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An Anatomical Study of the Acromian Process of the Scapula and its Clinical Implications

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ABSTRACT

Background: The acromion process of scapula projects perpendicularly from the lateral part of the spine of scapula. It is important because of its morphometric variations. It is associated with many ailments of the shoulder joint. The morphometric of acromion plays a vital role in impingement syndrome and the pathogenesis of rotator cuff disease.

Objective: The aim of the study was to measure and record the morphometric values and the morphology of the acromion process of the scapula.

Methods: The study was carried out on 72 dry adults human scapula of unknown sex and age. The acromion length, acromion breadth, acromio coracoids distance, and the acromio glenoid distance was measured with the help of a digital vernier calliper. The morphology of the acromio process was also noted.

Result: The type II (curved) acromion was found to be the highest 48 cases (66.67%) followed by (hooked) type III in 15 cases (20.83 %). and the minimum is type I (flat) in 9 cases (12.5%) The mean acromial length was 43.10±4.47 acromial width was 24.69±2.60. The mean acromio coracoids distance was 34.17±4.63 and acromio glenoid distance was 25.80±2.96.

Conclusion: The result of the present study will help the orthopaedics surgeons to treat the various pathology of the shoulder joint. It is of great interest of radiologists to interpret the MRI reports, Physiotherapists to mobilize to shoulder joint, Anthropologists to study the bipedal gait.

Key Words: Acromion, Morphometry, Rotator cuff diseases coracoids, Hooked

INTRODUCTION

The acromian process of scapula projects perpendicularly from the lateral end of the spine of the scapula. The acromian process has a tip medial and lateral borders with a dorsal and ventral surface. The crest of the spine of scapula becomes continues with the lateral border of the acromian. The medial end is short with a small oval facet for articulation was the lateral end of the clavicle to form acromio- clavicular synovial joint. The tip of the process gives attachment to the coroco acromial ligament. Thus the under the surface of anterior one-third of the acromial process, the coracoacromial ligaments and the coracoids process together form the coracoacromial arch which gives protection and stability to be shoulder joint.¹

This arch prevents the upward dislocation of the shoulder joint and the subacromial bursa is present below this arch. The arch is fairly a non-elastic structure and the subacromial

bursa, tendons of rotator cuff muscles and the long tendon of biceps passes beneath the arch.² The rotator cuff is formed by the fusion of the tendons of the supraspinatus, sub scapularies, infraspinatus and tares minor. So when there is any pathology that causes, narrowing of the space, leads to impingement.

The study of morphometry of the acromial process is important as it is commonly involved impingement syndrome of the shoulder joint. The factor responsible for the syndrome can be classified into anatomical and functional. The anatomical cause includes the variations in shape and inclinations of the acromial and functional when there is the thickening of the rotator cuff due to chronic inflammation.^{3,4} Morphologically the acromial process is classified into three types by Bigliani et al.⁵

1. Type I (Flat)
2. Type II (Convex)
3. Type III (Hooked)

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The morphometric knowledge of the variations of the acromion must be kept in mind during surgery of the shoulder joint. It will help the orthopaedic surgeons while doing surgical repair around the shoulder joint.⁶ Therefore the present study aimed to record the various dimensions and morphology of the acromial process of the scapula.

MATERIALS AND METHODS

The present study was carried out on 72 dry adult scapula of unknown sex and age from the medical colleges of eastern Odisha. The bones having external deformities were discarded and the bones with the intact acromial process were included. All the scapula were cleaned and labelled. The following measurement was taken with the help of digital vernier callipers and recorded in millimetres.

- The maximum length of the acromial process (Anterior-Posterior distance along the long axis)
- Maximum breadth of acromial process (Distance between medial and lateral borders at the midpoint of acromial process)
- Acromio coracoids distance (Distance between the tip of acromion and tip of the coracoid process.
- Acromio glenoid distance (Distance between the tip of acromio to the supraglenoid tubercle.
- The type of acromion were classified into 3 types by Bigliani et al.
 1. Flat (Type I)-figure. 1
 2. Curved (Type II)-figure. 2
 3. Hooked (Type III)-figure. 3

The above data were then statistically analysed using Microsoft excels software. The mean value, percentage and standard deviation were used to analyze the data. The ‘p’ value was obtained by using unpaired test. The difference was considered to be statistically significant if ‘p’ value was less than 0.05.

RESULTS

In the present study of 72 dry scapulae it was found the shape of the acromial process was maximum in 48 cases (66.67%) was type II(curved) and the minimum is the type I (flat) in 9 cases (12.5%) and hooked type III(hooked) in 15 cases (20.83 %). All the measures were tabulated in table 1.

Table 1: Shape of acromion process of scapula

| Shape | Right (n=36) | Left(n=36) | Total (n=72) |
|------------------|--------------|------------|--------------|
| Type I(flat) | 3(8.3%) | 6(16.67%) | 9(12.5%) |
| Type II(curved) | 28(77.78%) | 20(55.55%) | 48(66.67%) |
| Type III(hooked) | 9(25%) | 6(16.67%) | 15(20.83%) |

The average length of the acromion process in the right side is 43.52 mm and that of the left side is 37.95mm. The mean value of acromial length in total samples is 43.10 mm. The mean value of acromial breadth in total samples is 24.69 mm. The average breadth of acromion process in the right side is 24.36 mm and that of the left side is 25.02 mm. The acromial coracoid distance average is 34.17 mm in total samples with 33.53mm on the right side and 30.25 mm on the left side.

The mean acromial glenoid distance was found to be 25.80 mm in total samples with 25.80 mm and 25.71mm in right and left side respectively. All the measures were tabulated in table 2.

Table 2: The different measurements of acromion processes

| Measurement | Right side (in mm), n=36 | Left side (in mm), n=36 | Total (in mm), n=72 | P-value |
|--------------------------------|--------------------------|-------------------------|---------------------|---------|
| Length of the acromion process | 43.52±4.30 | 37.95±4.82 | 43.10±4.47 | 0.369 |
| Breadth of acromion process | 24.36±2.40 | 25.02±2.86 | 24.69±2.60 | 0.261 |
| Acromio-coracoid distance | 33.53±4.99 | 30.25±4.35 | 34.17±4.63 | 0.261 |
| Acromio-glenoid distance | 25.90±3.14 | 25.71±2.91 | 25.80±2.96 | 0.78 |

DISCUSSION

The morphometry measurements of the acromial process were closely associated with shoulder impingement and rotator cuff tear. The variations in the morphology of the acromial process play a vital role in shoulder girdle pathology. It is believed that the hooked acromial (type II) was mostly involved in rotator cuff lesions⁷. This can be explained by the fact that the size of subacromial space is decreased in hooked acromial which frequently leads to impingement of the rotator cuff.²

The scapula undergoes significant change during the evolution of the upper extremity due to increased functional demands of the prehensile limb. The spine of the acromial process of the scapula is increased during the development from the pronograde to the orthograde. This change is due to the progressive distal migration of the part of the insertion of the deltoid muscle with the acquisition of a tree limb.

In the current study, the frequency of shape acromion process was highest for Type II (Curved) followed by type III (Hooked) and a very low incidence of Type I (Flat) scapulae. The findings were similar to Coskun ‘et al’.⁸ Schetino ‘et al’.⁹ and Singhora ‘et al’¹⁰. However, high incidence of Type II, followed by Type I and less number of Type III ac-

romion process was observed by El-Din et al.¹¹, Saha et al.¹² and Gosavi et al.⁷. All the measures were tabulated in table 3.

Table 3: Comparison of Types of Acromion in Different Populations

| Population groups | Authors | Type of Acromion process |
|-------------------|-------------------|--------------------------|
| East Indian | Present study | Curved > Hooked > Flat |
| North indian | Singroha R et al. | Curved > Hooked > Flat |
| Turkish | Coskun et al. | Curved > Hooked > Flat |
| Brazilian | Schetino et al. | Curved > Hooked > Flat |
| Rajasthan | Singh et al. | Curved = Hooked > Flat |
| Egyptian | El-Din et al. | Curved > Flat > Hooked |
| Indian | Saha et al. | Curved > Flat > Hooked |
| Maharashtra | Gosavi et al. | Curved > Flat > Hooked |
| South Indian | Jacinth JS et al. | Curved > Flat > Hooked |

In the present study, we found that the mean value of acromion length, acromion width as 43.10 mm and 24.69 mm respectively which is similar to the studies done by Gosavi et al.⁷ where the mean length of the acromion was 43.7 mm and the mean width was 22.87 mm. and Singh et al. were the mean values of acromion length and acromion width as 46.1 mm and 23.2 mm respectively.² Similar studies done by Coskun et al. and Singroha R et al. had reported the acromion length as 44.7 mm and 45.05mm respectively and acromion width as 23.60 mm and 25.79mm respectively.

The current findings of acromial length and breadth are less than the studies done by Mansur et al.¹³, El-Din et al.¹¹ and Paraskevas et al.² but more than the studies done by Sitha 'et al'¹⁴. The acromio-coracoid distance and acromion glenoid distance in the current study found to be 34.17 mm and 25.80 mm respectively which is very similar to the studies done by Vinay G 'et al'¹⁵ in which the acromio-coracoid and acromio glenoid distance was 34.05mm and 30.05mm respectively. The present study data shows lesser values compared to the studies done by Mansur 'et al' and Singh 'et al' but higher than the studies done by Gosavi 'et al', El-Din et al and Coskun et al. All the measures were tabulated in Table 4.

Table 4: Comparison of parameters of acromion process in different populations

| Authors | Length (mm) | Width (mm) | acromio-coracoid distance (mm) | Acromio-glenoid distance (mm) |
|------------------------------------------------|-------------|------------|--------------------------------|-------------------------------|
| Present study | 43.10 | 24.69 | 34.17 | 25.80 |
| Singroha R et al. ¹⁰ (North Indian) | 45.05 | 25.79 | 37.96 | 29.86 |

| | | | | |
|-------------------------------------------|-------|-------|-------|-------|
| Mansur et al. ⁶ (Nepalese) | 46.01 | 26.93 | 39.21 | 31.9 |
| Coskun et al. ³ (Turkish) | 44.7 | 23.60 | 17.8 | |
| Gosavi et al. ¹⁰ (Maharashtra) | 43.7 | 22.78 | 26.9 | 22.68 |
| Singh et al. ² (Rajasthan) | 46.1 | 23.2 | 37.5 | 27 |
| El-Din et al. ⁸ (Egyptian) | 52.81 | 32.05 | 31.34 | 27.39 |
| Paraskevas et al. ¹² (Greek) | 46.1 | 22.3 | 28.1 | 17.7 |

CONCLUSION

The acromial process plays a vital role in the stability and formation of the shoulder joint. The study of anatomical variation of the acromial process will help the surgeons to treat rotator cuff pathologies and shoulder impingement syndrome. It is also important in forensic investigations and racial determination thus helpful for forensic exports and anthropologist. It will also hold physiotherapist to mobilize the frozen shoulder and to increase its mobility.

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Figure 1: Flat acromion process.



Figure 2: Curved acromion process.



Figure 3: Hooked acromion process.