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Original Research Article

A Study of Anthropometric Measurement of Human Dry Scapula and Its Clinical Importance

Tejal Parmar[1], Dr. Geethanjali. B. S [2], Dr. Aga ammarmurthuza[3], Mr. Surendra Babu[4], Dr. Varsha mokhasi[5], Dr. Mohan kumar H[6]

[1]Final Year Medical Student, Vydehi Medical College & Research Centre, Bangalore, India
[2]Associate Professor, Department of Anatomy, East Point College of Medical Science and Research Centre, Jnana Prabha" 113/2 Virgonagar Post Bidarahalli, Bengaluru, Karnataka 560049, India
[3]Assistant Professor, Department of Anatomy, Vydehi Medical College & Research Centre, Bangalore, India
[4]Tutor, PHD Scholar, Department of Anatomy, Vydehi Medical College & Research Centre, Bangalore, India
[5]Professor & HOD, Department of Anatomy, Vydehi Medical College & Research Centre, Bangalore, India
[6]Professor, Department of ophthalmology, Sri Devaraj Urs Medical College, Tamaka, Kolar, Karnataka 563101, India

***Corresponding author:** Dr. Geethanjali. B. S
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Abstract

Introduction: The paired scapular bone are present on dorsal aspect of thorax with its process like spine, coracoids and acromial; and it has superior, inferior and glenoid or lateral angles; costal and dorsal surfaces and surascapular notch on its superior border. The detailed knowledge of scapular anatomy and its morphometric & osteometric measurements are essential for treatment of shoulder blade disorders like displacement fracture and for corrective prosthetic surgeries. ***Materials and methods:*** 60 dry intact scapulae (24 right & 36 left) were examined for the study were taken from department of anatomy, Vydehi Institute of Medical Science & Research Centre, Bangalore and from East Point College of Medical Science And Research Centre, Bangalore. The different parameters of the scapula were taken for the measurements. ***Results:*** In the present study average parameters of scapular length was 13.5 cm, scapular width was 8.6cm, glenoid height was 3.5cm and its width was 2.2cm, acromion length was 3.8 cm and its breadth was 2.2cm, corocoid length 3.68cm and its thickness 1.17cm, projection length of spine 12.2cm, acromio-corocoid distance 3.56 cm and acromio-glenoid distance 2.75 cm, suprascapular notch depth 0.83cm & superior transverse diameter of notch was 1.75cm, superior angle of scapula was 91.7^0, inferior angle was 37.6^0, lateral angle was 55.1^0, glenopolar angle was 34.3^0 & glenoinclination angle was 11.5^0. ***Conclusion:*** This data of detailed measurements of different parameters of scapula may be helpful for athropologists and anatomists and also for surgeons to aid in the management of various shoulder diseases and in designing implants for the shoulder joint.

Keywords: Suprascapular notch, Scapula, Entrapment syndrome, Anthropometric measurement, Coracoid grafts, Shoulder arthroplasty.

INTRODUCTION

The shoulder blade is a flat bone that lies on the dorsal aspect ofthe thorax, over 2nd to 7th ribs. It has ventrally subscapular fossa, dorsally the spine of scapula divides into supraspinatous and infraspinous fossa [1]. The glenoid cavity is on the lateral angle of the scapula. It is a shallow, pyriform in shape. It is the most frequently dislocated joint is the shoulder joint. In case of trauma glenoid is the more prone for dislocation & fracture [2]. The knowledge about of morphology of glenoid anatomy is essentialin diagnosis of osseous Bankartlesions and osteochondral defects and in designing of glenoid prosthesis for shoulder arthroplasty [3]. The morphology of the acromion and other related structures in the shoulder joint is of importance diagnostically for interpretation of images and surgical procedures in conditions associated with this joint [4]. The Acromion morphology has a major role in diagnosis of impingement syndrome of shoulder joint and the rotator cuff diseases [5]. The junction between the superior border of the scapula and the root of the corocoid process is a depression known as suprascapular notch. This notch is bridged by a ligament attached between the corner of the notch for the passage of suprascapular nerve [6]. The different morphology in the shape of suprascapular notch along with partial and complete ossification of suprascapular notch by the suprascapular ligament leads to nerve compression during movements of shoulder joint. The suprascapular nerve is compressed at the suprascapular notch or at the spinoglenoid notch. This nerve entrapment syndrome causes pain along the dorsolateral

part of shoulder joint leading to atrophy of the muscles supplied by it. This suprascapular nerve entrapment syndrome was described by Kopell and Thompson [7]. The morphometry of glenopolar angle has a important role in management of floating shoulder. It measures the obliquity of glenoid cavity with that of body of scapula, hence the anatomy of glenopolar and glenoid inclination angles has an major role in treatment and prognosis [8].

The aim of the study is to measure the different parameters of scapula which will be helpful for anatomist and surgeon in the management and designing prosthesis for various shoulder diseases and for shoulder arhtroplasty.

MATERIALS AND METHODS

A total of 60 dry (24 right & 36 left) unpaired adult human cadaveric scapulae were taken from the department of Anatomy, Vydehi Institute of Medical Sciences and Research Centre Bangalore and from East Point College of Medical Science and Research Centre Bangalore were evaluated. Clear features of intact scapulae were included and scapulae which were broken or defective was excluded from study. All the parameters of scapula were measured by Vernier caliper and the angles were measured using scale and protractor [9, 10].

The statistical analysis was done. Mean, Standard deviation, Minimum and Maximum was calculated.

The following measurements of the scapula were taken:

The Scapula length was measured by taking the maximum distance between Superior border to the inferior angle of scapula [9]. The Scapula width was measured by taking maximum distance between the spine on medial border to glenoid on lateral border [9]. The Glenoid height was measured taking the distance from superior to inferior point on the glenoid margin [9]. The Glenoid width was measured taking maximum breadth from anterior to posterior margin of glenoid [9]. The acromion length was measured by taking maximum distance between anterior and posterior border of acromion process [9]. The acromion breadth was measured by taking maximum distance between the lateral and medial borders of acromion process [9]. The coracoid length was measured by taking the distance on horizontal part between the base & the tip of the coracoid process. The Coracoid thickness was measured by taking maximum thickness of corocoid process [9]. The spine Projection length of scapula was measured by taking distance between root of the spine and lateral border of acromion process [9]. The acromiocoracoid distance was measured by taking the distance between the tip of acromion and tip of the coracoid processes [9]. The acromioglenoidal distance was measured by taking the distance between tip of acromion process and supraglenoid tubercle of glenoid [9]. TheSuprascapular notch width was measured by the maximum distance between the corners of the suprascapular notch on the superior border of the scapulae [9]. Thesuprascapular notch depth was measured by the maximum distance between an imaginary line between the superior corners of the notch to the deepest point of the suprascapular notch [9]. The Gleno-polar angle was measured between a line connecting the superior to inferior point on glenoid cavity and a line connecting the superior most point of glenoid cavity with the inferior angle of scapula [9]. The glenoid inclination angle was measured between a line drawn perpendicular to the line connecting the midpoint of height of the glenoid cavity and medial border of scapula and a line drawn perpendicular to the tangent along the medial border of the scapula to superior point on glenoid cavity [9]. The angles of scapula were measured as follows where, superior angle is the angle between scales along superior & medial border of scapula measured with protractor [10]. The inferior angle is the angle between scales along lateral & medial border of scapula measured with protractor [10]. The lateral angle is open at the glenoid fossa measured between the scales along the superior & lateral border at infraglenoid tubercle with protractor [10].

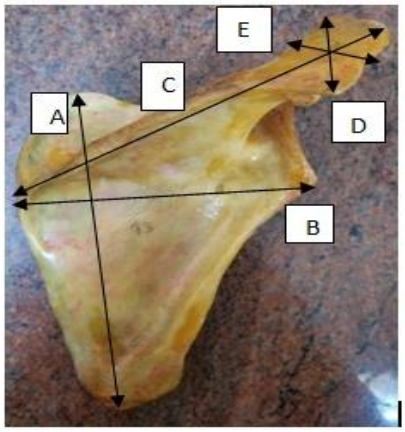

Fig-1: Showing the different parameters of the Scapula, A:Length of Scapula, B: Bredth of Scapula, C:Projection Spine Length , D: Length of Acromion, E:Width of Acromion

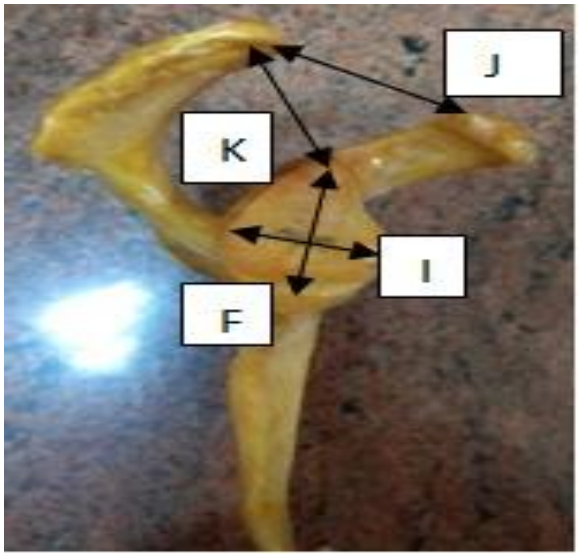

Fig-2: Showing the different parameters of the Scapula. F: Height of Glenoid cavity, I: Width of Glenoid cavity, J:Distance between Acromion & Corocoid process, K: Distance between Acromion and Glenoid

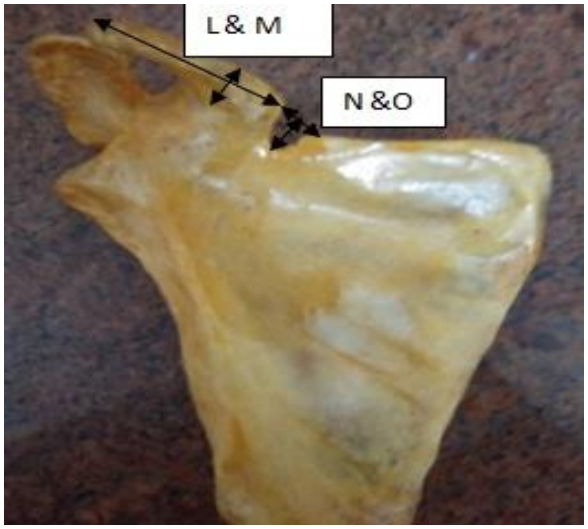

Fig-3: Showing the different parameters of the Scapula. L&M: Length and Thickness of Corocoid process, N & O: Width and Depth of Suprascapular notch

Fig-4: Showing the measurement of Gleno-polar angle

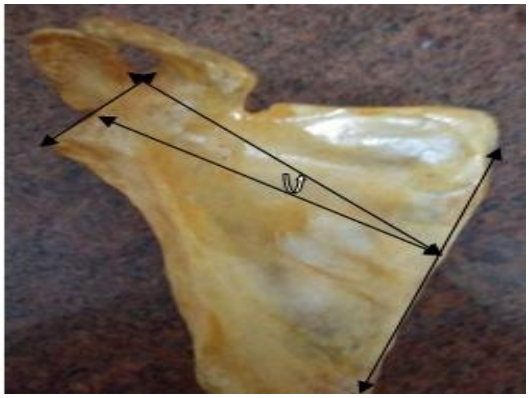

Fig-5: Showing the measurement of Glenoid-inclination angle

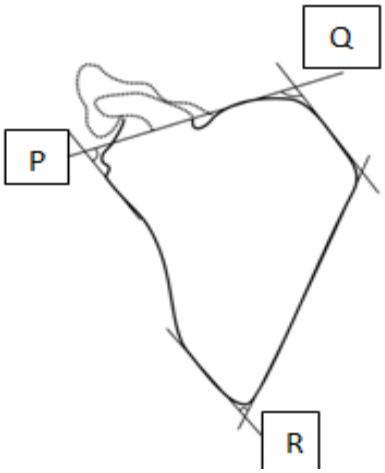

Fig-6: Showing angles of scapula, P: superior angle, Q: lateral angle, R: inferior angle of scapula

RESULT

Table-1: Showing Mean & SD of different parameters of the Scapula

	Measurements	Mean± SD
1	Maximum Scapular length	13.58±0.98cm
2	Maximum Scapular width	8.64±0.79 cm
3	Height of Glenoid	3.58±0.31 cm
4	Width of Glenoid	2.22±0.22 cm
5	Acromion maximum length	3.84±0.61 cm
6	Acromion maximum breadth	2.22±0.37 cm
7	Coracoid length	3.68±0.36 cm
8	Projection Spine length	12.2±0.77 cm
9	Supra scapular notch depth	0.83 ±0.55 cm
10	Supra scapular notch width	1.75 ±1.21 cm
11	Acromio-coracoid distance	3.56±0.78 cm
12	Acromio-glenoid distance	2.75±0.47 cm
13	Coracoid thickness	1.178±0.21 cm
14	Superior angle	91.7±2.69 cm
15	Inferior angle	$37.6^{0}\pm4.4^{0}$
16	Lateral angle	$55.1^{0}\pm3.7^{0}$
17	Gleno-polar angle	$34.3^{0}\pm4.6^{0}$
18	Glenoid-inclination angle	$11.5^{0}\pm2.02^{0}$

In the present study average parameters of scapular length was 13.5±0.98 cm, width 8.6±0.79cm, glenoid height was 3.5±0.31cm and its width was 2.2±0.22cm, acromion length was 3.8±0.61cm and its breadth was 2.2±0.37cm, corocoid length was 3.68±0.36cm & its thickness was 1.17±0.21cm, Projection spine length was 12.2±0.77cm, acromio-corocoid distance was 3.56±0.77 cm and Acromio-

glenoid distance was 2.75 ±0.47cm, suprascapular notch depth was 0.83±0.55cm and its width was 1.75±1.2cm, superior angle of scapula was $91.7^0 \pm 2.69^0$, inferior angle of scapula was $37.6^0 \pm 4.4^0$, lateral angle of scapula was $55.1^0 \pm 3.7^0$, glenopolar angle was $34.3^0 \pm 4.6^0$, glenoidinclination angle of scapula was $11.5^0 \pm 2.0^0$.

DISCUSSION

Table-2: Showing the comparison of length and width of Scapula, depth and width of Suprascapular notch with other Authors

Sl. no	Authors	Maximum Scapular length(MSL) (cms)	Maximum Scapular width(MSW) (cms)	Suprascapular notch maximum depth (cms)	Suprascapular notch Width (cms)
1	Kavitha P *et al.*, [11]	14.51	10.55	--	--
2	Waelamin NE *et al.*, [12]	15.1	10.72	--	--
3	Paraskevas G *et al.*, [13]	14.76	10.19	--	--
4	Peter Ericson L *et al.*, [9]	14.14	9.86	0.547	0.907
5	Polguj M *et al.*, [14]	15.5		--	---
6	Sitha P *et al.*, [15]	13.11	9.57	--	--
7	Swapna R Chavan *et al.*, [16]	13.7	9.93	0.595	--
8	Present study	15.4	10.9	2.3	0.5

Table-3: Showing the comparison of Glenoid height & width with other Authors

Sl. No	Authors	Glenoid height (cms)	Glenoid width (cms)
1	Kavitha P *et al.*, [11]	3.50	6.6
2	Mamatha T *et al.*, [3]	3.36	2.01
3	Sitha P *et al.*, [15]	3.36	2.56
4	WaelaminNE *et al.*, [12]	3.89	2.81
5	Peter Ericsonet L *et al.*, [9]	3.68	2.50
6	CoskunN *et al.*, [5]	--	2.46
7	Swapna R Chavan [16]	3.68	2.50
8	Present study	4.2	2.9

Table-4: showing the comparison of length and width of acromion, corocoid thickness and projection of spine length with other Authors

Sl. No	Authors	Acromion width (cms)	Acromion length (cms)	Coracoid Thickness (cms)	projection spine length (cms)
1	Wael Amin NE *et al.*, [12]	5.28	3.20		
2	Sitha P *et al.*, [15]	4.0	2.39	3.78	--
3	Singh J *et al.*, [17]	4.61	2.32		
4	Peter Ericson L *et al.*, [9]	4.32	2.46	3.904	
5	Paraskevas G *et al.*, [13]	4.61	23.9		
7	Swapna R Chavan. [16]	4.29	23.22	4.01	12.30
8	Polguj M *et al.*, [14]	--			13.2
9	Coskun N *et al.*, [5]			1.94	
10	Kavitha P *et al.*, [11]			4.10	
11	Present study	4.9	3.0	1.5	13.9

Table-5: showing the comparison of Acromion-corocid and Acromion-glenoid distance with other Authors

Sl. No	Authors	Acromio- coracoid distance (cms)	Acromio- glenoid distance (cms)
1	Wael Amin NE *et al*., [12]	3.13	2.73
2	Singh J *et al*., [17]	2.85	2.7
3	Sitha P *et al.*, [15]	1.48	1.8
4	Cezayir E *et al.*, [18]	--	3.0
sp5	Peter Ericson L *et al.*, [9]	3.185	2.44
6	Paraskevas G *et al*., [12]	2.81	1.77
7	Present study	6.1	3.9

Table-6: showing the comparison of angles of scapula with other Authors

SL. NO	Scapular angle (degree)	Peter Ericson L *et al*., [9]	Swapna R Chavan *et al.*, [16]	Sharma R *et al.*, [10]	Present study
1	Superior angle	91.7	92.2	100.83	90.36
2	Inferior angle	37.66	36.32	63.62	37.13
3	Lateral angle	55.10	54.21	61.72	54.9
4	Glenoid inclination angle	11.58	--	--	10.86
5	Gleno polar angle	34.34	--	--	33.85

In the present study, length and width of Scapula and Glenoid were more in values when compared other studies. Length and width of Acromion was lower compared to Wael Amin *et al.*, studies [12] and higher than the rest of the other studies. Thickness of Coracoid was lower than other author's studies, whereas projection spine length was higher than Polguji *et al*., [14] and Swapna R Chavan *et al*., [16] studies. Acromio-coracoid distance and Acromio- glenoid distance was found to be greater than other studies. Superior, inferior and lateral angle of scapula, glenoid inclination, glenopolar angle were less compared to other authors. Suprascapular notch depth was found to be greater than other studies and its width was lesser than Peter Ericson *et al*., [9] studies.

CONCLUSION

The parameters measured were greater in values except for the width of suprascapular notch and angles of scapula found to be lesser when compared to others. The morphometry of scapula were different in different regions of the world and this can be attributed to racial, ethnicand regional differences. A thorough knowledge of these normal osteometric values are essential to understand disease pathologies and treat different shoulder pathologies accurately and also for effective management of significantly displaced scapular fracture along with rehabilitation of shoulder injuries. This study helps in biomedical research in structuring and designing of shoulder joint implants. Finally it has also contributed for demographic studies and also helps in ambiguous cases of medico legal importance.

REFERENCES

1. Moore, K. L., & Dalley, A. F. (1999). Clinically oriented anatomy, 4th ed, Philadelphia, USA: Lippincot Williams and Wilkins, 668-669.
2. Sinnatamby, C. S. (2006). Last's Anatomy, Regional and Applied, 11th ed, London: Churchill Livingstone, 50-52.
3. Mamatha, T., Pai, S. R., Murlimanju, B. V., Kalthur, S. G., Pai, M. M., & Kumar, B. (***2015).*** Morphometry of Glenoid Cavity. Journal of Clinical and Diagnostic Research, *9(8).*
4. Collipal, E., Silva, H., Ortega, L., Espinoza, E., & Martínez, C. (2010). El Acromion y sus Diferentes Formas. *International Journal of Morphology*, *28*(4), 1189-1192.
5. Coskun, N., Karaali, K., Cevikol, C., Demirel, B. M., & Sindel, M. (2006). Anatomical basics and variations of the scapula in Turkish adults. *Saudi medical journal*, *27*(9), 1320-1325.
6. Standring, S., Ellis, H., Healy, J., Johnson, D., & Williams, A. (2008). Pectoral girdle, shoulder region and axilla. *Gray's Anatomy. 40th Ed. Edinburgh: Churchill Livingston Elsevier. p*, 791-822.
7. Thompson, W. A. L., & Kopell, H. P. (1959). Peripheral entrapment neuropathies of the upper extremity. *New England Journal of Medicine*, *260*(25), 1261-1265.
8. Kim, K. C., Rhee, K. J., Shin, H. D., & Yang, J. Y. (2008). Can the glenopolar angle be used to predict outcome and treatment of the floating shoulder?. *Journal of Trauma and Acute Care Surgery*, *64*(1), 174-178.
9. Lingamdenne, P. E., & Marapaka, P. (2016). Measurement and analysis of anthropometric measurements of the human scapula in Telangana region, India. *Int J Anat Res*, *4*(3), 2677-2683.

10. Sharma, R., Singla, R. K., Kullar, J. S., & Sharma, R. (2013). A cadaveric study of different angles of scapula and their role in kinesiometrics and muscle morphology. *Journal of the Nepal Medical Association*, *52*(191), 494-499.
11. Kavita, P., & Singh, J. (2013). Morphology of coracoid process and glenoid cavity in adult human scapulae. *International Journal of Analytical, Pharmaceutical and Biomedical Sciences*, *2*(2), 62-65.
12. El-Din, W. A. N., & Ali, M. H. M. (2015). A morphometric study of the patterns and variations of the acromion and glenoid cavity of the scapulae in Egyptian population. *Journal of clinical and diagnostic research: JCDR*, *9*(8), AC08-AC11.
13. Paraskevas, G., Tzaveas, A., Papaziogas, B., Kitsoulis, P., Natsis, K., & Spanidou1, S. (2008). Morphological parameters of the acromion. Folia Morphol, 67,255–60.
14. Polguj, M., Jędrzejewski, K. S., Podgórski, M., & Topol, M. (2011). Correlation between morphometry of the suprascapular notch and anthropometric measurements of the scapula. *Folia morphologica*, *70*(2), 109-115.
15. Piyawinijwong, S., Sirisathira, N., & Chuncharunee, A. (2004). The Scapula: osseous dimensions and gender dimorphism in Thais. *Siriraj Hosp Gaz*, *56*(7), 356-365.
16. Chavan, S. R., Bhoir, M., & Verma, S. (2017). A study of anthropometric measurements of the human scapula in Maharashtra, India. *International Journal of Anatomy*, *1*(2), 23-26.
17. Singh, J., Pahuja, K., & Agarwal, R. (2013). Morphometric parameters of the acromion process in adult human scapulae. *Indian J Basic Appl Med Res*, *2*, 1165-70.
18. Cezayir, E., Ates, Y., Ersoy, M., & Tekdemir, I. (2004). Morphometric anatomy of the acromion and the coracoacromial arch. *Acta Orthopaedica et Traumatologica Turcica; Vol 29, No 3 (1995); 224-226*.