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Original Research Article

A Retrospective Observational Assessment of the Segments of Humerus: A Cadaveric Analysis

Suman Kumari[1], Chandan Kumar[2], Rajendra Prasad[3]

[1]Assistant Professor, Department of Anatomy, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India

[2]Tutor, Department of Anatomy, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India

[3]Professor and HOD, Department of Anatomy, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India

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Corresponding author: Dr. Chandan Kumar
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Abstract

Aim: The present study was conducted for morphometric study of segments of humerus.

Methods: Our study was a retrospective study conducted at department of Anatomy for 20 months. The present study was performed on 50 cadaveric humeri (25 left sided and 25 right sided). All were of unknown age and gender.

Results: The length of humerus of right side was more as compare to left side. AP diameter of head is almost equal of both sides. Mediolateral diameter of head was more of left side whereas head height was more of left humerus.

Conclusion: The morpho-metric dimensions of right side of humerus were more than that of left side. There was variability in dimensions which was found in different studies. Proper measurements are required when surgical procedures are to be done. More studies should be conducted measuring head heights.

Keywords: Humerus segments; Morphometry, Mid shaft girth, Prostheses, trochlea, capitulum

Introduction

Though much advancement in science has been done, but estimating the stature of the individual from bones and as well as reconstructions of life from the human skeletal still remains a challenge for many anthropologists and forensic experts. Statures estimated from the human skeletal remains is an important step in assessing health and general body size trends among the given populations [1] and also have an important role in the identification of missing persons in to medico-legal investigations. [2] Morphometric analysis is frequently carried out on the remains of the long bones of the individual in anthropology and forensic science investigations. [3,4,5] The humerus is the longest and strongest bone of upper extremity. It has expanded upper end, lower end and a cylindrical shaft. Upper end consist of head, neck, greater and lesser tubercle and intertubercular sulcus. Lower end consist of capitulum, trochlea, radial fossa, coronoid fossa, olecranon fossa, medial and lateral epicondyles. Intact humerus and its segments is very important for anatomists and forensic experts to investigate the identity of a skeleton. In anthropology and forensic science morphometric analysis is carried out on remains of the long bones of the individual in absence of cranium and pelvis. [6-8]

However in absence of long bones of lower limb, estimation of living stature can also be assessed by the long bones of upper limb such as humerus, radius and ulna. [9,10] When the whole length of long bones are not available, but only segment of bones is available, some methods can be employed for usefulness of fragments of humerus. [11] We can find out the total humerus length by fragments of humerus for estimation of sex. [12] Mullers was the first scientist who measured the five segments of humerus by using margin of articular surfaces and key point of muscle attachment. [4] Morphometry of distal end of humerus is also important for determination of sex. [13]

Morphometrical analysis of bone is very important not only for the reconstruction surgery but also for determining the gender of dead bodies. The examination of the upper and lower limb asymmetries can be useful to medical anthropologists, archeologists, forensic experts and for medico legal studies. The humerus confers important advantages over other long bones of

human body in that its entire outline can readily be traced on total body X-ray absorptiometry images, and its shape can be modelled as a cylinder with excellent accuracy. [14]

The present study was conducted for morphometric study of segments of humerus.

Materials and Methods

Our study was a retrospective study conducted at Department of Anatomy, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India for 20 months. All the intact/non damaged humeri were included in the study whereas damaged and Pathological humeri were excluded.

The Materials required for study included Sliding Vernier caliper, Scale, Non elastic thread and Osteometer.

Procedure

The present study was performed on 50 cadaveric humeri (25 left sided and 25 right sided). All were of unknown age and gender. Length of humerus, Head of Humerus, AP diameter and Medio-Lateral diameter of humerus head was calculated as follows-

Total length (L)

Functional length of humerus which is distance between upper and lower end in anatomical position is recorded in mms with the help of osteometer. [11]

Antero posterior dimeter of head(AP)

Distance between middle point of anatomical neck anteriorly to middle point of neck posteriorly. [11]

Medio lateral dimeter of head (MLD)

Distance between middle point of upper margin of greater tubercle till middle point of medial margin of surgical neck. [15]

Head height (H)

Distance between highest point of anterior margin of anatomical neck to lowest point of posterior margin of anatomical neck.

Statistical analysis was done with the help of SPSS 25. Descriptive and analytical statistical analysis was done. Analysis was done by Pearsons correlation. Linear multivariant regression equation was calculated.

Results

Table 1: Length, AP head, MLD and head height on left side of shoulder with respect to mean±SD

Parameters	Mean	Standard Deviation	Standard error	Minimum	Maximum
Length	306.425812	18.8589086	3.1675524	262.0000	314.976512
AP Head	38.106135	2.7515844	0.5013834	30.8200	42.9200
MLD 47.2700	43.750000	3.7436135	0.6723740	24.8000	44.2700
Head Height	32.019356	2.7398565	0.4920942	25.4500	37.3300

Table 2: Length, AP head, MLD and head height on right side of shoulder with respect to mean±SD

Parameters	Mean	StandardDeviation	Standard error	Minimum	Maximum
Length	312.306632	16.1412936	3.3739540	305.558862	316.084473
AP Head	38.549060	2.4547542	0.4481728	32.6000	42.3000
MLD 47.2700	43.196667	2.7772628	0.4980196	36.2400	44.215231
Head Height	32.823000	2.3626930	.4304572	24.6000	34.3600

The length of humerus of right side was more as compare to left side. AP diameter of head is almost equal of both sides. Mediolateral diameter of head was more of left side whereas head height was more of left humerus.

Figure 1: Total length

Figure 2: Antero posterior diameter of head (AP)

Figure 3: Medio lateral diameter of head (MLD)

Figure 4: Head height(H)

Discussion

In upper body largest bone is humerus. The upper end of humerus comprises of rounded head with proximal and medial part of upper end of the bone. It forms articulation with glenoid cavity of scapula. [11] The head is joined to shaft by constricted neck and two eminences, with both tubercles. [16] The head of the humerus forms less than half a spheroid. Its smooth articular surface which is thicker centrally is covered with hyaline cartilages. When arm is at rest by the side it is directed upwards, medially and backwards to articulate with glenoid cavity of scapula. Proximal fractures of humerus are common injuries. They occur along with epiphyseal lines of proximal humerus and within humeral segments. [17]

The length of humerus of right side was more as compare to left side. AP diameter of head is almost equal of both sides. Mediolateral diameter of head was more of left side whereas head height was more of left humerus. The study done by Sinha P et al [18], the maximum transverse diameter of head of humerus was 38.85 ±5.09 mm and 38.18, ±4.79 mm on right and left side respectively. The study done by Akman et al [19], the maximum vertical diameter of head of humerus was 41.0 ±5.1 mm and 40.9 ±3.9 mm in right and left side respectively. DeLude et al [20] conducted a study which was to describe the extramedullary humeral morphology in paired humeri to determine whether geometric differences exist from side to side in the same individual. Seventy-six cadaveric humeri were investigated to

study the three-dimensional morphometric data based on CT scan by Aroonjarattham and colleagues. [21] Vettivel S et al [22] conducted a study to determine handedness from the morphometry of intertubercular sulcus of humerus. Somesh and colleagues [23] performed morphometric analysis of segments of humerus. Lokanadham and colleagues [24] conducted a morphometric analysis of dry humerus bones in Indian population and compared the parameters between both the sexes. [25]

Anthropometry measurements are extremely useful to estimate stature and bone length from the skeletal remains of body. It's a very important step in assessing health as well as general body size trends away the given populations is stature estimated from the human skeletal remains. It also has an unmeasurable role in the identification of persons that are missing into medical legal investigations, finding the mean values of different humerus segment which helps in forensic and anthropometric practice. For the assessment of the living stature of the individual, assessment of long bones of the individual is very important in anthropological practice for morphometric analysis in case of pelvis, cranium and long bones such as tibia and femur of the lower limb collectively remains the best. In case of absence of lower limb bones the estimation of living stature can be done by the help of remains of upper limb bones like humerus, radius and ulna. In a previous study, significant positive correlation with the humeral length was found in some fragments of both sides considering the proximal and distal ends and they could estimate the humeral length from these fragments and the results were obtained in right side.[25] However in our study only the longitudinal measurements and the associated proximal and distal segments of the humerus are considered.

Conclusion

The morpho-metric dimensions of right side of humerus were more than that of left side. There was variability in dimensions which was found in different studies. Proper measurements are required when surgical procedures are to be done. More studies should be conducted measuring head heights.

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