International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

*Original Research Article*

# Morphometry of Head of Ulna - An Anatomical Study

Vijaykishan B[1], Lakshmi TA[2], Jyotsna B[1], Rema D[3]

[1]Post Graduate, [2]Assistant Professor, [3]Professor,
Department of Anatomy, St. John's Medical College, Bangalore, India.

Corresponding Author: Rema D

*Received: 28/03/2016* *Revised: 21/04/2016* *Accepted: 22/04/2016*

## ABSTRACT

**Introduction:** Detailed anatomical knowledge of head of ulna plays a major role in understanding and treating post injury instability, painful conditions of distal radio-ulnar joint and for designing prosthesis, hence the present study was taken up.
**Materials and methods:** Cross sectional observational study was carried out on 100 dried cadaveric ulnae (50 right, 50 left). The parameters that were measured are, a) The maximum height of seat; b) The maximum width of pole; c) The maximum width of fovea in transverse axis; d) The length of styloid process. The above parameters were measured with digital vernier callipers of 0.01mm accuracy and results analysed using SPSS software version 16.
**Results:** The mean seat height was 5.9±0.7mm.The mean pole width was4.9±0.8mm. The mean width of fovea was5.3±0.7 mm. The mean length of styloid process was4.69±0.7mm.
**Conclusion:** Significant differences for seat height and length of styloid between right and left side was noticed. These parameters could be considered before reconstruction of the joint.

***Key words:*** Head of the ulna, Styloid process, Seat, Pole, Fovea.

## INTRODUCTION

Ulnar head prosthesis is a valuable option in patients with ulnar head fracture who require ulnar head replacement. [1] An in-depth knowledge of the anatomy of the distal end of the ulna would prove invaluable in reconstruction surgeries involving this region. The distal end of ulna consists of head, ulnar styloid process and fovea. The head has two parts namely pole and seat. (Refer figure 1)

The pole part of the head of ulna is separated from the triquetral by triangular fibrocartilaginous complex. The apex of a triangular fibrocartilaginous complex sits in the fovea. The seat part of the head of ulna articulates with the ulnar notch of radius forming distal radio ulnar joint. The relative lengths of distal articular surfaces of radius and ulna are variable. [2] The fibrocartilaginous articular disc binds the distal ends of the ulna and radius. The proximal surface articulates with the ulnar head, the distal is part of the radiocarpal joint, and articulates with the lunate and, when the hand is adducted, the triquetrum. The two main ligaments stabilising the distal radio ulnar joint are palmar and dorsal radio ulnar ligaments. [3] Traumatic arthritis, arthrosis, rheumatoid arthritis, Colles' fracture, tenosynovitis of extensor carpi ulnaris and injury to triangular fibrocartilage complex are some of the common conditions that might require ulnar head replacement. [4] A prosthesis that could resemble the ulnar head as closely as possible would definitely help in bringing about better congruence between the articulating surfaces. Thus this study was taken up to obtain morphometric values of

the head of ulna that would help improved results ulnar head replacement surgeries.

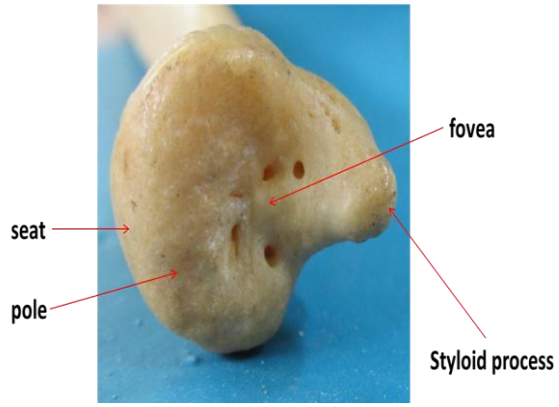

**Fig 1: Distal end of ulna.**

## MATERIALS AND METHODS

Cross sectional analytical study was performed on 100 adult dry cadaveric ulnae (50 right and 50 left) of unknown gender selected from the department of Anatomy, St John's Medical College, Bangalore. All dry ulnae were inspected carefully and those damaged at the head of ulna and ones showing obvious pathology like healed fractures were excluded from study. The following parameters were measured:

1. The maximum height of the seat(SH) as the distance between lateral most point in the upper margin to the lateral most point in the lower margin of the seat.(Refer fig 2)
2. The maximum width of fovea in transverse axis (FW) as the distance between points where transverse axis meets the lateral most point on the lateral margin of fovea and the lateral end of base of styloid. (Refer fig 3)
3. Maximum width of pole in transverse axis (PW) as the distance between the points where the transverse axis meets the margins of the pole. (Refer fig 4)
4. Length of styloid process (LS) as the distance between tip of styloid process to the base of styloid process. (Refer fig 5)

Measurements were taken directly on the ulnae with the help of digital vernier calliper accurate up to 0.1mm.

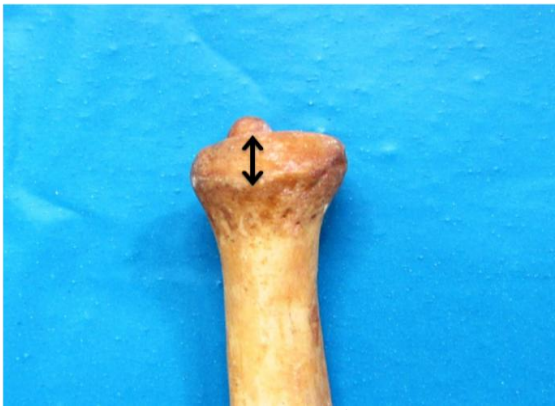
**Fig 2: Maximum height of seat (SH).**

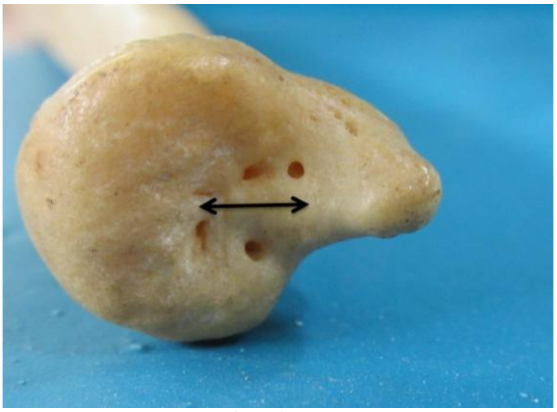
**Fig 3: Maximum width of the fovea in transverse axis (FW).**

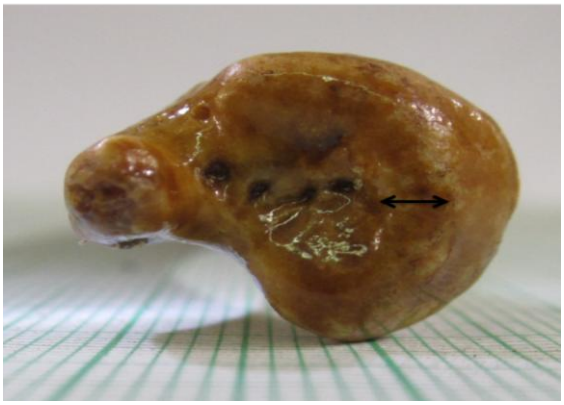
**Fig 4: Maximum width of pole in transverse axis (PW).**


**Fig 5: Length of styloid process (LS).**

***Statistics***

Statistical analysis was done using SPSS version 16. Mean and standard deviation were calculated. Side differences were compared using student 'T' test. 'P' value < 0.005 was considered significant.

## RESULTS

The results are compiled in Table 1.

**Table1: Mean, SD, p value of the measured parameters**

| Parameters | Combined Mean ± SD (left and right) | Right Ulna Mean ± SD n=50 | Left Ulna Mean ± SD n=50 | P value |
|---|---|---|---|---|
| SH(mm) | 5.9 ±0.7 | 6.06 ± 0.7 | 5.75 ± 0.7 | 0.042 |
| PW(mm) | 4.9 ± 0.8 | 4.92 ± 0.7 | 4.93 ± 0.9 | 0.98 |
| FW(mm) | 5.3 ± 0.7 | 5.42 ± 0.7 | 5.17 ± 0.6 | 0.08 |
| LS(mm) | 4.69 ± 0.7 | 4.89 ± 0.7 | 4.5 ± 0.7 | 0.008 |

Significant difference was noted in the seat height and length of styloid process between right and left ulna.

**Table 2: Comparison with previous studies for seat height (SH)**

| Author | Year | population | Number (n) | Right SH | Left SH |
|---|---|---|---|---|---|
| Sharma A et al | 2011 | Indian | n=100 | 5.90 ± 0.69 | 6.90±0.87 |
| Joshi S D et al | 2009 | Indian | n=129 | 6.39 | 5.26 |
| Present study | 2013 | Indian | n=100 | 6.06±0.7 | 5.75±0.7 |

**Table 3: Comparison with previous studies for pole width (PW)**

| Author | Year | Population | Number | Right PW | Left PW |
|---|---|---|---|---|---|
| Sharma A et al | 2011 | Indian | 100 | 5.40±0.9 | 6.10±0.69 |
| Joshi S D et al | 2009 | Indian | 129 | 5.26 | 4.76 |
| Present study | 2013 | Indian | 100 | 4.92±0.7 | 4.93±0.94 |

**Table 4: Comparison with previous studies for fovea width (FW)**

| Author | Year | Population | number | Right FW | Left FW |
|---|---|---|---|---|---|
| Sharma A et al | 2011 | Indian | 100 | 4.50±0.47 | 4.90±1.10 |
| Joshi S D et al | 2009 | Indian | 129 | 5.26 | 5.18 |
| Present | 2013 | Indian | 100 | 5.42±0.7 | 5.17±0.69 |

**Table 5: Comparison with previous studies for length of styloid process (LS)**

| Author | Year | Population | number | Right LS | Left LS |
|---|---|---|---|---|---|
| Sharma A et al | 2011 | Indian | n=100 | 5.20±0.82 | 5.00±0.67 |
| Present study | 2013 | Indian | n=100 | 4.89±0.7 | 4.5±0.74 |

## DISCUSSION

The wrist is a complex, compound joint consisting of the midcarpal joint, radio carpal joint, and distal radio ulnar joint. The distal radio ulnar joint together with the proximal radio ulnar joint allows pronation-supination of the wrist. Motion of distal radio ulnar joint is not a simple hinge-like motion, but rather a complex motion. The difference in curvature between the sigmoid notch of radius and ulnar head leads to joint incongruity that allows both rotational and translational motion. Distal radio ulnar joint motion depends on the ligament between the radius and ulna and can be affected by injury or disease, such as distal radio ulnar joint instability, malunion of the distal radius, or radioulnar synostosis and hence these measurements are taken. [5]

The present study is in concurrence with that done by Sharma A and Joshi S D et al with respect to significant difference between left and right sides in case of SH. The difference could be due to usage of the particular hand especially if we consider handedness and occupation. [6] The right side seat height in the present study is almost same as that of study done by Sharma A et al but less when compared to the study done by Joshi S D et al. Left sided seat height is less when compared to the study done by Sharma A et al and is almost same when compared to the study done by Joshi S D et al. (Refer Table 2)

Left and right side pole width (PW) in the present study is less when compared to the study done by Sharma A et al and Joshi S D et al. In both the studies done by

Sharma et al and Joshi et al, significant differences were noted in the pole width of right and left side which was not found in the present study. (Refer Table 3)

Right side fovea width is more when compared to the study done by Sharma A et al and Joshi S D et al. Left side fovea width is more when compared to the study done by Sharma A et al and less when compared to the study done by Joshi S D et al.(Refer table 4)

Length of right and left side styloid process is less when compared to the study done by Sharma A et al. (Refer Table 5)

Differences noted could be because of the different population used in the study. Ours is a South Indian study whereas Sharma and Joshi's were based on North Indian populations.

The overall values for most of the parameters appear lesser in the present study as compared to the North Indian studies. This difference could be attributed to the overall smaller stature of South Indians. [7]

Prosthetic replacements of ulnar head continue to evolve. It was revealed that 70% patients had satisfactory results. 40% had the tilting of prosthesis. 15% had the frank fracture of implant. Complications following implantation of the ulnar head include recurrent instability. [8] The ulnar head prosthesis is a modular endoprosthesis is that consists of a metal stem with a shaft that can be implanted into the intramedullary canal of the distal ulna. [9] Taking into consideration the measurements done on the articulating surface of the head while production of ulnar head prosthesis, could improve the results of the implantation.

The morphometric measurements done in the present study provides a data base on the Indian population, which could be considered while producing ulnar prosthesis.

## CONCLUSION

Significant differences have been noted in seat height and length of styloid process between right and left sides. These parameters should be considered before surgical reconstruction of the particular side.

Further studies need to done using higher imaging techniques comparing the above parameters with respect to the handedness of the individual, which also could have a significant influence on the morphometry of the articulating surface.

The bones that we used for the study were not segregated into males or females. Study based on the gender differences would add to the data base.

Remodelling and construction of prosthesis based on the morphometric data of the particular population would considerably improve the results of prosthetic surgeries.

## REFERENCES


1. Sharma A, Kumar A, Singh P.Anatomical study of the distal end of cadaveric human ulnae: a clinical consideration for the management of distal radioulnar joint injuries. Singapore Med J. 2011;52(9):673.
2. Joshi SD, Joshi SS, Athavale SA, Kishve PS, Jadhav SD. Metrical and non-metrical study of lower end of ulna. J AnatSoc India. 2009; 58:156-60.
3. Standring S et al. Gray's anatomy: The Anatomical basis of clinical practice. 40th ed UK: Elsevier Ltd; 2008; 867-871.
4. Herbert TJ, Schoonhoven JV. Ulnar Head Replacement. Techniques in hand and upper extremity surgery.*2007*; *11*(*1*):98-108.
5. Lee SK, Song YD, Choy WS. Correlation between dorsovolar translation and rotation of the radius on the distal radioulnar joint during supination and pronation of forearm. Acta Orthop. 2015; 81: 511-522.
6. KitsoulisPV, Paraskevas G, Iliou K, Marini A. Clinical study of the radioulnar deviation of the wrist joint and relevant impact factors.BMC Musculoskeletal Disorders.2010;11:9.
7. Prasanna LC, Bhonsale, D'Souza AS, Mamatha H, Thomas RH, Sachin KS. Facial indices of North and South Indian Adults: Reliability in Stature Estimation and sexual Dimorphism.

Journal of Clinical and Diagnostic Research. 2013; 7(8):1540-1542.
8. Tsai PC, Paksima N. The Distal Radioulnar Joint. Bulletin of the NYU Hospital for Joint Diseases. 2009; 67(1):90-6.
9. Sauerbier M, Werner AA, Enderle E, Vetter M, Vonier D. Ulnar head replacement and related biomechanics. J Wrist Surg. 2013; 2:27-32.

How to cite this article: Vijaykishan B, Lakshmi TA, Jyotsna B et al. Morphometry of head of ulna - an anatomical study. Int J Health Sci Res. 2016; 6(5):89-93.

**********