



MORPHOLOGICAL AND MORPHOMETRIC STUDY OF HUMAN CAPITATE BONE AND ITS ANATOMICAL SIGNIFICANCE.

**Dr. Vaibhavi
Dipakbhai Bhatti**

3rd Year Resident Baroda Medical College, vadodara.

Dr. Hina B. Rajput

Associate Professor -- Baroda Medical College, vadodara.

**Dr. Vivek Vijay
Trivedi**

3rd Year Resident - Baroda Medical College, vadodara.

ABSTRACT

Introduction: The capitate bone, the largest and central carpal bone, is crucial in wrist biomechanics and clinical interventions. Its anatomical relationships are vital for diagnosing and treating wrist-related conditions. This study aimed to analyze the morphology and morphometry of the capitate bone to enhance clinical and surgical understanding. **Materials And Methods:** This observational study examined 62 capitates bones (34 right and 28 left) of unknown sex and age from the Anatomy Department, Medical College Baroda, Gujarat. Measurements such as head circumference, facet dimensions, and nutrient foramina counts on various surfaces were recorded using digital vernier calipers to ensure precision. **Results:** The mean head circumference of the capitate bone was 35.36 ± 2.6 mm, with a total length of 21.77 ± 1.88 mm. The widths at the base and middle were 7.15 ± 1.07 mm and 12.15 ± 1.03 mm, respectively. The median number of nutrient foramina varied across surfaces: mediate side (3, range 2–4), lateral side (2, range 1–2), palmar side (1, range 0–2), and dorsal side (2, range 1–3). These findings align partially with previous studies but show differences due to methodological variations. **Discussion:** Understanding the morphology and morphometry of the capitate bone has significant implications for wrist arthroplasty and other surgical procedures. Variations in measurements compared to computer-assisted studies highlight the importance of methodological accuracy. This research provides critical anatomical insights to refine surgical techniques and improve outcomes for wrist-related conditions.

KEYWORDS :

INTRODUCTION:

Out of all the Carpal bones, the capitate is the central and largest carpal bone. (1) It is located in the distal row of carpal bones. The capitate bone is situated directly next to the metacarpal bone of the ring finger on its outer surface. It articulates with the base of the third metacarpal via its triangular distal concavo-convex surface. Its lateral border is a concave strip for articulation with the medial side of the base of the second metacarpal. Its dorsomedial angle usually bears a facet for articulation with the base of the 4th metacarpal. The head projects into the concavity formed by the lunate and scaphoid; the proximal surface articulates with the lunate, and the lateral surface with the scaphoid. The facet for the scaphoid and trapezoid, though usually continuous on the distolateral surface, may be separated by a rough interval. The medial surface bears a large facet for articulation with the hamate, which is deeper proximally where it is partly non-articular. (2) Palmar and dorsal surfaces are roughened for carpal ligaments, the dorsal being the larger. (3)

Understanding these anatomical relationships is not just a matter of academic interest, but it also has significant practical implications. This knowledge provides clinicians with the foundation to orient to the capitate bone on the wrist during clinical examination and intervention, enhancing their ability to diagnose and treat wrist-related conditions.

Aim And Objectives:

to analyse the morphology and morphometry of capitate bone.

MATERIALS AND METHODS:

This observational study was conducted with meticulous care, examining 62 capitate bones (34 right and 28 left-sided) of unknown sex and age collected from the Anatomy Department of Medical College Baroda, Gujarat. The parameters of the capitate that were measured, including the circumference of the head of the capitate bone, the width and length of the facet of the medial surface, and the nutrient foramen on the lateral, medial, dorsal, and palmar surfaces, were all carefully

recorded. This attention to detail ensures the reliability and accuracy of our findings.

General Morphometric Measurements:

All measurements were meticulously taken after placing the capitate bone in its anatomical position and using a digital vernier calliper, ensuring our study's highest level of precision and accuracy.

Head Circumference Of Capitate:

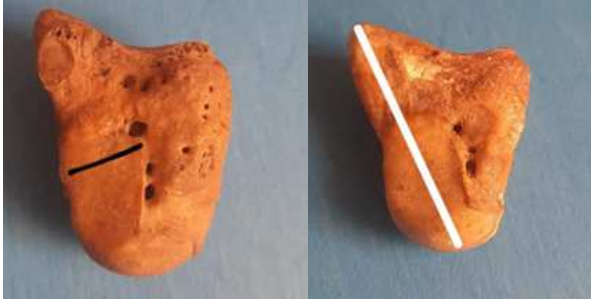
The head circumference was measured by winding a thread around the bone. A point was marked on the thread using a marker or pen. After placing this thread on plain paper, the measurements were done using vernier callipers.

The Length And Width Of The Facet On The Medial Surface Of The Capitate:

The outline was marked on graph paper after placing the capitate bone in its anatomical position. The measurements were done using vernier callipers.



Head Circumference



width of the facet on the medial surface length of the facet on the medial surface

Width of Capitate at Base:

Each bone was placed on graph paper, and its outline was traced onto the paper. The most prominent point on the medial side and the most prominent one on the lateral side of the most proximal part of the bone were marked. Then, the width at the base was measured using the digital vernier calliper.

Width Of Capitate In The Middle:

An outline was traced onto the graph paper. The most prominent points on the medial aspect and lateral aspect of the narrow-constricted part of the capitate were marked. The width was then measured

The number of Nutrient Foramina:

The number of nutrient foramina on the capitate was observed using a magnifying lens on the Medial, Lateral, palmar, and Dorsal surfaces of the Capitate bone.



Foramina on the medial surface Foramina on the dorsal surface



Foramina on the palmar surface Foramina on lateral surface

RESULT:

The mean circumference of the head of the capitate was 35.36 ± 2.6 mm. The length of the facet on the medial surface was 16.23 ± 1.93 mm, and the width was 6.44 ± 0.85 mm. The total length of the capitate bone was 21.77 ± 1.88 mm, and the total width of the capitate bone at the base was 7.15 ± 1.07 mm, and in the middle, was 12.15 ± 1.03 mm. The mean length of the facet on the dorsomedial surface was 3.72 ± 0.54 mm, and the mean width was 3.83 ± 0.59 mm. The median number of nutrient foramina on the capitate bone on the mediate side was 3 (2-4), on the lateral side was 2 (1-2), on the palmar side was 1 (0-2), and the dorsal side was 2 (1-3).

Table 1: Mean Measurements Of The Different Anatomical Variables

Name of the anatomical variables		Minimum (mm)	Maximum (mm)	Measurements in mm (Mean ± SD)
Head circumference of Capitate		31	41.19	35.36 ± 2.6
Facet on the medial surface	Length	2.9	5.7	16.23 ± 1.93
	Width	2.9	5.8	6.44 ± 0.85
The total length of the Capitate		18	24.3	21.77 ± 1.88
Total width of Capitate	At base	5.3	9.7	7.15 ± 1.07
	At middle	8.7	13.6	12.15 ± 1.03
Facet on the dorsomedial surface	Length	2.9	5.7	3.72 ± 0.54
	Width	2.9	5.8	3.83 ± 0.59

Table 2: Number Of Nutrient Foramina On The Different Sides Of The Capitate Bone

Different sides of the Capitate bone	Minimum	Maximum	Numbers of nutrient foramina (Median (IQR))
Mediate side	0	6	3 (2-4)
Lateral side	0	5	2 (1-2)
Palmar side	0	3	1 (0-2)
Dorsal side	0	4	2 (1-3)

DISCUSSION:

Wrist arthroplasty is a treatment option for patients with advanced destruction of the carpus and radio-carpal joint, but the main complication is the failure of fixation in the carpus. (4) Defining the anatomy and quantifying the anatomical variability is the first step to refining wrist arthroplasty designs and surgical techniques. Our study focuses on the capitate carpal bone and its surrounding anatomy as fixation points in currently available wrist arthroplasty devices.

In our study, we examined the detailed anatomy of the capitate in 62 participants. Our study found that the mean circumference of the head of the capitate was 35.36 ± 2.6 mm. The total length of the capitate bone was 21.77 ± 1.88 mm, and the total width of the capitate bone at the base was 7.15 ± 1.07 mm, and in the middle, was 12.15 ± 1.03 mm. Similar results were found in the study conducted by Aparna VK et al., measured that the mean circumference of the head on the right side was 37.3 mm and of the left side was 42.6 mm, the mean width of the facet on the medial surface on the right side was 6.53 mm and on the left side was 6.92 mm, the mean length of facet on the medial surface on the right side 17.12 mm and on left side 17.14 mm. (5)

The mean vascular foramen on the medial surface was 5, the lateral surface was 2, the palmar surface was 2, and the dorsal surface was 3. In the study conducted by F. Xiang et al. in the Affiliated Hospital of Southwest Medical University from July 2019 to October 2021, the mean length of the capitate one was 24.92 ± 0.89 mm for the left side and 23.83 ± 1.58 mm for the right side, which was lower than our study, but the difference was not statistically significant. They also measured the mean width at the base, which was 13.67 ± 1.80 mm and 13.33 ± 1.23 mm for left and right capitate, respectively, which was significantly higher than the findings of our study. (6) A study conducted by Wu Huan et al. in China utilised computer software to measure the length and width of the capitate bone. The measurements obtained were 16.30 ± 0.43 mm for length and 9.75 ± 0.76 mm for width. (7)

The measures acquired in our study differ significantly from those obtained through computer reconstruction. We hypothesise that this discrepancy may arise from the computer's inability to reconstruct the edge bone quality of the capitate bone accurately. On the other hand, measurements obtained from intact specimens involve determining the thickness of cartilage on both the proximal and distal surfaces of the capitate bone. Consequently, the anatomical measurements taken on physical specimens are greater in size.

REFERENCES:

1. Eathorne, SW (March 2005). "The wrist: clinical anatomy and physical examination--an update". *Primary Care*. **32** (1): 17-33.
2. Drake, Richard L.; Vogl, Wayne; Tibbitts, Adam W.M. Mitchell; illustrations by Richard; Richardson, Paul (2005). *Gray's anatomy for students*. Philadelphia: Elsevier/Churchill Livingstone.
3. Standing, S. (2016) *Gray's Anatomy: The Anatomical Basis of Clinical Practice*. Gray's Anatomy Series 41st edn
4. Campbell CC, Neustein TM, Daly CA, Wagner ER. Surgical Treatment of Wrist Arthritis in Young Patients. *JBJS Rev*. 2020 Mar;8(3):e0078. doi: 10.2106/JBJS.RVW.19.00078.
5. Aparna VK, Fatima Z, Rao JK. Morphological and morphometric study of dried human scaphoid bone and its clinical significance in Telangana region. *Int J Sci Res* 2021;10:58-60.
6. Xiang F, Fan W, Tan X, Liu J, Gu H, Yang Y. A novel capitate bone Ilizarov external fixator for treating Kienböck's disease: an anatomical and biomechanical study. *Sci Rep*. 2024 Mar 26;14(1):7111. doi: 10.1038/s41598-024-55445-3.
7. Wu H, Xu Y, Luo H, et al. Anatomical basis of the morphology and blood supply of the capitate bone. *Chin. J. Clin. Anat*. 2020;38(02):160-165. doi: 10.13418/j.issn.1001-165x.2020.02.012.