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CASE STUDY

Morphometric study of segments of humerus in Indian population

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ABSTRACT

Background: Humerus is the longest and strongest bone of the upper limb. It has an upper end, lower end, and a cylindrical shaft. If there is absence of cranium, pelvis, and long bone of the lower limb, evaluation of stature can be estimated by long bones such as humerus, ulna, and radius. We can also detect the total length of humerus by its segments. The understanding of morphometric segments of humerus is essential to demonstrate the length of humerus and sex of person. **Aims and Objectives:** Aims and objectives of my study are to determine the length of humeral segments and to compare with the total length of humerus in Indian population, which will help to estimate the stature of individual. **Materials and Methods:** In the present study, 40 dry humerus of unknown age and sex was collected from the Department of Anatomy, Hi-Tech Medical College and Hospital, Rourkela, and also from other medical college of Orissa. **Result:** In this study, 40 dry humerus were included out of which, 20 were of (R) and 20 were of (L). Measurement of six different parameters were taken from this study: (1) Mean maximum length of humerus, (2) Mean transverse and vertical diameter of humerus, (3) Mean distance b/w proximal and distal edge of olecranon fossa, (4) Mean distance b/w distal edge of olecranon fossa and trochlea, and (5) Mean distance b/w proximal edge of olecranon fossa and distal edge of trochlea. **Conclusion:** The understanding of morphometric segments of humerus is essential to demonstrate the length of humerus, age, sex, and stature of person and it is also essential for forensic experts, archeologists, and anatomists. It is also pleasant for orthopedic surgeons in various reconstructive surgery for various implants.

Keywords: Humerus, Morphometry, Forensic anthropology

INTRODUCTION

Humerus is the longest and strongest bone of the upper limb. It has an expanded upper end, lower end, and cylindrical shaft.

Proximal end of humerus consists of head, the anatomical neck, greater and lesser tubercles, and surgical neck. The greater and lesser tubercles are prominent landmarks on the proximal end of humerus and serve as attachment site for the four rotator cuff muscles of the glenohumeral joint. One of the most important features the proximal end of humerus is the surgical neck. Because the surgical neck is weaker than more proximal regions of the bone, it is one of the sites where the humerus commonly fractures.

Estimation of stature from bones of unidentified bodies or skeleton remains is important in medicolegal investigation.[1] In the absence of pelvis and cranium, morphometric analysis carried on the remains of long bones of an individual remains the best way for assessment of living stature of the individual.[2] When whole long bones are not available, a total length of humerus can be determined by the measurement of different segments.[3]

Estimation of bone length from incomplete long bones was first described by Muller, she defined five segments for the humerus based on margin of articular surfaces and key points of muscle attachment.[4] The present study is conducted for

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morphometric study of segments. The measurement of various segments of humerus is very important to provide data for various implants in the reconstruction of various humerus fractures.[5]

MATERIAL AND METHODS

The present study was conducted on 40 dry humerus of unknown age, sex, and race obtained from the Department of Anatomy, Hi-tech Medical College and Hospital, Rourkela, and also from other medical college of Orissa. The bones obtained are free from pathological changes. The bones which are incomplete or damaged were excluded from the study.

Measurement of six different parameters was taken from this study:

1) Maximum length of humerus – it is the distance between the highest point of head of humerus and most distal point of trachea.
2) Maximum vertical diameter of head – it is the straight distance between the highest and lowest points on articular surface
3) Maximum transverse diameter of head – it is the straight distance between the most lateral points on the articular surface of head
4) Distance between proximal and distal edge of olecranon fossa
5) Distance between proximal edge of olecranon fossa and distal edge of trochlea
6) Distance between distal edge of olecranon fossa and distal edge of trochlea

RESULTS

In the present study, a total of 40 humerus were included of which 20 were of the right and 20 were of the left side. Maximum length of the right and left humerus were 308.94 ± 8.06 and 305.84 ± 7.07, respectively. While the total maximum length of humerus was 306.48 ± 7.46 mm, the mean vertical diameter of the head of humerus was 40.55 ± 1.02 of the right side and 41.33 ± 0.92, respectively. The mean transverse diameter of the head of humerus was 38.06 ± 1.50 mm of the right side and 37.10 ± 0.63 mm of the left side, respectively. Mean distance b/w proximal and distal edge of olecranon fossa were 18.26 ± 1.07 mm of the right side and 17.97 ± 0.78 mm of the left side, respectively. Mean distance b/w proximal edge of olecranon fossa and the distal edge of trochlea were 32.47 ± 1.37 mm

Figure 1: Mean vertical diameter of head of humerus

Figure 2: Transverse diameter of head of humerus

Figure 3: Mean distance between proximal and distance edge of olecranon fossa

Table 1: Showing measurement of six different parametes of humerus

Serial no.	Parameters (mm)	Right	Left	Total
1	Maximum length of humerus	308.94±8.06 mm	305.84±7.07 mm	306.48±7.46 mm
2	Maximum vertical diameter of head of humerus	40.55±1.02 mm	41.33±0.92 mm	41.42±1.06 mm
3	Mean transverse diameter of head of humerus	38.06±1.50 mm	37.10±0.63 mm	38.05±1.23 mm
4	Mean distance B/w proximal and distal edge of olecranon fossa	18.26±1.07 mm	17.97±0.78 mm	18.36±0.83 mm
5	Mean distance B/w proximal edge of olecranon and distal edge of trochlea	32.47±1.37 mm	32.21±1.20 mm	33.38±1.22 mm
6	Mean distance B/w distal edge of olecranon fossa and trochlea	15.09 ± 0.72 mm	14.08 ± 0.72 mm	14 ± 0.8 mm

Figure 4: Mean distance between proximal edge of olecranon fossa and distal edge of trochlea

Figure 5: Mean distance between distal edge of olecranon fossa and trochlea

of the right side and 32.21 ± 1.20 mm of the left side, respectively. Mean distance b/w distal edge of the olecranon fossa and distal edge of trochlea were 15.09 ± 0.72 mm of the right side and 14.80 ± 0.72 mm of the left side, respectively [Figures 1-5 and Table 1].

DISCUSSION

In present study, the maximum length of humerus was 308.94 ± 8.06 mm on the right side and 305.84 ± 7.02 mm on the left side respectively whereas study done by Akman *et al*.,[6] maximum length of humerus was 307.1 ± 20.6 mm on the right side and 304 ± 18.9 mm on left side, respectively. Study done by Somesh *et al*.,[7] maximum length of the humerus was 309.6 ± 20.6 mm on the right side and 299.6 ± 22.5 mm on the left side, respectively.

The study done by Alkman, the maximum vertical diameter of head of humerus was 41.0 ± 5.1 mm on the right side and 40.9 ± 3.9 mm on the left side, respectively, whereas in the study done Pranoti, the maximum vertical diameter of head of humerus was 42.01 ± 4.39 mm on the right side and 40.93 ± 5.14 mm on the left side, respectively. In the present study, the maximum vertical diameter of head of humerus was 40.58 ± 1.02 mm and 41.33 ± 0.92 mm, respectively. The present study was similar to the study which was done by Alkman and Pranoti.

The study done by Pranoti, the maximum transverse diameter of head of humerus was 38.85 ± 5.09 mm on right side and 38.18 ± 4.79 mm on left side respectively, whereas in the present study maximum transverse diameter of head of humerus was 38.06 ± 1.50 mm on right side and 37.10 ± 0.63 mm on left side, respectively.

In this study, the mean distance b/w proximal edge of olecranon and distal edge of trochlea was 32.47 ± 1.37 mm of the right side and 32.21 ± 1.20 mm of the left side, which was very close to study done by Premchand.

Table 2: Comparison of maximum length of humerus

Authors	Year	Right	Left
Alkman *et al*.[6]	2006	307.1±20.6 mm	304±18.9 mm
Somesh *et al*.[7]	2011	309.6±20.6 mm	299.6±22.5 mm
Present study	2023	308.94 ± 8.66 mm	308.34 ± 8.06 mm

Table 3: Comparison of vertical diameter of head of humerus

Author	Year	Right	Left
Alkman *et al*.[7]	2006	41.0±5.5.1 mm	40.9±3.9 mm
Pranoti[8]	2007	42.01±4.39 mm	40.93±5.14 mm
Present study	2023	40.55 ± 1.02 mm	41.33 ± 0.92 mm

Table 4: Comparison of transverse diameter of head of humerus

Author	Year	Right	Left
Pranoti[9]	2017	38.85±5.09 mm	38.18±4.79 mm
Present study	2023	38.06 ± 1.50 mm	37.10 ± 0.63 mm

Table 5: Comparison of distance b/w proximal and distal edge of olecranon fossa of humerus

Authors	Year	Right	Left
Akman *et al*.[6]	2006	24.2±2.07 mm	23.9±2.63 mm
Premchand and Manjappa[8]	2014	17.6±0.16 mm	18.2±0.15 mm
Present Study	2023	18.26 ± 1.07 mm	17.97 ± 0.78 mm

Table 6: Comparison of distance b/w proximal edge of olecranon and distal edge of trochlea

Author	Year	Right	Left
Akman *et al*.[6]	2006	37.26±4.71 mm	35.72±4.30 mm
Somesh *et al*.[7]	2011	37.26±4.71 mm	35.72±4.30 mm
Premchand and Manjappa[8]	2014	31.60±2.30 mm	32.70±2.50 mm
Present study	2023	32.47 ± 1.37 mm	32.21 ± 1.20 mm

Table 7: Comparison of distance b/w distal edge of olecranon fossa and distal edge of trochlea

Author	Year	Right	Left
Wright and Vasquez[3]	2003	17.37±3.36 mm	16.82±2.20 mm
Premchand and Manjappa[8]	2014	14.00±1.30 mm	14.40±0.14 mm
Present study	2023	15.09 ± 0.72 mm	14.80 ± 0.72 mm

In this study, the mean distance b/w distal edge of olecranon fossa and distal edge of trochlea was 15.07 ± 0.72 mm on the right side and 14.80 ± 0.72 mm on the left side, respectively, which was very close to study done by Premchand [Tables 2-7].

CONCLUSION

The knowledge of morphometric segments of humerus is very essential for anatomist, archeologist, and forensic expert. It is also helpful for determination of age, stature, and sex of the individual. It is also helpful for orthopedic surgeons in its various reconstructive surgery.

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CONFLICTS OF INTEREST

None.

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