

Correlation of upper end of humerus with its length

Savita Kadam (Khiste)^{1*}, Gautam Shroff², Suvarna Gulanikar³, Smita Shinde⁴

^{1,3,4}Assistant Professor, ²Professor, Department of Anatomy, MGM's Medical College and Hospital, Aurangabad, Maharashtra, INDIA.

Email: arun_khiste@yahoo.in

Abstract

It is a well established fact that stature of the diseased can be estimated with the help of length of humerus. In this study, we have made an attempt to estimate the length of humerus by the remains of its upper end. **Objective:** To determine the length of the humerus by multivariate analysis of the upper end of humerus **Material and Methods-** 100 humeri from Mahathma Gandhi Medical College, Aurangabad bone bank are studied. All are dry free of damage or deformity. The personal records of all humeri for age, sex and race are available with the Bone Bank. **Result-** Length of humerus is highly correlated with Vertical Diameter of head of humerus (VDH), Circumference of anatomical head (CA), Transverse diameter of head of humerus (TDH) and Circumference of surgical neck (CS) **Conclusion:** Length of humerus can be determined from various upper end parameters. Out of which the VDH is more significant. These findings may help in anthropometric, forensic, and archaeological investigations for the estimation of the stature of the remains of unknown bodies by using regression equations.

Key words: Circumference of anatomical head (CA), Transverse diameter of head of humerus (TDH), Circumference of surgical neck (CS), Width of bicipital groove (WPG), Maximum width of upper end (WDU)

* Address for Correspondence:

Dr. Savita Kadam (Khiste), Assistant Professor, Department of Anatomy, MGM's Medical College and Hospital, Aurangabad, Maharashtra, INDIA.

Email: arun_khiste@yahoo.in

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INTRODUCTION

Length of humerus is an important parameter for anthropometric, forensic and racial studies. It has been found that upper end of humerus has profound effect on its length. Various human races differ but very little in the degree in which the males surpass the females in the length of long bone.¹ Anatomists are consulted frequently by law enforcement authorities regarding identification of skeletal remains found under suspicious circumstances, while the anthropologist are also interested in finding the age, sex, stature and other details about the skeletal remains found during archaeological excavations².

Traditional methods of assignment of sex on the pattern of skeletal morphology do not have an explicit basis. Visual impressions of the bones can seldom be as accurate because of the many pitfalls associated with the subjective assessment of the observer. The introduction of precise measurement method not only provides simplicity and accuracy but also is an attempt where science replaces art. Identification of sex from skeleton is an important demographic assessment in the Medico legal investigations³. The determination of sex, age and estimation of stature from bones play an important role in identifying unknown bodies, parts of bodies or skeletal remains³. In medico legal practice statements on probable sex of decomposed body or part of bodies are often expected even during autopsy. Therefore, it is necessary to do extensive studies on skeletons, restricted to a few easily accessible dimensions from bones which are prepared only by mechanically removing soft tissues, tendons and ligaments. Humerus is the longest and the largest bone in the upper limb.⁴ It has expanded ends with a shaft. Upper end consists of head, lesser and greater tubercle, upper part of intertubercular sulcus (bicipital groove) and neck. Head is articular, spheroidal and forms about one-third of a sphere. It articulates with glenoid

cavity of scapula to form shoulder joint. Lesser tubercle presents a smooth muscular impression which projects forward just beyond the head. The lateral margin of the lesser tubercle is sharp and is separated from the greater tubercle by the upper part of the intertubercular sulcus. Greater tubercle occupies the most lateral part of the upper end and its convex lateral surface forms the rounded contour of the shoulder. Humerus has anatomical neck and surgical neck. Anatomical neck is a constriction that immediately succeeds the head. Surgical neck is a constriction between the expanded upper end and the cylindrical shaft of the humerus. Climate, heredity, nutritional status of the population is reported to have an effect on the stature and length of long bones. In India, multiplication factors were derived for calculation of the stature way back by Pan⁵ for Hindus of Bengal, Bohar and Orissa, Nath⁶ for UP population, Siddiqui and Shah⁷ and Sohal⁸ for Punjabis. Kotle and Bansal⁹ formulated regression formulae predicting stature from long bones of upper extremity on a sample. Panse A. A (1979) in her study- “Estimation of stature and determination of sex from appendicular skeleton” observed that differences in all parameters between two sexes are statistically significant.¹¹

AIM OF PRESENT STUDY

To achieve highest possible accuracy in establishing length of humerus with its upper end

MATERIAL AND METHOD

The instruments which are used for measurement of various parameters are as follows-

- a) Osteometer
- b) Sliding Vernier caliper
- c) Non elastic thread, Marker pencil, pens, etc

The following measurements are taken for each humerus.

1. **Circumference of head of anatomical neck (CA)** - The circumference of the anatomical neck of the humerus is measured by marking a fixed point at groove opposite to the greater tubercle on the anatomical neck with a marker pencil and running the non-elastic thread along the groove starting from the fixed point and back to it. The length of the thread is recorded on scale in mms.
2. **Vertical diameter of head (VDH)** - This is the maximum diameter of head, in vertical plane of head of humerus. This is measured by Vernier caliper in mms.
3. **Transverse diameter of head (TDH)** - This is the maximum diameter of head, in transverse plane of the head of humerus. This is also measured by Vernier caliper in mms.

4. **Circumference of surgical neck (CS)** - It is measured at a point 1cm below the lowest point of the margin of articular surface of the head of humerus: the point is in line with medial epicondyle. It is measured with the help of non-elastic thread by the same method as that of (CA).
5. **Maximum width of upper end of Humerus (WDU)** – It is recorded by placing the upper end of the humerus transversely with the lesser tubercle facing upwards in the osteometer and recording the distance shown on osteometer in mms.
6. **Width of bicipital groove (WDG)** – It is the distance between the two lips of bicipital groove measured at the level of surgical neck with the help of Vernier caliper.

OBSERVATION

Upper end parameters of 100 humeri are measured by descriptive statistics. These calculations are mentioned in the following table.

	Statistics						
	Length	CA	VDH	TDH	CS	WDU	WDG
Mean	298.62	124.24	40.62	37.40	85.35	44.98	9.76
SEM	2.118	1.096	.373	.367	.859	.461	.145
SD	21.176	10.956	3.730	3.730	8.595	4.612	1.450

Later on, Pearsons correlation has been determined. It shows that values of CA and VDH are more than 0.8 indicating high correlation with the length of humerus. TDH, VDH and CS also show good correlation.

CORRELATIONS

Pearson correlation	Left	Right	Length
CA	.843	.834	.836
VDH	.842	.835	.837
TDH	.795	.811	.800
CS	.733	.783	.757
WDU	.722	.661	.694
WDG	.321	.486	.404

With this a multivariate regression equation has been determined by SPSS 19.

RIGHT LENGTH= 107.692+0.527(CA) +1.884(VDH) +0.716(CS)-0.202(WDU) +0.373(TDH)-1.621(WDG)
R=0.862

LEFT LENGTH=77.011+1.219(CA) +3.361(VDH) +0.639(CS)-0.194(WDU)-2.9(TDH)-0.439(WDG)
R=0.864

TOTAL LENGTH (L) =93.088+0.802(CA) +2.546(VDH) +0.63(CS)-0.125(WDU)-0.965(TDH)-0.977(WDG)
R=0.858

DISCUSSION

Humerus is a commonly studied long bone. In present study, we have analyzed the data by both routine statistical methods and multivariate linear discriminate analysis method and compared the results 100 adult humeri are studied in department of Anatomy. In all, 7 parameters are measured. In present study, we found that we can find out the length of humerus from its various upper end parameters .

Length of humerus

Length of humerus is statistically a very significant parameter. The following table shows the comparison of present study with that of different workers. It is evident that mean, SD, SEM values are more in European races which are explained on the basis of racial differences

Sr. No	Name of worker	N	Length			N	VDH		
			MEAN	SD	SEM		MEAN	SD	SEM
1	Khan (1959)	-	306	-	-	-	44.25	-	-
2	Singh et al(1972)	216	295.97	16.85	-	-	-	-	-
3	Panse(1979)	71	297.97	17.4	-	71	41.25	3.1	-
4	M Yasar et al(1998) Chinese	41	298.65	14.46	-	41	42	2.77	-
5	M Yasar et al(1998) Thais	70	289.75	15.65	-	70	41.3	2.11	-
6	M Yasar et al(1998) Japanese	44	287.15	10.42	-	44	44.6	1.76	-
7	Maryan Sten et al (1991) For hite	55	322.5	17.9	-	55	46.1	3.2	-
8	Maryan Sten et al (1991) For black	43	365.35	14.8	-	40	40.7	2.1	-
9	Mall G et al(2001)	64	320.5	-	-	-	47	-	-
10	Present study	100	298.12	21.18	2.118	100	40.62	3.73	0.373

Where, N= No. of Humeri studied; SD=standard deviation; SEM=Standard error of mean



CONCLUSION

Length of humerus is well determined by multivariate regression equation. VDH and CA are more significant. This study can help in determination of stature of a diseased, in Forensic medicine and Anthropometrical studies.

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