Original Article

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A Morphometric Study of Acromion Process of Scapula in Telangana Region

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Abstract

Introduction: The anatomy of the acromion varies considerably from individual to individual, and certain acromial shapes have been associated with an impingement syndrome. Neer's theory of impingement was further boosted by Nicholson who stated that a higher incidence of rotator cuff tears was present in patients with Bigliani Type III acromion (Hook Type). *Objectives:* (1) To study the morphometric features of acromion process of scapula (Type, Tength, Tidth and Thickness). (2) To compare the morphology of acromion process and morphology of scapula with those of previous studies. *Materials and Methods:* The study includes 60 dry scapulae out of them, 30 are of right and 30 are of left side. Only bones with clear and intact features were used for the study while damaged scapulae were excluded. The bone belongs to mature specimens, but the exact ages and gender of the specimens were not known. Descriptive statistics and correlation were calculated using SPSS 20 version. *Results:* The mean length, width, and thickness of acromion process of scapulae were 41.4 mm, 24 mm and 8.2 mm respectively. We found Type I and Type II acromion process were more in the Telangana region i.e., 46.66% and 38.34 % respectively. The Type III acromion process were 15%. *Conclusion:* In the present study we found Type I and Type II acromion processes were more in number in the Telangana Region with a very low incidence of Type III acromion process.

Keywords: Neer's theory of impingement; Bigliani Type III acromion.

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Introduction

Abduction of the arm may pinch the supraspinatus muscle between the head of the humerus and the arch created by the acromion and the coracoacromial ligament. The anatomy of the acromion varies considerably from individual to individual, and certain acromial shapes have been associated with an impingement syndrome.[1] Rotator cuff impingement syndrome is a painful disorder which is thought to arise from repetitive compression or rubbing of the tendons (mainly supraspinatus) under the coracoacromial arch.[2]

Codman in 1931 was the first to note that many patients with inability to abduct the arm had incomplete or complete ruptures of the supraspinatus tendon, rather than primary bursal problems. In 1972, Neer described impingement syndrome. Neer also noted that the anterior third of the acromion and its anterior lip seemed to be the offending structure in most cases. Acromion morphology has been implicated as contributing to impingement. Bigliani, Morrison and April described three types of acromion morphology and noted an increase in rotator cuff tears with Type III or hooked acromions. In a cadaver study of 140 shoulders, one third had full-thickness tears of the rotator cuff, 73% of which were in shoulders with Type III acromions.

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Neer describes the impingement into intrinsic and extrinsic types. The intrinsic impingement includes the thickening of the rotator cuff, calcium deposits within the rotator cuff, and the thickening of the subacromial bursa. The extrinsic impingement occurs when the space available for the rotator cuff is diminished; examples include subacromial spurring, acromial fracture or pathological osacrominale, osteophytes off the undersurface of the acromioclavicular joint, and exostoses at the greater tuberosity. Other investigators have suggested that the acromion shape and the coracoacromial ligament are not the primary problems. Codmon, Ozaki *et al.*, Sarkar and Uhthoff, and Ogata and Uhthoff suggested that intrinsic rotator cuff degeneration is the primary cause with subacromial changes occurring secondarily. Based on the observations by Neer, Bigliani *et al.,* and others, the recommended treatment for impingement syndrome has been anterior acromioplasty to remove the offending structure.[3]

Neer's theory of impingement was further boosted by Nicholson who stated that a higher incidence of rotator cuff tears was present in patients with Bigliani Type III acromion (Hook Type). Recently, Wang *et al.* concluded that patients with Bigliani Type II and III acromion are poor responders for conservative treatment.[4]

Objectives

1. To study morphometric features of the acromion process of scapula (type, length, width and thickness).
2. To study morphometric features of scapula (length and width).
3. To measure Acromio-glenoid and Acromio-coracoid distance.
4. To compare the morphology of acromion process and morphology of scapula with those of previous studies.

Materials and Methods

The study was performed at the department of Anatomy, Kamineni Institute of medical sciences, Narketpally, state Telangana (India).

The study includes 60 dry scapulae out of them, 30 are of right and 30 are of left side. Only bones with clear and intact features were used for the study while damaged scapulae were excluded. The bone belongs to mature specimens, but the exact ages and gender of the specimens were not known. We measured the length, width and thickness of the acromion process of scapula, length and width of the scapula, Acromio-glenoid and Acromio-coracoid distance. The mean of these parameters was found out and correlated.

The measurements are done by using vernier caliper. Ethical approval was taken for the research study from ethical committee of the institution. Descriptive statistics (mean ± SD) and correlation were calculated using SPSS 20 version. The morphometric values of the sides were analyzed using an unpaired *t*-test. Statistical significance was set $p \leq 0.05$.

The scapular parameters:

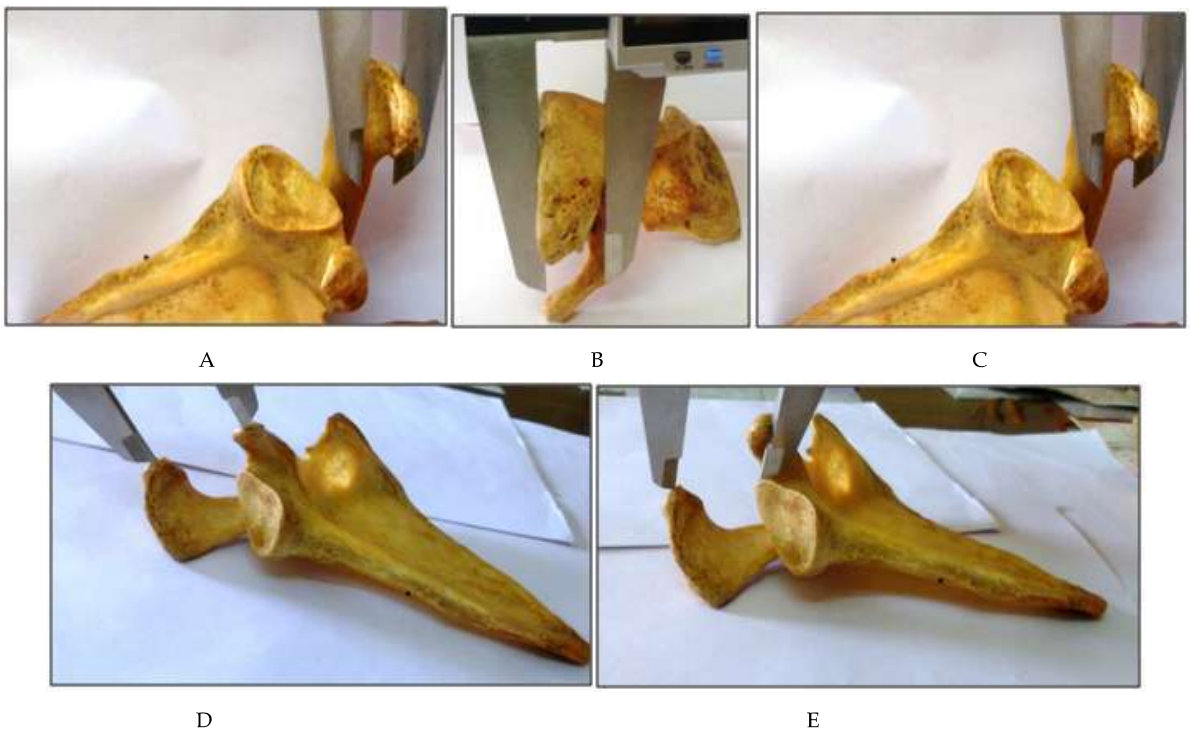
- *Maximum length*: is the maximum longitudinal diameter between the superomedial and inferior angle.
- *Maximum width*: is the maximum transverse diameter between the medial border of the scapula, where the spine meets the body of the scapula and the anterior lip of the glenoid (shown in **Figs. 1A and B**).

A B

Figs. 1A: L-Maximum length of scapula B. W-Maximum width of scapula

The acromion parameters:

- *Maximum length*: is the distance between tip and midpoint of posterior border of acromion process.
- *Maximum breadth*: is the distance between the lateral and medial borders at the midpoint of the acromion process.
- *Thickness*: is 1 *cm* behind the anterior border and 1 *cm* medial to the lateral border.
- *The Acromio-coracoid distance*: is the distance between both tips of acromion and coracoid processes.
- *The Acromio-glenoid distance*: is the distance between tip of acromion process and supraglenoid tubercle. **Figs. 2A to E** are given bellow:



A B C D E

Figs. 2A. Length of the Acromion process **B.** Width of the Acromion process **C.** Thickness of the Acromion process D. Acromio-coracoid distance **E.** Acromio-glenoid distance

The acromial type was classified according to Bigliani *et al.* (1986). Type I represents a flat, Type II a curved, and Type III a hooked undersurface of the acromion process of the scapula.[5] (Shown in **Fig. 3A to C**).

The descriptive statistics (Mean ± SD) and correlation were calculated using SPSS 20 version. The morphometric values of the sides were analyzed using an unpaired t-test.

A B C

Figs. 3A to C:

Results

In the present study we found the mean value of length of scapulae was 134.5 *mm* while it was 133 *mm* in right side and 136 *mm* in left side scapulae. The mean value of the width of scapulae was 98.8 *mm* whereas it was 99.6 *mm* in right side and 98 *mm* in left side scapulae. A summary of measurements regarding scapula and acromion process were shown in **Table 1 and 2**.

The mean length, width, and thickness of acromion process of scapulae were 41.4 *mm*, 24 *mm* and 8.2 *mm* respectively. The mean length, width, and thickness of acromion process of right side scapulae were 41.5 *mm*, 24.3 *mm* and 8.5 *mm* respectively. The mean length, width, and thickness of acromion process of left side scapulae were 41.4 *mm*, 23.6 *mm* and 7.9 *mm* respectively.

Table 2 shows; The length of the scapula is in positive correlation with the length of acromion process of scapula and it is significant. The width of the scapula is in positive correlation with the width of acromion process of scapula and it is significant.

The mean Acromio-coracoid distance and Acromio-glenoid distance were 36.5 *mm* and 27.2 *mm*. **Table 2 shows**; Acromio-coracoid distance and Acromio-glenoid distance is in positive correlation and are significant.

Table 1: Descriptive statistics of various parameters of scapulae

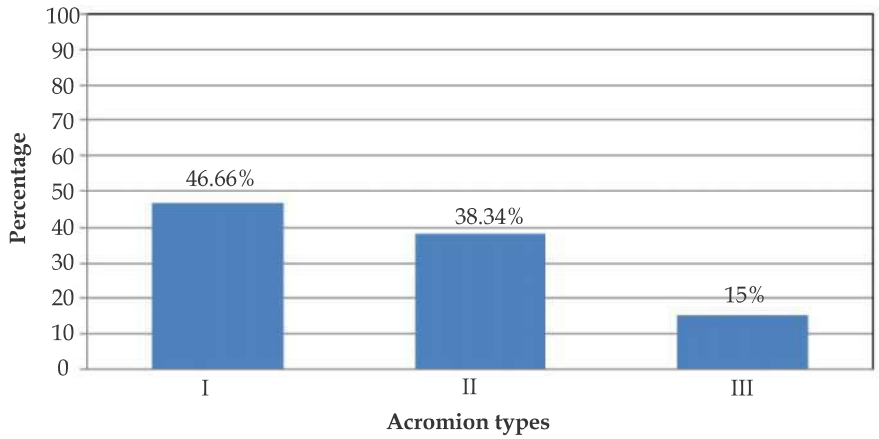
Parameters	Mean ± S.D Right Scapula (*mm*)	Mean ± S.D Left Scapula (*mm*)
Length of Scapula	133.0 ± 10.6	136.0 ± 10.1
Width of Scapula	99.6 ± 7.2	98.0 ± 8.1
Length of Acromion process	41.5 ± 3.6	41.4 ± 5.1
Width of Acromion process	24.3 ± 3.2	23.6 ± 3.1
Thickness of Acromion Process	8.5 ± 1.4	7.9 ± 1.0
Acromio-coracoid distance	37.8 ± 6.2	35.1 ± 2.9
Acromio-glenoid distance	28.2 ± 4.7	26.1 ± 3.8

Table 2: Correlation between various parameters of scapulae

Parameters	Mean ± S.D	*r* value	*p* value
Length of Scapula	134.5 ± 10.4	0.652**	0.000*
Length of Acromion process	41.4 ± 4.4		
Width of Scapula	98.8 ± 7.6	0.450**	0.000*
Width of Acromion process	24.0 ± 3.1		
Acromio-coracoid distance	36.5 ± 5.0	0.564**	0.000*
Acromio-glenoid distance	27.2 ± 4.3		

* *p* value is significant at ≤ 0.05.

**Correlation is significant at the 0.01 level (2-tailed).



Graph 1: Showing percentage of Types of Acromion process of Scapula

We found Type I and Type II acromion process are more in the Telangana region *i.e.*, 46.66% and 38.34 % respectively. This study shows Type I, Type II and Type III acromion process were 46.66%, 38.34%, and 15% respectively (**Graph 1**).

Discussion

We found the mean value of scapular length as 134.5 *mm* whereas Chandani Gupta *et al.* reported this mean as 139.3 *mm*, in another study by VVael Amin *et al.* in egyptian population found it as 151.16 *mm*. The mean value of scapular length is more in egyptian population, that may be due to population variation. G Paraskevas *et al.*, Jaskaran Singh *et al.* found the mean scapular length as 147.6 *mm* and 145.1 *mm* respectively.

The mean value of scapular width was found 98.8 *mm* in total scapulae, whereas Chandni Gupta *et al.*, G Paraskevas *et al.*, Jaskaran Singh *et al.* and VVael Amin *et al.* found this value as 101.4 *mm*, 101.9 *mm*, 105.5 *mm* and 107.22 *mm* respectively (**Table 3**).

In present study the mean value of length of the acromion process of right scapulae was 41.5 *mm* and left scapulae was 41.4 *mm*. So the length of the acromion process in right scapulae and left scapulae is nearly same. But Jaskaran Singh *et al.* found that the right acromion process was longer than left by 0.80 which was also found to be insignificant. We found the mean value of the length of acromion process as 41.4 *mm* while Chandni Gupta *et al.*, Jaskaran Singh *et al.*, G Paraskevas *et al.*, and VVael Amin *et al.* observed it as 42.1 *mm*, 46.1 *mm*, 46.1 *mm*, and 52.33 *mm* respectively.

The mean value of the width of acromion process in present study is 24 *mm*. Chandni Gupta *et al.* also found mean value of the width of acromion process as 24.2 *mm*. So this mean value of the width of acromion process in present study is nearly similar as found by Chandni Gupta *et al.*, G Paraskevas *et al.*, Jaskaran Singh *et al.* and VVael Amin *et al.* observed the mean value of width of acromion process as 22.3 *mm*, 23.2 *mm* and 32.09 *mm* respectively (**Table 3**).

Table 3: Morphometric parameters of scapula and acromion process observed by different authors

Sl. no.	Study	Parameters in *mm*						
		Length of scapula	Width of scapula	Length of acromion process	Width of acromion process	Thickness of acromion process	Acromio-coracoid distance	Acromio-glenoid distance
1	G Paraskevas[6] 2008 (Greek)	147.6	101.9	46.1	22.3	8.8	28.1	17.7
2	Jaskaran Singh[7] Sept. 2013 (India)	145.1	105.5	46.1	23.2	6.60	37.5	27
3	Chandni Gupta[8] Sept. 2014 (India)	139.3	101.4	42.1	24.2	7.3	30.9	24.7
4	Vvael Amin[9] Aug. 2015 (Egypt)	151.16	107.22	52.33	32.09	9.11	31.10	27.11
5	Present Study (India)	134.5	98.8	41.4	24	8.2	36.5	27.2

Chandni Gupta *et al.* found the mean value of the thickness of acromion process as 7.3 *mm* in right side scapula and 7.4 *mm* in left side scapula. In the present study the mean value of thickness of acromion process is 8.5 *mm* in right side scapula and 7.9 *mm* in left side scapula. Jaskaran Singh *et al.* found the mean value of the thickness of acromion process as 6.6 *mm* in right side scapula and 6.7 *mm* in left side scapula.

Jaskaran Singh *et al*, VVael Amin *et al.* found the acromio-coracoid distance on the right and left side scapulae as 37.1 *mm*, and 37.9 and 31.1 and 31.58 *mm* respectively. Chandni Gupta *et al* found the mean value of acromio-coracoid distance on the right and left side scapulae as 31.8 *mm* and 30.3 *mm* respectively. In the present study the mean value of acromio-coracoid distance was observed as 37.8 *mm* and 35.1 *mm* in right and left side scapulae respectively (**Table 3**).

Jaskaran Singh *et al*, VVael Amin *et al* found the mean value of acromio-glenoid distance on the right and left side scapulae as 26.6 *mm* and 27.6 *mm* and 27.11 *mm* and 27.67 *mm* respectively. In the present study the mean value of acromio-glenoid distance was observed as 28.2 *mm* and 26.1 *mm* in right and left side scapulae respectively. Chandni Gupta *et al. found* the mean value of acromio-glenoid distance

in the right and left scapulae as 25.3 *mm* and 24.3 *mm* respectively (**Table 3**).

Jaskaran Singh *et al.* examined the three Types of acromion. Type I (flat) was seen in 22.5%, Type II (curved) in 38.8%, and Type III (hooked) in 38.8% of total samples. Chandni Gupta *et al.* found the distribution of acromial type as Type I - 32 %, Type II - 22 %, and Type III - 46%. Shilpa Gosavi *et al.* found the distribution of acromial Type as Type I - 13.3 %, Type II - 81.88 %, and Type III - 4.7 %.[10] VVael Amin *et al.* found the distribution of acromial type as Type I - 26.88%, Type II - 45.62%, and Type III - 15%. G Paraskevas *et al.* found the distribution of acromial type as Type I - 26.1%, Type II - 55.6%, and Type III - 18.1%.Schippinger G *et al.* investigated anatomy of acromion using MRI and they found the distribution of acromial Type as Type I - 67.7 %, Type II - 32.3 and Type III acromion were not found.[11] In the present study high incidence of acromial Type I - 46.66%, followed by Type II - 38.34%, and very low incidence of acromial Type III - 15% was observed (**Table 4**).

In the present study high incidence of acromial Type I - 46.66%, followed by Type II - 38.34%, and very low incidence of acromial Type III - 15% was observed.

Table 4: Types of acromion processes found by different authors

Sl. no.	Study	Types of Acromion Process		
		I	II	III
1	G Paraskevas[6] 2008 (Greek)	26.1	55.6	18.1
2	Jaskaran Singh[7] Sept 2013 (India)	22.5	38.8	38.8
3	Chandni gupta[8] Sept 2014 India)	32	22	46
4	Vvael Amin[9] Aug 2015 (Egypt)	26.88	45.62	15
5	Present Study (India)	46.66	38.34	15

Conclusion

In the present study we found Type I and Type II acromion processes were more in number in the Telangana region with a very low incidence of Type III acromion process. The length and width of scapula were in positive correlation with the length and width of acromion process of scapula. Acromio-coracoid distance and Acromio-glenoid distance was also in the positive correlation. This data on various distances of acromion process may be helpful to the orthopaedicians during surgical repair around the shoulder joint. The morphometric analysis of the acromion process may be used like an auxiliary to promote a better knowledge about the diseases that appear in the Telangana region.

Conflicts of interest: None

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