

## MORPHOMETRIC STUDY OF THE ACROMION PROCESS OF SCAPULA AND ITS CLINICAL IMPORTANCE IN SOUTH INDIAN POPULATION

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### ABSTRACT

**Background:** Due to its many variations, scapula became one of the most interesting bones of human skeleton. The acromion process projects forwards almost perpendicularly from the lateral end of spine of scapula. The acromion process is associated with a variety of ailments in the shoulder joint. As morphometry of the Acromion process of the scapula is an important factor implicated in impingement syndrome of the shoulder joint, the purpose of present study is to record the morphometric values of the acromion process and its morphological features in South Indian population.

**Methodology:** One hundred and sixty-four dry adult scapulae of unknown age and sex belonging to South Indian population were studied. The acromial length, acromial width, acromio-coracoid distance and acromio-glenoid distance were measured using Vernier caliper and recorded in millimeters (mm). Different types of acromion process are also noted.

**Results:** The mean acromial length was  $42.47 \pm 4.68$  mm, the mean acromial width was  $26.57 \pm 3.28$  mm. The mean acromio-coracoid distance was  $34.05 \pm 4.94$  mm. The average acromio-glenoid distance was  $30.05 \pm 4.08$  mm. The three types of acromion were observed as type – I flat was seen in 37.1%, type II curved in 47.5% and type III hooked in 15.2%.

**Conclusion:** Knowledge of the morphometric data of acromion process may not only help the surgeons during surgical repair around the shoulder joint but also may be of interest to the anthropologists while studying the evolution of bipedal gait.

**KEY WORDS:** Acromion, Morphometry, Shoulder, Scapula.

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### INTRODUCTION

The scapula is a large, flat triangular bone which has three processes spine, acromion and coracoid process. The acromion process projects forwards almost at right angles from the lateral end of the spine of scapula. It articulates with lateral end of clavicle and is the origin of

deltoid and trapezius muscles. The anterior part of acromion process, coraco-acromial ligament and coracoid process forms an arch called coraco-acromial arch [1].

This arch is fairly a non- elastic structure and rotator cuff tendons, sub acromial bursa and biceps tendon will pass beneath this arch [2].

Any process acquired or congenital, that narrows the space available for these structures can cause mechanical impingement. The morphometry of acromion process is of clinical importance as it is commonly involved in impingement syndrome of shoulder joint. The predominant theory for the impingement syndrome classifies the contributing factors as anatomical and functional. The anatomical causes include the shape and inclination of the acromion [3]. The slope and length of the acromion and height of the arch are most closely associated with degenerative changes [4].

Bigliani et al. studied 140 shoulders and classified the acromial morphology into three types: type I or flat, type 2 or curved and type 3 or hooked. Since this time the Bigliani-Morrison-April morphological classification has been the diagnostic tool for the impingement syndrome and rotator cuff tears [5]. The knowledge regarding the shape and various distances of the acromion process might benefit the orthopedicians during surgical repair around the shoulder joint [6]. It is widely accepted that the rotator cuff lesions are noticed mainly in hooked acromion [7]. The aim of current study was to record the morphometric values and morphology of acromion process of scapula in South Indian population.

## MATERIALS AND METHODS

The present study was carried out on 164 dry, adult scapulae (90 right, 74 left) of unknown age and sex obtained from various medical colleges in and around Bangalore and Kerala. Bones with clear and intact features were used, while broken and damaged scapulae excluded from the study. Each scapula underwent a morphological evaluation and following parameters of acromion process were measured using Vernier caliper and recorded in millimeters (mm). Data was analyzed using SPSS software and mean values presented in tables. Descriptive statistics like percentage, mean and standard deviation were used to analyze the data obtained. An independent Student's t-test was used to compare quantitative variables. Statistical significance was set at 0.05.

**The maximum length of acromion process in mm:** the anteroposterior length of the acromion

in the longitudinal axis.

**The maximum breadth of acromion in mm:** the distance between the lateral and medial borders at the midpoint of the acromion process.

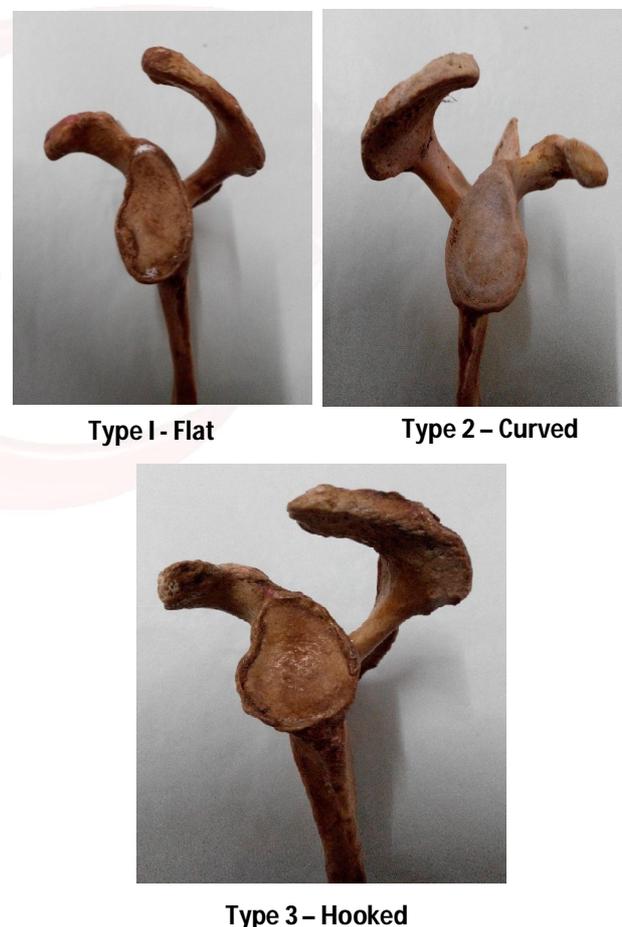
**The acromio-coracoid distance in mm:** the distance between tip of acromion process and tip of coracoid process.

**The acromio-glenoid distance in mm:** the distance between the tip of acromion process and surpaglenoid tubercle.

**Types of acromion according to Bigliani et al:** type 1 – flat, type 2 – curved, type 3 - hooked.

## RESULTS

**Fig. 1:** Showing the types of scapulae (a) Type I – Flat, (b) Type II – Curved (c) Type – III – Hooked.



In the present study, the mean values of acromion length were found to be 42.47 mm in total samples, 42.48 mm in right side and 42.46 mm in left side. The acromion width mean values were found as 26.57 mm in total sample, 26.68 mm in right side and 26.44 in left side. The average distance from tip of acromion process to the tip of coracoid process was found to be 34.05 mm in total sample, in right side

33.81mm and 34.34 in left side. The mean acromio-glenoid distance observed 30.05 in total sample, in right side 29.79 mm and 30.36 mm in left side. We examined the three types of acromion. Type – I flat was seen in 61 (37.1 %), type – II curved in 78 (47.5%) and type – III hooked in 25 (15.2%) of total samples. A summary of measurements regarding the acromion process of scapula were shown in following Tables – 1 to 4.

**Table 1:** Statistical measurements of the length of acromion process (n = 164).

Details of Measurements	Right	Left
Numbers	90	74
Range	33.7 – 53.2	32.5 – 55.7
Mean	42.48	42.46
Standard deviation (S.D)	4.33	5.09
p - value	0.97	
t - value	0.04	

**Table 2:** Statistical measurements of the breadth of acromion process (n = 164).

Details of Measurements	Right	Left
Numbers	90	74
Range	21.8 – 36.2	19.7 – 35.1
Mean	26.68	26.44
Standard deviation (S.D)	3.08	3.54
p - value	0.65	
t - value	0.45	

**Table 3:** Statistical measurements of the Acromio-cora-coid distance (n = 164).

Details of Measurements	Right	Left
Numbers	90	74
Range	26.4 – 48.1	26.3 – 51.2
Mean	33.81	34.34
Standard deviation (S.D)	4.65	5.3
p - value	0.5	
t - value	-0.68	

**Table 4:** Statistical measurements of the Acromio-glenoid distance (n = 164).

Details of Measurements	Right	Left
Numbers	90	74
Range	22.9 – 40.5	23.7 – 41.1
Mean	29.79	30.36
Standard deviation (S.D)	4.04	4.14
p - value	0.38	
t - value	-0.88	

## DISCUSSION

Various studies have been conducted on the morphology of acromion process of scapulae. The association between acromial morphology, shoulder impingement and rotator cuff tears has

been well documented [4-7]. We found the mean value of acromion length, acromion width as 42.47 mm and 26.57 mm respectively. Anetzberger and Putz observed mean acromial length as 47.00 mm [8].

In another study, Singh et al showed the mean values of acromion length and acromion width as 46.1 mm and 23.2 mm respectively, which is near to the values of present study. Similar studies done by Coskun et al had reported the acromion length as 44.7 mm and acromion width as 32.0 mm [9]. Sitha et al observed the same parameters as acromion length 40.1 mm and acromion width 23.9 mm respectively [10]. Paraskevas et al found the mean length and width of acromion process as 46.1 mm and 22.3 mm respectively. Mansur et al has observed that the length of acromion process of right scapulae mean value 46.46 mm and left side was 45.57 mm, which is higher than the values of present study. In our study the mean values of acromion width of right and left side were 26.68 mm and 26.44 mm respectively. The average value of acromion width of right scapulae was 26.63 mm and left scapulae was 27.23 mm as reported in the study of Mansur et al, which is very close to the present study.

The distance taken from tip of acromion to the tip of coracoid process, mean value found to be 34.05 mm in total sample and 33.81 mm right side as well as 34.34 in left side. Mansur et al [3] observed mean values of acromio-cora-coid distance on the right and left side as 39.03 mm and 39.39 mm respectively. Singh et al<sup>1</sup> in his study noted the mean value of acromio-cora-coid distance 37.5 mm in total sample and 37.1 mm in right side and 37.9 mm in left side. The present study data shows slightly lesser values compared to these previous studies. The mean values of acromio-glenoid distance were 30.05 mm in total samples, 29.79 mm in right side and 30.36 mm in left side. Mansur et al showed the mean values of acromio-glenoid distance was 31.83 mm in right side and 31.97 mm in left side, similarly Singh et al [1] showed the mean values of acromio-glenoid distance was 26.6 mm in right side and 27.6 mm in left side respectively. Edelson JG et al performed various measurements in 200 scapulae and concluded that the slope and length of the acromion and height

of the arch are most closely associated with degenerative changes [11].

According to the Bigliani et al [5] classification, three main types of acromial morphology have been described: type – I (flat); type – 2 (curved) and type – III (hooked). In the present study, type – I flat was seen in 37.1%, type II curved in 47.5% and type III hooked in 15.2%. Singh et al<sup>1</sup> in their study, the type – I flat was seen in 22.5%, type – II curved in 38.8% and type – III hooked in 38.8%. According to Coskun et al [9] type – I flat was seen 10%, type – II curved in 73% and type – III hooked in 17%. It is widely accepted that rotator cuff lesions are noticed mainly in type – III hooked acromion.

## CONCLUSION

The acromion process plays an important role in formation and provides stability to the shoulder joint. The purpose of the present study was to record the basic morphometric values of the acromion process in South Indian population sample. The morphometric data of acromion process and types of acromion may be helpful for the orthopedicians during surgical repair around the shoulder joint. The morphometric analysis of the acromion can be used like an auxiliary to promote a better knowledge about the disease that appears in the shoulder region.

**Conflicts of Interests: None**

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