# Morphometric Analysis of Coracoid Process in Adult Human Scapula in Eastern Odisha Population

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## Abstract

**Background:** Coracoid process is a bird's beak like projection which arises superolaterally from the upper border of the head. It plays an important role in shoulder function. The aim of our study is to measure the dimensions of the coracoid process of the scapula.

**Method:** The study was performed on 104 specimens of human scapula of unknown sex obtained from the Department of Anatomy of Institute of Medical Sciences & SUM hospital. The dimensions recorded were breath, length, height,thickness and types of coraco-glenoid space by using digital vernier calipers. These parameters were compared on both the sides.

**Results:** The most predominant coraco-glenoid space was found to be the round bracket (Type I). Statistically insignificant difference was noted in all four parameters between right and left. Though all the four parameters have higher values on right side in comparison to left side but the difference was statistically insignificant. The results are as such length of coracoid- 39.91±3.16 mm; width of coracoid- 14.00±2.03 mm; tip thickness of coracoid- 8.32±1.87 mm; height of base coracoid- 22.87±3.55 mm; width of base of coracoid- 10.50 ±2.64 mm;

**Conclusions:** The study of variation of dimensions of coracoid process provides valuable information regarding the role of these parameters in etiology of subcoracoid impingement syndrome which will help the radiologist and orthopedic surgeons for diagnosing various pathologies and plan for surgical procedure on coracoid process.

***Keywords:*** *Coracoid, Coraco-glenoid, morphometry, Subcoracoid impingement syndrome.*

## Introduction

The scapula is a large triangular flat bone which lies posterolaterally on the chest wall corresponding to second to seventh ribs. It has 2 surfaces-dorsal and costal surfaces; 3 borders-superior, medial and lateral borders; 3 angles, superior inferior and lateral angles and three processes called spine, acromion and the coracoid process. Each process has its separate importance.

The Coracoid process is a bird's beak like projection which arises superolaterally from the upper border of the head and is bent sharply so as to project forwards and slightly laterally.[1] The shoulder joint is highly mobile joint with less stability. It is a ball and socket type of synovial joint in which the large head of humerus articulates with the shallow glenoid cavity. So, the coracoid process is often referred to as the 'lighthouse of

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shoulder' in orthopedic literature.[2] The coracoacromial anatomy includes acromion, coracoacomial ligament and tip of coracoid process. The disparity in the height and length of coracoid process is responsible for altered shape of space between rotator cuff and coracoacromial arch. [3] The coracoid process is involved in many surgical procedures on the glenohumeral joint which forms an important part of the scapular glenoid structure. [4] The anatomy of the coracoids process and its related structures in the glenohumeral joint is required to study the radiological images and tocarry out surgical procedures in various shoulder pathology. The detail study of the dimensions of the coracoids process will help the surgeons for surgical procedures like drill hole placement, hardware fixation and prosthetic positioning.[5] Morphology of the coracoids process plays an importantrole in understanding impingement syndrome and pathogenesis of rotator cuff diseases.[6]

This study will also help the Forensic experts in determination of gender from these parameters.

A very few studies has been done regarding the morphometric values of coracoid process in eastern Indian population, so, the present study was planned to study the different parameters of coracoids process and types of coraco-glenoid space in adult human scapula of Eastern Odisha population.

The scapula is the anchoring point for the postural muscles of the shoulder; it provides stability necessary for a huge combination of movements around the shoulder joint. The coracoid process is rarely injured. It has a 3 dimensional orientation which makes it difficult to interpret in radiological images.[2] Any congenital variations and minimal iatrogenic changes in orientation can predispose to subcoracoid impingement.[7]

## Material and Method

The material for the present study comprised of 104 adult dry scapulae of unknown age and sex, obtained from the Department of Anatomy of Institute of Medical Sciences & sumhospital.

The dry adult scapulae taken for study were labeledwith suffix R (right) or L (left). All the scapule were cleaned thoroughly and complete in all aspects were included in this study and broken and deformed ones were excluded. The following parameters were measured on the coracoid process with help of digital Vernier caliper accurate up to 0.01 mm. The parameters taken were as follows

1. Length of coracoid process: (distance from the tip to the of horizontalpart)

2. Width of coracoid process:(Antero-posterior distance at the midpoint of coracoidprocess).

3. Thickness of coracoid process (supero inferior distance 1cm posterior to the tip)

4. Base height (maximum superoinferior distantance of the base)

5. Base width (maximum lateral-medial distantance of the base).

Coraco-glenoid space was classified by Gallino et al.[8]into

1. Round bracket (Type I),

2. Square bracket (II)

3. Fish hook (III)

## Result

All the measurements were taken and the data was tabulated and analyzed using Microsoft Excels software. P value was calculated by using unpaired t test for various parameters. Difference was considered to be statistically significant if p value obtained was less than 0.05.

The shape of the coraco-glenoid space was found to be round bracket like (Figure 1) in 58 cases (55.76 %), square bracket like (Figure 2) in 33 cases (31.74 %) and fish hooked like (Figure 3) in 13 cases (12.50 %). All the measurements are displayed in Table 1

**Length of coracoid process:** The mean length of coracoid process was observed to be 39.91±3.16 mm in the present study. The mean length was more on left side in comparison to right side but the difference was statistically insignificant.

**Breadth of coracoid process:** The mean breadth of coracoid process was observed to be 14.00±2.03 mm in the present study. The mean breadth was more on left side in comparison to right side but the difference was statistically insignificant.

**Thickness of coracoid process:** The mean thickness of coracoid process was observed to be

8.32±1.87 mm in the present study. It was more in left side in comparison to right side but the difference was statistically insignificant.

**Height of base of coracoid process:** The mean height of base of coracoid process was observed to be 22.87±3.55 mm in the present study. The mean height was more on left side in comparison to right side but the difference was statistically insignificant.

**Width of base of coracoid process:** The mean width of base of coracoid process was observed to be 10.50 ±2.64 mm in the present study. The mean width was more on right side in comparison to left side but the difference was statistically insignificant. All the measurements are displayed in Table 2.

**Table 1: Different shapes of coraco-glenoid shapes.**

| Shape | Right Side | Left Side | Total |
|---|---|---|---|
| Rounded | 38(63.33%) | 20(45.45%) | 58(55.76%) |
| Square | 18 (30%) | 15(34.10%) | 33(31.74%) |
| Hooked | 4(6.67%) | 9(20.45%) | 13 (12.50%) |
| Total | (100%) | (100%) | (100%) |

**Table 2: Observations of different parameters of coracoid process.**

| Parameter | Range of Measurements (mm) | | Mean±SD (mm) | | Average Mean±SD (mm) | P value |
|---|---|---|---|---|---|---|
| | Right (n=60) | Left(n=44) | Right | Left | | |
| Length | 34.5 -44.04 | 35.72 – 41.84 | 39.66 ± 3.0 | 40.27 ± 2.30 | 39.91 ± 3.16 | 0.18 |
| Breath | 10.58- 17.86 | 10.84 – 17.08 | 13.93 ± 2.1 | 14.11 ±3.21 | 14.00 ± 2.03 | 0.09 |
| Thickness | 6.1 – 10.32 | 7.36 – 10.56 | 8.09 ± 1.42 | 8.64 ± 1.00 | 8.32 ± 1.27 | 0.77 |
| B. Height | 12.6 - 26.75 | 6.36 - 17.84 | 22.59 ± 3.75 | 23.24 ± 3.41 | 22.87 ± 3.55 | 0.46 |
| B. Width | 16.42 – 28.82 | 6.76 – 13.84 | 10.66 ± 2.89 | 10.29 ± 2.37 | 10.50 ± 2.64 | 0.73 |

**Figure 1: Type-I (round bracket) coraco-glenoid space**

**Figure 2: Type-II (square bracket) coraco-glenoid space.**

**Figure 3: Type-III (fish hooked) coraco-glenoid space.**

## Discussion

Coracoid process plays important role in functions of scapula. The coracoid process acts like a lever through which the muscular action of the biceps, coracobrachialis, and pectoralis minor muscles exerts a force on the glenoid. The shoulder joint is a most frequently dislocated in adults as well as children, the injury of thecoracoid process is very rare.So fractures of coracoid present a challenge to repair by the operating surgeons. The frequency of fracture ofcoracoid process was between 3% and 13% of all the fractures involving scapula. The base of the coracoid is most commonly fractured. The results obtained in the presentstudy demonstrates the dimensions of the coracoid process can help in deriving appropriate strategy for repair of the fracture. Various ways of open surgical and arthroscopic access to the shoulder involves the coracoid process. So, its morphometry is of pivotal importance in surgeries of the shoulder joint.

Various studies have shown that the skeletal morphometry is influenced by different factors such as race and sex.[9,10] The study of the morphometry of coracoid process shows that it as a key structure and potential mediator in shoulder surgery and pathology.[11]

The mean length of coracoid process was found to be 39.91±3.16 mm with mean of 39.66 ± 3.0 on right side and 40.27 ± 2.30 on left side. The findings of the current study is similar to those found out by Kavita et al[12],Kour et al[13] and Rajan et al[3]. While the findings of Gallino et al[6]; and Burke et al[14] are slightly higher than present study and the results found by, Piyawinijwong et al[15] and Gumina et al[16] is less than our study.

The mean breath of coracoid process was found to be 14.00±2.03 mm in the present study with mean of 13.93 ± 2.1 on right side and 14.11 ± 3.21 on left side. This findings is similar to those found by Rajan et al,Kour et al and Verma et al[3,13,17] but the studies done by Piyawinijwong et al[15] found slight lower value than the current study.

The mean thickness of coracoid process was observed to be 8.32 ± 1.27mm in the present studywith mean of 8.09 ± 1.42mm on right side and 8.64 ± 1.00mm on left side which is almost equal to that of the findings of Verma et al[17] and S. Kalra et al.[18]The findings of Coskun et al, and Piyawinijwong et al is lower than the present study[1,15].

The mean height of the base of coracoid process was observed to be 22.87 ± 3.55 mm in the present study with mean of 22.59 ± 3.75 mm on right side and 23.24 ± 3.41mm on left side. Our findings are higher in comparison to the studies done byRajan et al, Piyawinijwong et al and Gumina et al[3, 15, 16] and it is similar to the findings of Verma et al.[17]

The mean width of the base of coracoid process was observed to be 10.50 ± 2.64 mm in the present study with mean of 10.66 ± 2.89 mm on right side and 10.29 ± 2.37mm on left side. Our findings are similar to the studies done by FathiM et al.[19]

**Shape of coraco-glenoid cavity:** In the present study Type I(round bracket)was the most common type seen in 55.78% of the scapulae out of which 63.33% of sample on right side and 45.45 % on left side. The second most common type was Type II(square bracket)seen in 31.74 % which was found 30 % on right side and 34.10 % on left side and least is Type III (fish hooked)vshape in 12.50 % which was 6.67% % on right and 20.45 % on left side. The findings of the current study was similar to the findings of the Verma et al and Gumina et al.[17,16]

## Conclusion

The morphometric analysis of the coracoid process should be used like a tool for surgical procedure on coracoid process. A very few studies has been done to demonstrate the various dimensions of coracoid process. It will help the orthopedic surgeons to operate the gleno-humeral joint during impingement syndrome, rotator cuff rupture and for shoulder prosthesis in total shoulder arthroplasty. The study of the dimensions of coracoid process helps the radiologists to interpret any pathological conditions associated with it. These findings might also be useful in determination of gender by the forensic experts. The various scapular dimensions obtained in this study will also be useful in comparative anatomy and manufacturing prosthetic products. The current study will be of immense help in orthopedic surgeries on the shoulder joint and in biomechanical engineering for designing implants for total shoulder replacement

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