*IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*
*e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 24, Issue 7 Ser.3 (July 2025), PP 38-42*
*www.iosrjournals.org*

# A Morphometric Study of Acromion Process and Suprascapular Notch of Scapula Using Dry Scapulae

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***Abstract:***
***Background****: The anatomy of acromion process and related structures in the shoulder joint is of immense importance and is required to interpret radiological images and carry out surgical procedures in various shoulder pathologies. Morphology of the acromion is believed to play an important role in understanding shoulder impingement syndrome and pathogenesis of rotator-cuff diseases. The suprascapular notch is present at its anterolateral end of the superior border of scapula. The size and shape of suprascapular notch may be a factor in suprascapular nerve entrapment.*
***Objectives****: To determine and evaluate the prevalence the acromion process types, acromion tilt and the suprascapular notch types using various morphometric measurements.*
***Materials and Methods:*** *a cross-sectional study was carried out among 95 dried scapula bones obtained from the department of Anatomy, Regional Institute of Medical Sciences (RIMS) and Jawaharlal Nehru Institute of Medical Sciences (JNIMS) from period of November 2023 to February 2024 at the Department of Anatomy of Regional Institute of Medical Sciences, Imphal*
***Results:*** *The most common variety of acromion type was Type 2 (82.1%) followed by Type 1 (10.5%) and Type 3(7.4%) while Type 4 and Type 5 were not found. The mean Acromion tilt (AT) was 34±4.75°. The suprascapular notch type shows higher incidence of Type II in 59 cases (62.1%) followed by Type I in 19 cases (20%), Type III in 14 cases (14.7%) and Type IV in 3 cases (3.2%) respectively.*
***Keywords:*** *Acromion, suprascapular notch, variable morphology, scapula.*

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Date of Submission: 02-07-2025 Date of Acceptance: 11-07-2025

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## I. Introduction

The acromion process projects forward as a continuation of the spine of scapula at almost right angle from the lateral end. The lateral border of acromion is the continuation of lower border of crest of spine at acromion angle and forms subcutaneous bony landmark.[1]

The anatomy of acromion process and related structures in the shoulder joint is important and required to interpret radiological images and carry out surgical procedures in various shoulder pathologies. Morphology of the acromion is believed to play an important role in understanding the impingement syndrome and pathogenesis of rotator cuff diseases.[2]

The suprascapular notch is present at its anterolateral end of superior border of scapula. The notch is bridge by superior transverse ligament (suprascapular ligament). The ligament is sometimes ossified thus forming a foramen which transmits the suprascapular nerve whereas the suprascapular vessels pass backward above the ligament.[1] The size and shape of suprascapular notch may be a factor in suprascapular nerve entrapment. Suprascapular nerve entrapment is an uncommon cause of shoulder pathology that often presents with posterior shoulder pain and wasting of the supraspinatus and infraspinatus muscle[3]. Natsis K[4] et al proposed to classify the morphology of the suprascapular notch into 5 types on basis of specific geometrical parameters that clearly distinguish one type from another. Five types of Suprascapular notch were observed: type I, no discrete notch; type II, notch with longer transverse than vertical diameter; type III, notch with longer vertical diameter; type IV, a bony foramen; type V, a notch and a bony foramen.[4]

The current study involves the morphometric study of acromion and suprascapular notch.

## II. Materials and Methods

The present Cross-sectional study was carried out at the Department of Anatomy of Regional Institute of Medical Sciences, Imphal. 95 numbers of intact dry adult scapula bones of unknown sex were obtained from the Department of Anatomy, Regional Institute of Medical Sciences (RIMS) and Jawaharlal Nehru Institute of Medical Sciences (JNIMS). Fracture and deformed scapula bones were excluded.Morphometric measurements were taken using a digital vernier calliper and bone holder. Photographs of all the levelled scapulae were taken after calibration and acromion tilt were measured using the National institute of health Image J software. Acromial length was measured from the most anterior-inferior point to the most posterior-inferior point of the acromion, this imaginary line (AL) was divided into anterior, mid and posterior thirds. The highest acromial undersurface was then measured from the imaginary line (AL) as the Acromion height (AH). Acromion process types and its variations were evaluated using modified Epstein classification according to Stelhe[5] et al, Type I (flat) is when the height of the highest acromial undersurface (AH) is less than 2% of the acromial length (AL). Type II (curved) is when the highest point is>2% of the length, and over the middle third. Type III (hooked) is when the highest point is>2% of the length, and over the anterior third. Type IV (reversed curved) is when the lowest point of the undersurface is under the acromial length. e Type V (S-shaped) is a proposed pattern in which the undersurface of the acromion is both>2% over the acromial length is one area and under it in another section.

A line is drawn from the most anterior-inferior point towards the most posterior-inferior point of the acromion (acromial length). Another line is then drawn from the most postero-inferior acromial point to the most inferior and lateral point of the coracoid process. The internal angle between these two lines is the AT.

The maximum transverse diameter and maximum vertical diameter of suprascapular notch were measured. Five types of Suprascapular notch were observed: Type I, no discrete notch; Type II, notch with longer transverse than vertical diameter; type III, notch with longer vertical diameter; Type IV, a bony foramen; Type V, a notch and a bony foramen as proposed by Natsis K[4] et al.

## III. Results

Acromion process type: In the present study of 95 dry scapulae, Type II (curved) acromion process were observed in majority (82.1%) of the scapulae followed by Type I acromion process in 10.5% and type III in 7.4%. Type IV and V acromion process were not observed in present study. A mean Acromion tilt (AT) was calculated as 34±4.75°. The suprascapular notch types (Table 2) showed higher incidence of Type II in 59 cases (62.1%) followed by Type I in 19 cases (20%), Type III in 14 cases (14.7%) and Type IV in 3 cases (3.2%) respectively.

**Table 1**. Distribution of acromion process type:

| Type of acromion process | Definition | Distribution |
|---|---|---|
| Type I (Flat) | Height of the highest acromial undersurface is less than 2% of the acromial length | 10 (10.5 %) |
| Type II (Curved) | The highest point is>2% the length, and over the middle third | 78 (82.1 %) |
| Type III (Hooked) | The highest point is>2% the length, and over the anterior third | 7 (7.4 %) |
| Type IV (Reversed curved) | The lowest point of the undersurface is under the acromial length | 0 |
| Type V (S- shaped) | A proposed pattern in which the undersurface of the acromion is both>2% over the acromial length is one area and under it in another section | 0 |

**Table 2**. Distribution of suprascapular notch

| Type | Definition | Distribution |
|---|---|---|
| Type I | Discrete notch | 19 (20%) |
| Type II | Notch with greater transverse diameter | 59 (62.1%) |
| Type III | Notch with greater vertical diameter | 14 (14.7%) |
| Type IV | Bony foramen | 3 (3.2%) |
| Type V | Notch and bony foramen | 0 |

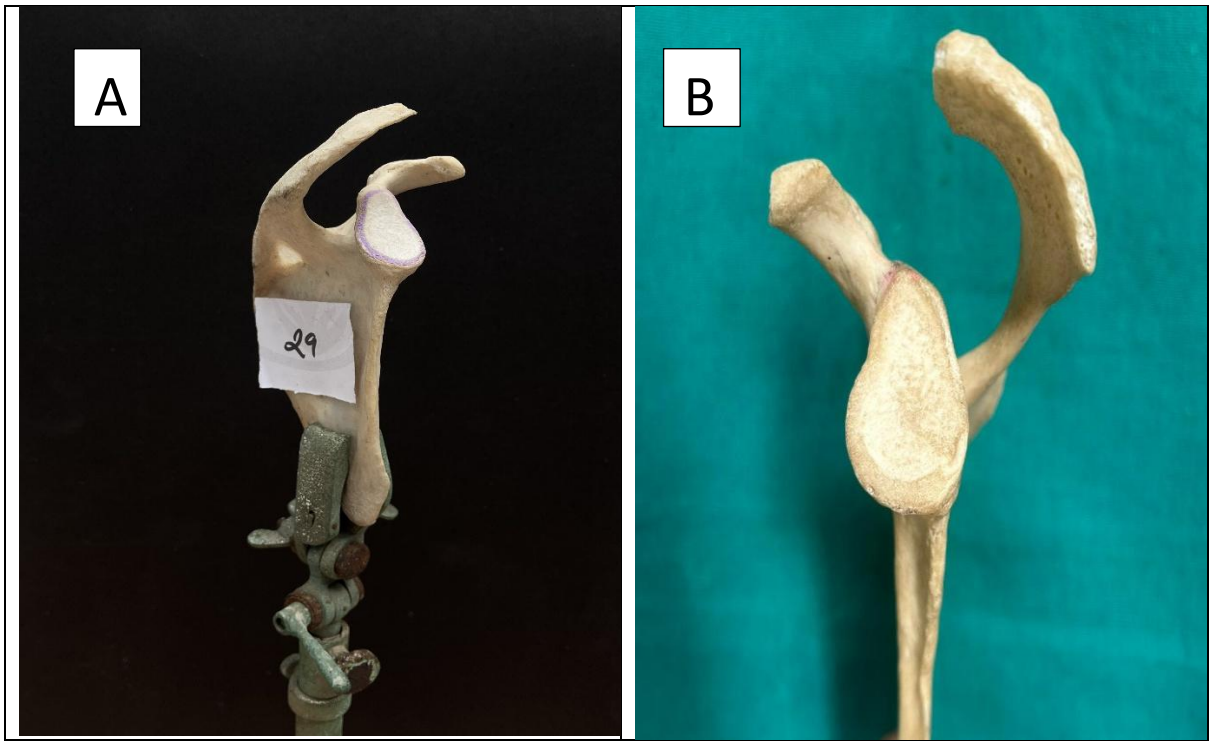


Fig 1: Acromion process types (A) Type 1; (B) Type 2

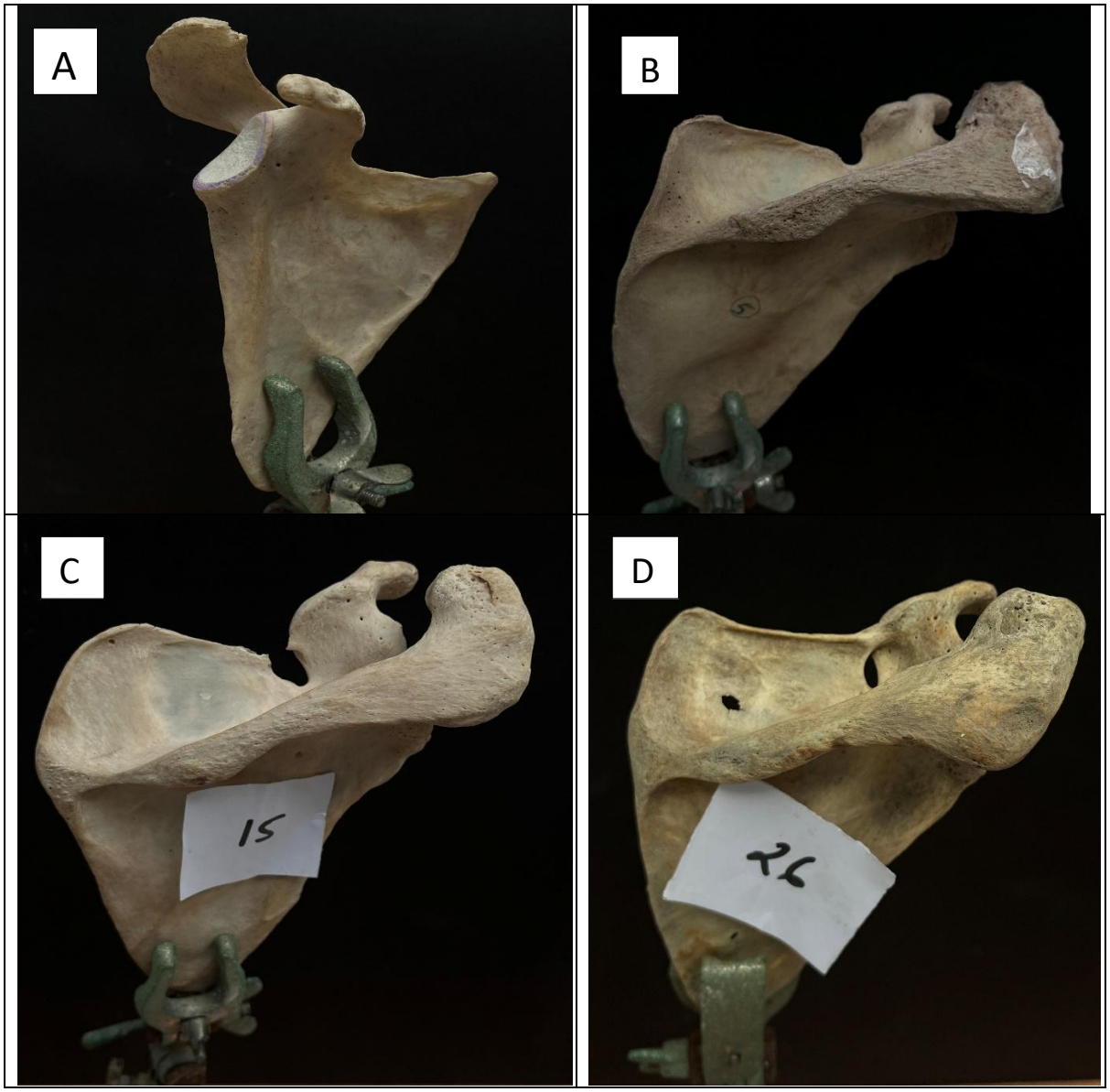


Fig 2: Supra scapular notch types (A) Type 1; (B) Type 2; (C) Type 3; (D) Type 4

## IV. Discussion

The mean acromion length and height observed in the study were 40.04 ± 5.08 mm and 3.18 ± 1.52 mm, respectively. Among the acromion types, Type II was the most prevalent, observed in 78 cases (82.1%), followed by Type I in 10 cases (10.5%) and Type III in 7 cases (7.4%). This suggests that the curved type is the most common, followed by the flat and hooked types. These findings are consistent with those of Gosavi S[2] et al., who reported Type II in 81.88% of cases, Type I in 13.38%, and Type III in 4.72% in the Indian population. In contrast, Singh J[6] et al. found a different pattern, with Type I being more common (31%), followed by Type II (48%) and Type III (21%). Similarly, Coskun[7] et al. reported a higher incidence of Type II (73%), however the second most common was Type III (17%), followed by Type I (10%), indicating that the hooked type was more frequent than the flat type.

The present study shows a mean Acromion tilt (AT) of 34±4.75. The association between the AT and shoulder pathology has not been completely defined due to controversy between authors, hypothesizing a smaller degree of inclination is correlated to Rotator cuff tear, and a higher degree of inclination with healthy shoulder.

The mean transverse diameter and vertical diameter of suprascapular notch were 9.56±2.86 and 6.32±2.37 respectively. This present study shows higher no. of Type II in 59 cases (62.1%) followed by Type I in 19 cases (20%), Type III in 14 cases (14.7%) and Type IV in 3 cases (3.2%) respectively. While in the study carried out by K. Natsis[4] et al, they found higher incidence of both Type II (41.85%) and Type III (41.85%) followed by Type I (8.3%), Type IV (7.3%) and Type V (0.7%).

## V. Conclusion

The knowledge of the morphology and morphometry of the acromion process and suprascapular notch has drawn the attention of anatomists, radiologist, anthropologists and orthopaedicians alike. The findings of the study may be useful in the sport medicine, orthopaecdic surgery.

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