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A morphometric study of human scapula concerned with snapping scapula syndrome

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Abstract:

Introduction: The snapping scapula syndrome is an infrequently described cause of shoulder pain .This syndrome was first described by Boinet in 1867. Milch and Burman described this phenomenon to be secondary to an abnormality between the anterior surface of scapula and the thoracic wall **Aims and Objective:** To study human scapula concerned with Snapping Scapula Syndrome **Methodology:** One hundred and one unpaired (56 left and 45 rights sided), complete and undamaged dry human scapulae were obtained from a teaching medical institute of Mumbai. The bones were of unknown age and gender. The parameters measured were recorded in the proforma. The study was conducted after receiving approval from institutional ethics committee. Data was entered in Microsoft Excel 2007 and then transferred to SPSS version 17. Statistical analysis was done using SPSS software version 17 and mean, median, range and standard deviation were calculated. **Result:** Distance between the inferior surface of acromial process and supraglenoid tubercle was 29.38±2.8 mm. Average forward angulation of base of coracoid process at costal surface was141.95±8.25 degrees. Superomedial angle of the costal surface was137.93±8.85 degrees. Average anteroposterior thickness of superior angle of scapula was 3.28±1.06 mm. Anteroposterior thickness of inferior angle of scapula measured in this study ranged from 3.8 mm to 9.5 mm with average of 6.75±1.06 mm. Out of 101 studied scapulae, rhinocerous horn was present in 16.83 percent. **Conclusion:** Knowledge of this morphometric data will be a guide for understanding the vulnerability of person for various surgical conditions involving scapula like snapping scapula, coracoid impingement syndrome, fractures, dislocations, arthritis and this data will also be of help during various diagnostic and therapeutic interventions of these conditions.

Keywords: morphometric study of human scapula, Snapping Scapula Syndrome, scapula

Introduction:

The snapping scapula syndrome is an infrequently described cause of shoulder pain .This syndrome was first described by Boinet in 1867. Milch and Burman[1] described this phenomenon to be secondary to an abnormality between the anterior surface of scapula and the thoracic wall. The superomedial border and the inferior pole of the scapula have wide anatomic variability. When no obvious deformity is found, it is hypothesized that an excessive forward curvature of the superomedial corner of the scapula is the cause of the disorder. A bony projection at the inferior pole is present in 22% of the population, making it the second most

common site for symptoms. The scapula connects the humerus with the clavicle. The scapula forms the posterior part of the shoulder girdle. In humans, it is a flat bone, roughly triangular in shape, placed on a posterolateral aspect of the thoracic cage overlapping second to seventh ribs.[2] Normal anatomy and normal movements of scapula are important for the smooth functioning of the entire upper limb. Variations in scapula will not only affect shoulder girdle movements but also will have effects on movements of shoulder joint. The scapula may be subjected to fractures, dislocations, arthritis, tumors and developmental abnormalities.[3] Pain in the anterior region of the shoulder is a frequent complaint among patients with scapular girdle injuries. Generally treatable cause of this pain is chronic subcoracoid impingement.[4,5] The main symptom in patients with proven subcoracoid impingement is a dull pain in front of shoulder. The coracoacromial arch includes the acromion, coracoacromial ligament and the coracoid process. The subcoracoid space is occupied in vivo by several soft tissue structures, such as the articular capsule of the gleno humeral joint, the subscapularis tendon and the subacromial bursa. The shape and size of this space depend on its limiting skeletal structures.[6,7] Therefore anatomical morphometric studies of these structures may provide information as to the aetiology of the subcoracoid impingement. It is the variation in the height and length of the coracoid process in most cases which is responsible for altering the size and shape of the space between the coracoacromial arch and the rotator cuff.[8] The initial treatment indicated for coracoids impingement syndrome (CIS) is conservative and includes anti-inflammatory medication, local anaesthesia, and physiotherapy. Coracoplasty (excision of the posterolateral border of the coracoid process) is indicated in patients who are refractory to that treatments[9] in this way to understand the etiology, to reach a diagnosis and execution of investigative and therapeutic procedures require morphometric data of coracoid process. The incidence of acromioplasty has increased dramatically in recent decades. Acromioplasty is often performed as a part of subacromial decompression. 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 may also be of interest to the anthropologists when studying about the evolution of the bipedal gait. Snapping scapula syndrome is thought to be caused by irregular motion between the scapula and thoracic rib cage.[1,10,11] This abnormal scapulothoracic motion can be the result from one of several causes.[12,13] The known etiological factors of snapping scapula are bony and soft tissue in origin. Despite the increasing use of advanced roentgenographic diagnostic techniques, no definitive cause has been attributed to this debilitating condition. The osseous incongruity of costal surface of scapula still remains as a significant causative factor of snapping scapula.[14] Variations in anatomy of scapula may be responsible for causing symptoms by itself or secondary to reduction of intervening soft tissue between scapula and the thoracic wall. Knowledge of the variations in morphology of scapula may help in diagnosis and localization of site of local anaesthetic injection aimed for pain relief or even deciding the extent of area to be resected in resistant cases.

Aims and Objective:

To Study Human Scapula Concerned with Snapping Scapula Syndrome.

Material and Methods:

One hundred and one unpaired (56 left and 45 rights sided) complete and undamaged dry human scapulae were obtained from a teaching medical institute of Mumbai. The bones were of unknown age and gender. The parameters measured were recorded in the proforma. The study was conducted after receiving approval from institutional ethics committee. Anatomical measurements were taken using a wooden scale, divider, Vernier calliper of least count 0.01, protractor, 60 and 45 degree

squares, non-elastic cotton threads, in white and red colour and a copper wire the data was entered in Microsoft Excel 2007 and then transferred to SPSS version 17. Statistical analysis was done using SPSS software version 17 and mean, median, range and standard deviation were calculate.

Result:

Table 1(A): Distance between the Inferior Surface of Acromial Process and Supraglenoid Tubercle (n-101)

Variable	Mean	Median	SD	Range	Min	Max
Distance between the inferior surface of acromial process and supraglenoid tubercle (in mm)	29.38	29	2.8	14	22	36

Table 1(B): Distance between the Inferior Surface of Acromial Process and Supraglenoid Tubercle

Distance between the inferior surface of acromial process and supraglenoid tubercle (in mm)	Frequency	Percent
22-26	14	13.86
27-31	63	62.38
>31	24	23.76
Total	101	100

Distance between the inferior surface of acromion process and supraglenoid tubercle varied from 22 to 36 mm with an average of 29.38 mm. Most scapulae (62.37%) had distance between the inferior surface of acromial process and supraglenoid tubercle in the range of 27 to 31 mm.

Table 2(A): Superomedial Angle of the Costal Surface (n-101)

Variable	Mean	Median	SD	Range	Min	Max
Superomedial angle of the costal surface (in degree)	137.93	139	8.85	42	113	155

Table 2(B): Superomedial Angle of the Costal Surface

Superomedial angle of the costal surface (in degree)	Frequency	Percent
113-126	11	10.89
127-140	50	49.51
>140	40	39.6
Total	101	100

Superomedial angle of the costal surface varied from 113 to 155 degrees with an average of 137.93 degree. Most scapulae (49.5%) had superomedial angle of the costal surface in the range of 127 to 140 degrees.

Table 3(A): Forward Angulation of Base of Coracoid Process at Costal Surface (n-101)

Variable	Mean	Median	SD	Range	Min	Max
Forward angulation of base of coracoid process at costal surface (in degrees)	141.95	142	8.25	36	122	158

Table 3(B): Forward Angulation of Base of Coracoid Process at Costal Surface

Forward angulation of base of coracoids process at costal surface (in degrees)	Frequency	Percent
122-133	16	15.84
134-145	47	46.53
>145	38	37.63
Total	101	100

Forward angulation of base of coracoid process at costal surface varied from 122 to 158 degrees with an average of 141.95 degrees. Most scapulae (46.53%) had forward angulation of base of coracoid process at costal surface in the range of 134 to 145 degrees.

Table 4(A): Antero-Posterior Thickness of Superior Angle of Scapula (n-101)

Variable	Mean	Median	SD	Range	Min	Max
Antero-posterior thickness of superior angle of scapula (in mm)	3.28	3	1.06	7	2	9

Table 4(B): Antero-Posterior Thickness of Superior Angle of Scapula

Antero-posterior thickness of superior angle of scapula (in mm)	Frequency	Percent
2.0-4.0	87	86.14
4.1-6.0	12	11.88
>6.0	02	1.98
Total	101	100

Antero-posterior thickness of superior angle of scapula varied from 2 mm to 9 mm with an average of 3.28 mm. Most scapulae (86.14%) had antero-posterior thickness of superior angle of scapula in the range of 2 to 4 mm.

Table 5 (A): Antero-Posterior Thickness of Inferior Angle of Scapula (n-101)

Variable	Mean	Median	SD	Range	Min	Max
Antero-posterior thickness of inferior angle of scapula (in mm)	6.75	6.8	1.06	5.7	3.8	9.5

Table 5 (B): Antero-Posterior Thickness of Inferior Angle of Scapula

Antero-posterior thickness of inferior angle of scapula (in mm)	Frequency	Percent
3.8-5.7	16	15.84
5.8-7.7	71	70.3
>7.7	14	13.86
Total	101	100

Antero-posterior thickness of inferior angle of scapula varied from 3.8 mm to 9.5 mm with an average of 6.75 mm. Most scapulae (70.29%) had antero-posterior thickness of inferior angle of scapula in the range of 5.8 to 7.7 mm.

Table 6: Rhinoceros Horn (n-101)

Rhinoceros horn	Frequency	Percentage
Present	17	16.83
Absent	84	83.17
Total	101	100

Out of 101 studied scapulae, rhinoceros horn was present in 16.83 percent.

Discussion:

Normal anatomy and normal movements of scapula are important for the smooth functioning of the entire upper limb. Variations in scapula will not only affect shoulder girdle movements but also will have effects on movements of shoulder joint. In present study the various dimensions of 101 scapulae were studied. The known etiological factors of snapping scapula are bony and soft tissue in origin. Despite the increasing use of advanced roentgen graphic diagnostic techniques, no definitive cause has been attributed to this debilitating condition. The osseous incongruity of costal surface of scapula still remains as a significant causative factor of snapping scapula.[14] In our study distance between the inferior surface of acromial process and supraglenoid tubercle was 29.38±2.8. Paraskevas et al.[15] reported it as 17.7 mm. Variations in normal anatomy of costal surface of scapula may disrupt smooth scapulothoracic movements and may cause snapping scapula. The known etiological factors of snapping scapula are

bony and soft tissue in origin. Continuous strong pull of serratus anterior may lead to excessive forward bending of upper margin of scapula. In case of Sprengle's deformity, forward bending of superior margin is not unusual. The scapula is less protected at superior angle. Milch et al.[1] reported that the abnormal forward curvature might be the cause of snapping scapula. In present study superomedial angle of the costal surface was 137.93±8.85 degrees. Thus more forward bending of upper segment of scapula towards thoracic wall (acute superomedial angle) may reduce the space between scapula and thoracic wall. As a result there is more likelihood of friction between the superior angle and thoracic wall, especially during activities involving overhead arm movement like swimming, rowing, throwing etc. Mozeset al.[17] evaluated the curvature of scapula in 20 cases in snapping scapula syndrome. In all cases costomedial angle was found to be less than 142 degrees. In our study average forward angulation of base of coracoid process at costal surface was 141.95±8.25 degrees. It ranged from 122 to 158 degrees. This finding is similar to finding noted by Aggarwal et al.[16] they reported it as 141.34±6.53 degrees. Excessive forward angulation may cause snapping scapula syndrome. However, Mozes et al.[17] in their study reported in one case scapular incongruity at the base of coracoids process detected by three-dimensional computed tomography which had been missed on plain radiographs and computed tomography. It was cited as an etiological factor in causation of scapular snapping. Thickening of superior angle due to various causes like Luschka's tubercle, osteochondroma, exostoses, etc. may be another etiological factors for the causation of snapping scapula. In the present study, average antero-posterior thickness of superior angle of scapula was 3.28±1.06 mm. The observations in the present study were found to be similar to those reported by Aggarwal et al.[16] and Lehtinen et al.[18] Aggarwal et al.[16] reported it as 3.34±0.87 mm. Whereas, Lehtinen et al.[18] reported it as 3.27±0.9 mm. The resection of thickest portion of superior angle has been known to relieve discomfort caused by its rubbing with the chest wall. Inferior angle is another known site of friction of scapula with the thoracic wall. Mean thickness found in our study is almost similar to that measured by Aggarwalet al.[16] In our study rhinocerous horn was present in 16.83% scapulae.

Conclusion:

Knowledge of this morphometric data will be a guide for understanding the vulnerability of person for various surgical conditions involving scapula like snapping scapula, coracoid impingement syndrome, fractures, dislocations, arthritis and this data will also be of help during various diagnostic and therapeutic interventions of these conditions.

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