

## A Cross-Sectional Study of Morphometric Measurements of the Lower end of the Ulna

Ranjan Kumar Das<sup>1</sup>, Charulata Sarangi<sup>2</sup>

<sup>1</sup>Professor, Department of Anatomy, DRIEMS Institute of Health Science & Hospital, Cuttack, Odisha, India<sup>1</sup>

<sup>2</sup>Associate Professor, Department of Anatomy, DRIEMS Institute of Health Science & Hospital, Cuttack, Odisha, India<sup>2</sup>

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Corresponding author: Dr. Ranjan Kumar Das

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### Abstract

**Objective:** In reconstructive procedures, the distal end of the ulna's anatomy is crucial. Head, styloid process, and fovea are located at the distal end. The Ulnar head is made up of two components, the pole and the seat. Due to non-union of the distal ulnar metaphysis, a fracture of the distal end of the radius is associated with a severe form of ulna fracture. This is similar to Baldwin's operation, which aims to create pseudo arthrosis in the lower end of the ulna by extra periosteal resection of a segment of the ulna's metaphysis.

**Method:** This study was conducted on 104 totally ossified, dry adult ulnae (52 right and 52 left), regardless of age, gender, etc. at Department of Anatomy, DRIEMS Institute of Health Science & Hospital, Cuttack from August 2021 to September 2022. Vernier digital calipers were used to take all of the measurements.

**Results:** The maximum pole width was 4.12 mm on average on both sides. The maximum seat height was 3.86 mm on average on both sides. The largest fovea width measured 3.85 mm on average on both sides. The greatest styloid process length averaged 6.174 mm on both sides.

**Conclusion:** Clinically, this study is crucial for anatomists, forensic experts, orthopedic surgeons, prosthetists, and researchers conducting medicolegal investigations, as well as for those creating appropriate prostheses and treating patients with lower ulna fractures.

**Keywords:** Lower end of Ulna, Seat, Fovea, Pole, And Styloid Process.

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### Introduction

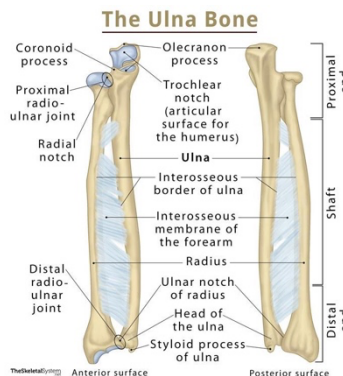
In reconstructive procedures, the distal end of the ulna's anatomy is crucial. Head, styloid process, and fovea are located at the distal end. Ulnar head is made up of two components, the pole and the seat. The triangular-shaped fibro cartilaginous complex sits between the pole and the triquetral bone. On the tip of the triangular fibro cartilaginous complex, the fovea is located. The inferior radioulnar joint is formed by the seat articulating with the

radius' ulnar notch. The head of the ulna had to be replaced with prosthetic material due to rheumatoid arthritis, traumatic arthritis, arthrosis, tenosynovitis of the extensor carpi ulnaris, injury to the triangular fibrocartilage complex, and Colles' fracture.

Two-thirds of the head of the ulna's perimeter, which is protected by articular cartilage, are covered by the seat. The stable distal end of the ulna is used as a

guide when rotating the forearm. Galeazzi fracture dislocation can happen in conjunction with ulna's styloid process fracture. The replacement of prosthetic

limbs and the treatment of distal radio-ulnar injury are both aided by the distal end of the ulna's morphometric values [Figure 1; 1].



**Figure 1: Distal of Ulna**

The head and styloid process are formed by expanding the ulna's distal end. The head can be grasped when the hand is in supination and is visible from the posteromedial carpal aspect when the forearm is pronated. Its convex lateral surface articulates with the ulna's radial notch. Its smooth distal surface is separated from the carpus by an articular disc. The styloid process and its articular surface are joined at the apex. One cm above the styloid process of the radius, the distal end of the ulna is palpable. There is a vertical groove on the back of the ulna between the head and the styloid process. The styloid process of the ulna's apex is where the ulnar collateral ligament attaches [2]. Unlike the impaction of the head of the ulna against the ulnocarpal impaction, ulnar styloid triquetral impaction is a pathological condition that generates pain on the ulnar side and has distinct radiographic and clinical features.

The styloid process of the ulna, which is located across from the proximal end of the lunate, is tender and painful on the ulnar side of the wrist. Anatomical variations in the length of the styloid process of the ulna were shown, and the styloid process of the ulna concept was introduced. The distal half of the radius rotates by 150 degrees arc on the

supination-pronation axis, which is stationary in reference to the ulna, and the lateral movements of the radius by 30 degrees allow this movement to rotate by 180 degrees for hand rotation.

Strong impacts on the thenar side of the hand during athletic activities result in wrist hyperextension, intercarpal supination, and ulnar deviation. The Herbert ulnar head prosthesis was implanted to treat ulnar head fracture and dislocation. Joints like the ulnocarpal joints and distal radioulnar joints are affected by trauma to the area around the head of the ulna. Untreated severe ulna injuries can result in arthrosis of the distal radioulnar joint [3, 4].

The results of this study may aid orthopaedic surgeons and prosthetists in treating lower end of ulna with triquetrum fractures.

## Methods

**Study Design:** This cross-sectional study was carried out at Department of Anatomy, DRIEMS Institute of Health Science & Hospital, Cuttack from August 2021 to September 2022.

**Methodology:** Vernier digital callipers were used to take all of the measurements. The following variables were looked at:

The distal end of the ulna, which connects to the wrist's triangular fibrocartilaginous complex, serves as the pole. The distance between the sites where the transverse axis meets the pole's borders was measured along the transverse axis. Using a Digital Vernier calliper, the maximum width of the pole seen at the distal end of the ulna was recorded. The seat refers to more than two-thirds of the distal convex lateral articular surface of the ulna's head. It was calculated as the distance from the seat's lateralmost points in the upper and lower margins, respectively. A digital vernier calliper was used to measure the highest height of the seat that could be seen at the distal end of the ulna. The indentation known as the fovea is located at the distal end of the ulna. The distance between the sites where the transverse axis meets the lateralmost point on the lateral border of the fovea and the lateral end of the base of the styloid process of the ulna was measured in transverse axis.

Using a Digital Vernier calliper, the maximum width of the fovea at the distal end of the ulna was seen and recorded. The bony protrusion from the medial and posterior surface of the lower end of the ulna is called the styloid process. The distance between the styloid process's tips

to its base is used to measure it. Using a digital vernier calliper, the styloid process' maximum length was examined and noted.

**Sample Size:** 104 dried adult ulnae that were totally osseous were used in this study (52 right & 52 left)

**Ethical Consideration:** The ethical committee of DRIEMS Institute of Health Science & Hospital after written consent was obtained from the individuals.

### Results

Due to the fact that they did not come from the same individuals, there was a little discrepancy in the values of the lower ends of the ulna on the right and left sides of the body for all 4 parameters. Statistics do not support the significance of the values of all 4 parameters at the lower end of the ulna on either side.

The maximum pole width was 4.12 on average on both sides. The maximum seat height on both sides was 3.85 on average. The fovea's maximal width was 3.85 mm on average on both sides.

The greatest styloid process length averaged 6.174 mm on both sides. Table No. 1 provides the results for each parameter for the right and left ulnae.

**Table 1: Results displaying all of the right and left ulna's parameters**

Parameters	Right ulna (Mean/S.D.)	Left ulna (Mean/S.D.)	t	D.F.	P-value	95% C.I. for the mean difference
Mean maximum width of pole	4.18±0.61	4.06±0.51	1.068	48	0.290	-0.10-0.34
Mean maximum height of seat	3.90±0.54	3.80±0.46	1.160	48	0.250	-0.06-0.27
Mean maximum width of fovea	3.82±0.43	3.88±0.41	0.600	48	0.550	-0.23-0.12
Mean maximum length of styloid process	6.25±1.10	6.08±1.05	0.788	48	0.433	-0.25-0.5

## Discussion

In normal life, hand and radius movements revolve around the fixed point represented by the ulna's distal end. The significance of the distal end of the ulna is helpful for the management of complex injuries as well as for therapy [5]. In the current study, the mean maximum pole width on the right side was  $4.18 \pm 0.61$  mm and on the left side was  $4.06 \pm 0.51$  mm. The results of the current investigation are consistent with those found in Bangalore, India by Vijaykishan B et al (2016) [6]. The values from Sharma A. (2011) in North India were marginally higher than the values [7] from the present study and the South Indian studies.

On the right side of the seat, the mean maximum height was  $3.90 \pm 0.53$  mm, whereas on the left, it was  $3.80 \pm 0.45$  mm. The values found by the current study are lower than those by Vijaykishan B et al, Zarana AA et al, Sharma A et al, Oommen SS, and Joshi SD et al.

On the right side, the mean maximal fovea width was 3.82 mm while on the left, it was  $3.88 \pm 0.41$  mm. The values found by the current study are lower than those by Vijaykishan B et al, Zarana AA et al, Sharma A et al, Oommen SS, and Joshi SD et al.

The mean maximal length of the styloid process in the current study was  $6.25 \pm 1.10$  mm on the right side and  $6.08 \pm 1.05$  mm on the left. The values found by the current study are higher than those by Vijaykishan B et al, Zarana AA et al, Sharma A et al, and Oommen SS. [8]

## Conclusion

For the purpose of operating on patients with fractures at the lower end of the ulna, this study is crucial for anatomists,

forensic experts, orthopaedic surgeons, prosthetists, and researchers conducting medicolegal investigations.

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