



## CARPAL BONE (CAPITATE) STUDY IN CADAVERS OF VIDARBHA REGION

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### ABSTRACT

Various features of human identity can be determined by the study of human skeleton. Bone age development is one of the significant indicators depicting the growth status in children. The present study is done in Vidarbha region of Maharashtra where climatic conditions, nutritional status Socio-economic status and pattern of diseases are different from other regions. Measurements of even smaller bones i.e carpal bones like capitates are helpful in determining the age, sex and stature of an individual. Aim of the study is to assess different measurements of human capitata for assessment of age, sex and bilateral asymmetry. The study is carried out in the department of Anatomy NKPSIMS, Nagpur. 60 fully ossified capitates belonging to dissection hall cadavers of both sexes and known age are included in the study. Measurements were taken using vernier calipers and spreading calipers. To analyze various parameters statistical methods are used to find out mean, SD, Coefficient of variation, & SE of mean. Sex differentiation is also done by using identification points on the bones. Identification points are the limiting points of the range for males and females. The parameters were compared with the work done by other researchers and it was concluded that sex determination can be done with the help of demarking points also weight and length are best parameters for sex determination.

**KEYWORDS :** Bilateral asymmetry, Sex differentiation, Paramaters of identity.



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## INTRODUCTION

The study of human skeleton is done to establish the individual identity like age sex stature etc. Work in this field has been in progress since later half of the 19<sup>th</sup> century. According to Hooton (1940) "Determination of sex from post cranial skeleton in adults is easy and certain in about 90% cases, difficult but possible in another 10% and quite dubious in the remainder. For determination of sex pelvis was thought to be best part of human skeleton followed by skull. Order of appearance of ossification centers in the carpal region is well documented; though disharmonic patterns do arise in situations of congenital malformations and environmental adversities (Dreizen et al 1958, Pozananski et al 1971). Several atlases have been developed on skeletal development in hand (Greulich and Pyle 1959, Tanner and White house 1975, Meschan 1975, Himes 1984). Ossification center appears first in the capitate bone of hand. Development in the bone age is one of the significant indicators depicting the growth status in children. A computerized bone age estimation system based on analysis of geometric features of carpal bone was devised by chi wen hsieh et al (2007). He deduced that LSR (land sea ratio, ratio of bone area to background of ROI) method was more effective than others because it had less CPU time utilization because of low calculation loads. Automatic bone age estimation based on carpal bone image was done by Zhonghua yi xue za zhi (2001). He concluded that computerized BAE system results were satisfactory with 0.5-year tolerance. He had proposed a 2<sup>nd</sup> stage edge detection method for carpal bone features extraction and a method for locating the carpal bone region of interest. But as pointed out by Krogman (1946) "Even when the entire human body, pelvis, and skull are available not more than 95% accuracy can be achieved". Present study is carried out in Vidarbha region of Maharashtra where climatic conditions, nutritional status, socio-economic status and pattern of diseases are different from other regions viz; Marathwada and Western

Maharashtra. The study is done with an aim to assess different measurements of human Capitate for assessment of age and sex.

## MATERIALS AND METHODS

The present study is carried out in the Department of Anatomy NKP Salve Institute of Medical Sciences, Nagpur. 60 fully ossified capitates belonging to dissection hall cadavers of both sexes and known age were studied. Bones of each side of both sexes were numbered and kept separately. Bones with pathology were excluded from the study. The present study was approved by the Institutional Ethical Committee and after that the work was started. 60 capitate bones of both the sides (Right and Left) were studied out of which 30 belongs to males and remaining 30 belongs to females. Measurements of the bones were taken using vernier calipers and spreading callipers. Bony points were first localized and measurements were taken simultaneously on both the sides. All measurements were taken in millimeters and milligrams.

6 parameters were applied for the study.

- i) Length of the capitates.
- ii) Breadth of the capitates.
- iii) Height of the capitates.
- iv) Weight of the capitates.
- v) Head circumference of the capitates.
- vi) Bilateral asymmetry of the capitates.

Analysis of various parameters was done to find out mean, SD, Coefficient of variation, & Standard error. Examination of bone was done to determine the frequency of certain features which either were omitted from classical account or deviate from descriptions found in various standard text books. As per the method adopted by Lowrance EW & Latimer HB (1957) bony measurements were isolated from the demarking points. Demarking point = Mean +/- 3 S.D. Statistical calculations were done by using the formulae like mean, standard

deviation etc. Sex differentiation was also done by using identification points. These identification points were the limiting points of the range for males and females.

**Table No. 1**  
**Showing measurements of length of capitate.**

Detailed Measurements	RIGHT		LEFT	
	MALE	FEMALE	MALE	FEMALE
No. of bones	30	30	30	30
Range	1.4 – 1.9	1.2 – 1.6	1.3 – 1.8	1.2 – 1.7
Mean	1.64	1.40	1.55	1.45
S.D.	0.31	0.23	0.27	0.29
Calculated Range	1.31 – 1.98	1.11 – 1.71	1.23 – 1.92	1.13 – 1.84
D.P.	> 1.76	< 1.31	> 1.62	< 1.38
% beyond D.P.	24.60	22.19	25.53	27.42

**Table No. 2**  
**Showing measurements of breadth of capitate.**

Detailed Measurements	RIGHT		LEFT	
	MALE	FEMALE	MALE	FEMALE
No. of bones	30	30	30	30
Range	1.1 – 1.5	0.9 – 1.4	1.0 – 1.6	0.8 – 1.4
Mean	1.29	1.21	1.33	1.13
S.D.	0.24	0.20	0.29	0.19
Calculated Range	0.9 – 1.61	0.78 – 1.52	0.86 – 1.74	0.71 – 1.57
D.P.	> 1.36	< 1.14	> 1.42	< 1.0
% beyond D.P.	28.73	20.97	21.59	27.61

**Table No. 3**  
**Showing measurements of height of capitate.**

Detailed Measurements	RIGHT		LEFT	
	MALE	FEMALE	MALE	FEMALE
No. of bones	30	30	30	30
Range	1.8 – 2.3	1.6 – 2.2	1.9 – 2.6	1.7 – 2.4
Mean	2.05	1.88	2.23	2.03
S.D.	0.33	0.46	0.36	0.43
Calculated Range	1.71 – 2.43	1.56 – 2.39	1.79 – 2.73	1.53 – 2.57
D.P.	> 2.26	< 1.62	> 2.39	< 1.83
% beyond D.P.	31.46	23.14	27.58	21.39

**Table No. 4**  
**Showing measurements of weight (grams) of capitate.**

Detailed Measurements	RIGHT		LEFT	
	MALE	FEMALE	MALE	FEMALE
No. of bones	30	30	30	30
Range	1.7 – 2.8	1.2 – 2.1	1.9 – 2.7	1.1 – 2.3
Mean	2.27	1.65	2.33	1.76
S.D.	0.59	0.60	0.41	0.44
Calculated Range	1.53 – 2.93	1.16 – 2.29	2.14 – 2.86	0.89 – 2.47
D.P.	> 2.41	< 1.57	> 2.52	< 1.60
% beyond D.P.	29.48	22.33	33.90	24.86

**Table No. 5**  
**Showing measurements of head circumference of capitata.**

Detailed Measurements	RIGHT		LEFT	
	MALE	FEMALE	MALE	FEMALE
No. of bones	30	30	30	30
Range	3.8 – 4.7	3.2 – 4.2	3.6 – 4.5	3.0 – 3.9
Mean	4.25	3.66	4.05	3.45
S.D.	0.47	0.38	0.45	0.44
Calculated Range	3.68 – 4.81	3.10 – 4.34	3.51 – 4.62	2.89 – 4.12
D.P.	> 4.32	< 3.35	> 3.82	< 3.23
% beyond D.P.	36.47	31.54	40.21	38.79

## DISCUSSION

The various parameters of capitates bone were measured to determine the sexual dimorphism of the capitata bones and compared with different authors.

**Length of capitata** : Right capitata in females was 1.6 cm and right capitata in male was above this value i.e. 78.33% of the right male capitates had their length exceeding 1.6 cm. Similarly the smallest right male capitata was 1.4 cm and 67.23% of the female right capitates were less than this value. By these identification points (I.P.) 78.33% male and 67.23% of the female right capitates could be identified. On the basis of the demarcating points (D.P. = Mean  $\pm$  3 S.D.) 24.60% male and 22.19% female bones could be sexed correctly.

**Breadth of capitata** : In the present study 72.66% male and 81.33% female right capitates could be identified. 28.73% male and 20.97% female bones could be sexed accurately with the help of demarking points. Similarly 66.00% male and 78.33% female left capitates could be identified on the basis of which 21.59% male and 27.61% female bones could be sexed accurately.

**Height of capitata** : It was observed that 62.86% male and 71.66% female right capitates could be identified and 31.46% male and 23.14% female bones could be sexed accurately. Whereas 82.43% male and 76.11% female left capitates were identified and 27.58% male and 21.39% female bones would be sexed accurately.

**Weight of capitata** : On the right side 76.81% male and 63.41% female capitates could be identified and 29.48% male and 22.33% female

bones could be sexed accurately. Similarly 69.91% male and 80.39% female left capitates could be identified and 33.90% male and 24.86% female bones could be sexed correctly.

**Head circumference of capitata** : In this study 86.81% male and 74.83% female right capitates could be identified and 36.47% male and 31.54% female bones could be sexed correctly. While 79.24% male and 71.61% female left capitates were identified and 40.21% male and 38.79% female bones could be sexed correctly. From the above discussion it was found that the length and weight of the capitates were the best parameter for determining the sex in both males and females. After that the breadth, height and head circumference were also the useful parameters. Similar findings were reported by **Fan BC and Jong TL (2001), Chi-Wen Hsieh et (2007) and Lowrance EW and Latimer HB (1957)**. Various findings in the present series were in accordance with the studies conducted by different authors. All the values fall within the normal range of human variations. As compared to the values found by different authors the values of the present study showed some similarities although differences exist.

## CONCLUSION

Conclusions drawn from the present study denotes that sex determination can be accurately done with the help of demarking points where weight and length were considered as the best parameters for sex determination.

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