Morphometry of Acromion Process of Human Scapulae and Its Clinical Importance Amongst Nepalese Population

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ABSTRACT

Background

Morphometry of the acromion process of the scapula is an important factor implicated in impingement syndrome of the shoulder joint. Authors who have studied this process have tried to classify it according to the standard Bigliani classification viz., type 1, 2 and 3.

Objectives

To analyze and classify the acromion process of human scapulae.

Methods

The present study was observational, cross-sectional and descriptive in nature. The present study was conducted on 68 adult human scapulae (30 right and 38 left) of unknown age and sex in the Department of Anatomy, Kathmandu University School of Medical Sciences, Dhulikhel, Nepal. The length and breadth of the acromion process and the distances from the tip of the acromion process to the uppermost point of the glenoid cavity and to the tip of the corocoid process were measured with a help of caliper and measuring tape.

Results

The average length of acromion process on the right and left scapulae were 46.46 ± 5SD mm and 45.57 ± 5.21 SD mm respectively. The average breadth of acromion process of right and left scapulae were 26.63 ± 3.55 SD mm and 27.23 ± 3.06 SD mm respectively. The acromio-coracoid distance on the right and left side were 39.03 + 6.20 mm and 39.39 +5.32 mm respectively. The acromio-glenoid distance was also measured which was 31.83 +3.66 mm & 31.97 +3.96 mm on right and left side respectively. The acromion process was classified in the present study into 3 types, based on the shape as: Triangular - 36.76%, Quadrangular - 52.94% and Tubular - 10.29%.

Conclusions

Knowing the data on the shape and various distances of acromion may not only help the orthopaedicians during surgical repair around the shoulder joint but also may be of interest to the anthropologists when studying about the evolution of the bipedal gait. The morphometric analysis of the acromion should be used like an auxiliary to promote a better knowledge about the disease that appears in this area.

KEY WORD

Acromian process, corocoid process, morphometry, scapula

INTRODUCTION

Morphometry of the acromion process of the scapula is an important factor implicated in impingement syndrome of the shoulder joint. The acromion is related to a variety of disorders in the shoulder.[1] There are very few studies in the literature which adduce a wide range of measurements to describe the various shapes and variants of acromion.

The predominant theory for the impingement syndrome of the rotator cuff muscles (supraspinatus, infraspinatus, teres minor and subascapularis) classifies the contributing

factors as anatomical and functional. The anatomical causes include the shape and the inclination of the acromion process.

Each individual presents with variations in shoulder anatomy, overall conditioning and fitness, and degrees of shoulder laxity that make the precise evaluation of pathologic lesions difficult.[2] The slope and length of the acromion and the height of the arch are most closely associated with degenerative changes.[3] It is widely accepted that rotator cuff lesions are noticed mainly in the hooked acromia (62–66% of the cases of rotator cuff rupture involve the type III acromion).[4]

The clinical significance of this study rests on the causative effect of the shape of the acromion in relation to the impingement syndrome as well as to rotator cuff rupture. The aim of this study was to record and study the morphometric analysis of the acromion process of scapula in a Nepalese population sample.

METHODS

The material of the present study consisted of 68 human dry scapulae (30 right and 38 left) of unknown age and sex in the Department of Anatomy, Kathmandu University School of Medical Sciences, Dhulikhel, Nepal from April 2011 to March 2012. Several parameters related to acromion process were measured with the help of a vernier caliper and a measuring tape as follows:

•The maximum length of acromion process in mm: the distance between tip and midpoint of posterior border of acromion process

•The maximum breadth of acromion in mm: the distance between the lateral and medial borders at the midpoint of the acromion process

•The acromio-coracoid distance in mm: the distance between tip of acromion process and tip of corocoid process

•The acromio-glenoidal distance in mm: the distance between tip of acromion process and supraglenoid tubercle

An independent Student's t-test was used to compare quantitative variables. Statistical significance was set at 0.05.

RESULTS

As shown in table-1 and 2, the length of the acromion process of right scapulae varies from 36 mm to 54 mm with an average of 46.46 ± 5mm S.D. The length of the acromion process of left scapulae varies from 31mm to 59 mm with an average 45.57 ± 5.21 mm S.D. It has been observed that the right acromion process was longer than the left by 0.89 mm. Although the length of the right acromion process to be marginally more than the left acromion process, the differences in length were statistically insignificant (t = 0.634, p = 0.264). Similarly, the breadth of the acromion process of right scapulae varies from 21 mm to 37 mm with an average of 26.63 ± 3.55mm S.D. The breadth of

Table 1. Statistical measurements of the length of acromion process (n=68).

Details of Measurements	Right	Left
Numbers	30	38
Range	36 -54 mm	31 – 59 mm
Mean	46.46 mm	45.57 mm
Standard deviation(S.D.)	5	5.21
p – value	0.264	
t – value	0.634	

Table 2. Statistical measurements of the breadth of acromion process (n=68).

Details of Measurements	Right	Left
Numbers	30	38
Range	21- 37 mm	22 – 34 mm
Mean value	26.63 mm	27.23 mm
Standard deviation(S.D.)	3.55	3.06
P - value	0.225	
t - value	0.758	

Table 3. Statistical measurements of the Acromio-corocoid distance (n=68).

Details of Measurements	Right	Left
Numbers	30	38
Range	24-53 mm	28 – 55 mm
Mean value	26.63 mm	39.39 mm
Standard deviation(S.D.)	3.55	5.28
P - value	0.398	
t - value	0.259	

Table 4. Statistical measurements of the Acromio-glenoid distance (n=68).

Details of Measurements	Right	Left
Numbers	30	38
Range	24-42 mm	26 – 44 mm
Mean value	31 mm	31.97 mm
Standard deviation(S.D.)	3.70	3.97
P - value	0.440	
t - value	0.150	

Table 5. Shape of acromion process of scapulae.

Shape	Right (n=30)	Percentage	Left (n=38)	Percentage	Total	
Triangular	15	50%	10	26.31%	25	36.76%
Quadrangular	11	36.66%	25	65.78%	36	52.94%
Tubular	4	13.33%	3	7.89%	7	10.29%

Figure 1. Length (A) and Breadth (B) of acromion process.

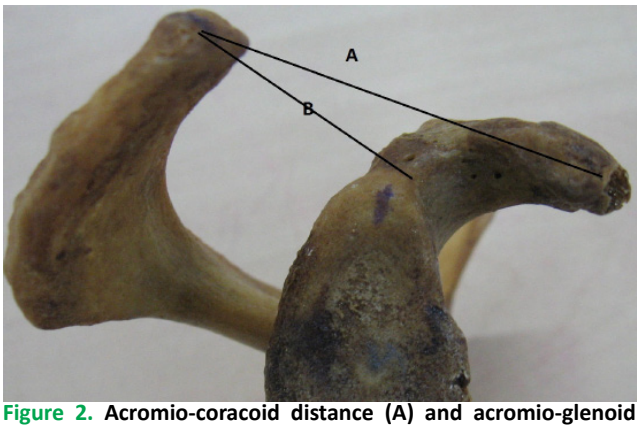

Figure 2. Acromio-coracoid distance (A) and acromio-glenoid distance (B).

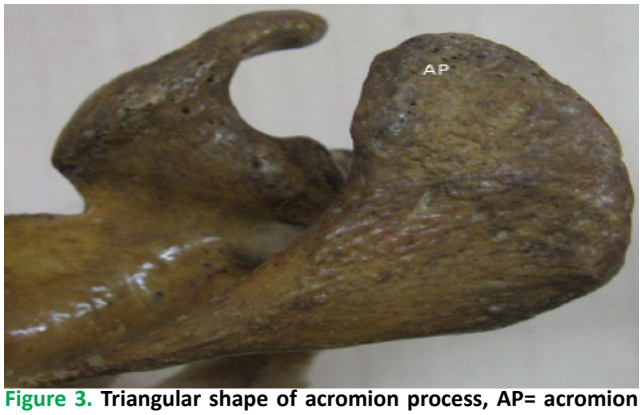

Figure 3. Triangular shape of acromion process, AP= acromion process.

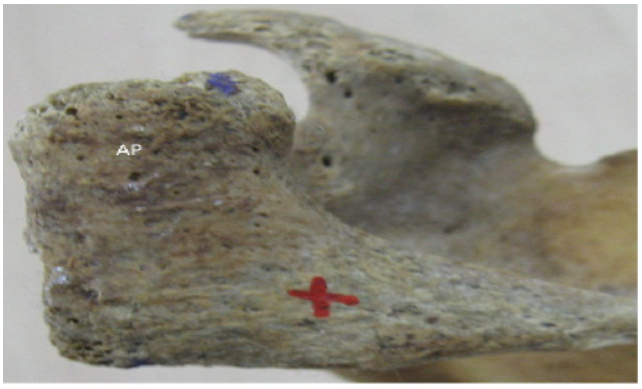

Figure 4. Quadriangular shape of acromion process, AP= acromion process.

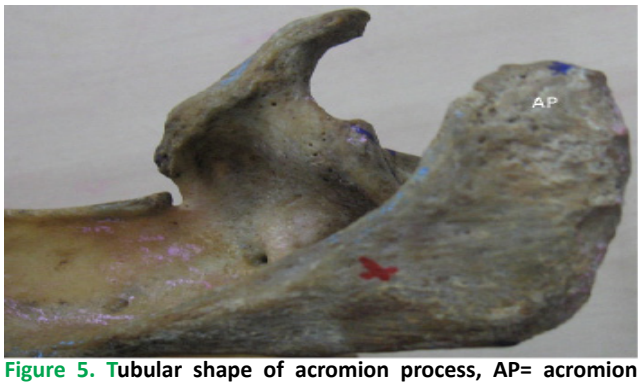

Figure 5. Tubular shape of acromion process, AP= acromion process.

the acromion process of left scapulae varies from 22 mm to 34 mm with an average 27.23 ± 3.06 mm S.D. It has been observed that the right acromion process was longer than the left by 0.60 mm. Although the breadth of the acromion process of right scapulae to be marginally less than the left acromion process, the differences were statistically insignificant (t = 0.758, p = 0.225).

As shown in table 3 and 4: The acromio-coracoid distance on the right and left side vary 24 – 53 mm with the average 39.03 + 6.20 mm and 28 – 55 mm with the average 39.39 + 5.32 mm respectively. It has been observed that there were no statistically differences between right and left side (t = 0.259, p = 0.398). Similarly, the acromio-glenoid distance was found to be varied from 24 – 42 mm with average distances 31.83 + 3.66 mm and from 26 – 44 mm with average distances 31.97 + 3.96 mm on right and left side respectively. It has been noticed that acromio-glenoid distances were same on both side (t = 0.150, p = 0.440). As shown in table 5: on the basis of shape of acromion process, it can be classified into 3 types as: Triangular - 36.76%, Quadrangular - 52.94% and Tubular - 10.29%.

DISCUSSION

Various studies have been conducted on the morphology of the acromion process of the scapulae. The association between acromial morphology, shoulder impingement, and rotator cuff tears has been well documented.[4-8]

According to the Bigliani, et al classification scheme, three main types of acromial morphology have been described:

type-I (flat); type-II (curved) and type-III (hooked).[5] They reported the following relative percentages of the three types of acromion process: 8.6% for type-I, 42.0% for type-II, and 38.6% for type-III. The occurrence of rotator cuff tears to be most closely associated with type III acromia.[6]

The undersurface of the anterior one third of the acromion was pinpointed by Neer CS as the area responsible for impinging upon the components of the rotator cuff (especially the supraspinatus tendon). He noted a characteristic ridge of spurs (enthesophytes) on the anterior acromion process. The relationship of acromial morphology to the clinical syndrome of shoulder impingement was an important precursor to rotator cuff tears in 95% of Neer's cases.[7,8]

Edelson JG et al performed various measurements in 200 scapulae and concluded that the slope and length of the acromion and the height of the arch are most closely associated with degenerative changes.[3] Edelson et al (1993) reported an incidence of "os acromiale" of 8.2% in a sample of 270 scapulae.[9]

Ciochon RL et al devised two measurements, the coracoacromial projection index and the height of the glenoid cavity in Hominoidea, Cercopithecoidea and Ceboidea, and showed that hominoid shoulder joints are much more mobile than cercopithecoid shoulder joints. They advocated that the coracoacromial ligament in human is a trait shared only with other hominoid apes among anthropoid primates.[10]

Farley TE et al proposed a classification which includes a fourth type of acromion, which is concave downward.[11] This classification has not gained much acceptance, mainly owing to the very small incidence of this type of acromion (1.6–13.3%) and the absence of correlation with rotator cuff pathology.[11]

Natsis K et al claimed that enthesophytes were significantly more common ($p < 0.05$) in the type III acromion, and this combination was particularly associated with subacromial impingement syndrome and rotator cuff tears. In type I and type IV acromia the incidence of enthesophytes was very small and rotator cuff tears were rare.[12]

In the present study, it is important to note that length and breadth of acromion process of scapulae and acrmio-corocoid distance and acromio-glenoid distance do not present statistically significant differences between right and left scapulae. But we were able to classify acromion process, on the basis of shape, into three types as: Triangular - 36.76%, Quadrangular - 52.94% and Tubular - 10.29%. The different shapes of acromion may also play important role in impingement syndrome. This type of variations of acromion process should be kept in mind during surgery around the shoulder joint. It may also help Anthropologists during their study on evolution of acromia.

CONCLUSION

The above data on the shape and various distances of acromion may not only help the orthopaedicians during surgical repair around the shoulder joint but also may be of interest to the anthropologists when studying about the evolution of the bipedal gait. The clinical significance of this study rests on the causative effect of the shape of the acromion in relation to the impingement syndrome as well as to rotator cuff rupture.

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