al (2001)	30	36 ± 4 mm
Churchill et al., (2001)	Male – 200	37 ± 2.2 mm
	Female - 144	32.6 ± 1.8 mm
Luis Rios Frutos (2002)	Male – 65	36.08 ± 2.0 mm
	Female - 38	31.17 ± 1.7 mm
Ozer et al., (2006)	Male – 94	38.71 ± 2.71 mm
	Female - 92	33.79 ± 3.08 mm
Karelse et al., (2007)	40	35.9 ± 3.6 mm
Mamatha et al.,	Right – 98	33.67 ± 2.82 mm
	Left – 104	33.92 ± 2.87 mm
Present study	Right – 74	34.81 ± 2.46
	Left – 62	33.37 ± 2.96

In the present study, the average antero-posterior diameter (AP-1) of the lower half of glenoid cavity of the right side was 24.07 ± 2.58 and that of left side was 22.75 ± 2.45 . These values indicate that the right side glenoid cavity is broader in the lower half than the left side glenoid cavity. The average antero-posterior diameters obtained by earlier authors were compared with the present study (Pai, 2011) (Table 2).

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Table 2: Comparison of the antero-posterior (AP-1) diameter by various authors

Observers	No. of specimens	Mean AP-1 diameter
Mallon <i>et al.</i> , (1992)	28	24±3.3mm
Iannotti <i>et al.</i> , (1992)	140	29±3.2mm
Von Schroeder <i>et al.</i> , (2001)	30	28.6±3.3mm
Churchill <i>et al.</i> , (2001)	Male- 200 Female- 144	27.8±1.6mm 23.6±1.5mm
Luis Rios Frutos (2002)	Male- 65 Female-38	26.31±1.5mm 22.31±1.4mm
Ozer <i>et al.</i> , (2006)	Male-94 Female-92	27.33±2.4mm 22.72±1.72mm
Karelse <i>et al.</i> , (2007)	40	27.2±3mm
Mamatha <i>et al.</i> ,	Right-98 Left-104	23.35±2.04mm 23.02±2.30mm
Present study	Right-74 Left-62	24.07±2.58 22.75±2.45

The antero-posterior diameter measured by Mallon et al for 28 specimens was 24±3.3mm. The antero-posterior diameter of right side glenoid cavity recorded in our present study agrees with Mallon et al. In a study done by Luis Rios Frutos et al and Ozer et al, the antero-posterior diameter of 38 female glenoid cavity was 22.31±1.4mm and 92 female glenoid cavity was 22.72±1.72mm respectively. The findings of the present study on left side glenoid cavity agree with the study of Luis Rios Frutos et al and Ozer et al on female scapula. The antero-posterior diameter measured on glenoid cavity by Iannotti et al on 140 specimens, Von Schroeder et al on 30 specimens, Churchill et al on 200 male glenoid cavity, Luis Rios Frutos et al on 65 male glenoid cavity, Ozer et al on 94 male glenoid cavity, Karelse et al on 40 specimens were more than the value recorded in our present study.



Image 1: Pear shaped



Image 2: Oval Shaped



Image 3: Inverted Coma

In the present study, average antero-posterior diameter (AP-2) of upper half of right glenoid cavity was 15.27±1.92mm and that of left glenoid cavity was 15.19±2.31mm. These values indicate that the right side glenoid cavity is slightly broader than the left side glenoid cavity. In the study done by Mamatha et al, the AP-2 of the upper half of the right glenoid cavity was 16.27±2.01mm and that of left side glenoid cavity was 15.77±1.96mm. The findings in the present study agree with the study done by Mamatha et al.

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Based on the presence of notch on the anterior margin of glenoid cavity, various shapes of glenoid cavity have been described. We found that on right side, 19 % were oval and on left side 26% were oval without any recognizable notch. On the right side, 66% of glenoid had indistinct notch and was classified as pear shape and that of left side was 58%. The glenoid cavity with a distinct notch was classified as inverted comma. We found that on the right side 15% and on left side 16% glenoid cavity shaped inverted comma. Knowledge of dimensions and shape of the glenoid are important for the orthopedic surgeons for total shoulder arthroplasty. Size of the glenoid cavity is known to be variable in different population (Shilpa et al., 2011). Hence understanding the variations in the anatomy of glenoid is very much essential while dealing with the pathological conditions. In a study done by Mathew et al., in South India among type 2 diabetes mellitus patients recorded that 16.5% of them suffered from frozen shoulder. 5.48% from peri-arthritis of shoulder and 3.55% from rotator cuff injury (Mathew, 2013). An increase in the aging population accompanied by an increase in the incidence of type 2 diabetes mellitus, indicate that arthritic diseases of the shoulder may become more common in the near future in the south Indian population (Patil and Burji, 2012).

REFERENCES

- Breathnach AS (1965).** Frazer's Anatomy of the human skeleton. 6th ed. London: J and A Churchill Ltd.; p. 63-70.
- Churchill RS, Brems JJ and Kotschi H (2001).** Glenoid size, inclination and version: An anatomic study. *Journal of Shoulder Elbow Surgery* **10** 327-332.
- Datta AK (2004).** Essentials of Human Anatomy. 3rd ed. Kolkata: Current Book International.
- Frutos LR (2002).** Determination of Sex from the clavicle and scapula in a Guatemalan contemporary rural indigenous population. *American Journal of Forensic Medicine and Pathology* **23** 284-288.
- Iannotti JP, Gabriel JP, Schneck SL, Evans BG and Misra S (1992).** The normal glenohumeral relationships. An anatomical study of one hundred and forty shoulders. *Journal of Bone Joint Surgery America* **74** 491-500.
- Karelse A, Kegels L and De Wilde L (2007).** The pillars of the scapula. *Clinical Anatomy* **20** 392-399.
- Mallon WJ, Brown HR, Vogler JB and Martinez S (1992).** Radio-graphic and geometric anatomy of the scapula. *Clinical Orthopaedics and Related Research* **277** 142-154.
- Mamatha T, Pai SR, Muralimanju BV, Kalthur SG, Pai MM, Kumar B (2011).** Morphology of glenoid cavity. *Online Journal of Health and Allied Sciences* **10**(3) 7.
- Mathew AJ, Nair JB and Pillai SS (2011).** Rheumatic musculoskeletal manifestations in type 2 diabetes mellitus patients in south India. *International Journal of Rheumatic Diseases* **14** 55-60.
- Ozer I, Katayama K, Sagir M and Gulec E (2006).** Sex determination using the scapula in medieval skeletons from East Anatolia. *Collegium antropologicum* **30**(2) 415-419.
- Patil GV, Kolagi SI, Ramdurg C (2014).** Morphometric study of scapular glenoid cavities. *Global Journal of Medical Research: Orthopedics and Musculoskeletal System* **14**(2) 9-14.
- Rajput HB, Vyas KK and Shroff BD (2012).** A Study of morphological patterns of the glenoid cavity of scapula. *National J of Medical Research*. **2**(4) 504-507.
- Shilpa G, Jadhav S, Garud R (2013).** Morphometric study of Scapular glenoid cavity in Indian population. *IOSR Journal of Dental and Medical Sciences*, **13**(9) 67-69.
- Sinha P, Bhutia K, Tamang B and Sarda R (2016).** Morphometric Study of Glenoid Cavity of Dry Human Scapula. *International Journal of Medical Research Professionals* **2**(3) 86-90.
- Sinnatamby CS (1999).** Last's anatomy. Regional and applied. 10th ed. Edinburgh: Churchill Livingstone.
- von Schroeder HP, Kuiper SD and Botte MJ (2001).** Osseous anatomy of the scapula. *Clinical Orthopaedic Related Research* **383** 131-139.