Original Article

The Morphometric Measurement of Segments of Humerus

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ABSTRACT

Background: Estimating the stature from bones play an important role in identifying the unknown bodies or skeletal remains. Anthropometric techniques have been commonly used to estimate stature from the skeletal remains by anthropologists and anatomists for over a hundred years. Knowledge of the mean values of segments of long bone like humerus is very helpful for the investigator to define the identity of a skeleton and also helps to make the various implants for the reconstructive surgery of fractures of humerus.

Objectives: To determine the value of measurements of various segments of humerus in the Indian population & compare the findings with other populations as well as to provide data for prosthesis formation.

Material and method: The study was conducted on 100 dry humeri bones. Total length of humerus is measured with osteometric board and 5 distal segments of humerus are measured with Vernier calliper.

Result: In our study, we observed that mean values of the total humerus length is 30.32 ± 1.58 cm and 30.39 ± 1.66 cm on the left and right side respectively. We found mean value of five distal segments of humerus as mentioned below: D1-5.66 ± 0.36 & 5.58 ± 0.42 cm on right & left side respectively; D2-3.87 ± 0.25 & 3.90 ± 0.30 cm on right & left side respectively; D3-2.26 ± 0.18 & 2.24 ± 0.20 cm on right & left side respectively; D4-5.42 ± 0.33 & 5.39 ± 0.41 cm on right & left side respectively; D5-1.45 ± 0.15 & 1.45 ± 0.17 cm on right & left side respectively.

Conclusion: The study provides morphometric data of distal end of humerus, which will be helpful to place the various implants in the reconstructive surgery of humerus fractures. The length of humerus in Indian population is similar to that of Turkish & Brazilian population values.

Key words: humerus, segment, osteometric board.

INTRODUCTION

As human populations differ in physical characteristics, it is expected that their bones should exhibit variety of discernable differences. So the mean values of segments of long bone like humerus helps the investigator to define the identity of a skeleton. Also, these data give evidences to indicate the characteristic features of a population for archaeological materials.

Fall on outstretched hand is common cause of distal humeral fractures e.g. supracondylar fracture. Our study supplies the mean values of the different morphometric measurements from the humerus. These measurements indicate the characteristic morphological features of humerus segments in our Indian population and also provide data to make the various implants for the reconstruction of humerus fractures.

Therefore, the study was made to determine the mean values of humerus segments in our population and compare the findings with other populations to assist in forensic and archaeological cases as well as to provide data for prosthesis formation.

MATERIAL AND METHODS

The study was carried out in the Department of Anatomy, Government Medical College, Surat during period of October 2009 to November 2011. Hundred dry humeri (right = 50; left = 50) of unknown sex are taken from the collection of the Department. For the measurements of the humeral length, an osteometric board is used (precision = 0.1 cm). The measurements of the different segments are made by means a Vernier calliper, with a similar precision = 0.1 cm. Broken, diseased and damaged bones are excluded from the study. Humeral length is obtained through the vertical

distance from tip of the humeral head to the horizontal line passing in the apex of the trochlea. Then five distal (D) segments are measured. (Figure 1A & 1B).

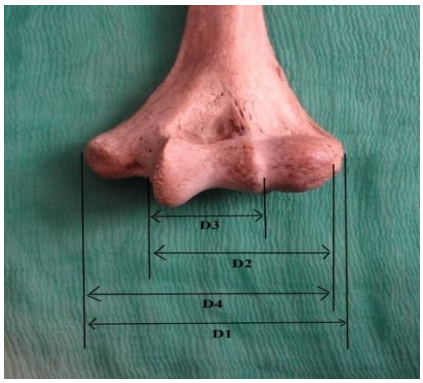

Figure 1A

Following measures are taken:
MHL-Maximum humeral length, the distance between the most proximal points of the head of humerus to the most distal point of the trochlea.
D1 - Horizontal distance from medial epicondyle to lateral epicondyle.
D2 - Horizontal distance from medial margin of trochlea to capitulum.
D3 - Maximum transverse diameter of trochlea.
D4 - Horizontal distance from medial epicondyle to capitulum.
D5 - Anteroposterior diameter of the trochlea.
By using these measurements, mean and standard deviation were calculated.

RESULTS

Table 1: Mean & SD of various measurements of humerus

Measurement	Mean ± SD (cm)	
	Right sided humerus	Left sided humerus
MHL	30.39 ± 1.66	30.32 ± 1.58
D1	5.66 ± 0.36	5.58 ± 0.42
D2	3.87 ± 0.25	3.90 ± 0.30
D3	2.26 ± 0.18	2.26 ± 0.18
D4	5.42 ± 0.33	5.39 ± 0.41
D5	1.45 ± 0.15	1.45 ± 0.17

Table 1 shows mean value and standard deviation of maximum humeral length (MHL) and distal segments of humeri of right and left side respectively.

DISCUSSION

The humerus is the longest bone of the upper limb. In forensic investigations and anthropometric studies, the mean value of the total humerus length gives important evidence to indicate the characteristic features of a population [1-2].

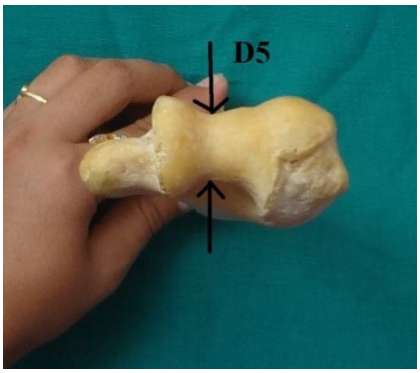

Figure 1B

Sales AD et al have measured mean value of the total humerus length & proximal and distal segment of humerus of Brazilian population [3].

Akman, Karakap and Bozkir (2006) observed mean values of measurements of five segments of the humerus and its maximum length in Turkish population and compare their data with other population [4].

In our study the mean values of the total humerus length was identified as 30.32 ± 1.58 cm and 30.39 ± 1.66 cm on the left and right sided humerus respectively. Sales AD et al have observed mean values of the total humerus length as 31.3 ± 2.3 cm and 30.5 ± 1.6 cm on the right and left side respectively. Akman et al have observed maximum length of humerus as 30.71 ± 2.08 cm and 30.48 ± 1.89 cm on the right and left side respectively in Turkish population.

Olecranon fractures occur in 10% of all upper extremity lesions. It occurs because of indirect or direct trauma, especially forced hyperextension of the elbow joint [5]. The distal humerus has a unique anatomy and it freely articulates with radius and ulna. Fracture of distal humerus may give rise to complications such as damage to nerve and blood vessels. So it is difficult to treat such fractures. Many implants are available for the different fracture patterns observed in the distal humerus and these implants are contoured specifically for the anatomy of this region [6]. In our study, we measured five distal humeral segments & compare the data with that of study done by Sales AD et al. (Table 2)

Table 2: comparison of our data with those given by Sales AD et al.

Measurement	Our study		Study by Sales AD et al	
	Mean ± SD (cm)		Mean ± SD (cm)	
	Right sided humerus	Left sided humerus	Right sided humerus	Left sided humerus
D1	5.66 ± 0.36	5.58 ± 0.42	5.8 ± 0.6	5.7 ± 0.4
D2	3.87 ± 0.25	3.90 ± 0.30	4.0 ± 0.4	3.9 ± 0.4
D3	2.26 ± 0.18	2.24 ± 0.20	2.4 ± 0.3	2.4 ± 0.2
D4	5.42 ± 0.33	5.39 ± 0.41	5.8 ± 0.5	5.6 ± 0.4
D5	1.45 ± 0.15	1.45 ± 0.17	1.6 ± 0.2	1.6 ± 0.1

When we compare our data with those given by Sales AD et al, mean values of different segments are almost similar. We consider that some discrepancies could be the result of factors such as age, sex, race and also environmental factors affecting bone growth.

CONCLUSION

Our study supplies the mean values of the five distal segments of the humerus & maximum length of humerus. These measurements may help to indicate the characteristic morphological features of humerus segments in our Indian population and also provide data for formation of various implants used in the surgery of humerus fractures. Our study demonstrates that value of maximum length of humerus in Indian population is similar with that of Turkish & Brazilian population.

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