

## ASSESSMENT OF MORPHOLOGICAL AND MORPHOMETRIC STUDY ON THE SCAPULA

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Received : 18/09/2022  
Received in revised form : 25/11/2022  
Accepted : 08/12/2022

**Keywords:**  
Orthopaedic Surgeons, Acromion  
Process, Scapula.

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DOI: 10.47009/jamp.2023.5.1.167

Source of Support: Nil,  
Conflict of Interest: None declared

*Int J Acad Med Pharm*  
2023; 5 (1); 804-806



### Abstract

**Background:** To assess morphological and morphometric study on the scapula. **Materials and Methods:** Fifty- eight completely ossified, dry, unbroken scapulae of both sides were taken and parameters such as morphological shapes of the glenoid cavity, types of inferior surface of acromion process according to appearance, shapes of the tip of the acromion, maximum length, breadth, acromio-coracoid distance, thickness, acromio-glenoidal distance, Superior-Inferior glenoid diameter, anterior- posterior glenoid diameter 1 and anterior- posterior glenoid diameter 2 was recorded. **Result:** Morphological shapes of the tip of the acromion on right and left side was square tip in 16 and 18, cobra shaped in 14 and 13 and intermediate in 28 and 27 respectively. Types of acromion process according to slope on right and left side was curved in 32 and 33, flat in 12 and 13 and hooked in 12 and 10 respectively. Types of the inferior surface of the acromion process was smooth in 34 and 36 and rough in 22 and 20 respectively. Shapes of the glenoid cavity was oval in 24 and 23, pear in 22 and 20 and inverted comma in 10 and 13 respectively. The difference was significant ( $P < 0.05$ ). Scapular parameters on right and left side had maximum length (mm) of 150.2 and 150.6, maximum width (mm) was 108.4 and 108.2 and width / length index (%) was 70.4 and 70.6 respectively. Acromion parameters on right and left side had maximum length (mm) of 51.6 and 51.4, maximum breadth (mm) of 32.4 and 32.2, thickness (mm) of 9.5 and 9.0, the acromio-coracoid distance (mm) was 31.2 mm and 30.6, the acromio-glenoidal distance (mm) was 28.7 and 28.2. Glenoid parameters had superior-inferior glenoid diameter (mm) of 37.4 and 38.0, anterior-posterior glenoid diameter 1 (mm) was 22.4 and 21.3 and anterior-posterior glenoid diameter 2 (mm) was 29.5 and 28.8 respectively. The difference was significant ( $P < 0.05$ ). **Conclusion:** Variations in the size and shape of the acromion process and glenoid cavity is useful for orthopaedic surgeons to understand the shoulder pathology better.

## INTRODUCTION

Scapula is a bone forms shoulder girdle and is one of the bones that have variations.<sup>[1]</sup> It is a flat triangular bone that overlies on the posterolateral aspect of the chest wall over the second to the seventh rib. Its lateral angle becomes truncated and broadened that bears the glenoid cavity which articulates with the head of the humerus in the shoulder joint.<sup>[2]</sup> The glenoid cavity which is also known as the head of the scapula is connected to the plate like body by an anatomical neck which is most distinct at its dorsal and inferior aspects.<sup>[3]</sup>

The phylogenic, ontogenic and racial variations of the scapula, make it as one of the most interesting bones for research. The meticulous dimensions of the scapula are of major importance in the patho-

mechanics of rotator cuff disease, total shoulder arthroplasty, and recurrent shoulder dislocation.<sup>[4]</sup> The acromion is related to a variety of disorders and contributes to pathologic conditions in the shoulder. Moreover, its morphology is an important tool in shoulder pathology diagnosis. The predominant theory for the impingement syndrome of the rotator cuff muscles classifies the causative agents as anatomical and functional.<sup>[5]</sup> The anatomical causes include the shape and inclination of the acromion process. This theory was supported by other studies that showed a high incidence of rotator cuff disease with type III acromia. Therefore, morphometry of the acromion is important as its anatomical variation may contribute to shoulder pathologies.<sup>[6]</sup> We performed this study to assess morphological and morphometric study on the scapula.

## MATERIALS AND METHODS

After considering the utility of the study and obtaining approval from ethical review committee of the institute, we selected fifty- eight completely ossified, dry, unbroken scapulae of both genders.

Parameters such as morphological shapes of the glenoid cavity, types of inferior surface of acromion process according to appearance, shapes of the tip of the acromion, maximum length, breadth, acromio-coracoid distance, thickness, acromio-glenoidal distance, Superior-Inferior glenoid diameter, anterior- posterior glenoid diameter 1 and anterior-posterior glenoid diameter 2 was recorded. The results were compiled and subjected for statistical analysis using Mann Whitney U test. P value less than 0.05 was set significant.

## RESULTS

Morphological shapes of the tip of the acromion on right and left side was square tip in 16 and 18, cobra shaped in 14 and 13 and intermediate in 28 and 27 respectively. Types of acromion process according

to slope on right and left side was curved in 32 and 33, flat in 12 and 13 and hooked in 12 and 10 respectively. Types of the inferior surface of the acromion process was smooth in 34 and 36 and rough in 22 and 20 respectively. Shapes of the glenoid cavity was oval in 24 and 23, pear in 22 and 20 and inverted comma in 10 and 13 respectively. The difference was significant ( $P < 0.05$ ) [Table 1].

Scapular parameters on right and left side had maximum length (mm) of 150.2 and 150.6, maximum width (mm) was 108.4 and 108.2 and width / length index (%) was 70.4 and 70.6 respectively. Acromion parameters on right and left side had maximum length (mm) of 51.6 and 51.4, maximum breadth (mm) of 32.4 and 32.2, thickness (mm) of 9.5 and 9.0, the acromio-coracoid distance (mm) was 31.2 mm and 30.6, the acromio-glenoidal distance (mm) was 28.7 and 28.2. Glenoid parameters had superior-inferior glenoid diameter (mm) of 37.4 and 38.0, anterior-posterior glenoid diameter 1 (mm) was 22.4 and 21.3 and anterior-posterior glenoid diameter 2 (mm) was 29.5 and 28.8 respectively. The difference was significant ( $P < 0.05$ ) [Table 2].

**Table 1: Morphological parameters**

Parameters	Variables	Right	Left	P value
Morphological shapes of the tip of the acromion	Square tip	16	18	0.06
	Cobra shaped	14	13	
	intermediate	28	27	
Types of acromion process according to slope	Curved	32	33	0.03
	Flat	12	13	
	Hooked	12	10	
Types of the inferior surface of the acromion process	Smooth	34	36	0.12
	Rough	22	20	
Shapes of the glenoid cavity	Oval	24	23	0.17
	Pear	22	20	
	Inverted comma	10	13	

**Table 2: Assessment of scapular, acromion and glenoid parameters**

Parameters	Variables	Right	Left	P value
Scapular parameters	Maximum length (mm)	150.2	150.6	0.91
	Maximum width (mm)	108.4	108.2	
	Width / length index (%)	70.4	70.6	
Acromion parameters	Maximum length	51.6	51.4	0.82
	Maximum breadth	32.4	32.2	
	Thickness	9.5	9.0	
	The acromio-coracoid distance	31.2	30.6	
	The acromio-glenoidal distance	28.7	28.2	
Glenoid parameters	Superior-inferior glenoid diameter	37.4	38.0	0.94
	Anterior-posterior glenoid diameter 1	22.4	21.3	
	Anterior-posterior glenoid diameter 2	29.5	28.8	

## DISCUSSION

Scapula possesses three processes and three angles, the acromion, coracoid and the spinous process; the superior, inferior and lateral angles respectively.<sup>[7]</sup> It also has medial, lateral and superior borders and two surfaces which are the anterior or costal surface and the posterior or dorsal surface. There is a notch present on its antero- superior part, that is, on the anterior glenoid rim which gives its different shape.<sup>[8]</sup> When this glenoid notch is indistinct its

shape is piriform or pear or tear drop, when it is distinct it looks like inverted comma shape and when it is absent its oval shape. Variations in the superior transverse scapular ligament and the suprascapular notch are the most recognized possible predisposing factors for suprascapular notch (SSN) entrapment.<sup>[9]</sup> We performed this study to assess morphological and morphometric study on the scapula.

Our results showed that Morphological shapes of the tip of the acromion on right and left side was square tip in 16 and 18, cobra shaped in 14 and 13 and

intermediate in 28 and 27 respectively. Types of acromion process according to slope on right and left side was curved in 32 and 33, flat in 12 and 13 and hooked in 12 and 10 respectively. Azhagiri et al,<sup>[10]</sup> out of 100 scapulae studied, 48 were right sided and 52 were left sided. The mean of maximum length of the right scapula was 149.58±10.33 mm and the left side was 148.63±10.33 mm. Among the glenoid cavities, 54 were inverted comma shaped, 30 were pear shaped, and 16 were oval shaped. In one right-sided scapula bony spur extends from base of coracoid process to supra scapular notch.

Types of the inferior surface of the acromion process was smooth in 34 and 36 and rough in 22 and 20 respectively. Shapes of the glenoid cavity was oval in 24 and 23, pear in 22 and 20 and inverted comma in 10 and 13 respectively. Din et al,<sup>[11]</sup> measured acromial and glenoid morphology to describe their anatomical patterns and variations to establish possible morpho-functional correlations related to race and geographic region. 160 scapulae of unknown age and sex were studied. Morphological shapes of the tip of the acromion; types of acromion; and morphological shapes of the glenoid were evaluated. Length and width of the scapulae, length, breadth and thickness of the acromion process and distances of the acromio-coracoid and acromio-glenoid in addition to glenoid diameters were measured. The intermediate shape of the acromion presented with the highest incidence, while the cobra shaped presented with the lowest distribution in both sides. The oval shaped glenoid cavity presented with the highest incidence while the inverted coma shaped showed the lowest incidence.

Scapular parameters on right and left side had maximum length (mm) of 150.2 and 150.6, maximum width (mm) was 108.4 and 108.2 and width / length index (%) was 70.4 and 70.6 respectively. Acromion parameters on right and left side had maximum length (mm) of 51.6 and 51.4, maximum breadth (mm) of 32.4 and 32.2, thickness (mm) of 9.5 and 9.0, the acromio-coracoid distance (mm) was 31.2 mm and 30.6, the acromio-glenoidal distance (mm) was 28.7 and 28.2. Kalita et al,<sup>[12]</sup> in their study different morphometric parameters of scapula and humerus were measured. Scapula of Binturong was a flat almost square shaped bone with similar width in both dorsal and ventral border with a wide scapular neck, average circumference of which is around 8.04 cm. Average maximum length and width of the scapula of Binturong was 8.81 cm and 6.56 cm, respectively. A small foramen was seen at the neck of the scapula perforating the ventral portion of the scapular spine. Average maximum total length of Binturong Humerus was 12.81 cm. Proximal extremity of the humerus carries a caudally present oval shaped head, average maximum width of which is about 2.05cm.

Glenoid parameters had superior-inferior glenoid diameter (mm) of 37.4 and 38.0, anterior-posterior glenoid diameter 1 (mm) was 22.4 and 21.3 and anterior-posterior glenoid diameter 2 (mm) was 29.5 and 28.8 respectively. Mansur et al,<sup>[13]</sup> reported that the mean right acromion-coracoid distance was 39.03 on the right side and 39.39 mm on the left side in Nepalese population. Singh et al,<sup>[14]</sup> reported it to be 37.5 mm.

## CONCLUSION

Variations in the size and shape of the acromion process and glenoid cavity is useful for orthopaedic surgeons to understand the shoulder pathology better.

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