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Study of acromion process: Central Indian population

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Abstract
The purpose of the present study was to record the various parameters of Acromion process. Length, Breadth, Thickness of Acromion process along with this Acromio coracoid distance, Acromio glenoid distance, Coraco glenoid distance and Height of Coracoacromial arch were measured by manual vernier calliper on 90 dried scapulae in the Department of Anatomy, LN Medical college and Research Centre, Bhopal, India. According to Bigliani *et al.*, acromial process was classified into three types: type I or flat, type II or convex and type III or hooked type. In the present study Type 2 is the most common then Type 1followed by Type 3. The result of the present study will be of paramount importance to orthopaedic surgeons, radiologist, anthropologists and anatomist.

Keywords: acromion, shoulder, impingement syndrome, scapulae

1. Introduction
For impingement syndrome and Rotator cuff, acromioplasty is still the standard operative treatment and there has been a substantial increase in its incidence [1]. Based on clinical evaluation of the patient, acromioplasty is indicated which is further supported by changes which occur in the morphology of acromial process on standard radiographs [2].
Scapula consist of glenoid cavity, coracoid process and acromion process in its lateral end. Acromion process is flat and elongated which arises from the spine of scapula. Coracoacromial arch begins from coracoid process to anterior third of the acromion processs including coracoacromial ligament. Below this arch a wide subacromial space of 1 to 1.5 cm is present which contains subacromial bursa, rotator cuff and the tendon of the long head of the biceps muscle which passes through bicipital groove [3].
According to Bigliani *et al.*, they classified acromial process into three types: type I or flat, type II or convex and type III or hooked type. Bigliani-Morrison-April morphological classification has been the dominant diagnostic tool for the impingement syndrome and rotatorcuff tears [4].
Natsis *et al.* 2007, conducted a cadaveric study by visual inspection on 423 dried scapulae & demonstrated a fourth type of acromion process which was present in only 2.6% [5].
Though acromion process plays important role in the formation, stability and surgical interventions to the shoulder joint so, various dimensions of acromion process are also important factors which can be taken into consideration for acromioplasty, a surgical procedure used for treatment of rotator cuff impingement syndrome [3].
There is paucity of clinical data available on morphometric parameters of acromion processes in Indian population which can be correlated with various pathologies of shoulder.
Thus, the present study was conducted on dry scapulae to collect the morphological data of acromion process in Central Indian population and to compare it with other studies.

2. Material and methods
The material of the present study consist of 90 dry human scapulae of unknown age and sex in the Department of Anatomy, LN Medical college & Research centre, Bhopal, India from March ‘2018 to June ‘2018. Out of which 45 belongs to right side and 45 belongs to left side. Scapulae which were in good condition and had intact acromion and coracoid process were included in the study where as broken and fragmented scapulae were excluded from the study. Ethical clearance was given by the Institunal Ethics Committee (IEC). After that measurements were taken by using sliding manual vernier calliper in millimetres.
The following parameters related to acromion process were measured-
Length: Distance between the tips of acromion process to the midpoint of posterior border of acromion process.
Breadth: Distance between the midpoint of the anteromedial border and postero lateral border of acromion process.
Thickness: Distance between superior and inferior surface at the midpoints of amidpoints of anteromedial and posterolateral borders.
Coracoacromial Distance: Distance between the tips of corocoid process to tip of acromion process.
Acromioglenoidal Distance: Distance between the tips of acromion process to supraglenoid tubercle.
Coracoglenoid Distance: Distance between the tips of coracoid process to supraglenoid tubercle.
Height of Coracoacromial Arch: Distance between supra glenoid tubercle to a line joining the tip of acromion process to the tip of corocoid process.

2.1 Statistical analysis
All data obtained were analysed using the Microsoft excel and

Epi Info (Version 7 Software). Statistical significance was accepted when p-value is ≤ 0.05.

3. Result

Table 1: Type of the acromion process of scapula.

TYPE	Curvature	Right	%	Left	%	Both	%
Type 1	Flat	10	22.22	12	26.66	22	24.40
Type 2	Curved	27	60.00	26	57.77	53	58.82
Type 3	Hooked	08	17.77	07	15.00	16	22.85
Total	90	45	100	45	100	45	100

After the classification of acromion process as Type 1,2 and 3, it was analysed that curved type of acromion process are found to be most common on right side and left side i.e 27 in right scapulae (60%) and 26 in left scapulae (57.77%). The least common is Hooked type of acromion process 8 on right side (17.77%) and 7 on left side (15.00%). While in the middle range, it is the Flat type of acromion process found10 on right side (22.22%) and 12 on left side (26.66%). When we compare it overall, Type 1 is the most common and Type 3 is the least common type. The mean length of the acromion process on the right side was 47.44 ± 3.92, range 40 mm to 51 mm and on left side it was 45.86 ± 1.92 ranging from 43mm to 49 mm. It was found to larger on right side by 1.54 mm. While comparing the breadth of the acromion process it was found to be larger again on right side by 1.74 mm. Mean and range of breadth on right side was found to be 26.80 ± 2.21 mm and 24 mm to 30 mm while on left side it was 25.06 ± 3.41, ranging from 20 mm to 29mm. Thickness of the acromion process is found to be statistically significant ($p < 0.023$ and $t = 2.40$). 1.07 mm thicker on right side. Mean thickness on right side is 8.60 ± 1.59 mm (range 7 to 13mm) while on left side it is 7.53 ± 0.63 mm (7 to 8 mm). The length, breadth and thickness was found to be larger on the right side.

Table 2: Statistical measurements of acromion process and coracoacromial arch.

Parameters of acromion process (mm)		N	Mean	Std. Deviation	p-value	t-value
Legth	Left	45	45.8667	1.92230	0.185	1.359
	Right	45	47.4000	3.92428		
Breadth	Left	45	25.0667	3.41147	0.11	1.651
	Right	45	26.8000	2.21037		
Thickness	Left	45	7.5333	.63994	0.023	2.404
	Right	45	8.6000	1.59463		
Acromio coracoid distance	Left	45	40.1333	3.13657	0.854	0.186
	Right	45	39.8000	6.17830		
Acromio glenoid distance	Left	45	33.4000	3.18030	0.016	2.556
	Right	45	29.9333	4.18273		
Coraco glenoid distance	Left	45	26.3333	1.83874	0.607	0.52
	Right	45	25.8667	2.94877		
Height of coracoacromial arch	Left	45	20.3333	3.43650	0.191	1.341
	Right	45	18.6000	3.64104		

Now, the acromiocoracoid distance had the mean value of 39.80 ± 6.17 ranges 22 to 52mm on right side while on left side it had 40.13 ± 3.13 mean value and ranges from 37 to 48mm which is statistically insignificant. Widest acromiocoracoid distance was 52 mm on right side while narrowest was 22mm on same side. The mean acromioglenoid distance is 29 ± 4.18 on right side and 33.40 ± 3.18 on left side which is statistically significant. Maximun distance between tip of acromion process and supraglenoid tubercle was found to be 39 mm on right side while 22 mm on left side. A new parameter which is coracoglenoid distance was taken in this study, widest measurement of it is 29 mm on both right and left side. Narrowest distance was found to be of 20mm on left side. Mean of coracoglenoid distance was found to be of 25.86±2.94 and 26.33±1.83 on right and left side respectively. Mean of Height of coracoacromial arch was found to be 18.60 ± 3.64 on right side and 20.33 ± 3.43 on left side.

4. Discussion

Many clinical and radiological studies have already been conducted on acromion process. In clinical studies like Balke *et al.* [2] and Torrens *et al.* [16] they found a correlation between various parameters of acromion process with Rotator cuff tear and impingement syndrome. Similarly a radiological studies was done by Mallon *et al.* [6] and Acer *et al.* [7], in which morphometric assessment of the acromion process thickness, acromion width, acromion length and the distance between the acromion and coracoid process (A-CP) were measured on radiographs. Tendinitis which occurs as a result of compression of rotator cuff tendons under coracoacromial arc is one of the most common causes of shoulder pain [8]. In which compression of supraspinatus tendon is most common, one of the important reason for this is the morphology of acromion process and Coracoacromial distance to understand etiology of shoulder pains [9]. Biglinani LU *et al*, classified three main types of acromion i.e., Type-I (flat), Type-II (curved) and
Type-III (hooked). The least common hooked type of acromion process had closely related to the subacromial impingement syndrome and rotator cuff tear [10].

Table 3: Comparison of type of the acromion process of scapula with previous studies.

Authors	Year	Population	Number	Type 1	Type 2	Type 3
Nicholson GP *et al.* [11]	1996	North america	420	32%	42%	26%
Singh J *et al.* [12]	2O13	Indian	129	22.5%	38.8%	38.8%
Coskun N *et al.* [13]	2006	Turkish	90	10%	73%	17%
Getz JD *et al.* [14]	1996	Greece	423	22.8%	68.5%	8.6%
Panigrahi TK *et al.* [13]	2017	Indian	297	25.59%	56.90%	17.51%
Present Study	2018	Central indian	90	24.40%	58.82%	22.85%

In present study we observed maximum number of Type II (curved acromia) in 53 (58.82%) out of 90 scapulae. Type I (flat acromion processes) were the second highest occurring 22 (24.40%) followed by the Type III (Hooked acromions) were least common and found in 16 (22.85%) of the specimen studied. The result of our study is in proximate with Panigrahi TK *et al.* [15] and Getz JD *et al.* [14]

Saha *et al.* [4] and Panigrahi *et al.* [15] performed various measurement in 200 scapulae and 297 scapulae respectively. In the present study, length and breadth of the acromion process on the right side is 47.40mm and 26.80 mm while on the left side it was found to be 45.86 mm a nd 25.06mm. Both the measurements are in congruent with the above two studies. Also Collıpal *et al.* [18], have recorded acromion length as 69.12 ± 3.5 mm on the right side and 63.15 ± 7.1 mm on the left side. Also acromion width as 25.12 ± 1.8 mm on the right side and 25.12 ± 1.8 mm on the left side.

The thickness of acromion was observed as 7.55 mm in the present study which was similar to the study in done by Nicholson *et al.* [17] and Panigrahi *et al.* [15].

Collıpal *et al.* [18] have documented acromio coracoid distance as 39.76 ± 5.2 mm on the right and 39.55 ± 5.4 mm on the left and they have mentioned that the difference between two sides are not statistically significant. Also Panigrahi *et al.* [15] have recorded this distance as 37.49± 4.87mm on right side and 37.23 ± 4.48 mm on left side. In the present study on central Indian population this parameter was found to be 40.13 ± 13 mm on left side and 39.80 ± 6.17 mm on right side. Furthermore, since our findings are close to those detected by Torres *et al.* [16].

Study done by Paraskevas *et al.*, among Greek population mentioned AG distance as 17.7 mm [3]. Where as Mansur *et al.* in the Nepalese population mentioned AG distance as 31.4 mm [19]. While in the present results are almost similar to Panigrahi *et al.* which is on the right side as 29.9 ± 4.1 mm and on the left side it is 33.4 ± 3.1 mm [15].

5. Conclusion

The present study contains parameters of adult acromion process which will help orthopaedic surgeon in the approach to be used and precision of the operative technique. Present study will support for planning and executing acromioplasty for various shoulder pathologies.

6. References

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