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Morphometric and Morphological Study of the Glenoid Cavity of Human Scapulae in Rayalaseema Zone of South India and It's Surgical Significance

Dr. G. Manoj Kumar Reddy	MD, Assistant Professor, Dept. of Anatomy, RIMS, Kadapa, Andhra Pradesh
Dr. G.N.Charitha	MD, Assistant Professor, Dept. of Anatomy, RIMS, Kadapa, Andhra Pradesh
Dr. I. Vinayak	Post graduate, Dept. of Anatomy, RIMS, Kadapa, Andhra Pradesh

ABSTRACT

Glenoid cavity is the expanded lateral angle of Scapula, articulating with the Head of the Humerus forming Shoulder joint Measurements and shape of the Glenoid cavity of the scapula are important in designing the Glenoid component of shoulder prosthesis, treating conditions like recurrent arthritis of shoulder joint. In the present study, by studying the dried Human scapulae the average measurements and incidence of different shapes of Glenoid cavity of south Indian population has been reported.

KEYWORDS

INTRODUCTION: Scapula is a triangular flat bone present on the posterolateral aspect of the chest wall having, superior, Medial and Lateral borders, Costal and Dorsal surfaces, Superior, Inferior and Lateral angles. Glenoid cavity is the expanded lateral angle of Scapula, articulating with the Head of the Humerus forming Shoulder joint. A notch present on its anterior margin, arbitrarily divides it into upper and lower segments having different Antero-posterior measurements [1] ***Figure No.1, Figure No.2***. Three different shapes [2] are described for Glenoid cavity, Pear shaped, Inverted comma shaped and Oval shaped.

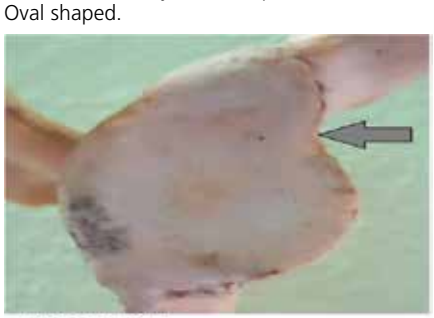

FIGURE:1
NOTCH ON THE ANTERIOR MARGIN DIVIDING GLENOID INTO UPPER AND LOWER SEGMENTS

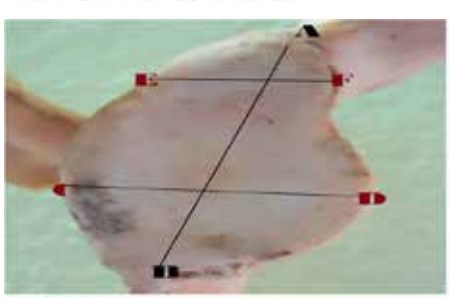

FIGURE:2
DIAMETERS OF THE GLENOID CAVITY
AB: SI DIAMETER
EF: AP1 DIAMETER (UPPER)
CD: AP2 DIAMETER (LOWER)

AIM OF THE STUDY: The aim of the Present study is to; calculate the mean Vertical and Antero-posterior diameters of the Glenoid cavity and to study the variations in the shape of the Glenoid cavity relevant to the population of Andhrapradesh, which may help in the better understanding of the shoulder pathology.

MATERIALS AND METHODS: A total number of 124 (Right: 58, Left: 66) dried Human Scapulae were studied from the collections of Dept. of Anatomy, Rajiv Gandhi Institute ofssss Medical Sciences, Kadapa. Maximum vertical (SI) diameter, ***Figure No.3***, maximum AP (AP1) Diameter of upper segment ***Figure No.4***, and Maximum AP (AP2) Diameter of lower segment, ***Figure No.5*** are measured for each Glenoid cavity, using Sliding Vernier calipers and the results were tabulated.

FIGURE:3
MESURMENT OF SI (VERTICAL) DIAMETER OF GLENOID CAVITY

FIGURE:4
MEASURMENT OF AP1 (HORIZANTAL DIAMETER OF UPPER SEGMENT) OF GLENOID CAVITY

FIGURE:5
MEASURMENT OF AP2 (HORIZANTAL DIAMETER OF LOWER SEGMENT) OF GLENOID CAVITY

The shape of the Glenoid cavity of each Scapula was studied using impregnation with lead pencil, ***Figure No.6, Figure No.7, Figure No.8*** and the results were tabulated.

FIGURE:6
PEAR SHAPED GLENOID CAVITY

FIGURE:7
INVERTED COMMA SHAPED GLENOID CAVITY

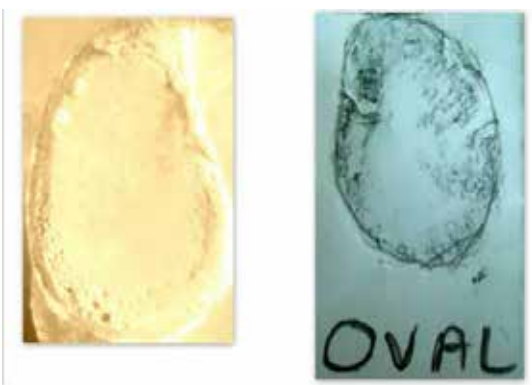

FIGURE:8
OVAL SHAPED GLENOID CAVITY

OBSERVATIONS: The following table shows the measurements and shapes of Glenoid cavity on the Right side

TABLE No.1: Measurements and shapes of Glenoid cavity on the Right side

SINO	SI DIAMETER In mm	API DIAMETER In mm	AP2 DIAMETER In mm	SHAPE OF THE GLENOID CAVITY
1.	34.56	15.46	24.64	Pear
2.	34.42	16.66	23.86	Pear
3.	33.66	16.64	23.96	Pear
4.	35.24	15.48	24.24	Inverted-Comma
5.	36.42	15.96	24.45	Oval
6.	34.40	17.24	24.56	Inverted-Comma
7.	34.50	17.36	23.98	Pear
8.	34.96	16.88	24.60	Pear
9.	33.46	16.56	24.36	Inverted-Comma
10 .	33.94	17.20	24.26	Pear
11.	33.64	15.20	22.26	Pear
12.	34.65	15.98	24.62	Oval
13.	34.98	16.45	24.89	Pear
14.	33.46	15.98	24.46	Inverted-Comma
15.	33.78	16.34	24.20	Pear
16.	32.34	17.34	25.56	Inverted-Comma
17.	34.45	17.56	23.98	Pear
18.	35.56	15.78	23.98	Pear
19.	33.40	16.64	23.89	Inverted-Comma
20.	32.56	16.67	25.56	Pear
21	33.87	17.21	25.78	Inverted-Comma

22.	35.32	18.00	24.56	Pear
23.	32.32	16.84	25.87	Pear
24.	35.10	15.98	25.01	Pear
25.	36.00	17.00	25.21	Inverted-Comma
26.	34.45	16.98	24.56	Inverted-Comma
27.	34.52	16.54	24.45	Pear
28.	35.00	16.86	23.89	Pear
29.	35.11	14.98	23.78	Pear
30.	34.21	15.98	23.46	Inverted-Comma
31.	34.43	17.34	23.56	Pear
32	33.98	17.24	24.57	Pear
33	34.67	16.84	24.78	Pear
34.	35.60	16.54	24.67	Inverted-Comma
35.	34.56	15.87	23.97	Pear
36.	34.68	17.56	25.12	Oval
37.	33.56	15.98	24.00	Inverted-Comma
38.	33.59	16.78	23.09	Pear
39.	33.54	16.67	25.06	Inverted-Comma
40.	34.67	16.64	25.18	Pear
41.	32.54	16.54	24.98	Inverted-Comma
42.	34.54	16.89	24.97	Oval
43	32.34	16.86	24.89	Pear
44.	34.25	16.84	24.78	Inverted-Comma
45.	35.11	15.67	24.32	Pear
46.	35.00	15.78	23.89	Pear
47.	35.30	15.76	23.99	Inverted-Comma
48.	33.90	16.45	23.78	Pear
49.	32.90	16.64	23.87	Pear
50.	34.80	15.98	25.10	Inverted-Comma
51.	34.50	16.45	25.21	Oval
52.	33.45	15.98	24.40	Inverted-Comma
53.	34.34	16.78	25.00	Inverted-Comma
54.	35.45	16.67	24.23	Pear
55.	34.45	16.64	24.22	Inverted-Comma
56.	35.98	16.54	23.91	Oval
57.	33.11	16.89	24.11	Pear
58.	32.98	16.86	23.93	Inverted-Comma
MEAN	*34.28*±*4.08 mm*	*16.54*±3.02*mm*	*24.42*±2.12 *mm*	

The following table shows the measurements and shapes of Glenoid cavity on the LEFT SIDE,

TABLE No.2: Measurements and shapes of Glenoid cavity on the Left side

SINO	SI DIAMETER In mm	API DIAMETER In mm	AP2 DIAMETER In mm	SHAPE OF THE GLENOID CAVITY
1.	33.90	16.43	23.45	Pear
2.	32.90	16.67	23.98	Inverted-Comma
3.	34.80	16.45	24.00	Pear
4.	34.50	15.98	24.21	Pear
5.	35.11	15.48	24.56	Inverted-Comma
6.	34.21	16.00	24.34	Pear
7.	34.43	16.78	24.34	Inverted-Comma
8.	33.98	16.67	23.78	Pear
9.	34.67	16.45	23.98	Inverted-Comma
10.	35.60	16.56	23.99	Pear
11.	35.54	16.57	23.89	Inverted-Comma
12.	34.56	16.67	23.96	Inverted-Comma
13.	34.68	16.50	23.45	Pear
14.	33.56	16.67	23.78	Inverted-Comma
15.	33.59	16.89	23.68	Pear
16.	33.54	16.54	23.99	Oval
17.	33.98	17.01	24.02	Pear
18.	34.67	15.96	24.42	Inverted-Comma
19.	35.60	15.78	24.12	Inverted-Comma
20.	34.56	17.43	24.30	Pear
21	34.68	16.33	24.10	Inverted-Comma
22.	33.56	16.56	24.00	Pear
23.	33.59	15.97	23.69	Inverted-Comma
24.	33.54	17.32	23.34	Inverted-Comma
25.	34.45	17.11	23.45	Pear
26.	35.98	16.43	23.76	Oval
27.	34.66	15.98	23.56	Inverted-Comma
28.	34.67	16.78	23.96	Pear
29.	35.98	16.67	24.03	Inverted-Comma
30.	35.09	16.64	24.34	Pear
31.	35.98	16.54	24.90	Inverted-Comma
32	33.87	16.89	23.98	Inverted-Comma
33	34.23	16.86	23.97	Pear
34.	34.54	17.20	23.67	Inverted-Comma
35.	34.65	15.98	23.45	Pear
36.	34.78	16.45	24.00	Pear
37.	35.11	15.98	23.02	Inverted-Comma
38.	33.98	16.34	23.95	Pear
39.	34.56	17.34	24.45	Pear
40.	34.67	17.56	23.56	Pear
41.	34.32	15.78	24.56	Inverted-Comma
42.	34.12	16.64	23.02	Inverted-Comma
43	34.50	16.67	23.90	Pear
44.	34.98	17.21	23.89	Pear
45.	35.00	18.00	23.67	Inverted-Comma
46.	33.96	16.84	23.56	Pear
47.	33.97	15.98	23.20	Pear
48.	34.21	17.00	24.00	Inverted-Comma
49.	34.00	16.98	23.90	Inverted-Comma
50.	34.23	16.89	23.98	Pear
51.	32.32	16.54	23.96	Inverted-Comma
52.	34.98	16.66	24.40	Inverted-Comma
53.	33.46	16.64	23.70	Inverted-Comma
54.	33.78	15.48	24.23	Pear
55.	32.34	15.96	24.22	Pear
56.	34.45	17.24	23.98	Pear
57.	35.56	17.36	24.01	Oval
58.	33.40	16.88	23.93	Pear
59.	34.67	15.98	24.40	Pear
60.	32.54	16.86	23.90	Pear
61.	34.54	16.67	24.23	Pear
62	32.34	16.64	24.22	Pear
63.	34.25	16.54	23.91	Inverted-Comma
64.	35.11	16.89	24.11	Pear
65.	35.00	16.45	23.93	Oval
66.	35.30	16.56	23.69	Pear
MEAN	*34.36*±3.64*mm*	*16.60*±2.52*mm*	*23.93*±1.54 *mm*	

RESULTS: The following table shows the average measurements of the Glenoid cavity of the scapula.

TABLE No.3: Average Measurements of Glenoid cavity

	Right side	Left side
Mean SI DIAMETER	34.28±4.08 mm	34.36±3.64mm
Mean API DIAMETER	16.54±3.02mm	16.60±2.52mm
Mean AP2 DIAMETER	24.42±2.12 mm	23.93±1.54 mm

The following table shows the average incidence of different shapes of the Glenoid cavity,

TABLE No.4: Average incidence of different shapes of Glenoid cavity

	Right side	Left side
Total number	58	66
Pear	31 (53.45%)	36 (54.54%)
InvertedComma	21 (36.21%)	26 (39.40%)
Oval	06 (10.34%)	04 (6.06%)

In the present study conducted the average Vertical (SUPERIO INFERIOR, SI) Diameter of the Glenoid cavity is on right side is 34.28±4.08 mm, left side is34.36±3.64mm. The average Anterio posterior diameter of the Upper segment (AP1) on right side is 16.54±3.02mm, left side is16.60±2.52mm and the average Anterio posterior diameter of the Lower segment (AP2) on right side is 24.42±2.12 mm, left side is 23.93±1.54 mm.

The incidence of Pear shaped Glenoids on the right side is53.45%, left side is 54.54%; Inverted comma shaped on the right side is 36.21%, left side is 39.40%; and oval shaped on the right side is10.34%, left side is6.06%.

COMPARISION WITH PREVIOUS STUDIES: the following table shows the comparision of the observations made in the present study with those made in the previous studies,

TABLE 5: Comparision with the previous studies.

STUDY		AVERAGE SI DIAMETER	AVERAGE AP1 DIAMETER	AVERAGE AP2 DIAMETER	Pear Shaped %	InvertedComma Shaped %	Oval shaped %
PRESENT STUDY (2016)	Rt	34.28	16.54	24.72	53.45	36.21	10.34
	Lt	34.36	16.60	23.93	54.54	39.40	6.06
Girish V Patil et al (2014)	Rt	33.68±4.32	15.74±1.75	23.29±2.34	47.12	34.62	18.27
	Lt	32.09±4.11	16.81±1.74	24.90±2.95	45.0	32.5	22.5
Gosavi et al (2014)	Rt	35.03±5.25	17.72±1.89	24.17±2.57	54.83	12.9	32.25
	Lt	35.03±3.41	16.82±2.18	23.9±2.66	45.0	11.2	43.75
Hina B Rajput et al (2012)	Rt	34.76±3	15.10±2.54	23.31±3.0	49	35	16
	Lt	34.43±3.21	13.83±2.45	22.92±2.80	46	39	15
Mamatha et al (2011)	Rt	33.67±2.82	16.27±2.01	23.35±2.04	80		20
	Lt	33.92±2.87	15.77±1.96	23.02±2.30	76		24
Karlesle et al (2007)	Both sides	35.9±3.6	--	27.2±3	--	--	--
Von Schroeder et al (2001)	Both sides	36±4	--	28.6±3.3	--	--	--
Mallon et al (1992)	Both sides	35±4.1	--	24±3.3	--	--	--
Iannotti et al (1992)	Both sides	39±3.5	23±2.7	29±3.2	--	--	--

DISCUSSION: The observations made in this study regarding the measurements of the diameters of the Glenoid cavity are close to those made by Girish V Patil et al [3], Gosavi et al [4], Hina B Rajput et al [5], Mamatha et al [6] and Mallon et al [7]. The measurements made by Von Schroeder et al [8] and Iannotti et al [9]and Karlesle et al [10] are larger compared to those made in this study.

In the present study the incidence of Pear shaped Glenoid cavity is highest, followed by Inverted comma shaped, where as the Oval shaped Glenoid has the least incidence. This observation is close to that made by Girish V Patil et al and Hina B Rajput et al, but Gosavi et al, recorded the least incidence of Inverted comma shaped Glenoids.

SURGICAL SIGNIFICANCE: A thorough knowledge of normal anatomy and variations in the anatomy of the Glenoid cavity of the scapula is important in evaluating the pathological conditions like Bankart's lesions and osteochondral defects. The Knowledge of the shape and dimensions of the Glenoid are important in the design and fitting of Glenoid components for partial or total shoulder Replacement surgery (Arthroplasty) [3]. Knowledge about the shape and morphological parameters is essential for success of shoulder arthroplasty as otherwise there would be loosening of the joint necessisitating the need for revision surgery [11]. A knowledge of the shape and morphometry of glenoid fossa is essential for treating glenohumeral osteoarthritis [12]. The above data on the shape and various dimensions of the glenoid cavity may not only help the orthopedicians and prosthetists but also can be of interest to the anthropologists when studying about the evolution of the bipedal gait [13].

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