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Original Research Article

# A Study of the Assessment of Morphometric Analysis of Dry Adult Human Humeral Condyles Bone

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## Abstract

**Background:** Morphometry of the long bones is important for the identification of unknown bodies, estimation of height, age, gender in forensic science. The present study aimed at morphometric analysis of dry adult human humeral condyles in dry bone.

**Materials & Methods:** 62 dry humerii of adults of both genders were studied and parameters were measured in both left and right side.

**Results:** Out of 62 humerii, 38 were of males and 24 were of females. The mean (mm) length of right and left humerus was 294.3 and 294.5, transverse diameter was 36.5 and 38.7, vertical diameter was 43.1 and 41.0, diameter of girth was 136.5 and 124.1, breadth of trochlear was 26.4 and 26.3, maximum shaft diameter was 31.5 and 32.4, minimum shaft diameter was 26.5 and 27.1, antero- posterior diameter of trochlea was 28.9 and 28.7, distance between medial and lateral epicondyle was 57.3 and 56.2, surface area of head of humerus was 23.5 and 23.9. The difference was non- significant (P> 0.05).

**Conclusion:** The morphometric measurements of segments of humerus is important for identifying the relationship between length of long bones and height of living as well as unknown bone fragments.

**Keywords:** humerus, long bones, morphometry



## Introduction

The medial epicondyle, which forms a conspicuous, blunt projection on the medial side of the condyle, is where the medial border of the humerus ends. It is usually visible and subcutaneous, especially when the elbow is passively flexed. The nerve is palpable and can be rolled against the bone in this location; if jarred against the epicondyle, a characteristic tingling sensation is felt. The attachment of the superficial group of forearm flexors defines the lower portion of the front surface of the medial epicondyle. Although it extends no further than the lateral supracondylar ridge, the lateral epicondyle is located in the lateral region of the condyle's non-articular portion. The superficial group of the

forearm's extensor muscles arise from the lateral side of the lower humeral epiphysis, are clearly visible on its lateral and anterior surfaces. The anconeus has its origin in a small area of the posterior surface [1]. The supracondylar part of the medial border is less prominent than the lat eral one, which contributes to the promine nce of the medial epicondyle.The presence of the supracondylar process is the only n oticeable variation [2]. The medial and lateral epicondyles on the lower end of the humerus are where muscles and ligaments are attached [3]. The humerus is the largest and sturdiest bone of the superior extremity. It has a proximal end, a shaft and a distal end. The lateral epicondyle, capitulum, trochlea, and medial epicondyle are the features of the distal end of the arm bone. The medial and lateral epicondyles of the arm bone give attachment to muscles for the flexor and extensor compartments of the forearm, respectively [4]. The trochlea at the distal end of the arm bone joins with the trochlear indent of the ulna and the capitulum joins with the radial head to form the elbow joint. The medial flange of the trochlea is sharp and at a lower level than the capitulum. This influences the carrying angle at the elbow [5]. Morphometry of the long bones is important for the identification of unknown bodies, estimation of height, age, and gender in forensic science. Anthropological scientists, health experts, and anatomists have used anthropometric techniques for the estimation of the height of an individual and bone length from unknown skeletal remains [6]. There are two methods Qualitative morphological examination remains the quickest and easiest method and, in experienced scientists, results in 95-100% accuracy. In terms of repeatability, data evolution, objectivity, and applicability to both cranial and postcranial morphology, the morphometric methods are most considered [7]. Many studies confirmed the humerus by using classical osteometric techniques. The humerus is one of the strongest long bones of the skeleton, which even in a fragmented state is likely to be recorded in a forensic case [8].

## Aims and objectives

The present study is aimed at morphometric analysis of dry adult human humeral condyles bone.

## Materials & Methods

The present cross-sectional study, which was conducted on 62 dry adults human humerii of both genders in the Department of Anatomy, Jannayak Karpoori Thakur Medical College & Hospital, Madhepura, Bihar (India). This study was approved from institutional ethical committee.The study was carried out over a period of 6 months, from january 2022 to june 2022. Parameters such as maximum diameter of the shaft, minimum diameter of the shaft, anterior-posterior diameter of trochlea, distance between medial and lateral epicondyle and surface area of the head of the humerus, maximum length of humerus that measures the distance between the highest point of the head of the humerus to the most distal point of the trochlea, maximum transverse diameter of the head that measures the straight distance between the most lateral points on articular surface of the head, maximum vertical diameter of the head that measures the straight distance between the highest and lowest points on the articular surfaces, taken at right angle to the transverse diameter, girth of the head that measures the circumference of the head along its articular surface, breadth of the trochlea that measures the breadth between the midpoint of the lateral margin of the trochlea and midpoint of lateral margin of capitulum, were measured using digital caliper, measuring tape, graph paper, card board and measuring scale. Data thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

## Results

**Table 1: Distribution of dry humerii**

| Total- 62 | | |
|---|---|---|
| **Gender** | **Males** | **Females** |
| Number | 38 | 24 |

Table 1 shows that out of 62 humerii, 38 were of males and 24 were of females.

**Table 2: Measurement of left and right humerus bone parameters**

| Parameters (mm) | Right(mm) | Left(mm) | P value |
|---|---|---|---|
| Length | 294.3 | 294.5 | 0.12 |
| Transverse diameter | 36.5 | 38.7 | 0.17 |
| Vertical diameter | 43.1 | 41.0 | 0.25 |
| Diameter of girth | 136.5 | 124.1 | 0.36 |
| Breadth of trochlear | 26.4 | 26.3 | 0.11 |
| Maximum shaft diameter | 31.5 | 32.4 | 0.92 |
| Minimum shaft diameter | 26.5 | 27.1 | 0.91 |
| Antero- posterior diameter of trochlea | 28.9 | 28.7 | 0.52 |
| Distance between medial and lateral epicondyle | 57.3 | 56.2 | 0.75 |
| Surface area of head of humerus | 23.5 | 23.9 | 0.99 |

Table 2, Figure 1 shows that the mean (mm) length of the right and left humerus was 294.3 and 294.5, the transverse diameter was 36.5 and 38.7, the vertical diameter was 43.1 and 41.0, the diameter of girth was 136.5 and 124.1, the breadth of trochlear was 26.4 and 26.3, the maximum shaft diameter was 31.5 and 32.4, the minimum shaft diameter was 26.5 and 27.1, the antero-posterior diameter of trochlea was 28.9 and 28.7, and the surface area of the head of humerus was 23.5 and 23.9. The difference was non-significant (P> 0.05).

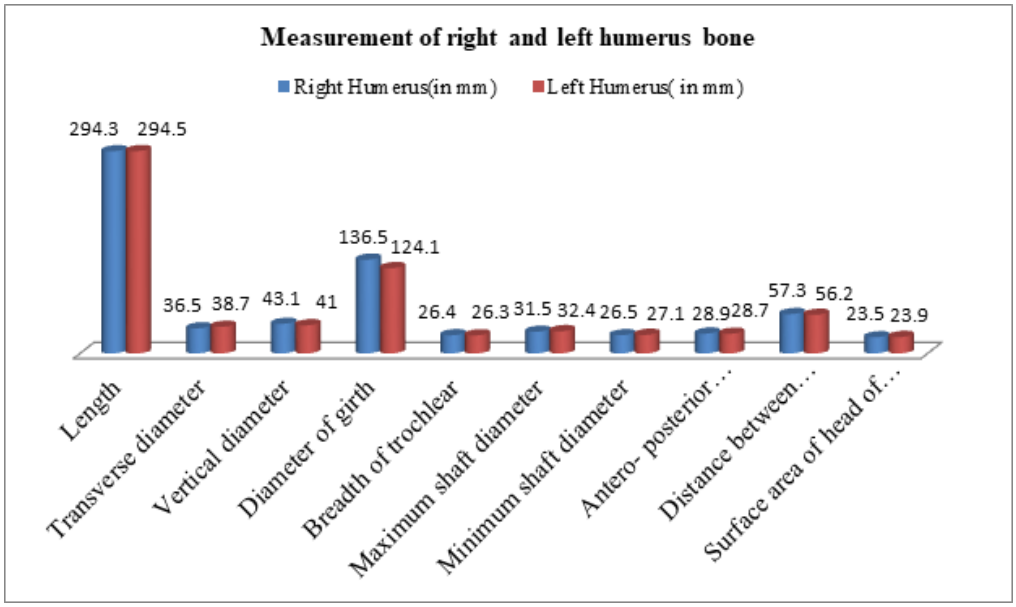


**Figure 1: Measurement of left and right humerus bone parameters**

## Discussion

Distal humeral arthroplasty is a reasonable treatment option for older patients with unreconstructable intraarticular fractures of the distal humerus as well as for younger patients with rheumatoid arthritis, orthopaedic tumours with significant bone loss, malunion, or osteomyelitis [9]. One of the longest bones in the human body is the humerus, which belongs to the upper limb. In forensic and anthropological practice, it plays a very important role because it is important to identify its length from the segmental measurements [10]. This method is an essential step in assessing health, sexual dimorphism, and the general body size that has trended among the past populations [11]. The present study is aimed at morphometric analysis of humeral condyles in dry bone. We found that out of 62 humerii, 38 were males and 24 were females. Burkhart et al. [12] reported that the postoperative mobilisation was immediate in elderly patients who underwent total elbow arthroplasty and they could do routine activities. We observed that mean (mm) length of right and left humerous was 294.3 mm and 294.5 mm, transverse diameter was 36.5mm and 38.7 mm, vertical diameter was 43.1 mm and 41.0 mm, diameter of girth was 136.5 mm and 124.1 mm, breadth of trochlear was 26.4 mm and 26.3 mm, maximum shaft diameter was 31.5 mm and 32.4 mm, minimum shaft diameter was 26.5 mm and 27.1 mm, antero- posterior diameter of trochlea was 28.9 mm and 28.7 mm, distance between medial and lateral epicondyle was 57.3 mm and 56.2 mm, surface area of head of humerus was 23.5 mm and 23.9 mm.

Vinay G et al. [13] aimed at providing morphometry of the distal end of the arm bone for comparison with different populations. The average value of the maximal length of the arm bone in the present study was 306.3 ± 21.19 mm in the right humerus and 301.1 ± 22.4 mm in the left humerus. The transverse distance between the medial and lateral epicondyles was 57.4 ± 4.8 mm and 56.0 ± 4.7 mm in right and left humerus, respectively. The average distance between the capitulum and medial end of trochlea horizontally was 39.6 ± 3.4 and 39.5 ± 4.3 mm in right and left humerus, respectively. The average maximum transverse diameter of the trochlea was 24.4 ± 2.6 and 23.5 ± 2.6 mm in right and left humerus, respectively. The average anteroposterior diameter of the trochlea was 17.0 ± 3.9 and 16.3 ± 3.7 mm in right and left humerus, respectively. Munoz et al [14] used remains of humerus segments to estimate the total length of humerus and gender. Orthopedic surgeons face difficulty in fixing the complex fractures involving the distal end of arm bone with damage to the nerve and blood vessels. The availability of pre-contoured implants helps in fracture reduction. The information of the morphometry of the distal end of the arm bone can assist in reconstructive surgeries through implants. Kumari et al. [15] studied 80 humerus (out of which 45 are of left side and 35 are of right side) to determine the different parameters of the humerus. The maximum length of the humerus was 284.39 ± 23.51 mm on left side and 291.20, ± 19.70 mm on the right side. Maximum transverse diameter was 39.21, ± 5.81 mm on left side and 36.91, ± 6.12 mm on the right side. Maximum vertical diameter of head was 41.96 ± 6.17 mm on left side 43.04, ± 5.42 mm on the right side. The maximum diameter of girth of head was 125.87 ± 12.78 mm on the left side and 137.61 ± 47.67 mm on the right side. [16] The breadth of trochlear on the left side was 26.85 ± 3.79 mm and 27.11±3.64 mm on the right side. The maximum diameter of shaft of humerus was 32.76 ±32.6 mm on left side and 32.04 ± 4.45 mm on the right side. The minimum diameter of shaft was 27.20 ± 2.90 mm on the left side and 26.55 ± 3.36 mm on the right side. Antero-posterior diameter of trochlea was 28.46 ±

2.81 mm on left side and 28.61 ± 2.76 mm on the right side. The distance between the medial and lateral condyle of humerus on the left side was 57.14 ± 6.44 mm and 58.67 ± 6.36 mm on the right side. The surface area of head of the humerus was 23.26 ± 4.80 mm on the left side and 23.20 ± 5.12 mm on the right side. The limitation the study is small sample size.

## Conclusion

Authors found that the morphometric measurements of segments of humerus is important for identifying the relationship between length of long bones and height of living as well as unknown bone fragments.

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