Section: Anatomy

Original Research Article

MORPHOMETRIC STUDY OF SHAFT AND LOWER END OF HUMERUS AND ITS APPLICATIONS IN CLINICAL PRACTICE

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Abstract

Background: Humerus is the bone of arm. It articulates with the radius and ulna and form the elbow joint. The morphometric analysis of lower end of humerus and upper end of radius and ulna is very valuable to correction of the various deformity related to the elbow joint. **Material and Methods:** The 115 dry humerus bones were selected from the department of Anatomy, Doon government medical college Dehradun and Sri Ram murti smarak Institute of medical and health sciences, Bareilly. Out of which 60 bones belongs to the right side and 55 from the left side. The age and sex of bones are unknown. Morphometric data of various parameters of the bones were recorded using vernier calipers and noted in the tabulated form. **Results:** The mean length of left and right humerus was noted 28.92± 2.39 cm &29.30± 2.35 cm. respectively. The mean transverse length of trochlea of the left and right humerus was measured 22.10± 2.99 mm and 22.90± 2.87mm. For left side the medial and lateral flange of trochlea were measured 11.42 ± 1.77mm and 8.74 ± 1.54 respectively. While for the right side it observed 11.15 ± 2.53 mm and 8.09 ± 2.36 mm respectively. The mean distance between the trochlea to capitulum on the left side were recorded 38.19 ± 3.96 mm, while it was 38.14 ± 4.44 mm on the right side. **Conclusion:** The knowledge of morphometric parameters observed in the present study may be helpful for the anthropological study and orthopaedic surgeons during the surgical procedures of elbow joint.

INTRODUCTION

Humerus is the longest bone of upper limb. It is the single and thickest bone which form the skeleton of arm. The lower limb bone femur and tibia are the most suitable bones for anthropological studies and forensic experts (Nath& Badkur,[1] Radoinova et al,[2], 2002). In the condition of unavailable of these bones, the morphometric analysis of the humerus (Kate & Majumdar, 1976),[3] play an important role in assessing the health and body size of any individual and very useful for forensic experts in the identification of age, sex , height for any living or dead (Bokariya et al., 2011.[4] Tellioglu & Karakas, 2013.[5] The total humerus length by a remains of humerus segments and estimation of sex from whole skeleton or remains can be estimated (Munoz et al).[6] This type of study is very useful in case of catastrophic events, such as train accidents, earthquakes, terrorist attacks, and plane crashes. Humerus has expanded ends and a shaft. The lower end of shaft is triangular. The lower expanded end having lateral and medial epicondyles. 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. Trochlea is a pulley shaped structure that covers the anterior, inferior and posterior surfaces of the condyle of humerus medially and on its lateral side, it is separated from capitulum by a faint groove. The metric and non-metric study of humerus is required to clinicians in repairing the proximal and distal fragment fractures/ reconstruction of trochlea and capitulum and designing of elbow prosthesis (Jupiter & Mehne, 1992).[7] Kate & Majumdar,[3] have been used specific osteometric techniques to estimating the humerus length from its fragments.

MATERIALS AND METHODS

Our study was performed with 115 humerus obtained from the Department of Anatomy, Sri Ram Murti Smarak Institute of Medical Sciences, Bareilly and Government Doon Medical College, Dehradun. The age and sex of the bones were not known. Out of 115 humerus bones 60 were right sided and 55 left sided. The bones having any type of deformities or damaged were not included for the study. The length of the humerus was calculated by using osteometric board. The maximum humeral length is the distance measured between the highest point of the humeral head and the lowest point of the trochlea. The various metric observations of the lower end of humerus were measured by digital vernier caliper. The transverse length of trochlea, medial and lateral flange of the Trochlea and distance between trochlea to capitulum were measured by digital vernier caliper. Data were analyzed by both descriptive (mean value, standard deviation, maximum and minimum values, percentages) and quantitative statistical methods.

RESULTS

In present study a total of 113 human humerus were observed. All the morphometric measurements were taken by osteometric board (for total length of humerus in centimeter) and verniercaliper (other parameters in millimeter). Mean, minimum, maximum and standard deviation values of all parameters of left and right side of humerus were determined and are shown in (Table I & Table 2). According to morphometric measurements of bones, the mean length of left humerus was 28.92± 2.39 cm and right humerus was 29.30± 2.35 cm. The mean transverse length of trochlea of the left humerus were measured 22.10± 2.99 mm and for the right humerus it was recorded 22.90± 2.87mm. The medial flange and lateral flange of trochlea of left side humerus were measured 11.42 ± 1.77mm and 8.74 ± 1.54respectively. While for the right side humerus medial and lateral flange of trochlea were recorded 11.15 ± 2.53 mm and 8.09 ± 2.36 mm respectively. The mean distance between the trochlea to capitulum on the left side were recorded 38.19 ± 3.96 mm, while it was 38.14 ± 4.44 mm on the right side.

Table 1: Value of metric parameters (of Humerus (left Humerus), Total no. of bone (n) = 60

S.N	Morphological parameters	Min.	Max.	Mean ±SD
1	Length of humerus (cm)	24.60	34.20	28.92±2.39
2	Tr.Length of Trochlea (mm)	16.37	27.76	22.10±2.99
3	Mf. of trochlea (mm)	8.65	13.88	11.42±1.77
4	Lf of trochlea (mm)	6.70	11.18	8.74±1.54
5	Distance between trochlea to capitulum (mm)	32.59	45.16	38.19±3.96

Table 2: Value of metric parameters of Humerus (right Humerus), Total no. of bone (n) = 55

S.N	Morphological parameters	Min.	Max.	Mean ±SD
1	Length of humerus (cm)	24.60	35.07	29.30±2.35
2	Tr. Length of Trochlea (mm)	18.72	26.62	22.90±2.87
3	Mf. Of trochlea (mm)	8.35	13.65	11.15±2.53
4	Lf of trochlea (mm)	4.47	10.55	8.09±2.36
5	Distance between trochlea to capitulum (mm)	32.34	43.57	38.14±4.44

Tr: transverse, cm: centimeter, mm: millimeter, Mf: medial flange of trochlea Lf: lateral flange of trochlea

Table 3: Comparative study of maximum length of Humerus (mm)

Researcher	Population	Left	Right
Akman et al[10], 2006	Turkish	304.88±20.8	307.1±20.8
Salles et al[11], 2009	Brazilian	305±16	313.0±23.0
Bokariya et al[4], 2011	--	307.00±1.27	312.9±1.74
Somesh et al[12], 2011	--	309.6±20.6	299.6±22.5
Desai et al[13], 2012	--	289.45±21.8	192.3±22.9
Present study,2023	North Indian	28.92±2.39 (cm)	29.30±2.35 (cm)

Figure 1: Osteometric board for measurement of length of Humerus

Figure 2: lower end of humerus showing the measurements of transverse length of trochlea to capitulum

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Figure 3: lower end of humerus showing the capitulum, trochlea and its medial and lateral flange

DISCUSSION

In the current study, the various dimensions and incidence of various morphological parameters of 115 dry human humerus have been observed and measured. All the metric parameters were recorded in the tabulated form. (Table 1 & table 2). In our observation the maximum transverse diameter of humerus is 28.92± 2.39 on left side and 29.30 ± 2.35 on right side. The values in the present study are very similar to the observations in the previous studies. (Table 3, Fig 1). The maximum transverse length of trochlea were recorded 22.10±2.99 on left side and 22.90±2.87 on the right side of the humerus. There is no any major difference between left and right side of humerus. The carrying angle of elbow joint is formed due to the difference between length of medial flange and lateral flange of trochlea. Beside this the angle of trachea, trochlea sulcus angle and inclination angle of olecranon fossa play a major role in determining the carrying angle of elbow.[8] In our study the transverse length of medial flange of trochlea is 11.42±1.99 and lateral flange of trochlea is 8.74±1.54 for left side of humerus and transverse length of medial flange of trochlea is 11.15±2.53 and lateral flange of trochlea is 8.09±2.36 for right side of humerus. Our observations show medial flange of trochlea is greater than the left flange of trochlea in the left and right side of the humerus which form an angulation called trochlear angle. Any structural variations in the carrying angle can cause varus or valgus of elbow joint. In our study the maximum distance between trochlea to capitulum were recorded 38.19±3.96 and 38.14±4.44 for left and right side of humerus respectively. Our findings are very close to the observation of Vinay et al 2021.[9]

CONCLUSION

In this study the morphometric parameters of Humerus were recorded and compare the maximum average length of humerus to the study of the others researchers. Any variations in the metric parameters of the trochlea may be the important cause of disturbance in the carrying angle of elbow joint. So the knowledge of observed metric parameters are very important to surgical procedures of elbow joint.

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