

Original Article

## Morphometric Study Of The Distal End Of Humerus With Its Clinical Applications

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### Abstract

**Background:** The arm bone is the largest and strongest bone of the superior extremity. Movement of the arm bone helps in essential activities like writing, lifting objects and throwing. The use of implants in communicated cracks in the lower end of the humerus of an aged person may be needed to retain mobility at the elbow joint. The present study aimed to provide morphometry of the distal end of the arm bone for comparison with different populations.

**Methodology:** The present study was performed on 300 dry adult humerus obtained from the Department of Anatomy at Index Medical College Department from February 2022 to June 2022.

**Results:** The mean length of the capitulum on the right side is 20.09mm and on the left side is 18.28mm, the mean Width of the capitulum on the right side is 20.09mm and on the left side is 17.80 mm, the mean of the Length of Trochlea on right side is 19.08 mm and on the left side is 18.51mm, the norm of Width of Trochlea on right side is 17.52 mm and on the left side is 16.72 mm, the standard of length of coronoid fossa on right side is 9.02 mm and on the left side is 8.91 mm, the mean of width of coronoid fossa on right side is 9.99 mm and on the left side is 9.43 mm, the mean of depth of coronoid fossa on right side is 4.35mm and on the left side is 4.25 mm, the mean of depth of coronoid fossa on right side is 7.37mm and on the left side is 47.07 mm, the mean of depth of coronoid fossa on right side is 8.86mm and on the left side is 7.64 mm, the mean of depth of radial fossa on right side is 2.05mm and on the left side is 2.07 mm, the standard of Length of olecranon fossa on right side is 18.82 mm and on the left side is 17.23 mm, the mean of width of olecranon fossa on right side is 25.93 mm and on the left side is 22.87 mm, the mean of depth of olecranon fossa on right side is 11.86 mm and on the left side is 11.82 mm, the mean of proximal point of olecranon fossa and distal point of trochlea on right side is 35.04 mm and on the left side is 34.71 mm, the mean Distance between Lateral epicondyle and Medial Epicondyle on right side is 56.16 mm and on the left side is 54.44 mm, respectively.

**Conclusion:** Morphometric parameters of 300 humeri were presented. This information can be helpful for surgeons in preparing implants and reconstruction of fractures of the distal end of the arm bone.

**Keywords:** Capitulum, Distal end, Fractures, Humerus, Trochlea

### Introduction

The distal end of the humerus is a modified condyle; it is wider transversely and has articular and non-articular parts. The articular part is curved forwards so that its anterior and posterior surfaces lie

in front of the corresponding characters of the shaft. It articulates with the radius and the ulna at the elbow joint and is divided by a faint groove into a lateral capitulum and a medial trochlea. The capitulum is a rounded, convex projection, considerably less than half a sphere, which covers the anterior and inferior surfaces of the lateral part of the condyle of the humerus but does not extend onto its posterior surface. It articulates with the discoid head of the radius, which lies in contact with its inferior surface in full extension of the elbow but slides onto its anterior surface during flexion. The groove of the trochlea winds backward and laterally from the anterior to the posterior surface of the bone and is broader, deeper, and more symmetrical posteriorly. Anteriorly, the medial flange of the pulley is longer than the lateral, and the surface adjoining its projecting medial margin is convex to accommodate itself to the medial part of the upper surface of the coronoid process of the ulna. These asymmetries entail varying angulation between the humeral and ulnar axes and some conjunct rotation. The non-articular part of the condyle includes the medial and lateral epicondyles and the olecranon, coronoid, and radial fossae.<sup>1,2,3</sup>

### Material and Method

The present study was performed on 300 dry adult humerus obtained from the Department of Anatomy at Index Medical College Department from February 2022 to June 2022.

### Method.

#### *Measurements of the distal epiphysis of Humerus.*

1. **LCH-WCH:** Length of the capitulum – Width of the capitulum.
2. **LTH-WTH:** Length of the trochlea – Width of the trochlea.
3. **LCF-WCF-DCF:** Length, width, and depth of the coronoid fossa.
4. **LRF-WRF-DRF:** The radial fossa's length, width, and depth.
5. **LOF-WOF-DOF:** Length, width, and depth of the olecranon fossa.
6. **POF-DTH:** The distance between the proximal point of the olecranon fossa and the distal point of the trochlea.
7. **LE-ME:** The distance between lateral epicondyle and medial epicondyle

**Data analysis:** the data were entered into Microsoft Excel (Office 2010, Microsoft Inc., USA) and followed by analysis using SPSS 23.0.



Image no.1 shows the distance between the lateral epicondyle and medial epicondyle.



**Image no.2 shows length of the capitulum**



**Image no. 3 showing the width of the trochlea**

**Results:**

The mean length of the capitulum on the right side is 20.09mm and on the left side is 18.28mm, , the mean Width of the capitulum on the right side is 20.09mm and on the left side is 17.80 mm, the mean of the Length of Trochlea on right side is 19.08 mm and on the left side is 18.51mm, the norm of Width of Trochlea on right side is 17.52 mm and on the left side is 16.72 mm, , the standard of length of coronoid fossa on right side is 9.02 mm and on the left side is 8.91 mm, the mean of width of coronoid fossa on right side is 9.99 mm and on the left side is 9.43 mm, the mean of depth of coronoid fossa on right side is 4.35mm and on the left side is 4.25 mm, the mean of depth of coronoid fossa on right side is 7.37mm and on the left side is 47.07 mm, the mean of depth of coronoid fossa on right side is 8.86mm and on the left side is 7.64 mm, the mean of depth of radial fossa on right side is 2.05mm and on the left side is 2.07 mm, the standard of Length of olecranon fossa on right side is 18.82 mm and on the left side is 17.23 mm, the mean of width of olecranon fossa on right side is 25.93 mm and on the left side is 22.87 mm, the mean of depth of olecranon fossa on right side is 11.86 mm and on the left side is 11.82 mm, the mean of proximal point of olecranon fossa and distal point of trochlea on right side is 35.04 mm and on the left side is 34.71 mm, the mean Distance between Lateral epicondyle and Medial Epicondyle on right side is 56.16 mm and on the left side is 54.44 mm, respectively.

## Discussion

In the index study, the mean values of length of the capitulum (LCH) on the left side is  $18.28 \pm 2.09$  mm and on the right side is  $20.09 \pm 2.69$  mm. The findings are comparable to **Aydin Kabakci et al<sup>4</sup>** as he observed that the mean values in the Turkish population on the right side it was  $18.32 \pm 1.60$  mm and on the left side it was  $17.34 \pm 1.84$  mm. The present study is conducted in Indian population and the mean value of width of the capitulum (WCH) on the left side is  $16.32 \pm 1.91$  mm and on the right side is  $17.80 \pm 2.9$  mm and it is compared with Turkish population study done by **Aydin Kabakci et al<sup>4</sup>** and he reported the mean on the right side was  $15.84 \pm 1.21$  mm and on the left side was  $17.12 \pm 1.84$  mm. In the index study the mean values of length of trochlea on the left side (LTH) is  $18.51 \pm 2.87$  mm and on right side is  $19.08 \pm 2.08$  mm and it is compared with the study of **Aydin Kabakci et al<sup>4</sup>** as he observed that the mean values on the right side was  $21.13 \pm 1.92$  mm and on the left side was  $20.71 \pm 2.04$  mm. **Aydin Kabakci et al<sup>4</sup>** founded that the mean values of the width of trochlea (WTH) in Turkish population were  $17.71 \pm 2.34$  mm on the right side and  $15.88 \pm 2.38$  mm on the left side and it is compared with present study, on the right side value is  $17.52 \pm 3.01$  mm and on the left side, it is  $16.72 \pm 2.29$  mm. The length of coronoid fossa (LCF) was observed in Turkish population by **Aydin Kabakci et al<sup>4</sup>** on the left side it was  $11.24 \pm 1.59$  mm and on the right side is  $12.54 \pm 7.66$  mm and the present study is compared with it on the left side it is  $8.91 \pm 1.66$  mm and on the right side, it is  $9.07 \pm 1.78$  mm. In the present study the width of coronoid fossa (WCF) on the left side is  $9.43 \pm 1.87$  mm and on the right side is  $9.99 \pm 1.38$  mm and it is compared with study of Turkish population done by **Aydin Kabakci et al<sup>4</sup>** the mean on the right side was  $12.95 \pm 1.73$  mm and on the left side was  $12.42 \pm 2.07$  mm. In the Turkish population study done by **Aydin Kabakci et al<sup>4</sup>** the mean of depth of coronoid fossa (DCF) on the right side was  $7.44 \pm 1.14$  and on the left side was  $6.82 \pm 1.35$  mm and in our study, we found that mean on the left side is  $4.25 \pm 1.15$  mm and on the right side is  $4.35 \pm 0.97$  mm. In the present study, the length of radial fossa on the left side is  $7.04 \pm 1.38$  mm and on the right side is  $7.37 \pm 1.38$  mm and it is comparable with the study of **Aydin Kabakci et al<sup>4</sup>** in the Turkish population as he reported the mean were  $8.52 \pm 1.23$  mm on the right side and on the left side it was  $8.03 \pm 1.43$  mm. In the present study, the mean of the width of radial fossa (WRF) on the right side is  $8.86 \pm 1.29$  mm and on the left side is  $7.64 \pm 1.69$  mm and it is comparable with Turkish population study done by **Aydin Kabakci et al<sup>4</sup>** as he observed that on the right side value was  $12.82 \pm 1.79$  and on the left side it was  $10.90 \pm 1.8$  mm. In the Turkish population by **Aydin Kabakci et al<sup>4</sup>** the mean of the depth of radial fossa (DRF) on the right side is  $3.41 \pm 1.10$  mm and on the left side is  $3.34 \pm 1.01$  mm and in our study, it is  $2.07 \pm 0.71$  mm on the right side and on the left side it is  $2.05 \pm 0.48$  mm.

In the present study, the mean of length of olecranon fossa (LOF) on the left side is  $17.23 \pm 3.18$  mm and on the right side is  $18.82 \pm 2.05$  mm and it is compared with Turkish population study, **Aydin Kabakci et al<sup>4</sup>** reported that the mean on the right side is  $19.10 \pm 1.4$  mm and on the left is  $19.46 \pm 1.94$  mm.

According to **Aydin Kabakci et al<sup>4</sup>** the mean values of width of olecranon fossa (WOF) in Turkish population on the right side was  $24.72 \pm 2.31$  mm and on the left it was  $25.16 \pm 2.45$  mm and it is compared with the present study on the right side mean value is  $25.93 \pm 2.92$  mm and on the left side it is  $22.87 \pm 3.22$  mm

In the present study the mean of depth of olecranon fossa (DOF) on the left side is  $11.82 \pm 1.69$  mm and on the right side is  $11.86 \pm 1.64$  mm and it is compared with Turkish population study done by **Aydin Kabakci et al<sup>4</sup>** the mean on the right side is  $13.41 \pm 1.78$  mm and on the left is  $14.60 \pm 1.44$  mm.

**Dr. Premchand et al<sup>6</sup>** observed the distance between the proximal point of olecranon fossa and distal point of coronoid fossa (POF-DTH) and observed the mean value  $32.70 \pm 2.51$  mm on the left side and  $31.64 \pm 2.30$  mm on the right side.

**Aydin Kabakci et al<sup>7</sup>** observed the mean value on the right side is  $33.81 \pm 2.70$  mm and on the left is  $35.69 \pm 3.13$  mm and the present study is compared with it on the right side we found the mean value is  $35.04 \pm 2.4$  mm and on the left side, it is  $34.71 \pm 2.65$  mm. Amudalapalli Siva Narayana et al

<sup>5</sup>reported the distance between lateral epicondyle and medial epicondyle (LE-ME) and founded mean value  $5.80 \pm 0.40$  cm on the right side and on the left side  $5.72 \pm 0.46$  cm.

**Zarana et al**<sup>6</sup> observed the mean values were  $5.66 \pm 0.36$  cm &  $5.58 \pm 0.42$  cm on the right and left side and the present study is compared with it on the right side it is  $55.18 \pm 5.76$  mm and on the left side is  $55.10 \pm 6.9$  mm.

### Conclusion

The difference observed in the distal humeral morphometry can be endorsed to genetic factors, race, environment and even continuous change in the mode of living of a human being. The morphometry of distal humerus can help in improving the designs of prosthetic implants which are used for reconstruction of complex fractures either by partial or total elbow arthroplasty.

### References

1. Boileau P, Walch G 1997 The three-dimensional geometry of the proximal humerus. Implications for surgical technique and prosthetic design. *J Bone Joint Surg Br* 79:857–65.
2. Dancker M 2013 The clinical, functional anatomy of the teres major muscle [diploma thesis]. Innsbruck Medical University.
3. Gray's Anatomy 41, forty-first edition pages 838- 839
4. Aydin kabakci, a. D.; buyukmumcu, m.; yilmaz, m. T.; cicekcibasi, a. E.; akın, d. & cihan, e. An osteometric study on humerus bones. *Int. J. Morphol.*, 35(1):219-226, 2017.
5. Dr. Premchand S. A., Dr. Manjappa T. Reconstruction of Humeral Length from Measurements of its Segments in South Indian Population *International Journal of Science and Research (IJSR)* ISSN (Online): 2319-7064 Impact Factor (2012): 3.358
6. Amudalapalli Siva Narayana, Ajay Ningaiah. A study on the nutrient foramen of humerus and observed that 87% bones have one and 11% have two nutrient foramina respectively *International Journal of Anatomy and Research, Int J Anat Res* 2016, Vol 4(3):2706-09. ISSN 2321-4287 DOI: <http://dx.doi.org/10.16965/ijar.2016.312>.
7. Zarana A. Ashiyani Seema Solanki, C. D. Mehta. The morphometric measurement of segments of humerus *Journal of Research in Medical and Dental Science* | Vol. 4 | Issue 1 | January – March 2016