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Morphometric Study of the Acromion Process and its Clinical Relevance

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Abstract

Background: The acromion process along with the coracoid process and the coracoacromial ligament form the coracoacromial arch which acts as a secondary socket for the shoulder joint. The subacromial space gives passage to the tendons of muscles forming the rotator cuff. Any abnormality, acquired or congenital, which leads to the reduction in the subacromial space can cause impingement syndrome. Morphology of the acromion thus plays an important role in impingement syndrome and the pathogenesis of rotator cuff diseases. **Subjects and Methods:** A total of 70 Indian unpaired dry human scapulae (Right-35, Left-35) of unknown sex were studied. Various parameters related to acromion process- a) Maximum length of acromion b) Maximum breadth of acromion c) Acromio-Glenoid distance and e) Acromio-Coracoid distance were measured with the help of a sliding digital vernier caliper and recorded in millimeters. **Results:** The mean values of each measurement were: maximum length of acromion: 43.10mm; maximum breadth acromion: 24.46mm; acromio- glenoid distance: 30.15 mm and acromio-coracoid distance: 37.05 mm. **Conclusion:** Knowledge of the morphometeric values of acromian process is important to the orthopaedicians in the differential diagnosis and surgical treatment of shoulder joint ailments, to the forensic experts in specimen identification from skeleton remains and to the anthropologists in their racial and population studies.

Keywords: scapula, acromion process, morphometry, impingement syndrome.

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Introduction

The scapula (shoulder blade) bears three processes- the spine, the acromion and the coracoid process. The acromion is a large, triangular/oblong prolongation of the lateral end of the spine, forming the summit of the shoulder. At the acromial angle, the lateral border of the acromion becomes continuous with the lower border of the crest of the spine. The medial border of the acromion is short and is marked anteriorly by a small, oval facet, for articulation with the lateral end of the clavicle. The acromion is subcutaneous over its dorsal surface, being covered only by the skin and superficial fascia. The inferior aspect of the acromion is smooth, and together with the coracoacromial ligament and the coracoid process forms a protective coracoacromial arch over the shoulder joint. The tendon of supraspinatus passes below the overhanging acromion and is separated from it and from deltoid by the subacromial bursa. The subacromial bursa functions as a secondary synovial articulation, facilitating movement between the coracoacromial arch and the subjacent supraspinatus muscle and shoulder joint.[1]

The coracoacromial arch is non-elastic and the underneath subacromial space, contains the tendons of rotator cuff muscles and biceps brachii muscle.[2] Any abnormality, acquired or congenital, which leads to the reduction in the subacromial space can cause impingement syndrome. Paraskevas et al,[2] reported that the length of the acromion has an effect on the acromio-glenoid distance and a shortening of this distance can predispose to impingement syndrome. Edelson et al,[3] noted that the slope and length of the acromion and the height of the coracoacromial arch are most closely associated with degenerative changes.

The most relevant factor determining the height of subacromial space is morphology of the acromion and its relationship with the coracoid process and glenoid cavity as stated by Torres et al.[4] Anetzberger et al,[5] in their study concluded that it is the length and width of the acromion which plays an important role in the pathogenesis of impingement syndrome, leading to rotator cuff disease. Neer6 was the first to introduce the concept of Subacromial Impingement Syndrome representing mechanical compression of the rotator cuff, subacromial bursa, and biceps tendon against the undersurface of the acromion and coracoacromial ligament. Acromion morphology is believed to play a key role in impingement syndrome and the pathogenesis of rotator cuff diseases.[7]

Therefore, the present study to record the various parameters related to the acromion process was carried out which would be of help to the orthopaedicians while carrying out surgical repairs around the shoulder joint especially in cases of subacromial impingement syndrome,

rotator cuff diseases etc.

Subjects and Methods

A total of 70 Indian unpaired right and left dry human scapulae of unknown sex were studied from teaching collection of the Anatomy department, GGS Medical College, Faridkot. Out of the total of 70 scapulae, 35 were of right side and 35 were of left side. All the scapulae selected were complete and showed normal anatomical features. Various parameters related to acromion process were measured with the help of a sliding digital vernier caliper and recorded in millimeters.

The following measurements of the acromion process were recorded:

1. Maximum Length of Acromion (MLA): distance between tip and midpoint of posterior border of acromion process. [Figure 1a.]
2. Maximum Breadth of Acromion (MBA): distance between the lateral and medial borders at the midpoint of the acromion process. [Figure 1b.]
3. Acromio-Glenoid distance (A-G distance): distance between tip of acromion process and supraglenoid tubercle. [Figure 1c.]
4. Acromio-Coracoid distance (A-C distance): distance between the tip of acromion and tip of the coracoid processes. [Figure 1d.]

a) Maximum Length of Acromion (MLA)

b) Maximum Breadth of Acromion (MBA)

The data was entered in the Microsoft Excel 2010 sheet and statistically analyzed, range, mean, standard deviation, standard error of mean, degree of freedom, p-value and t-value were calculated. Statistical analysis of the measured parameters was performed using paired t- test.

c) Acromio-Glenoid Distance(A-G distance)

d) Acromio-Coracoid Distance(A-C distance)

Figure 1: Showing the measurement of different parameters of the Acromion Process

Results

In the present study, of the total 70 scapulae studied, 35 were of the right side and 35 of the left side. The mean value of acromion length was found to be 43.10 mm in total samples, 43.47 mm in right side and 42.74 mm in left side. The mean value of acromion breadth was found to be 24.46 mm in total samples, 24.86 mm in right side and in 24.06 left side. The mean acromio-glenoid distance observed in

total samples was 30.15 mm, 30.03 mm in right side and 30.27 mm in left side. The mean acromio-coracoid process was found to be 37.05 mm in total sample, 36.14 mm in right side and 37.96 in left side. The mean length and breadth of acromion was more on the right side as compared to the left side whereas the mean acromio-glenoid distance and the mean acromio-coracoid distance was more on the left side, but the differences were statistically insignificant.

The values of various parameters of the acromion process recorded and calculated are shown in [Table 1 & 2].

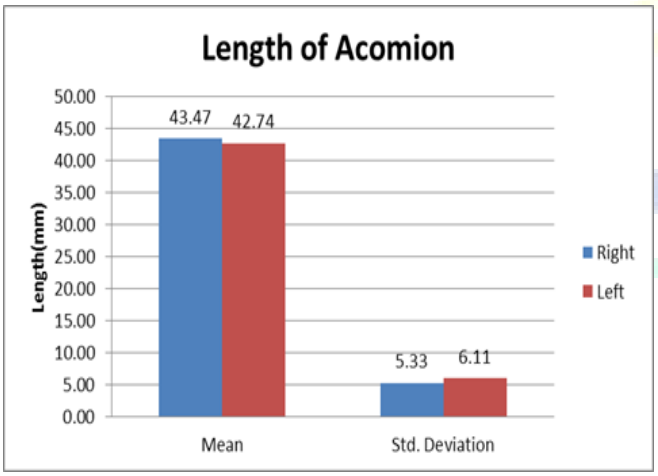
Table 1: Statistical measurements of different parameters of Right and Left side Acromion

Parameters	Right (N=35)				Left (N=35)			
	Range (mm)	Mean (mm)	SD (mm)	SEM (mm)	Range (mm)	Mean (mm)	S D (mm)	SEM (mm)
MLA	30.44-52.97	43.47	5.33	0.90	28.39-54.59	42.74	6.11	1.03
MBA	20.11-32.71	24.86	3.21	0.54	16.6-35.57	24.06	3.17	0.54
A-G distance	21.26-39.33	30.03	3.66	0.62	21.22-40.92	30.27	4.61	0.78
A-C distance	26.28-48.42	36.14	4.84	0.82	26.86-49.85	37.96	5.76	0.87

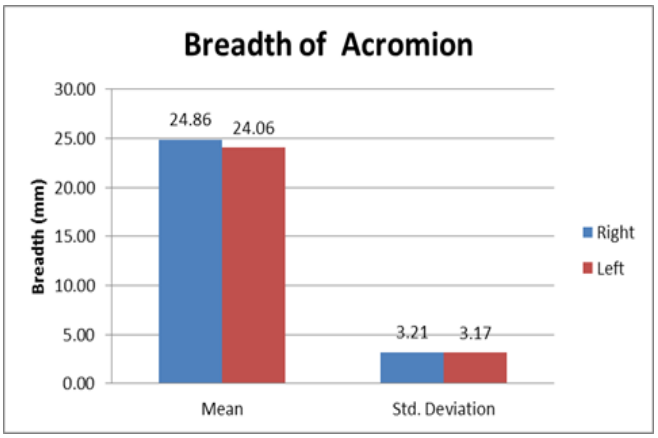
SD = Standard Deviation, SEM= Standard Error of Mean

Table 2: Result of paired t-test between acromion of Right & Left Scapulae

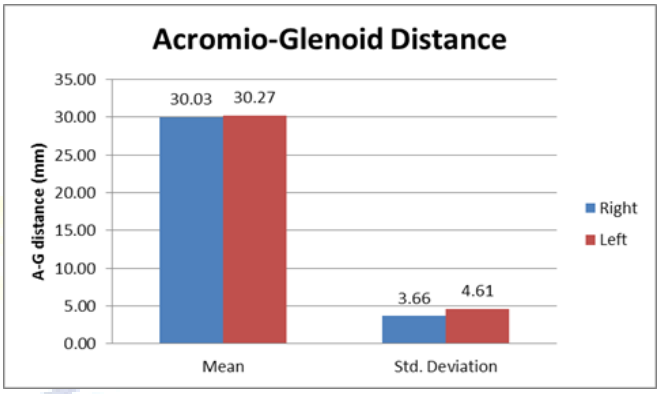
Parameters	Degree of freedom (Df)	t-Value	p-Value
MLA	68	0.530	0.598
MBA	68	1.051	0.297
A-G distance	68	-0.235	0.815
A-C distance	68	-1.426	0.158



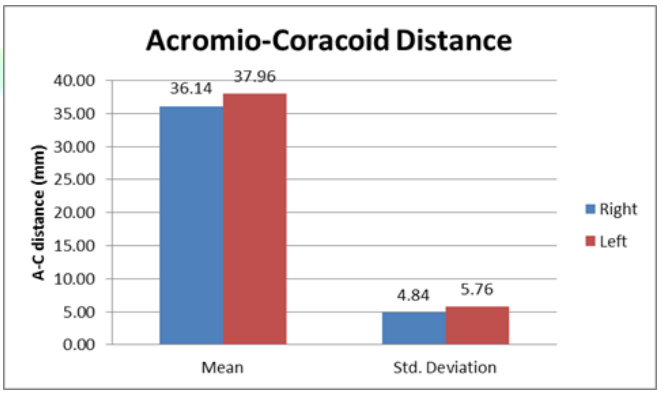
Graph1: Showing comparison of Mean & Standard Deviation of Length of Acromion of Right & Left Scapulae



Graph 2: Showing comparison of Mean & Standard Deviation of Breadth of Acromion of Right & Left Scapulae



Graph 3: Showing comparison of Mean & Standard Deviation of Acromio-Glenoid Distance of Right & Left Scapulae



Graph 4: Showing comparison of Mean & Standard Deviation of Acromio-Coracoid Distance of Right & Left Scapulae

Discussion

The human scapula has undergone the greatest alterations among the bones of the shoulder girdle, during the process of evolution of the upper limb due to the increased functional demands of a prehensile limb. During development there has been a gradual increase in the spine and the acromion process of the scapula.[8] The morphological parameters of the acromion provide a significant contribution to the anatomy of the coracoacromial arch and the subacromial space. Studies

conducted by various authors around the different regions of the world have revealed the relation between morphology of the acromion process and subacromial impingement syndrome and rotator cuff pathology which causes shoulder pain.[2-7]

Maximum Length of Acromion: In the present study the mean maximum length of acromion was found to be 43.10+5.70mm (Right= 43.47+ 5.33 mm & Left=42.74+6.11 mm) and the range was between 28.39mm- 54.59 mm (Right=30.44-52.97 mm & Left= 28.39- 54.59 mm). Wael Amin et al,[9] reported the length of acromion to be 52.81mm in Egyptians. Mansur DI et al,[10] recorded length of acromion to be 46.46 mm on right side and 45.57mm on left side in Nepalese population whereas a value of 40mm was reported by Sitha P et al,[11] in Thai population and 46.1mm by Paraskevas et al,[2] in Greeks. Lingamdenne PE et al,[12] reported mean length of 43.22mm in South Indian population, which is very close to our study.

Maximum Breadth of Acromion: The mean maximum breadth of acromion in the present study was found to be 24.46+3.19 mm (Right=24.86 + 3.21 mm & Left=24.06+ 3.17 mm) and the range was between 16.6 mm-35.57 mm (Right=20.11- 32.71mm & Left= 16.6-35.57mm). Wael Amin et al,[9] reported the breadth of acromion to be 32.05mm in Egyptians. Mansur DI et al,[10] recorded breadth of acromion to be 26.63mm on right side and 27.23 mm on left side in Nepalese population whereas a value of 23.9 mm was reported by Sitha P et al,[11] in Thai population and 22.3mm by Paraskevas et al in Greeks.[2] Lingamdenne PE et al,[12] reported mean breadth of 24.64 mm in South Indian population, which is very close to our study.

Acromio-Glenoid distance: In the present study the mean acromio-glenoid distance was found to be 30.15+ 4.13 mm (Right=30.03+3.66mm & Left= 30.27+ 4.61mm) and the range was between 21.22mm-40.92 mm (Right=21.26-39.33 mm & Left= 21.22-40.92 mm). Wael Amin et al,[9] recorded the acromio-glenoid distance to be 27.39 mm in Egyptian population. The acromio-glenoid distance measured by Mansur DI et al,[10] was 31.83 mm and 31.97 mm on right and left side respectively in Nepalese population. It was reported to be 18.1 mm in Thai population11, 17.7 mm in Greek population2 and 24.46 mm in South Indian population 12. The present study readings are close to that of Mansur DI et al,[10] recorded in Nepalese population.

Acromio-Coracoid distance: The mean acromio-coracoid distance in the present study was found to be37.05+5.36 mm (Right=36.14+4.84 mm & Left=37.96+5.76 mm) and the range was between 26.28 mm-49.85 mm (Right= 26.28-48.42 mm & Left=26.86-49.85 mm). The acromio-coracoid distance found by Wael Amin et al,[9] was 31.34 mm in Egyptians. Mansur DI et al,[10] recorded it as 39.03 on the right side and 39.39 mm on left side in Nepalese population. It was reported to be 14.8 mm in Thai population11, 28.1 mm in Greek population2 and 31.85 mm in South Indian population 12. Singh J et al,[13] reported it to be 37.5 mm in North Indian Population. The readings reported by us are close those reported by Singh J et al.[13]

In the present study, it can be noted that although the mean length and breadth of the acromion process on the right side was slightly more than the left side but that does not represent statistically significant differences. Similarly, the mean acromio-glenoid distance and the mean acromio-coracoid distance were slightly more on the left side, but the differences were again statistically insignificant. The differences in the readings of different authors can be attributed to regional and racial variations.

Conclusion

The overall goal of this study was to generate data that would be useful to the orthopaedicians in their differential diagnosis and surgical treatment of shoulder pains. The study would also help the forensic experts in specimen identification from skeleton remains. It would also be valuable for the anthropologists not only in their racial and population studies but also in their studies about the human evolution.

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