

Original Research Article

Morphometric study of acromion process in scapula of north Indian population

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ABSTRACT

Background: In scapula, the acromion process projects forwards almost at right angle from the lateral end of spine. Morphometry of the acromion process is an important factor in contributing to impingement syndrome of the shoulder joint.

Methods: The study was performed at Department of Anatomy, PGIMS Rohtak on 50 pairs of human scapula, out of which 30 were males and 20 were females. The various parameters like length, width, thickness, coraco-acromial distance, acromio-glenoid distance and types of acromion process were recorded using vernier calipers. These parameters were compared in both sexes on both the sides.

Results: Type-II Acromion i.e. Curved type was found to be most predominant. Statistically significant difference was noted in all the five parameters between males and females except Acromio-glenoid distance on right side.

Conclusions: Knowledge of the morphometric parameters of acromion process is important for Orthopaedicians, Anthropologists and Anatomists.

Keywords: Acromion, Acromio-glenoid, Coraco-acromial, Impingement syndrome

INTRODUCTION

The scapula is a large, flat and triangular bone which lies on the posterolateral aspect of the chest wall, covering parts of the second to seventh ribs. It has costal and dorsal surfaces; superior, lateral and medial borders; inferior, superior and lateral angles and three processes, the spine, its continuation the acromion and the coracoid process. The acromion process projects forwards almost at right angle from the lateral end of the spine of scapula. It has got medial and lateral borders. It forms the highest point of the shoulder and projects over the glenoid cavity.¹

The anterior third of the acromion process, the coracoacromial ligament, and the coracoid process form

the coracoacromial arch. The rotator cuff tendons, the subacromial bursa, the biceps tendon, and proximal humerus all pass beneath this arch. Any process acquired or congenital, that narrows the space available for these structures can cause mechanical impingement.²

Morphometry of the acromion process of the scapula plays a significant role in the pathogenesis of impingement syndrome of the shoulder joint and rotator cuff diseases.³ Bigliani et al categorized the acromial morphology into three types: Type I or flat, type II or curved, and type III or hooked.⁴ It is widely accepted that rotator cuff lesions are noticed mainly in the Type III or hooked acromion.⁵ The knowledge regarding the shape and various distances of the acromion process might benefit the orthopaedicians during surgical repair around

the shoulder joint. It is also helpful to Anthropologists during their study on evolution of acromion.⁶ This study might also be useful to Forensic experts in determination of gender from these parameters.

Since, there is dearth of literature regarding the morphometric values of acromion process in North Indian population, so, the present study was planned to study the different types of acromion process and its various morphometric parameters in dry scapula of North Indian population.

METHODS

The present study was conducted on 50 pairs of dry human scapulae in the Dept. of Anatomy, Pt. B.D. Sharma PGIMS, Rohtak (Haryana) in the year 2016-17. Out of 50 pairs, 30 belonged to males and 20 were of females. Bones with clear and intact features were included in this study. Acromion processes were classified into Type I (flat), II (curved) and III (hooked) as suggested by Bigliani et al.⁴ Various morphometric parameters were measured using digital vernier caliper accurate up to 0.01 mm. The parameters taken were as follows

- Maximum length: Distance between tip and midpoint of posterior border of acromion process.⁶ (Fig.1)

- Maximum width: Distance between the lateral and medial borders at the midpoint of the acromion process.⁶ (Figure 1).
- Anterior thickness: It was measured at a point 1 cm posterior to anterior border and 1 cm medial to lateral border.² (Figure 2).
- Coraco-acromial distance: Distance between tips of coracoid and acromion processes.⁶ (Figure 2).
- Acromio-glenoid distance: Distance between tip of acromion process and supraglenoid tubercle.⁶ (Figure 2).

Data obtained was analysed using SPSS 17.1 software. The Independent t-test was employed in the assessment of side and gender differences. p-value ≤ 0.05 was considered significant.

RESULTS

Type of acromion process: In a study of 100 dry scapulae of known sex from North Indian population, Type II (Curved) acromion process (Figure 4) was observed in majority (48%) of the scapulae. Type III (Hooked) acromion process (Figure 5) was present in 43% followed by type I (Flat) (Figure 3) in 9%. However, in females and on left side, different pattern was observed i.e. Type III (Hooked) > Type II (Curved) > Type I (Flat) acromion process (Table 1 and 2).

Table 1: Incidence of different types of acromion process in males and females.

Gender	Type I (Flat) (%)	Type II (Curved) (%)	Type III (Hooked) (%)
Males (n=60)	6 (10%)	32 (53.3%)	22 (36.7%)
Curved > Hooked > Flat			
Females (n=40)	3 (7.5%)	16 (40%)	21 (52.5 %)
Hooked > Curved > Flat			
Total	9	48	43
Curved > Hooked > Flat			

Table 2: Incidence of different types of acromion process on right and left sides.

Side	Type I (Flat) (%)	Type II (Curved) (%)	Type III (Hooked) (%)
Right (n=50)	4 (8%)	26 (52%)	20 (40%)
Curved > Hooked > Flat			
Left (n=50)	5 (10%)	22 (44%)	23 (46%)
Hooked > Curved > Flat			
Total	9	48	43
Curved > Hooked > Flat			

Maximum length of acromion process: The mean length of acromion process was observed to be 45.05 mm in the present study. It was more in males in comparison to females with statistically significant difference (Table 3). The mean length was more on right side in comparison to left side but the difference was statistically insignificant (Table 4).

Maximum width of acromion process: The mean width of acromion process was observed to be 25.79 mm in the present study. It was more in males in comparison to females with statistically significant difference (Table 3). The mean width was more on right side in comparison to left side but the difference was statistically insignificant (Table 4).

Table 3: Comparison of all the parameters between males and females on both sides with p value.

Parameter	Mean \pm SD		p-value
	Males n=30	Females n=20	
Length (R)	48.1 \pm 4.71	41 \pm 5.25	0.00
Length (L)	47.7 \pm 5.85	40.5 \pm 3.36	0.00
Width (R)	27.6 \pm 2.74	24.1 \pm 2.73	0.00
Width (L)	26.8 \pm 2.58	23.2 \pm 2.32	0.00
Thickness (R)	7.52 \pm 1.28	6.7 \pm 1.19	0.02
Thickness (L)	7.3 \pm 1.13	6.7 \pm 0.84	0.03
Coraco-acromial distance (R)	39.8 \pm 4.72	36.1 \pm 6.65	0.04
Coraco-acromial distance (L)	39.4 \pm 4.07	34.8 \pm 5.99	0.005
Acromio-glenoid distance (R)	30.8 \pm 3.26	28.8 \pm 4.27	0.08
Acromio-glenoid distance (L)	30.8 \pm 3.53	28 \pm 4.3	0.02

Table 4: Comparison of all the parameters between right and left sides in both males and females with p value.

Parameter	Mean \pm SD		p-value
	Right	Left	
Length (M)	48.1 \pm 4.71	47.7 \pm 5.85	0.74
Length (F)	41 \pm 5.25	40.5 \pm 3.36	0.74
Width (M)	27.6 \pm 2.74	26.8 \pm 2.58	0.28
Width (F)	24.1 \pm 2.73	23.2 \pm 2.32	0.29
Thickness (M)	7.52 \pm 1.28	7.3 \pm 1.13	0.46
Thickness (F)	6.7 \pm 1.19	6.7 \pm 0.84	0.9
Coraco-acromial distance (M)	39.8 \pm 4.72	39.4 \pm 4.07	0.74
Coraco-acromial distance (F)	36.1 \pm 6.65	34.8 \pm 5.99	0.54
Acromio-glenoid distance (M)	30.8 \pm 3.26	30.8 \pm 3.53	0.95
Acromio-glenoid distance (F)	28.8 \pm 4.27	28 \pm 4.3	0.58

Table 6: Comparison of parameters of acromion process in regional and international populations.

Authors	Length (mm)	Width (mm)	Thickness (mm)	Coraco-acromial distance (mm)	Acromio-glenoid distance (mm)
Present study (North Indian)	45.05	25.79	7.12	37.96	29.86
Mansur et al ⁶ (Nepalese)	46.01	26.93	-	39.21	31.9
Coskun et al ³ (Turkish)	44.7	-	-	17.8	-
Gosavi et al ¹⁰ (Maharashtra)	43.7	22.78	6.9	26.9	22.68
Singh et al ² (Rajasthan)	46.1	23.2	6.6	37.5	27
El-Din et al ⁸ (Egyptian)	52.81	32.05	9.06	31.34	27.39
Paraskevas et al ¹² (Greek)	46.1	22.3	6.8	28.1	17.7

Anterior thickness of acromion process: The mean anterior thickness of acromion process was observed to be 7.12 mm in the present study. It was more in males in comparison to females with statistically significant difference (Table 3). The mean anterior thickness was more on right side in comparison to left side but the difference was statistically insignificant (Table 4). Coraco-acromial distance: The mean coraco-acromial distance was observed to be 37.96 mm in the present study. It was more in males in comparison to females with statistically significant difference (Table 3). The mean coraco-acromial distance was more on right side in comparison to left side but the difference was statistically insignificant (Table 4).

Table 5: Comparison of types of acromion in different regional and international populations.

Population groups	Authors	Type of Acromion process
North Indian	Present study	Curved > Hooked > Flat
Turkish	Coskun et al ³	Curved > Hooked > Flat
Brazilian	Schetino et al ⁷	Curved > Hooked > Flat
Rajasthan	Singh et al ²	Curved = Hooked > Flat
Egyptian	El-Din et al ⁸	Curved > Flat > Hooked
Indian	Saha et al ⁹	Curved > Flat > Hooked
Maharashtra	Gosavi et al ¹⁰	Curved > Flat > Hooked
Thai	Sangiampong et al ¹¹	Curved > Hooked = Flat

Acromio-glenoid distance: The mean acromio-glenoid distance was observed to be 29.86 mm in the present study. It was more in males in comparison to females but the difference was statistically insignificant (Table 3). The mean coraco-acromial distance was more on right side in comparison to left side but the difference was statistically insignificant (Table 4).

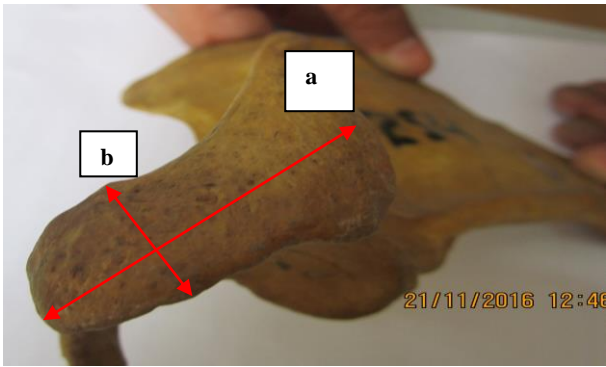


Figure 1: Maximum length (a) and maximum width (b) of acromion process.

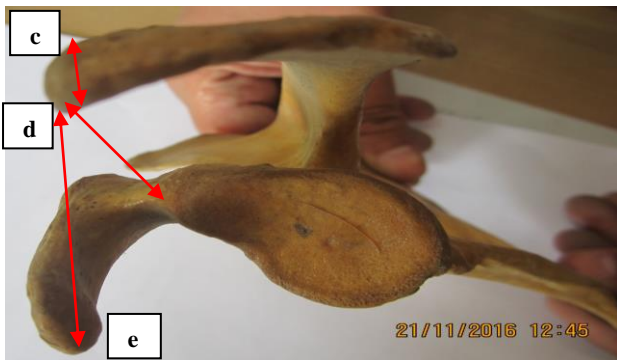


Figure 2: Anterior thickness of acromion (c), coraco-acromial distance (d), acromio-glenoid distance (e).

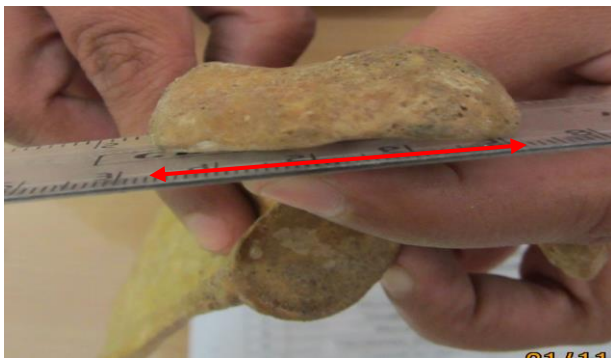


Figure 3: Type I (flat) acromion.



Figure 4: Type II (curved) acromion.

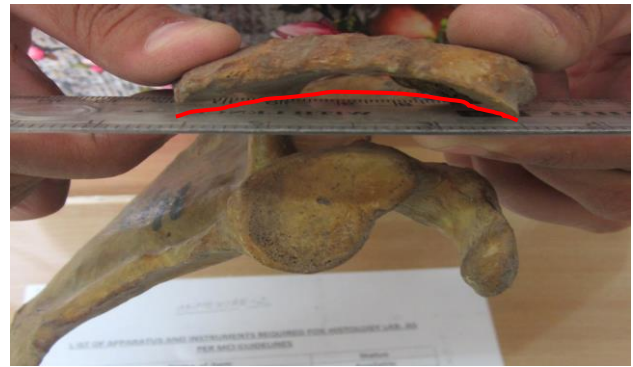


Figure 5: Type III (hooked) acromion.

DISCUSSION

Various studies have been conducted on the morphology and morphometry of the acromion process of the scapulae. The association between acromial morphology, shoulder impingement, and rotator cuff tears has been well documented.³ We have not found any study regarding acromion process in scapula of known sex.

Type of acromion process: High incidence of Type II (Curved) followed by type III (Hooked) and very low incidence of Type I (Flat) scapulae was observed in the present study. The findings were similar to Coskun et al³ in Turkish population and Schetino et al⁷ in Brazilian population. However, high incidence of Type II, followed by Type I and less number of Type III acromion process was observed by El-Din et al, Saha et al and Gosavi et al in Egyptian, Indian and Maharashtra population respectively (Table 5).⁸⁻¹⁰

Maximum length of acromion process: The mean length of acromion process was observed to be 45.05 mm in the present study. Our findings are very close to the findings of Mansur et al in Nepalese population according to which, mean length was 46.01mm.⁶ Coskun et al reported mean length to be 44.7 mm in Turkish population (Table 6).³

Maximum width of acromion process: The mean width of acromion process was observed to be 25.79 mm in the present study. Our findings are very close to the findings of Mansur et al in Nepalese population according to which, mean width was 26.93mm (Table 6).⁶

Anterior thickness of acromion process: The mean anterior thickness of acromion process was observed to be 7.12 mm in the present study. Our findings are close to the findings of Gosavi et al in Maharashtra population according to which, mean anterior thickness was 6.9 mm (Table 6).¹⁰

Coraco-acromial distance: The mean coraco-acromial distance was observed to be 37.96 mm in the present study. Our findings are close to the findings of Singh et al

in Rajasthani population according to which, mean coraco-acromial distance was 37.5 mm (Table 6).²

Acromio-glenoid distance: The mean acromio-glenoid distance was observed to be 29.86 mm in the present study. Our findings are very close to the findings of Mansur et al in Nepalese population according to which, mean acromio-glenoid distance was 31.9 mm (Table 6).⁶

CONCLUSION

In the present study on 100 scapulae, Type II (Curved) was found to be predominant. Statistically significant difference was noted in all the five parameters between males and females except Acromio-glenoid distance on right side. Though all the five parameters have higher values on right side in comparison to left side but the difference was statistically insignificant. The above data may not only help the orthopaedic surgeons during surgical repair around the shoulder joint but also may be of interest to the anthropologists when studying about the evolution of the bipedal gait. These findings might also be useful to forensic experts in determination of gender from these parameters.

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Conflict of interest: None declared

Ethical approval: Not required

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