Original Article

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Anatomy Section

Morphometry of the Acromion Process in Dry Human Scapulae and its Clinical Implications: A Cross-sectional Study

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ABSTRACT

Introduction: The coracoacromial arch, which extends laterally over the shoulder joint, is formed by the acromion process, coracoid process, and coracoacromial ligament. The acromion process plays an important role in shoulder joint formation. Morphological variations of the acromion process play a key role in determining the subacromial space. Acromioplasty is an important step in rotator cuff repair.

Aim: To investigate the morphometry of the acromion process in dry human scapulae and determine the various types of acromion processes.

Materials and Methods: An observational cross-sectional study was conducted in the Department of Anatomy at NRI Medical College and General Hospital, Chinakakani, Guntur, Andhra Pradesh, India. The study duration was one year and four months, from November 2020 to March 2022. A total of 100 dry human scapulae (50 right and 50 left) of unknown age and gender were included. Various types of acromion processes were identified. Measurements were taken using a digital vernier caliper (accurate to 0.01 mm) and protractor to measure parameters such as length, breadth, and thickness of the acromion process, acromiocoracoid distance, acromioglenoid distance, height of the coracoacromial arch, acromial slope, and acromial tilt. The data were analysed using Statistical Package for Social Sciences (SPSS) version 24.0. Mean, Standard Deviation (SD), and range were calculated for each morphometric parameter.

Results: Three types of acromion processes were observed: type I (31%), type II (48%), and type III (21%). The mean length, breadth, and thickness of the acromion process were 43.21±2.82 mm, 25.48±2.56 mm, and 6.84±1.24 mm, respectively. The mean acromiocoracoid distance, acromioglenoid distance, and height of the coracoacromial arch were 39.87±7.63 mm, 27.34±3.58 mm, and 21.52±1.98 mm, respectively. The mean acromial slope and acromial tilt observed were 32.34±4.62° and 37.46±6.37°, respectively.

Conclusion: The present study provides data on the shape, dimensions, slope, tilt, and various distances of the acromion process in dry human scapulae. The majority of the scapulae on both sides exhibited type II acromion process.

Keywords: Acromioplasty, Coracoid process, Impingement syndrome

INTRODUCTION

The scapula is a flat irregular bone located on the posterolateral aspect of the thoracic cage. It has three processes: the spine, acromion, and coracoid. The acromion (Greek: akros=highest; omos=shoulder) is a bony process of the scapula that is continuous with the spinous process. The acromion is formed from various ossification centres-preacromion, mesoacromion, and meta-acromion. These merge to form a triangular epiphyseal bone and finally fuse with the basiacromion. The basiacromion fuses with the scapular spine at 12 years, and all four centres fuse by 15 to 18 years [1]. In 1% to 15% of cases, this osseous union fails, and the acromion remains separate as an accessory bone called os acromiale [2].

The coracoacromial arch is formed by the acromion process and the coracoid process, bridged by the coracoacromial ligament. The arch extends laterally over the shoulder joint and articulates with the clavicle to form the acromioclavicular joint. The subacromial space lies between the humeral head inferiorly, the anterior third of the acromion, coracoacromial ligament, and the acromioclavicular joint superiorly. On radiographs, the height of the space between the acromion and humeral head ranges from 1.0 to 1.5 cm [3]. This space contains the rotator cuff tendons, the tendon of the long head of the biceps brachii, and a bursa. Reduction in the subacromial space can lead to shoulder impingement syndrome. Various structural abnormalities of the coracoacromial arch may cause a reduction in the subacromial space [4,5]. Morphological variations of the acromion process play a key role in determining the subacromial space. Bigliani LU et al., classified the acromion process into type I (flat), type II (curved), and type III (hooked), based on its concavity [6].

The initial thickness of the acromion process helps orthopaedic surgeons decide how much bone needs to be removed and how much can be saved to maintain rotator cuff dynamics post-surgery [7]. Variation in the morphology of the acromion process is one of the aetiological factors for impingement syndrome or rotator cuff injuries [8,9]. As acromioplasty is still the standard operative treatment for shoulder impingement [10], a comprehensive understanding of the morphology and morphometry of the acromion process may play an important role in the treatment of shoulder impingement syndrome. Additionally, the dimensions and shape of bones vary within and between populations. The morphology and morphometry of the acromion process have been described by various authors in different populations [11-16]. Considering the variability and clinical relevance, the present study aimed to document the morphometry of the acromion process in the South Indian population. The secondary objectives of the study were to determine the various types of acromion processes following the classification of Bigliani LU et al., [6].

MATERIALS AND METHODS

An observational cross-sectional study was conducted in the Department of Anatomy at NRI Medical College and General Hospital, Chinakakani, Guntur, Andhra Pradesh, India. The study duration was one year and four months, from November 2020 to March 2022. Ethical clearance was exempted by the Institutional Ethics Committee (IEC)

with reference number IEC/NRIMC&GH/245/2020. NRIMC and GH, as the study involved the use of dry bones obtained from cadavers.

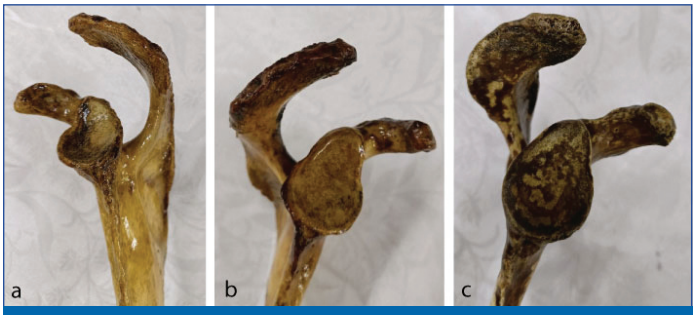
Inclusion criteria: A total of 100 dry human scapulae (50 right and 50 left) of unknown age and gender were included in the study.

Exclusion criteria: Scapulae with damaged or fractured acromion or any pathological changes in the acromion were excluded from the study.

Study Procedure

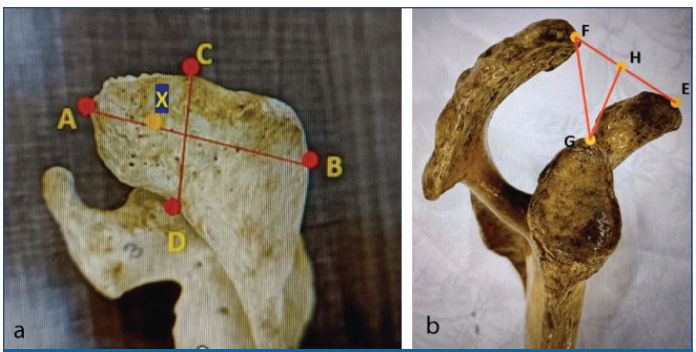
A digital vernier caliper, accurate to 0.01 mm, of Yuzuki make, and a stainless-steel digital protractor of Mitutoyo make were used to measure various morphometric parameters [17]. Each measurement was taken twice by the same observer, and the mean of the two values was taken as the final value to minimise error. The following data were evaluated:

- **Type of the acromion process:** The acromion process was classified into type I (flat), type II (curved), and type III (hooked) by observing its concavity [Table/Fig-1a-c] [6].



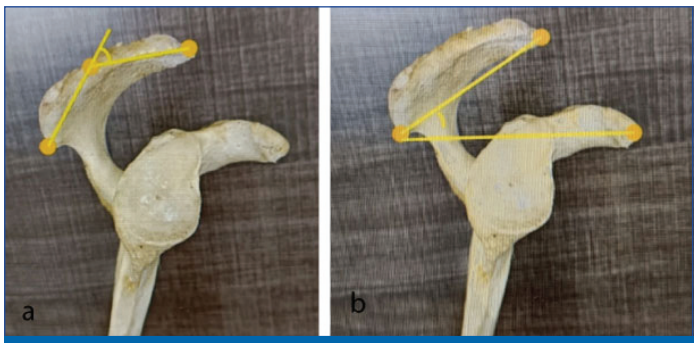
[Table/Fig-1]: a) Curved acromion; b) Flat acromion; c) Hooked acromion.

- **Length of acromion process (AB):** The distance between the superiormost point (A) and the inferiormost point (B) on the acromion [Table/Fig-2a].
- **Breadth of acromion process (CD):** The distance between the outermost point (C) and the innermost point (D) on the acromion [Table/Fig-2a].
- **Thickness of acromion:** The thickness was measured at the point X (1 cm posterior to the anterior border and 1 cm medial to the lateral border) [Table/Fig-2a].
- **Acromiocoracoid distance (ACD):** The distance measured from the tip of the coracoid process (E) to the tip of the acromion process (F) [Table/Fig-2b].
- **Acromioglenoid distance (AGD):** The distance measured from the supraglenoid tubercle (G) to the tip of the acromion process (F) [Table/Fig-2b].
- **Height of coracoacromial arch (HG):** The distance between the midpoint of a line joining the tips of the coracoid and acromion processes (H) and the supraglenoid tubercle (G) [Table/Fig-2b].



[Table/Fig-2]: a) Morphometric parameters of acromion. A- superior most point on the acromion; B- inferior most point on the acromion; C- outermost point on the acromion; D- innermost point on the acromion and X- a point at 1 cm inner to C and 1 cm inner to A. b) Acromiocoracoid distance, acromioglenoid distance and height of coracoacromial arch. E- tip of coracoid; F- tip of acromion; G- supraglenoid tubercle; H- midpoint of a line joining E and F.

- **Acromion slope:** The angle between two lines marked on the undersurface of the acromion on a lateral photograph-one line from the anteriormost point to the midpoint and another line from the midpoint to the posteriormost point [Table/Fig-3a] [17].
- **Acromion tilt:** The angle between two lines marked on a lateral photograph-one line drawn from the anteriormost point to the posteriormost point on the undersurface of the acromion, and another line from the coracoid tip to the posteriormost point on the undersurface of the acromion [Table/Fig-3b] [17].



[Table/Fig-3]: a) Acromial slope- The angle between two lines marked on the under surface of acromion- one line from the anterior most point to the midpoint and another line from the midpoint to the posterior most point. b) Acromial tilt- The angle between two lines- one line is drawn from the anterior most point to the posterior most point on the under surface of the acromion and another line from the coracoid tip to the posterior most point on the under surface of acromion.

STATISTICAL ANALYSIS

The data were analysed using SPSS version 24.0. The mean, standard deviation, and range were calculated for each of the morphometric parameters.

RESULTS

The most common type of acromion process observed in the present study was type II (curved) in 48% [Table/Fig-1a], followed by type I (flat) in 31% [Table/Fig-1b], and type III (hooked) in 21% of the scapulae [Table/Fig-1c]. The morphology of the acromion process on the right and left sides was studied in the present study and found that the majority on both sides (left and right) had type II acromion process, followed by type I and type III [Table/Fig-4].

Types	Right (n=50)	Left (n=50)	Total n (%)
I	13	18	31 (31)
II	22	26	48 (48)
III	15	06	21 (21)

[Table/Fig-4]: Type of acromion process (N=100).

The mean length, mean breadth, and mean thickness of the acromion process in the present study were 43.21±2.82 mm, 25.48±2.56 mm, and 6.84±1.24 mm, respectively. The mean acromiocoracoid distance, mean acromioglenoid distance, and mean height of the coracoacromial arch in the present study were 39.87±7.63 mm, 27.34±3.58 mm, and 21.52±1.98 mm, respectively [Table/Fig-5].

Parameters	Range		Mean±SD
	Minimum	Maximum	
Length of acromion process (mm)	34.49	52.85	43.21±2.82
Breadth of acromion process (mm)	18.76	28.9	25.48±2.56
Thickness of acromion process (mm)	4.8	7.67	6.84±1.24
Acromiocoracoid distance (mm)	24.78	47.24	39.87±7.63
Acromioglenoid distance (mm)	20.24	32.62	27.34±3.58
Height of coracoacromial arch (mm)	12.96	26.53	21.52±1.98
Acromion slope (degree)	18	39	32.34±4.62
Acromion tilt (degree)	22	48	37.46±6.37

[Table/Fig-5]: Morphometric parameters of the acromion process, acromiocoracoid distance, acromioglenoid distance, height of coracoacromial arch, acromion slope and acromion tilt.

DISCUSSION

The most common type of acromion process in the present study was type II curved (48%). This was followed by type I flat (31%) and type III hooked (21%). The morphology of the acromion process reported by various authors was compared in [Table/ Fig-6] [4,7-9,11-22]. Type II was reported as the most common type of acromion process in most of the previous studies [4,7-9,11-16], while a few studies described type I as the most common [21,23]. The variations in the morphology of the acromion play an important role in shoulder impingement syndrome [24]. Epstein RE et al., described that type III is the most important factor causing impingement syndrome [25]. Worland RL et al., observed a high incidence of rotator cuff tears in patients with type II and type III acromion [26]. Balke M et al., described that the incidence of type III acromion was higher in patients with rotator cuff tears [27].

Author and year of the study	Population	Sample size	Type I (%)	Type II (%)	Type III (%)
Getz JD et al., (1996) [11]	-		22.8	68.5	8.6
Natsis K et al., (2007) [12]	Greece	423	12.1	56.5	28.8
Paraskevas G et al., (2008) [4]	Greece	88	26.1	55.6	18.1
Schetino LP et al., (2013) [13]	Brazil	57	5.6	57.89	36.84
Naidoo N et al., (2015) [15]	Africa	120	34.6	51.1	14
Gosavi S et al., (2015) [16]	Maharashtra, India	127	13.38	81.88	4.72
El-Din WA and Ali MH (2015) [14]	Egypt	160	26.88	45.62	15
Saha S and Vasudeva N (2017) [7]	New Delhi, India	200	61	35	4
Singroha R et al., (2017) [18]	Haryana, India	100	9	48	43
Vinay G and Sivan S (2017) [8]	Karnataka and Kerala, India	164	37.1	47.5	15.2
Kumar Panigrahi T and Mishra D (2018) [19]	Odisha, India	297	25.59	56.9	17.51
Sinha MB et al., (2018) [20]	Chhattisgarh, India	164	24.59	49.18	26.22
Ravindranath Y et al., (2018) [9]	Karnataka, India	130	9.23	89.23	1.54
Prasad M et al., (2018) [21]	Tamil Nadu, India	70	57.14	40	2.85
Vinay KV et al., (2020) [22]	Karnataka, India	100	9	49	42
Hafezji HM (2021) [17]	Gujarat, India	150	23.33	49.33	27.34
Present study	Andhra Pradesh, India	100	31	48	21S

[Table/Fig-6]: Comparison of types of acromion process in various studies [4,7-9,11-22].

The mean length, mean breadth, and mean thickness of the acromion process in the present study were 43.21±2.82 mm, 25.48±2.56 mm, and 6.84±1.24 mm, respectively. These values are consistent with other studies done in the Indian population [8,17,20]. A comparative description of morphometric parameters reported by various authors is given in [Table/Fig-7] [4,7,8,14,17,20,28-30]. There is a higher chance of impingement when the thickness of the acromion is more than 8 mm [31]. In the present study, no scapulae were found with a thickness of the acromion process greater than 8 mm.

Author and year of the study	Population	Length (mm)	Breadth (mm)	Thickness (mm)
Paraskevas G et al., (2008) [4]	Greece	46.10	22.30	8.8
Coskun N et al., (2010) [28]	Turkey	69.12	25.12	-
Mansur DI et al., (2012) [29]	Nepal	46.02	26.93	-
Singh J et al., (2013) [30]	Rajasthan, India	46.1	23.3	6.6
El-Din WA and Ali MH (2015) [14]	Egypt	52.81	32.05	9.06
Vinay G and Sivan S (2017) [8]	Karnataka and Kerala, India	42.47	26.56	-
Saha S and Vasudeva N (2017) [7]	New Delhi, India	41	21.82	6.58
Sinha MB et al., (2018) [20]	Chhattisgarh, India	41.23	22.12	7.01
Vinay KV et al., (2020) [22]	Karnataka, India	48.76 (R); 45.5 (L)	27.43 (R); 26.67 (L)	-
Hafezji HM (2021) [17]	Gujarat, India	41.14	24.89	6.95
Present study	Andhra Pradesh, India	43.21	25.48	6.84

[Table/Fig-7]: Comparison of linear dimensions of acromion process in various studies [4,7,8,14,17,20,28-30].

The mean acromiocoracoid distance, acromioglenoid distance, and height of the coracoacromial arch (mm) in the present study were 39.87±7.63 mm, 27.34±3.58 mm, and 21.52±1.98 mm, respectively. These parameters were compared with previous studies [Table/Fig-8] [4,7,8,14,17,19,20,22,28-30]. The acromiocoracoid distance signifies the length of the coracoacromial ligament. A lesser acromiocoracoid distance may be associated with shoulder impingement syndrome [21]. The acromiocoracoid distance, acromioglenoid distance, and the height of the coracoacromial arch determine the subacromial space. A decrease in the subacromial space increases the risk of impingement syndrome [4].

Author and year of the study	Population	Acromiocoracoid distance (mm)	Acromioglenoid distance (mm)	Height of coracoacromial arch (mm)
Paraskevas G et al., (2008) [4]	Greece	28.1	17.7	-
Coskun N et al., (2010) [28]	Turkey	17.8	-	-
Mansur DI et al., (2012) [29]	Nepal	39.21	31.9	-
Singh J et al., (2013) [30]	Rajasthan, India			
El-Din WA and Ali MH (2015) [14]	Egypt	31.34	27.39	
Vinay G and Sivan S (2017) [8]	Karnataka and Kerala, India	34.05	30.08	-
Saha S and Vasudeva N (2017) [7]	New Delhi, India	28.43	26.21	
Sinha MB et al., (2018) [20]	Chhattisgarh, India	35.94	28.28	
Kumar Panigrahi T and Mishra D (2018) [19]	Odisha, India	37.47 (R); 37.23 (L)	26.39 (R); 24.2 (L)	21.01 (R); 19.52 (L)
Vinay KV et al., (2020) [22]	Karnataka, India	38.26 (R); 37.17 (L)	27.62 (R); 27.14 (L)	-
Hafezji HM (2021) [17]	Gujarat, India	41.77	30.06	19.32 (R); 19.09 (L)
Present study	Andhra Pradesh, India	39.87	27.34	21.52

[Table/Fig-8]: Comparison of acromiocoracoid distance, acromio-glenoid distance and height of coracoacromial arch in various studies [4,7,8,14,17,19,20,22,28-30].

The acromial slope and acromial tilt in the present study were 32.34±4.62 mm and 37.46±6.37 mm, respectively. The acromial slope observed in the present study was higher, and the tilt was lower compared to the findings of Hafezji HM and Sinha MB et al., [Table/Fig-9] [17,20]. Acromial slope denotes the relation of the anterior segment of the acromion with its posterior segment, while acromial tilt denotes the relation of the acromion process with the coracoid process. Acromial tilt and slope also determine the subacromial space. If the angles are smaller, the risk of impingement will be greater [17]. In the present study, acromial slope and tilt were

higher, as reported by previous authors in India, suggesting a lesser predisposition to shoulder impingement. The differences in the type and morphometric parameters of the acromion process of the scapula in various studies can be attributed to differences in the methodology of the study, as well as ethnic and racial differences.

Author and year of the study	Population	Acromial slope	Acromial tilt
Sinha MB et al., (2018) [20]	Chhattisgarh, India	31.390	43.780
Hafezji HM (2021) [17]	Gujarat, India	28.230	42.470
Present study	Andhra Pradesh, India	32.340	37.460

[Table/Fig-9]: Comparison of acromial slope and acromial tilt in various studies [17,20].

Limitation(s)

The scapulae used in the present study were of unknown age and gender. As the scapulae were obtained from different cadavers, the parameters of the right and left side cannot be compared. Hence, variations in the morphology and morphometry of the acromion process in relation to age, gender, and side were not studied.

CONCLUSION(S)

In the present study, type II (curved) acromion was found to be the most common morphological variant. Various morphometric parameters of the acromion process observed in the present study are consistent with other studies conducted in the Indian population. The higher acromial slope and tilt in the present study suggest a lesser predisposition to shoulder impingement among the Indian population. This information may be useful to radiologists and orthopaedic surgeons in planning the treatment and surgical repair of shoulder impingement.

REFERENCES

[1] Macalister A. Notes on acromion. J Anat Physiol. 1893;27(Pt 2):244.1-51.
[2] Sammarco VJ. Os acromiale: Frequency, anatomy, and clinical implications. J Bone Joint Surg Am. 2000;82(3):394-400. Doi: 10.2106/00004623-200003000-00010.
[3] Umer M, Qadir I, Azam M. Subacromial impingement syndrome. Orthop Rev (Pavia). 2012;4(2):e18. Doi: 10.4081/or.2012.e18.
[4] Paraskevas G, Tzaveas A, Papaziogas B, Kitsoulis P, Natsis K, Spanidou S. Morphological parameters of the acromion. Folia Morphol. (Warsz). 2008;67(4):255-60.
[5] Sperner G. Role of the subacromial space on development of the impingement syndrome. I Unfallchirurg. 1995;98(6):301-08.
[6] Bigliani LU, Morrison DS, April EW. The morphology of the acromion and its relationship to rotator cuff tears. Orthop Trans. 1986;10:228. Doi: 10.1016/S0278-5919(20)30586-X.
[7] Saha S, Vasudeva N. Morphometric evaluation of adult acromion process in North Indian population. J Clin Diagn Res. 2017;11(1):AC08-AC11. Doi: 10.7860%2FJCDR%2F2017%2F21060.9312.
[8] Vinay G, Sivan S. Morphometric study of the acromion process of scapula and its clinical importance in South Indian population. Int J Anat Res. 2017;5(3.3):4361-64. Doi: 10.16965/ijar.2017.336.
[9] Ravindranath Y, Abraham A, Thelekatt DJ, Oomen AT, Johnsia S. Acromion-anatomic study of South Indian dry scapulae. Int J Contemp Med Res. 2018;5(5):11-14. Doi: 10.21276/ijcmr.2018.5.5.18.
[10] Vitale MA, Arons RR, Hurwitz S, Ahmad CS, Levine WN. The rising incidence of acromioplasty. J Bone Joint Surg Am. 2010;92(9):1842-50. Doi: 10.2106/jbjs.i.01003.
[11] Getz JD, Recht MP, Piraino DW, Schils JP, Latimer BM, Jellema LM, et al. Acromial morphology: Relation to sex, age, symmetry, and subacromial enthesophytes. Radiology. 1996;199(3):737-42. Doi: 10.1148/radiology.199.3.8637998.
[12] Natsis K, Tsikaras P, Totlis T, Gigis I, Skandalakis P, Appell HJ, et al. Correlation between the four types of acromion and the existence of enthesophytes: A study on 423 dried scapulas and review of the literature. Clin Anat. 2007;20(3):267-72. Doi:10.1002/ca.20320.
[13] Schetino LP, Sousa Junior RR, Amâncio GP, Schetino MA, Almeida-Leite CM, Silva JH. Anatomical variations of acromions in Brazilian adult's scapulas. J Morphol Sci. 2013;30(2):98-102.
[14] El-Din WA, Ali MH. A morphometric study of the patterns and variations of the acromion and glenoid cavity of the scapulae in Egyptian population. J Clin Diagn Res. 2015;9(8):AC08-AC11. Doi: 10.7860%2FJCDR%2F2015%2F14362.6386.
[15] Naidoo N, Lazarus L, Osman SA, Satyapal KS. Acromial morphology and subacromial architecture in a South African population. Int J Morphol. 2015;33(3):817-25. Doi: 10.4067/S0717-95022015000300002.
[16] Gosavi S, Jadhav S, Garud R. Morphometry of acromion process: A study of Indian scapulae. Int J Pharm Res Health Sci. 2015;3(5):831-35. Doi: 10.18203/2320-6012.ijrms20174953.
[17] Hafezji HM. Osteological study of morphometric analysis of acromion process and its implication in impingement syndrome. Natl J Clin Anat. 2021;10(2):84-88. Doi: 10.4103/NJCA.NJCA_86_20.
[18] Singroha R, Verma U, Malik P, Kanta Rathee S. Morphometric study of acromion process in scapula of North Indian population. Int J Res Med Sci. 2017;5(11);4965-69.
[19] Kumar Panigrahi T, Mishra D. Morphometric anatomy of acromion process: An observational study. Int J Anat Radiol Surg. 2018;7(2):AO29-AO32. Doi: 10.7860/IJARS/2018/35971:2387.
[20] Sinha MB, Sinha HP, Joy P. The acromial morphology and its implication in impingement syndrome: An anatomical study. J Anat Soc India. 2018;67(1):30-34. Doi: 10.1016/j.jasi.2018.05.003.
[21] Prasad M, Rout S, Stephen PC. Acromion morphology and morphometry in the light of impingement syndrome and rotator cuff pathology. J Anat Soc India. 2019;68(1.2):7311-15. Doi: 10.4103/JASI.JASI_32_19.
[22] Vinay KV, Aravind U, Sangeetha DM, Arathy LN. Morphometry of acromion process of human scapulae. Int J Anat Res. 2020;8:7311-15. Doi: 10.16965/ijar.2019.364.
[23] Basvanna PN, Bajpe R. Study of acromial shapes in relation to gender. Natl J Clin Anat. 2019;8:87-90. Doi: 10.1055/s-0039-1693288.
[24] Nicholson GP, Goodman DA, Flatow EL, Bigliani LU. The acromion: Morphologic condition and age-related changes. A study of 420 scapulas. J Shoulder Elbow Surg. 1996;5(1):01-11. Doi: 10.1016/s1058-2746(96)80024-3.
[25] Epstein RE, Schweitzer ME, Frieman BG, Fenlin JM Jr., Mitchell DG. Hooked acromion: Prevalence on MR images of painful shoulders. Radiology. 1993;187(2):479-81. Doi: 10.1148/radiology.187.2.8475294.
[26] Worland RL, Lee D, Orozco CG, SozaRex F, Keenan J. Correlation of age, acromial morphology, and rotator cuff tear pathology diagnosed by ultrasound in asymptomatic patients. J South Orthop Assoc. 2003;12(1):23-26.
[27] Balke M, Schmidt C, Dedy N, Banerjee M, Bouillon B, Liem D. Correlation of acromial morphology with impingement syndrome and rotator cuff tears. Acta Orthop. 2013;84(2):178-83. Doi: 10.3109/17453674.2013.773413.
[28] Coskun N, Karaali K, Cevikol C, Demirel BM, Sindel M. Anatomical basics and variations of the scapula in Turkish adults. Saudi Med J. 2006;27(9):1320-25.
[29] Mansur DI, Khanal K, Haque MK, Sharma K. Morphometry of acromion process of human scapulae and its clinical importance amongst Nepalese population. Kathmandu Univ Med J. 2012;10(38):33-36. Doi: 10.3126/kumj.v10i2.7340.
[30] Singh J, Pahuja K, Aggarwal R. Morphometric parameters of the acromion process in adult human scapulae. Indian Journal of Basic Applied Medical Research. 2013;8:1165-70.
[31] Rockwood CA Jr., Burkhead WZ. Management of patients with massive rotator cuff defects by acromioplasty and rotator cuff debridement. Orthop Trans. 1988;12:190-91.

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