

**MORPHOLOGICAL AND MORPHOMETRIC ANALYSIS OF HOOK OF  
HAMATE IN SOUTH INDIAN POPULATION AND ITS CLINICAL  
IMPLICATION**

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## ABSTRACT

**Introduction:** The hamate carpal bone is a three-sided designed bone which forms the portion of the distal carpal row of the wrist. It has a hook-like process called the hook of hamate. The hamate bone has a large articular surface which contributes to the incomplete ball and socket type of joint allowing some movements. The aim of the study was to analyse the morphological and morphometric properties of the hook of hamate bones among the South Indian population.

**Materials and Methods:** Total of 24 dry processed hamate bones procured at the Department of Anatomy, Basic Medical Science, Saveetha Dental College was used to carry out the study. The length, breadth and the diagonal length of right and left hamate bone was taken measurement with a digital sliding vernier caliper. The values obtained were tabulated, evaluated using statistical analysis. The data was interpreted for any structural variations between right and left sides.

**Results:** Right diameter of hook of hamate was greater than the left, right diagonal length was greater than left diagonal of hook of hamate and right width greater than left width of hook of hamate bone. All the three pairs were statistically significant indicating p value less than 0.05.

**Conclusion:** Morphometric knowledge of the hook of hamate is utmost important for surgical approach on those regions. Apart from that it will also help in other fields such as orthopaedic surgery, evolutionary studies etc.

**KEYWORDS:** Hamate bone, hook of hamate, morphology, morphometry, anatomical variations, clinical implications.

## INTRODUCTION

The hamate is a triangular shaped bone that forms part of the distal carpal row, which articulates with the capitate (radially), triquetrum (proximally) and fifth and fourth metacarpals (distally). It has a hook like process dorsally and medially from the Palmar surface called hook of the hamate. The hamate bone has a large articular surface which contributes to the incomplete ball and socket type of joint allowing some movements (1).

Because human hamate morphology appears to favour the ability to produce a range of grips that are used to construct and use tools, variation in hamate shape has been exploited in investigations of the evolution of present human manipulative capacities (2). Primate morphologists have been particularly interested in the functional distinction of monkey and ape wrists (3). Because of its function in wrist mobility (i.e., ranges of motion), which is required for behaviours like vertical climbing and below-branch suspension utilised by current apes, hamate morphology has been prominent in debates of hominoid locomotor evolution (4)(5). Radiographic evaluation are some of the previous researches done on the hook of hamate (7,8).

Several concomitant hooks of hamate were not noted during cross sectional studies. Instead scaphoid fractures were proved.(9). Co-variations among different taxa of hamate bone were analysed, the size difference predicted did not meet the prediction (9,10)

This research is needed to analyse the hook of hamate in the South Indian population and to assess variations, fractures among the population for the hook of hamate bone. This work is not done anywhere in South India, thereby it will create awareness, knowledge about the hook of hamate bone among the South Indian population. Our scientist experts with their encompassing information, research experience, data has transformed to several publications globally in well reputed indexed Journals (11–18),(19),(20),(21),(22,23),(24),(25),(26–30). Therefore the aim of this research study was to analyse the morphological and morphometric properties of the hook of hamate bone among the South Indian population and its clinical implications.

## **MATERIALS AND METHODS**

A total of 24 dry human hamate bones at the Department of Anatomy, Basic Medical Science, Saveetha Dental College were used to carry out this study. The parameters included in this study are length, breadth, diameter, diagonal and width of left and right hook of hamate sides using a digital vernier caliper. The obtained data were analyzed and tabulated. The pros of the study was no sampling bias and nominal sample size. And the cons of the study is that a different geological population is not involved, we have a limited South Indian population. Two people were involved, the investigator and the principal investigator. All the values were noted and entered in an Excel sheet. The data were imported to SPSS statistical software for statistical analysis. “Paired sample T test” was done to examine the data and  $p < 0.05$  was regarded significant in statistical terms.

## **RESULTS**

The hook of hamate on the right and left side is shown in Figure 1. The present study has observed that the mean value for right diameter was 10.9280 mm while left diameter had a mean value of 10.7530 mm. Mean value of the left diagonal was measured to be 13.6145 mm while the right diagonal had a mean value of 14.2645 mm . Mean value of right width was 5.2375 mm while for left width it had a mean value of 5.07 mm (Table 1 and Figure 2).

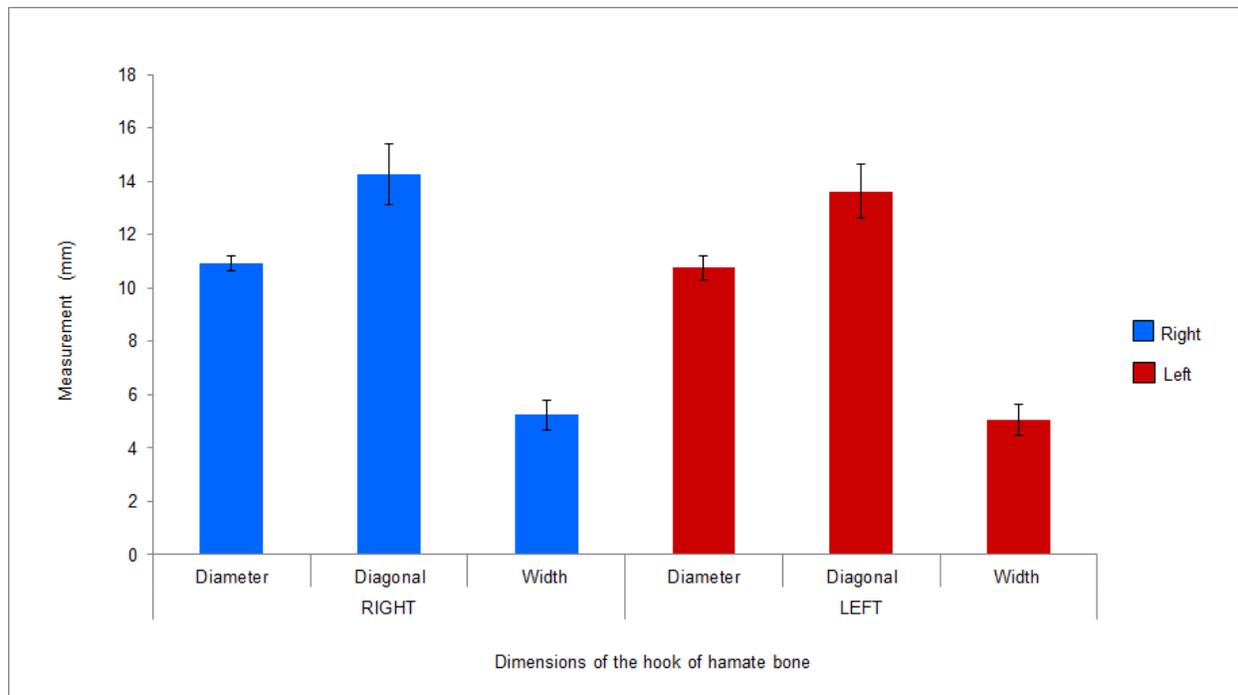
Pair 1 (Right & Left diameter of hook of hamate bone ) showed a significance value of 0.00,  $p < 0.05$ . Pair 2 (Right and left diagonal of hook of hamate) showed a significance value of 0.00,  $p < 0.05$ . And pair 3 (Right & Left width of hook of hamate) showed a significance value of 0.02,  $p < 0.05$ . Therefore all the three parameters are significant indicating  $p$  value less than 0.05,  $p < 0.05$ .

**Table 1: Shows the morphometric measurements of various parameters of hook of hamate. The values are expressed as Mean  $\pm$  SD.**

Parameters	Mean score	Significance
Right diameter	10.928	0.00
Left diameter	10.7530	0.00
Right diagonal	14.2645	0.00
Left diagonal	13.6145	0.00
Right width	5.23	0.029
Left width	5.07	0.029



**Figure 1: Showing left and right hamate bone with hook.**



**Figure 2: Graph showing average measurement of diameter, diagonal length and width of hook of hamate bone on right and left side. The x-axis represents the various dimensions of the bone and the Y-axis represents the measurements in mm. There was a significant difference in the diameter, T test showing  $p=0.00$  ( $p<0.05$ ), diagonal length showing  $p=0.00$  ( $p<0.05$ ) and width between right and left hamate bone, showing  $p=0.029$  ( $p<0.05$ ). All the analysis showed  $p<0.05$  indicating statistically significant.**

## DISCUSSION

Morphological analysis of hook of hamate bone reveals that the location and dimension of hook of hamate bone vary in different bony skeletons and a correct and clear knowledge of its clinical implication was analyzed. Morphometric analysis from the SPSS statistical software revealed that the meaning of left diameter of the hook of Hamate is lesser than right diameter, right diagonal is greater than left diagonal and right width is also greater than left with the hook of Hamate bone.

Morphological analysis reveals that the hook of hamate bone varies morphologically rarely or slightly in different organisms. Incidence of variation of the hook of hamate is rare (31). Some researchers believed the hook of hamate to be a consistent anatomical structure, which is a palpable bony structure that acts as a landmark for surgeons. Few cases report anatomic variations in the hook of hamate and might often go un-recognized (32). The hook of hamate is a landmark for surgeons that divide the ulnar border of the carpal tunnel from Guyon's Canal. It is also susceptible to fracture from accidents. We believe that hamate hook variation exists in the overall population..

Morphometric analysis data for morphometric dimensions of hook of Hamate bones were right diameter was 10.9 28mm, left diameter was 10.7 mm, right diagonal was 14.2 6mm, left diagonal was 13.6 mm, right width was 5.2375mm, left width was 5.0 7mm. All the three were statistically significant (  $P < 0.05$  ) . There were no significant differences between two methods in the seven parameters as follows the long part of the basement of hook, the short part of the basement of the hook, the long part of the waist of the hook, the short part of the waist of the hook, the long part of the top of the hook, the height of the hook, of hamate bone, and the distance between the top and the waist of the hook (33). The hook of hamate bones can be divided into three parts: the coronal part, waist part and the basal part. The measurement results can be used as a reference value directly in clinical treatments.

### **CONCLUSION**

Within the limits of the study, the morphological and morphometrical characteristics of Hook of Hamate bone was analysed which stated that the mean of right diameter of hook of hamate bone was greater than left diameter of hook of Hamate bone. This study was done to spread awareness regarding the hook of hamate among the South Indian population and for clinical significance. In this study measurements of the hook of hamate such as length, breath, width ,diagonal and diameter have been analysed which will be helpful for upcoming orthopaedic surgeons during surgery.

### **LIMITATION**

In this study there were only a few dry Hamate bones used and study was done in very less time. This study can be done with more dry Hamate bones and more time should be spent in the future.

### **FUTURE SCOPE**

In this study measurements of the hook of hamate such as length, breath, width ,diagonal and diameter have been analysed which will be helpful for upcoming orthopaedic surgeons during surgery.

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### **CONFLICTS OF INTEREST**

None declared

### **AUTHOR CONTRIBUTIONS**

Author 1: S Pragya, carried out the study by collecting data and drafted the manuscript after performing the necessary statistical analysis and in the preparation of the manuscript.

Author 2: Karthik Ganesh Mohanraj, aided in conception of the topic, designing the study and supervision of the study, correction and final approval of the manuscript.

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