"Morphometry Of Glenoid Cavity And Glenoid Labrum -A Cadaveric Study"

Dr Poonam Tenginkai[1]*,Dr Shilpa Bhimalli[2], Dr Basavaraj M Tenginkai[3]

***Corresponding Author: -** Dr Poonam Tenginkai
*1 Assistant Professor, Department of Anatomy KIMS Amalapuram Andhra Pradesh, India.
2 Professor, Department of Anatomy J N Medical College Belgaum Karnataka, India.
3 Assistant Professor, Department of Physiology, KIMS Amalapuram Andhra Pradesh.

Abstract

Background : The anatomical basis and variations of shape and size of glenoid cavity of scapula is of fundamental importance in understanding the rotator cuff disease, shoulder dislocation and to decide the proper size of the glenoid component in the shoulder arthroplasty The factors which pose to shoulder instability include abnormalities in the size, shape, and orientation of the articular surfaces; disruptions of the capsule, gleno-humeral ligaments, or labrum; the inadequacy of the short rotator muscles, particularly the subscapularis.

Objective: We studied Morphometrical diameters and shapes of the glenoid cavity with labrum attached and without labrum. Therefore, glenoid dimensions and version are vital while a surgeon prepares to resurface the glenoid during shoulder arthroplasty and discuss the clinical correlation in detail.

Material and Methods: The study was done on 21 human cadavers (42 shoulder joints), paired adult human scapulae. Measurement of superior to inferior diameter(mm) of the glenoid cavity with labrum attached (A-B mm) and without labrum attached (a-b mm). Measurement of Anterior to posterior diameter(mm) of the glenoid cavity of lower side with labrum attached (C-D mm) and without labrum attached (c-d mm). Measurement of Anterior to posterior diameter(mm) of the glenoid cavity of lower side. Measurement of Anterior to posterior diameter(mm) of the glenoid cavity of upper side with labrum attached (E-F mm) and without labrum attached (e-f mm). shape of the Glenoid Cavity and Thickness of the glenoid labrum were measured.

Results: Of the 21 human cadavers (14 Male and 7 Female) , (42 shoulder joints) respectively. It was also observed that A-P diameter with labrum was higher in males as compared to females and the thickness of labrum was higher in females. A-P diameter of glenoid cavity without labrum was significantly higher in males as compared to females. Right side (P=0.05), and Left side (P=0.0216)) Comparison of with and without labrum groups with respect to shape right

Out of the total 42 glenoid cavity samples examined with labrum in 14 males, the incidence of IC shape was 33.33 percent, O- 23.81 percent, P-were 9.52 percent, and round were 0.00 percent. And without labrum in males were observed to have incidence of IC shape was 33.33 percent, O- 23.8 1percent, P-were 9.52 percent, and round were 0.00 percent.

Conclusions: The glenoid dimensions and version are vital while a surgeon prepares to resurface the glenoid during shoulder arthroplasty and clinical correlation in detail.

Keywords: Glenoid cavity, Glenoid labrum, Arthroplasty, Implant, Prosthesis, Cadavers.

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Introduction

The study was done to determine various anthropometric measurements of scapula and glenoid cavity including the variations of its shape. The vertical diameter of the glenoid cavity is the longest and it is broader below than above. The surface is covered with hyaline cartilage in the fresh state and its slightly raised margins give attachment to a fibrocartilaginous structure –The glenoid labrum which deepens the cavity.

The scapula is a thin, triangular plate of bone which lies at a tangent to the posterolateral surface of the thorax. It has a long, slightly thickened, medial border which meets the thin,

Concave, superior border at the superior angle and markedly thickened lateral border at the inferior angle. The lateral angle is the thickest part of the bone. It is truncated, the end forming the shallow, pear- shape glenoid cavity which is continuous with the rest of the neck, and faces anterolaterally to articulate with the hemispherical head of the humerus.[1]
The glenoid rim presents a small notch on its anterior and upper part.

(1) The glenoid notch prevents the attachment of fibro-cartilaginous glenoidal labrum to the glenoidal rim, which can be detached leading to Bankart, s lesion

A knowledge of the shape and morphometry of glenoid fossa is essential for treating glenohumeral osteoarthritis.[2] The glenoid rim presents a small notch on its anterior and upper part. The glenoid notch prevents the attachment of fibro-cartilaginous glenoidal labrum to the glenoidal rim, which can be detached leading to Bankart, s lesion.[3]

The anatomical basis and variations of shape and size of glenoid cavity of scapula is of fundamental importance in understanding the rotator cuff disease, shoulder dislocation and to decide the proper size of the glenoid component in the shoulder arthroplasty. Total shoulder replacement is also being used as treatment. (1) Today's gold standard for primary glenoid replacement is a cemented all-polyethylene component t .[4] The GC provides a vertical axis for the movement of the head of humerus during abduction and when the arm is raised to the shoulder height, the head slides into the smaller upper part of glenoid cavity which is deepened by glenoid labrum.[5] The glenoid rim presents a notch in its antero-superior part, due to which various shapes of glenoid cavity are described like pear-shaped, oval or inverted comma shape .[6,7,8.] Studies done on soft tissue specimens have shown that when the glenoid notch is distinct, the glenoid labrum is often not attached to the rim of the glenoid at the site of the notch. This can be a predisposing factor in anterior dislocation of shoulder joint. Studies have also reported that the glenoid inclination is associated with full thickness rotator cuff tears. The basic modalities of treatment include repair of labrum, reinforcement of capsule by an overlapping repair and rearrangement of anterior muscles. Total shoulder repair is also being used as treatment .[9] the factors contributing to stability the shoulder joint are the deepening of the glenoid cavity by the glenoid labrum; the suprahumeral support provided by the coracoacromial arch, the capsule is strengthened by the fusion of tendons of rotator cuff muscles and glenohumeral and coracohumeral ligaments.[10] The two most common shoulder pathologies that necessitate surgery are instability, such as recurrent anterior dislocation of the shoulder.[11] The Gleno-humeral joint is a multi-axial ball-socket synovial joint. In 75% of subjects, the glenoid fossa is retro tilted to about 7.4 degrees in relationship to the plane of the scapula. This relationship is important in maintaining horizontal stability of the joint and hence counteracting tendency toward anterior displacement of the humeral head .[12,13,14.] The normal glenoid morphology is described as pear shaped and only when glenoid loose enough anterior-inferior bone assume the shape of an inverted pear. A bone loss of more than 21% would cause instability despite soft tissue repair.[15.] The factors which pose to shoulder instability include abnormalities in the size, shape, and orientation of the articular surfaces; disruptions of the capsule, gleno-humeral ligaments, or labrum; the inadequacy of the short rotator muscles, particularly the subscapularis.[16,17.] Joint instability subsequent to shoulder arthroplasty is one of the common complications reported to occur in up to 18.2% of cases.[18] Glenoid component fixing without correction of glenoid version and can lead to decentring of metallic humerus ball resulting in wearing of glenoid component and failure; rocking horse phenomenon.[19.]

Therefore, glenoid dimensions and version are vital while a surgeon prepares to resurface the glenoid during shoulder arthroplasty.[20]

Materials and methods

Study design: Observational study

Study setting: This study was conducted in the Department of Anatomy, Jawaharlal Nehru Medical College Belagavi Karnataka India.

Study participants: The study was done on 21 human cadavers (42 shoulder joints), paired with adult human scapulae. Ethical Considerations**:** Prior written consent was obtained, and legal documentation was completed by the body donors, expressing self-willingness to donate their body to the medical field.

Inclusion criteria: Shoulder joints with: Different shapes of glenoid cavity, with the fibrocartilaginous glenoid labrum.

Exclusion criteria: Shoulder joints with: Presence of irregularity in the cartilage. Presence of marginal ossification and/ or osteophytes.

Methods: Deep surgical incision was taken at 30 degrees to 45-degrees positions with the coracoid process and deltopectoral groove as land marks. The study was conducted in 2017 to 2018.

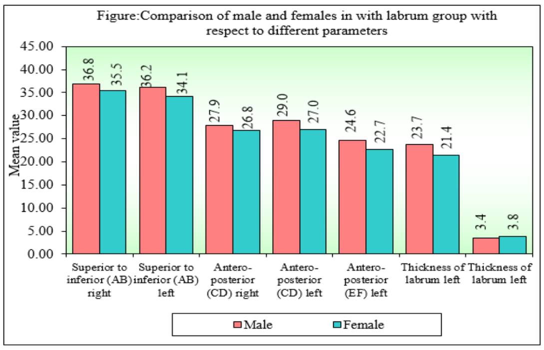
The measurements of glenoid fossa and glenoid labrum were taken.

- Measurement of superior to inferior diameter(mm) of the glenoid cavity with labrum attached (i.e., A-B mm).
- Measurement of superior to inferior diameter(mm) of the glenoid cavity without labrum attached (i.e., a-b mm).
- Measurement of Anterior to posterior diameter(mm) of the glenoid cavity of lower side with labrum attached (i.e., C-D mm).
- Measurement of Anterior to posterior diameter(mm) of the glenoid cavity of lower side without labrum attached (i.e. c-d mm).
- Measurement of Anterior to posterior diameter(mm) of the glenoid cavity of upper side with labrum attached (i.e. E-F mm).
- Measurement of Anterior to posterior diameter(mm) of the glenoid cavity of upper side without labrum attached (i.e. e-f mm).
- Observation of the shape of the Glenoid Cavity.
- Thickness of the glenoid labrum

RESULTS

Table: 1. Comparison of male and females in with labrum group with respect to different parameters by independent t test

Variable	Gender	Mean	SD	SE	t-value	p-value
Superior to inferior (AB) right	Male	36.82	4.20	1.12	0.7861	0.4415
	Female	35.49	2.03	0.77		
Superior to inferior (AB) left	Male	36.17	4.21	1.13	1.1116	0.2802
	Female	34.11	3.50	1.32		
Antero-posterior (CD) right	Male	27.90	3.04	0.81	0.8856	0.3869
	Female	26.77	2.06	0.78		
Antero-posterior (CD) left	Male	29.04	3.57	0.96	1.4075	0.1754
	Female	26.95	2.21	0.83		
Antero-posterior (EF) right	Male	24.61	2.92	0.78	1.0630	0.3011
	Female	22.66	5.56	2.10		
Antero-posterior (EF) left	Male	23.72	3.18	0.85	1.4689	0.1582
	Female	21.39	3.90	1.47		
Thickness of labrum left	Male	3.41	0.92	0.25	-1.0712	0.2975
	Female	3.82	0.60	0.23		
Thickness of labrum left	Male	2.89	0.82	0.22	-1.2762	0.2173
	Female	3.44	1.11	0.42		



1) According to the readings and the below table,
S-I (AB) diameter of the glenoid cavity on the right side with labrum varied of male 36.82 and female 35.49 respectively. And on left 36.17 and 34.11 between male and female respectively.

The A-P (CD) of glenoid cavity with labrum on right side with labrum varied from male 27.90 and female 26.77 respectively. And on left side it varied from 29.04 and 26.95 in between males and females respectively.

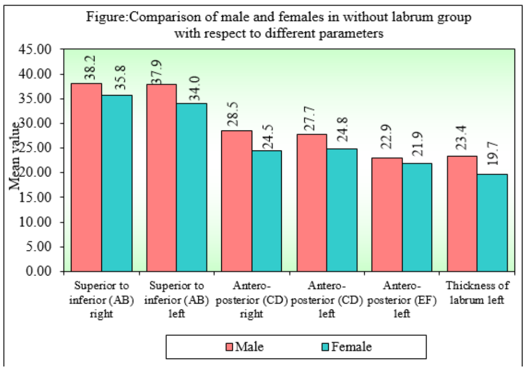
The A-P (EF) diameter of glenoid cavity with labrum on the right side of male 24.61 and female 22.66. And that on the left side it varied from 23.72 to 21.39 in between male and female respectively.

It was observed that S-I diameter with labrum was higher in males as compared to females
It was also observed that A-p diameter with labrum was higher in males as compared to females.
It was observed that the thickness of labrum was higher in females.

Table: 2) Comparison of male and females in without labrum group with respect to different parameters by independent t test

Variable	Gender	Mean	SD	SE	t-value	p-value
Superior to inferior (AB) right	Male	38.15	2.74	0.73	1.7958	0.0884
	Female	35.76	3.13	1.18		
Superior to inferior (AB) left	Male	37.91	3.41	0.91	2.3709	0.0285*
	Female	34.00	3.86	1.46		
Antero-posterior (CD) right	Male	28.50	5.04	1.35	2.0727	0.0500*
	Female	24.45	1.14	0.43		
Antero-posterior (CD) left	Male	27.72	2.73	0.73	2.5040	0.0216*
	Female	24.76	2.09	0.79		
Antero-posterior (EF) right	Male	22.94	2.81	0.75	0.8200	0.4224
	Female	21.88	2.76	1.04		
Antero-posterior (EF) left	Male	23.37	1.85	0.49	3.1443	0.0053*
	Female	19.70	3.57	1.35		

*p<0.05



2) According to the readings and the below table,
S-I (AB) diameter of the glenoid cavity on the right side without labrum varied of male 38.15 and female 35.76 respectively. And on left 37.91 and 34.00 between male and female respectively.

The A-P (CD) of glenoid cavity without labrum on right side varied from male 28.50 and female 24.45 respectively. And on left side it varied from 27.72 and 24.76 in between males and females respectively.

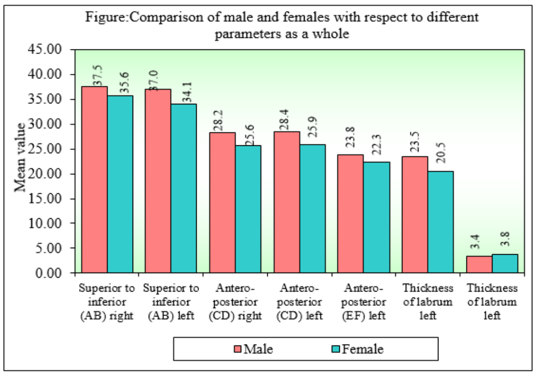
The A-P (EF) diameter of glenoid cavity without labrum on the right side of male 22.94 and female 21.88. And that on the left side it varied from 23.37 to 19.70 in between male and female respectively. It is observed that S-I diameter of the glenoid cavity without labrum was significantly higher in males as compared to females. (P=0.0285)

It was also observed that A-P diameter of glenoid cavity without labrum was significantly higer in males as compared to females. Right side (P=0.05), and Left side (P=0.0216)

Table 3: Comparison of male and females with respect to different parameters as a whole by independent t test

Variable	Gender	Mean	SD	SE	t-value	p-value
Superior to inferior (AB) right	Male	37.49	3.55	0.67	1.7456	0.0886
	Female	35.63	2.54	0.68		
Superior to inferior (AB) left	Male	37.04	3.86	0.73	2.4217	0.0201*
	Female	34.06	3.54	0.95		
Antero-posterior (CD) right	Male	28.20	4.10	0.77	2.2281	0.0316*
	Female	25.61	2.00	0.53		
Antero-posterior (CD) left	Male	28.38	3.19	0.60	2.6132	0.0126*
	Female	25.86	2.36	0.63		
Antero-posterior (EF) right	Male	23.77	2.94	0.55	1.3437	0.1866
	Female	22.27	4.24	1.13		
Antero-posterior (EF) left	Male	23.54	2.56	0.48	3.0784	0.0038*
	Female	20.54	3.69	0.99		
Thickness of labrum right	Male	3.41	0.92	0.25	-1.0712	0.2975
	Female	3.82	0.60	0.23		
Thickness of labrum left	Male	2.89	0.82	0.22	-1.2762	0.2173
	Female	3.44	1.11	0.42		

*p<0.05



3) In the present study the superior to inferior (AB) diameter of the glenoid cavity on the right side of both the male 37.49mm and female to 35.63 mm on and average respectively.

And on the left side the superior to inferior (AB) diameter varied from male 37.04mm, and female was 34.06mm. In this study Anterior to posterior (CD) glenoid diameter on the right side of both male 28.20mm and female 25.61 mm. And on the left side it varied i.e of male 28.38mm in males and females25.86. In this study Anterior to posterior (EF) glenoid diameter on the right side of both male 23.77mm and female 22.27 mm. And on to the left side of male 23.54 and that of females 20.54 .It is observed that the vertical diameter was significantly higher in males than in females (P=0.0201 and P=0.0316 respectively)

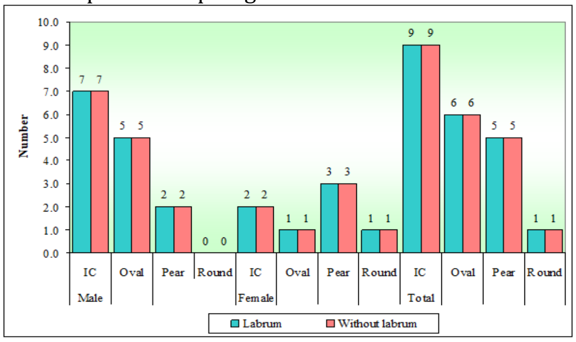
It was also observed that A-P diameter was significantly higher in males as compared to females (P=0.0316)

It was also observed that the thickness of glenoid labrum was higher in females.

Table 4: Comparison of with and without labrum groups with respect to shape right

Gender	Shape right	Labrum	%	Without labrum	%	Total	%
Male	IC	7	33.33	7	33.33	14	33.33
	Oval	5	23.81	5	23.81	10	23.81
	Pear	2	9.52	2	9.52	4	9.52
	Round	0	0.00	0	0.00	0	0.00
	Total	14	66.67	14	66.67	28	66.67
Female	IC	2	9.52	2	9.52	4	9.52
	Oval	1	4.76	1	4.76	2	4.76
	Pear	3	14.29	3	14.29	6	14.29
	Round	1	4.76	1	4.76	2	4.76
	Total	7	33.33	7	33.33	14	33.33
Chi-square=0.0291 P = 0.9995							

Figure: Comparison of with and without labrum groups with respect to shape right



4) Comparison of with and without labrum groups with respect to shape right**.**

Out of the total 42 glenoid cavity samples examined with labrum in 14 males, the incidence of IC shape was 33.33 percent, O-23.81 percent, P-were 9.52 percent, and round were 0.00 percent.

And without labrum in males were observed to have incidence of IC shape was 33.33 percent, O-23.8 1percent, P-were 9.52 percent, and round were 0.00 percent.

It was observed that there was no significant variations of the shape of the right side of the glenoid cavity without labrum in the males.

When the same was observed in the females, the incidence of the shapes calculated with labrum of right side were IC shape was 4.76 percent, O-9.52 percent, P-were 14.29 percent, and round were 4.76 percent.

And without labrum were IC shape was 4.76 percent, O- 9.52 percent, P-were 14.29 percent, and round were 0.00 percent of the right side.

From this it can be interpretated that the most common shapes observed in the males with labrum were IC shape was 14.2 percent, P-were 21.43 percent, of the right side.
Whereas the most common shapes observed in the females with labrum were IC shape was 25 percent, O-were 17.86 percent, of the right side.

In females the incidence with labrum the shape of the glenoid cavity was:
Were IC shape was 2.5 percent, O- 17.86 percent, P-7.14 percent, and R -0.00 percent.
And without labrum the incidence was IC shape was 2.5 percent, O- 17.86 percent, P-7.14 percent, R-0.00 percent.

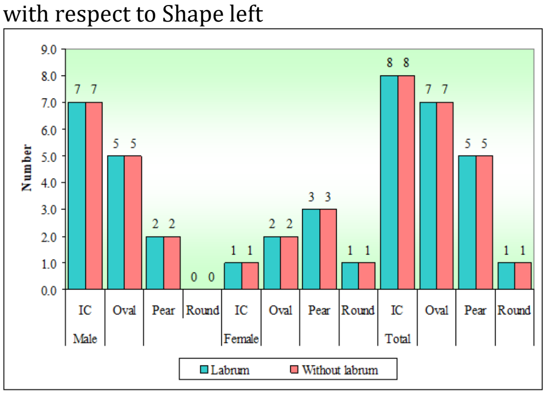
From this it can be interpretated that on the left glenoid cavities examined of both male and female, the most common shapes observed in males with and without labrum were oval and pear shaped.

And in females it was IC and oval with and without labrum respectively

Table: 5 Comparison of with and without labrum groups with respect to Shape left

Gender	Shape left	Labrum	%	Without labrum	%	Total	%
Male	IC	7	33.33	7	33.33	14	33.33
	Oval	5	23.81	5	23.81	10	23.81
	Pear	2	9.52	2	9.52	4	9.52
	Round	0	0.00	0	0.00	0	0.00
	Total	14	66.67	14	66.67	28	66.67
Female	IC	1	4.76	1	4.76	2	4.76
	Oval	2	9.52	2	9.52	4	9.52
	Pear	3	14.29	3	14.29	6	14.29
	Round	1	4.76	1	4.76	2	4.76
	Total	7	33.33	7	33.33	14	33.33
Total	IC	8	38.10	8	38.10	16	38.10
	Oval	7	33.33	7	33.33	14	33.33
	Pear	5	23.81	5	23.81	10	23.81
	Round	1	4.76	1	4.76	2	4.76
	Total	21	100.00	21	100.00	42	100.00
Chi-square=0.0000 P = 1.0000							

Figure: Comparison of with and without labrum groups with respect to Shape left



5) Comparison of with and without labrum groups with respect to Shape left

Comparison of male and females glenoid

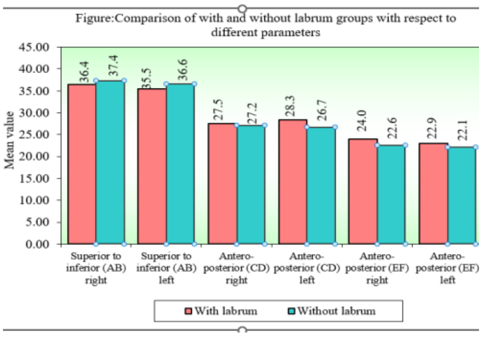
cavities in with and without labrum groups with respect to the shape of left glenoid cavities were observed in males IC- 7.14%, O-14.29%, P-21.43%, R-7.14%, these parameters were with labrum.

And without labrum were observed to be in males IC- 7.14%, O-14.29%, P-21.43%, R-7.14%, these parameters were with labrum.

So it can be interpretated that without labrum in males was also the same with respect to the males and females.

Table: 6 Comparison of with and without labrum groups with respect to different parameters by independent t test

Variable	Group	Mean	SD	SE	t-value	p-value
Superior to inferior (AB) right	With labrum	36.38	3.62	0.79	-0.9455	0.3501
	Without labrum	37.35	3.03	0.66		
Superior to inferior (AB) left	With labrum	35.48	4.03	0.88	-0.9119	0.3673
	Without labrum	36.60	3.95	0.86		
Antero-posterior (CD) right (Inferior)	With labrum	27.53	2.75	0.60	0.3193	0.7511
	Without labrum	27.15	4.56	0.99		
Antero-posterior (CD) left(Inferior)	With labrum	28.34	3.28	0.72	1.6912	0.0986
	Without labrum	26.73	2.87	0.63		
Antero-posterior (EF) right(Superior)	With labrum	23.96	3.96	0.86	1.3054	0.1992
	Without labrum	22.58	2.77	0.60		
Antero-posterior (EF) left(Superior)	With labrum	22.94	3.52	0.77	0.7851	0.4370
	Without labrum	22.14	3.03	0.66		



6) Superior to inferior diameter of right (AB) glenoid cavity with labrum mean was observed 36.38 and superior to inferior of right same without labrum mean was observed 37.35 and mean of superior to inferior left with labrum was 35.48 and without labrum was 36.60.

The mean values for Anterior to posterior right was (CD) of glenoid cavity with labrum was 27.53 and without labrum was 27.15 and that of left with labrum was 28.34 and without labrum was 26.73.

The mean values for Anterior to posterior of glenoid cavity right with labrum (EF) was 23.96 and without labrum was 22.58 and that of left labrum was 22.94 and without labrum was 22.14.

Discussion:

In our study, the most common shapes observed in the males with labrum were IC shape was 14.2 percent, P-were 21.43 percent, of the right side. Whereas the most common shapes observed in the females with labrum were IC shape was 25 percent, O-were 17.86 percent, of the right side. In females the incidence with labrum the shape of the glenoid cavity was: were IC shape was 2.5 percent, O- 17.86 percent, P-7.14 percent, and R -0.00 percent. And without labrum the incidence was IC shape was 2.5 percent, O- 17.86 percent, P-7.14 percent, R-0.00 percent. From this it can be interpretated that on the left glenoid cavities examined of both male and female, the most common shapes observed in males with and without labrum were oval and pear shaped. And in females it was IC and oval with and without labrum respectively.

Table 1 Comparison of Superior to inferior diameter of right and left glenoid cavity by various author studies.

Sr.n	Authors	No. of specimen	Mean±S.D
1.	Kate et al[25] 2016	R-33, L-34	33.83±3.54 34.30±4.06
2	Mamatha et al [21] 2011	R-98 L-104	33.67±2.82 33.92±2.87
3	Neeta Chabbra[9]2015	R-55 L-71	38.46±3.08 39.03±3.18
4	Present study	R-21 L-21	37.35±3.03 36.60±3.95

Table 2 Comparison of Anterior to posterior diameter of the glenoid cavity by different Authors

Sr.no	Authors	No. of specimen	Mean±S.D
1	Mamatha et al [21] 2011	R-98 L-104	23.35±2.04 23.02±2.30
2	Neeta Chabbra[9]2015	R-55 L-71	25.04±2.69 24.85±2.46
3	Present study (C-D)	R-21 L-21	27.15±4.56 26.73±2.87

Table 1 Comparison of Superior to inferior diameter of right and left glenoid cavity by various author studies.

Table 3 Comparison of Anterior to posterior diameter of upper side (i.e, E-F) of glenoid cavity with other studies.

Sr.no.	Authors	No. of specimen	Mean ±S.D
1	Mamatha et al [3] 2011	R-98 L-104	16.27±2.01 15.77±1.96
2	Neeta Chabbra[10]2015	R-55 L-71	18.70±2.22 18.6±2.07
3	Present study	R-21 L-21	22.58±2.77 22.14±3.03

Table 4 Comparison of shapes of the glenoid cavity by different authors.

In our present study one more shape Round was observed in one of left shoulder i.e 4.7%

Sr. No.	Authors	No. of specimen	Pear in %	Oval in %	Inverted comma in %
1.	Neeta Chabbra[9] 2015	R-55	47	31	22
		L-71	55	32	13
2.	Dhinsa et al[29] 2014	R-41	48.78	21.95	29.26
		L-39	46.15	17.94	35.89
3.	Present study	R-21	9.52	28.57	42.86
		L-21	23.81	33.33	38.16

Conclusions:

The anterior superior notch has deficient attachment of Glenoid labrum, the stability of the shoulder joint is weak and unstable at this point. So the orthopedic surgeons during shoulder joint arthroplasty can design a Glenoid cavity of oval shape or pear shape with the intact Glenoid labrum. So that stability of the shoulder joint is maintained. Therefore, glenoid dimensions and version are vital while a surgeon prepares to resurface the glenoid during shoulder arthroplasty and clinical correlation.

References:

CunninghamsManual of practical Anatomy 15 th edition

Gupta S, Magotra R, Kour M. Morphometric analysis of Glenoid Fossa of Scapula. Journal of Evolution of Medical and Dental Sciences.2015; Vol. 4, Issue 45, June 04; Page: 7761-7766, DOI: 10.14260/jemds/2015/1129

Prescher A, Klumpen T. The glenoid notch and its relation to the shape of the glenoid cavity of the scapula. J Anat.1997;190:457-460.

Karelse A, Kegels L, De Wilde L. The pillars of the scapula.Clin Anat. 2007;20; 392-399.

Gandhi K, Verma V, Ubbaida S, Satpute S. The Glenoid Cavity: its morphology and clinical significance. Int. J. Curr. Res. Med. Sci. 2015; 1(6): 1-5

Moore KL, Dalley AF, Agur AM. Clinical oriented anatomy. 6th Ed. Lippincott Wiliams& Wilkins, Philadelphia, 2010.

Standring S, Gray's Anatomy. TITLE?. 40th Ed., New York,Churchill Livingstone. 2008:794-821.

Breathnach AS. Frazer's Anatomy of the human skeleton, 6th ed. London: J and A Churchill ltd, 1965:pp. 63-70.

Chhabra N, Prakash S, Mishra B K. AN ANATOMICAL STUDY OF GLENOID CAVITY: ITS IMPORTANCE IN SHOULDER PROSTHESIS. International Journal of Anatomy and Research, 2015, Vol 3(3):1419-24. ISSN 2321- 4287 DOI: http://dx.doi.org/10.16965/ijar.2015.252

GirishV.Patil, Sanjeev I. Kolagi & Umesh Ramdurg. Morphometrical Study of Scapular GlenoidCavities. Global Journal of Medical Research: Orthopedicand Musculoskeletal System. Vol 14 Issue 2; International Research JournalPublisher: Global Journals Inc. (USA)ISSN: 2249-4618

Surgical exposures in orthopaedics the anatomical approach by Stanley hoppenfeld Peitdeboer 3 rd edition

Sarrafian SK. Gross and functional anatomy of theshoulde. ClinOrthop1983;173:11-18

Saha AK. Dynamic stability of the glenohumeraljoint. ActaOrthopScand 1971;42:491-505.

Saha AK. Mechanics of elevation of glenohumeraljoint: Its application in rehabilitation of flail shoulderin upper brachial plexus injuries and poliomyelitisand in replacement of the upper humerus byprosthesis. ActaOrthopScand 1973; 44:668-678.

Burkhart SS, DeBeer JF. Traumatic glenohumeral bone defects and their relationship to failure of arthroscopic bankartre pairs: significance of the inverted pear glenoid and the humeral engaging Hill-sachs lesion. Arthroscopy. 2000;16:677-694

Frankel VH, Nordin M (eds). Basic Biomechanics of the Skeletal System. Victor Hirsch Frankel Lippincott Williams & Wilkins, 2001.

Reeves B: Experiments on the tensile strength of the anterior capsular structures of the shoulder in man.J Bone Joint Surg [Br]. 1968;50:858-865.

Moeckel BH, Altchek DW, Warren RF, Wickiewicz TL, Dines DM. Instability of the shoulder after arthroplasty.J Bone Joint Surg Am 1993;75(4):492-497.

Walch G et al**,** Glenoid morphology in OA. Walchclassification., J Arthroplasty, 1999; 14:756-760

Stability of the shoulder joint: Cadaver study of stabilizing structuresJørgenOvesen& Strange Nielsen To cite this article: JørgenOvesen& Strange Nielsen (1985) Stability of the shoulder joint: Cadaver study of stabilizing structures, Acta Ortho paedica Scandinavica, 56:2, 149-151, DOI: 10.3109/17453678508994342 To link to this article: http://dx.doi.org/10.3109/17453678508994342

Mamatha T, Pai SR, Murlimanju BV, Kalthur SG, Pai MM, Kumar B.Morphometry of Glenoid Cavity.Online J Health Allied Scs. 2011;10(3):7 **URL:** http://www.ojhas.org/issue39/2011-3-7.htm

Moore KL, Dalley AF, Agur A M. Clinical Oriented Anatomy. 6th . Lippincott Williams and Wilkins, Philadelphia, 2010.

Sinnatamby CS. Last's Anatomy, Regional and Applied 2006.11th ed. London: Churchill Livingstone; pp. 50-52.

Yu JS, Greenway G, Resnick D. Osteochondral defect of the glenoid Fossa: Cross-sectional imaging features. Radiol1998;206:35-40.

Kate Deepali R, Ajari A, Chandanwale A, Bahetee B H , Babhulkar A. OSSEOUS ANATOMY OF GLENOID: CADAVERIC STUDY. 2016. International Journal of Anatomy and Research; Vol 4(2):2473-79. ISSN 2321-4287DOI: http://dx.doi.org/10.16965/ijar.2016.242.

Shewale S N, Laeeque MD , Sukre S B , Patil S C. MORPHOMETRIC STUDY OF GLENOID CAVITIES OF SCAPULAE IN MARATHWADA POPULATION. International Journal of Anatomy and Research, 2017, Vol 5(2.1):3759-65. ISSN 2321-4287 DOI: https://dx.doi.org/10.16965/ijar.2017.169.

Kumar Mahto1, Omar S. Dimensions of Glenoid Fossa of Scapula. Implications in the Biomechanics of an

Implant Design 2015, Katihar Medical College, Katihar, Bihar, India DOI: 10.17354/ijss/2015/324
ANDREAS PRESCHER AND THOMAS KLU. The glenoid notch and its relation to the shape of the glenoid cavity of the scapula MPEN. Institute of Anatomy, RWTH Aachen, Germany .1997; 190, pp. 457-460.
Gurusharan Singh Dhindsa .A study of Morphology of the Glenoid Cavity. Medical and Dental Sciences 2014; Page:7036-7043,
AbduelmenemAlashkham, AbdulrahmanAlraddadi, Roger Soames , Morphometric parameters of the Glenoid Fossa with the labrum attached.Centre for Anatomy and Human identification, University of Dundee, Dundee. United Kingdom, Human Anatomy Department, Faculty of Medicine, University of Zawia, Zawia, Libya.2016, 8(2): 93-97

Photographs

1. Superior to inferior diameter with glenoidal labrum attached.(i.e, A-B) no-Right