



## Morphometric Study of Acromion Process of Adult Human Scapula

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### ABSTRACT

The study was conducted on sixty adult scapulae obtained from the department of Anatomy GMC Jammu. Morphometry of acromion process was done and compared on right and left side. Dimensions of acromion process are of importance to orthopedicians during surgical repair i.e. acromioplasty and to anthropologists to study evolution of acromia and bipedal gait.

**KEYWORDS :** Scapula, acromion process, acromioplasty, subimpingement syndrome.

### INTRODUCTION:

Acromioplasty is an arthroscopic surgical procedure in which undersurface of acromion process is shaved to provide enough space so that rotator cuff tendons may not pinch and pain of impingement is relieved. It is often seen in aging adults. Anatomical considerations of acromion process are crucial for understanding its specific abnormalities such as rotator cuff injuries, impingement syndrome etc. It has been determined that using a multivariate discriminant analysis the maximum distance between acromio-coracoid process, length of coracoid process and length of glenoid cavity, it is possible to determine sex with 95% accuracy<sup>1</sup>. Morphometry of acromion process is an important factor implicated in impingement syndrome of shoulder joint<sup>2</sup>. It occurs when increased pressure within a confined anatomical space deleteriously affects enclosed tissues. Dimensions of acromion process and minimum distance between its inferior surface and superior rim of glenoid cavity were particularly important in acromioplasty in arthroscopic subacromial decompression and acromioclavicular arthritis<sup>3</sup>. Dimensions of spine along with acromion process are long enough to support screw pin or wire for fracture stabilization of acromioclavicular joint<sup>4</sup>.

### MATERIAL AND METHOD:

Sixty adult scapulae of unknown sex were taken from department of anatomy GMC Jammu. Dry adult scapulae of either sex, taken for study were free from physical deformity or abrasion and were complete in all aspects i.e. upper & lower end were intact. Scapulae were labelled from 1-60 with suffix R for Right and L for Left.

Morphometry of acromion process was done by taking measurements with help of vernier caliper:

1. Maximum length
2. Maximum breadth
3. Acromio coracoid distance.
4. Acromio glenoid distance.
5. Acromion thickness.

### OBSERVATION:

**TABLE NO :1 SHOWING MORPHOMETRIC MEASUREMENTS OF LEFT SIDED SCAPULAE**

S. No	Max. Length	Max. Breadth	Acromio-Coracoid distance	Acromio-Glenoid distance	Acromial thickness
1	4.60	2.60	2.50	1.60	0.35
2	5.00	2.40	3.30	2.00	0.35
3	4.80	2.50	3.20	2.20	0.40
4	4.90	2.60	3.00	2.00	0.35

5	4.70	3.40	3.20	2.40	0.45
6	5.00	2.80	3.20	1.80	0.40
7	4.70	3.40	3.00	2.40	0.45
8	4.00	2.30	2.50	1.80	0.25
9	4.20	2.50	2.70	1.60	0.25
10	4.60	2.60	2.50	2.50	0.25
11	5.00	2.30	3.00	2.40	0.35
12	4.90	2.60	3.00	2.50	0.40
13	5.10	2.40	3.00	2.30	0.25
14	4.70	2.20	3.20	2.20	0.25
15	3.60	2.20	2.50	2.00	0.30
16	4.20	2.70	2.50	2.20	0.40
17	3.70	2.00	2.50	2.10	0.30
18	5.00	2.40	3.30	2.00	0.35
19	4.70	3.40	3.20	1.80	0.45
20	4.10	2.10	2.00	1.60	0.20
21	3.70	2.40	2.50	1.50	0.25
22	4.00	2.40	3.00	1.80	0.35
23	5.60	2.80	2.40	2.20	0.35
24	4.20	2.20	2.50	2.00	0.30
25	3.60	1.50	2.00	2.50	0.30
26	4.70	2.70	3.20	2.00	0.40
27	4.50	2.50	2.20	1.80	0.35
28	4.20	2.50	2.40	1.80	0.40
29	4.00	2.30	2.00	2.00	0.25
30	4.50	2.50	2.20	2.00	0.30
MEAN	4.48	2.51	2.72	2.03	0.33
SD	0.504	0.397	0.424	0.289	0.070
RANGE	3.6 - 5.6	1.5 - 3.4	2 - 3.3	1.5 - 2.5	0.2 - 0.45

**TABLE NO. 2 SHOWING MORPHOMETRIC MEASUREMENTS OF RIGHT SIDED SCAPULAE**

S. No	Max. Length	Max. Breadth	Acromio-Coracoid distance	Acromio-Glenoid distance	Acromial thickness
31	4.80	2.60	3.40	2.50	0.30
32	5.00	3.20	3.50	2.50	0.45
33	3.80	2.20	2.50	1.50	0.15
34	3.80	2.00	2.00	1.50	0.20
35	5.00	2.20	3.00	2.60	0.40
36	5.00	3.00	2.60	2.40	0.40
37	3.80	2.30	3.20	2.10	0.35
38	4.30	2.50	2.60	2.40	0.30
39	4.90	3.00	3.00	2.50	0.35

40	4.80	2.50	3.00	2.00	0.30
41	4.30	2.40	2.30	1.50	0.35
42	4.70	2.80	3.20	2.10	0.40
43	5.00	3.00	3.00	2.20	0.40
44	5.00	3.00	3.50	2.10	0.40
45	4.50	2.50	3.00	1.50	0.30
46	5.00	3.00	3.00	2.40	0.40
47	4.50	2.50	2.60	1.80	0.30
48	3.80	2.20	3.20	2.10	0.25
49	4.20	2.50	2.00	1.50	0.35
50	5.10	3.20	3.00	2.00	0.35
51	5.20	3.00	3.20	2.00	0.40
52	3.80	2.00	2.00	1.50	0.20
53	5.60	3.00	3.20	2.50	0.45
54	4.60	2.40	2.00	1.80	0.30
55	5.00	2.20	2.60	2.00	0.40
56	5.00	2.00	2.00	2.00	0.40
57	4.20	2.60	2.30	1.70	0.25
58	5.00	3.40	3.00	2.00	0.40
59	5.10	3.20	3.00	2.50	0.40
60	5.00	2.60	2.80	2.00	0.35
MEAN	4.66	2.63	2.79	2.04	0.34
SD	0.500	0.406	0.471	0.362	0.076
RANGE	3.8 - 5.6	2 - 3.4	2 - 3.5	1.5 - 2.6	0.15 - 0.45

Five measurements were taken-

1. Maximum length of acromion process:

It was measured with help of vernier caliper (Fig: 1). Mean, range and standard deviation was calculated in centimeters both on right and left side. Mean on right 4.66cm (Range 3.8-5.6cm). Mean on left 4.45cm (Range 3.6-5.6 cm). The standard deviation on right side was 0.50 and on left side was 0.53 (Table no.1 and 2)

2. Maximum breadth of acromion process:

It was measured with help of vernier caliper (Fig:1). Mean, range and standard deviation was calculated in centimeters both on right and left side. Mean on right 2.63cm Range 2-3.4cm. Mean on left 2.5cm with range 1.5-3.4 cm. The standard deviation on right side was 0.41 and on left side was 0.4 (Table no.1 and 2).

3. Acromio-coracoid distance:

It was measured with help of vernier caliper (FIG:2). Mean, range and standard deviation was calculated in centimeters both on right and left side. Mean on right 2.79 cm Range 2-3.5cm. Mean on left 2.73cm with range 2-3.3cm. The standard deviation on right side was 0.46 and on left side was 0.41 (Table no.1 and 2).

4. Acromio-glenoid distance:

It was measured with the help of vernier caliper (Fig:2). Mean, range and standard deviation was calculated in centimeters both on right and left side. Mean on right 2.04 cm Range 1.5-2.6 cm. Mean on left 2.03cm with range 1.5-2.5cm. The standard deviation on right side was 0.3 and on left side was 0.2 (Table no.1 and 2).

5. Thickness of acromion process:

It was measured with help of vernier caliper (Fig:1). Mean, range and standard deviation was calculated in centimeters both on right and left side. Mean on right 0.70 cm. Range 0.5-1cm. Mean on left 0.66 cm with range 0.3-1cm. The standard deviation on right side was 0.15 and on left side was 0.16 (Table no.1 and 2).

**DISCUSSION:** The present study has been undertaken on a series of 60 adult human scapula (R:L=30:30) obtained from the Department of Anatomy, Government Medical College, Jammu. The shape of the acromion process and its various morphometric parameters were taken and statistical indices worked out. Acromial shape and dimensions are of importance during surgical repair to orthopaedicians and to anthropologists to study evolution of acromia and bipedal gait.

**1. Maximum length:**

The mean maximum length of acromion process was found to be 4.56±0.51 cm (range 3.6 -5.6 cm) with mean of 4.66±0.50 cm range=3.8-5.6 cm on right side; and 4.45±0.529 cm as mean, range= 3.6-5.6 cm on left side. Values of study conducted by Von Schroeder et al., (2001)<sup>5</sup> are slightly higher than present study. Results of Gallino et al., (1998)<sup>6</sup> study are less than that of present study. Results of Burke (2008)<sup>7</sup> are slightly higher than present study. Mansur et al., (2012)<sup>8</sup> also conducted a study on acromion process of Nepalese population. Average mean and standard deviation of length of acromion process on right side scapulae were 4.64± 0.5 cm while as that on left side was 4.55±0.5 cm. The range was found to be 3.6-5.4 cm on right side and 3.1 -5.9 cm on left side.

**Table no:3 Showing comparison of Maximum length of acromion process**

Authors	Race	Mean (cm)	Range (cm)	SD (cm)
Von Schroeder et.al <sup>5</sup>	Canadian	4.8	3.8-5.7	-
Gallino et al <sup>6</sup>	Egyptian	4.15	2.6-5.6	-
Burke <sup>7</sup>	(Ohio)	4.7	3.3- 7.2	0.61
Nicholson et al <sup>8</sup>	American	4.45	-	-
Piyawinijwong et.al <sup>9</sup>	Thai	4.41	3.4-5.6	0.47
Coskun <sup>10</sup>	Turkish	4.47	3.5-5-5	0.51
Present study	North Indian	4.56	3.6-5.6	0.51

Results of present study are corresponding more towards the study conducted by Nicholson et al., (1996)<sup>8</sup>, Piyawinijwong (2004)<sup>9</sup> and Coskun et al., (2006)<sup>10</sup> (Table no. 3).

**1. Maximum Breadth:**

The mean maximum breadth of acromion process was found to be 2.57±0.40 cm (range= 1.5-3.4 cm) with mean of 2.63±0.40 cm ( range = 2-3.4 cm) on right side; and 2.50±0.40 cm as mean ( range = 1.5-3.4 cm) on left side. In 2012 Mansur et al<sup>2</sup>, conducted study on acromion process and found that average breadth on right side scapulae and left side scapulae were 2.66±0.35 S.D and 2.72±0.30 S.D, with the range of 2.1 to 3.7 cm on right side and 2.2 – 3.4 on left side.

**Table no: 4 Showing comparison of Maximum breadth of Acromion process.**

Authors	Race	Mean (cm)	Range (cm)	SD (cm)
Von Schroeder et.al <sup>5</sup>	Canadian	2.19	1.5 - 2.7	-
Nicholson et al <sup>8</sup>	American	1.89	-	-
Piyawinijwong et.al <sup>9</sup>	Thai	2.5	1.69 - 3.42	0.37
Paraskevas et al <sup>11</sup>	Greek	2.23	1.9-2.8	-
Present study	North Indian	2.57	1.5-3.4	0.40

Results of Von Schroeder et al.,(2001)<sup>5</sup>, Nicholson et al.,( 1996)<sup>8</sup> and Paraskevas et al., (2008)<sup>11</sup> are less than present study . Results of present study are in concinnity with those of Piyawinijwong et al., (2004)<sup>9</sup> (Table no. 4).

**3. Acromio – coracoid distance:**

The dimension of acromio-coracoid distance provides useful information for portal placement for shoulder arthroscopy and acromioplasty.

**Table no: 5 Showing comparison of Acromio – coracoid distance**

Authors	Race	Mean (cm)	Range (cm)	SD (cm)
Von Schroeder et.al <sup>5</sup>	Canadian	2.7	-	0.5
Gallino et al <sup>6</sup>	Egyptian	2.7	1.2 - 4.1	-
Burke <sup>7</sup>	(Ohio)	7.49	5.5 – 9.9	0.73
Piyawinijwong et.al <sup>9</sup>	Thai	3.11	1.9- 3.8	0.41
Coskun <sup>10</sup>	Turkish	1.78	1.1 – 2.54	0.13
Present study	North Indian	2.76	2-3.5	0.44

The mean acromio coracoid distance was found to be  $2.76 \pm 0.44$ cm, (range =2-3.5cm) , with mean of  $2.79 \pm 0.47$  cm( range=2-3.5cm) on right side; and  $2.73 \pm 0.41$ cm as mean( range = 2-3.3 cm) on left side. Various studies done on same parameter were conducted by Gallino et al.,(1998)<sup>6</sup>, Von Schroeder et al.,(2001)<sup>5</sup>, Piyawinijwong et al.,(2004)<sup>9</sup>, Coskun et al.,(2006)<sup>10</sup> and Burke (2008)<sup>7</sup>. Results of Piyawinijwong et al.,(2004)<sup>9</sup> and Burke (2008)<sup>7</sup> are higher than present study while as results of Coskun et al.,(2006)<sup>10</sup> are on lower side. Results of present study correspond with that of Gallino et al.,(1998)<sup>6</sup> and Von Schroeder et al.,(2001)<sup>5</sup>(Table no.5).

**4) Acromio – glenoid distance:**

The dimensions of acromio-glenoid distance are important in acromioplasty in arthroscopic subacromial decompression or acromioclavicular arthritis.

**Table no: 6 Showing comparison of Acromio – glenoid distance**

Authors	Race	Mean (cm)	Range (cm)	SD (cm)
Von Schroeder et.al <sup>5</sup>	Canadian	1.6	1.3-1.9	0.2
Piyawinijwong et.al <sup>9</sup>	Thai	1.87	1.17-2.68	0.28
Paraskevas et al <sup>11</sup>	Greek	1.77	1.3-2	-
Present study	North Indian	2.04	1.5-2.6	0.326

The mean distance of Acromio – glenoid was found to be  $2.04 \pm$  cm, range 1.5-2.6, S.D = $0.326$ cm; with  $2.04 \pm$  cm range 1.5-2.6 and SD  $0.362$ cm on right side; and  $2.03 \pm$  as mean, range = 1.5-2.5 and SD= $0.289$ cm on left side. Results of present study are slightly higher than that of studies conducted by Von Schroeder et al.,(2001)<sup>5</sup>, Piyawinijwong et al.,( 2004)<sup>9</sup> and Paraskevas et al., (2008)<sup>11</sup>. The acromio glenoid distance was also measured by Mansur et al., (2012)<sup>2</sup> and mean of  $3.18 \pm 0.36$  and  $3.19 \pm 0.39$  cm on right and left side respectively. With range of 2.4- 4.2cm on right side .and 2.6-4.4 cm on left side (Table no. 6)

**5) Acromial thickness**

The mean acromial thickness was found to be  $0.34 \pm 0.073$  cm, (range = 0.15-0.45 cm) with mean of  $0.34 \pm 0.076$  cm (range 0.15-0.45cm) on right side; and  $0.33 \pm 0.070$ cm as mean (range = 0.2 to 0.45cm) on left side.

**Table no: 7 Showing comparison of Acromial Thickness**

Authors	Race	Mean (cm)	Range (cm)	SD (cm)
Von Schroeder et.al	Canadian	0.94	0.8-1.2	-
Gallino et al	Egyptian	0.69	0.3-1.6	-
Nicholson et al	American	0.72	-	-
Piyawinijwong et.al	Thai	0.72	0.36-1.19	0.15
Paraskevas	Greek	0.88	0.7-1.1	-
Present study	North Indian	0.34	0.15-0.45	0.073

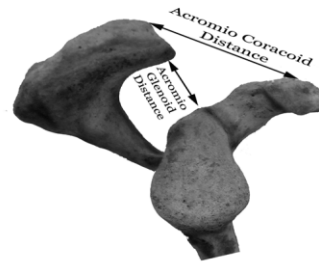
Nicholson et al.,(1996)<sup>8</sup>, Gallino et al.,(1998)<sup>6</sup>, Von Schroeder et al.,(2001)<sup>5</sup>, Piyawinijwong et al.,(2004)<sup>9</sup>, and Paraskevas et al.,( 2008)<sup>11</sup> also measured the same parameter. Results of present study are less than that of previous studies (Table no. 7)

**SUMMARY:** The morphometric analysis of the acromion process should be used like an auxiliary to promote a better knowledge about the disease, that appears in this area and are vital for planning and executing acromioplasty.



**FIG: 1 SHOWING LENGTH, BREADTH AND THICKNESS OF THE**

**ACROMION PROCESS.**



**FIG. 2 SHOWNIG ACROMIO – CORACOID AND ACROMIO-GLENOIDDISTANCE.**

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