



Morphological and Morphometrical Analysis of Dry Human Scaphoid Bone in South Indian Population and Its Clinical Implications

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Authors' contributions

This work was carried out in collaboration between both authors. Author KUM, 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 KGM, aided in conception of the topic, designing the study and supervision of the study, correction and final approval of the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

Introduction: Scaphoid is the second largest among all the carpal bones, which is present on the radial side of the proximal row of carpal bones. Scaphoid Fractures are the most common of the carpal bone injuries. Scaphoid Fractures heal slowly due to the limited blood circulation of the bone.

Materials and Methods: The study was performed on 20 Scaphoid Bones, which were collected from the Department of Anatomy, Saveetha dental college. By using digital vernier callipers, morphological and morphometrical parameters (length and breadth) of scaphoid bones were measured, tabulated and statistically analysed.

Results: All the 20 scaphoids showed the presence of tubercle. Double foramina in the main dorsal sulcus were seen in 7 right and 6 left specimens. No significant differences were found in lengths and breadths of the bone. In the present study, at least one foramen is found in all the main dorsal sulcus and the number of specimens showing presence of double foramen in the main dorsal sulcus are 7 right and 6 left specimens.

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Conclusion: This study showed that no significant morphological and morphometric differences were found between right and left sides. The data obtained in the present study will be helpful for the hand surgeons, radiologists and clinical anatomists for surgical reduction to follow up the reunion of fractured scaphoid bones.

Keywords: Morphology; morphometry; scaphoid bone; variation; clinical implications.

1. INTRODUCTION

Scaphoid bone is one of the carpal bones present on the radial side. It is the second largest bone in carpels. On the distolateral part of the palmar surface, a projection is present which is known as [1]. Scaphoid bone plays a crucial role in wrist dynamics as it is articulated with many other bones in hand and wrist. The wrist consists of 8 carpal bones [2]. The scaphoid has a dorsal and a palmar surface. Through the retrograde branches of the radial artery the major supply of blood to the scaphoid bone [3]. 75% of blood supply by the dorsal branches of the radial artery occurs through the foramina. Scaphoid fractures are most common. Scaphoid bone involved in moving and stabilizing wrist [4]. The older name for scaphoid bone is navicular bone. Scaphoid fractures on distal poles heal quickly due to the good supply of blood to the bone. Due to poor blood supply on the proximal side, the fractures do not heal quickly [5]. Due to insufficient blood supply, the bone dies, which is known as avascular necrosis. The difficulty in interpretation of scaphoid anatomy is due to the complex shape of scaphoid and its orientation within the carpels [6]. Scaphoid bone is a unique carpal bone due to its shape and function. In a three dimensional view it shows oblique orientation which performs unique functions. In young healthy individuals also the scaphoid fractures occur [7].

Scaphoid bone articulates with five bones, proximally with radius, distally with trapezoid, medially with capitate and lunate [8]. Its proximal surface is triangular, smooth and convex. Its palmar surface is concave and it articulates with radius and ulna, which helps in movements of the wrist. Its connections with two rows of carpal bones makes it most common to fractures [9]. One of the major functions of the hand is to grip and manipulate objects. The scaphoid bone position is similar to the position of the navicular bone. It has circumferences like proximal waist and distal at three different regions [10].

Scapholunate ligament is the connection between lunate bone and scaphoid bone.

Scaphoid fractures should be recognized quickly and should be treated by means of surgical fixation [11]. So, we can avoid malunion of scaphoid bone. As there is a scare of this kind of studies in the south indian population, it is useful for orthopedics to treat the scaphoid fractures. Many researchers had been done on different populations like the north indian population, there is scarce of this kind of research in south indian population. So it can be fulfilled with this kind of research in the south indian population between the left and right side. Our team has extensive knowledge and research experience that has translated into high quality publications [12–31]. This study aims at accurate morphological and morphometrical measurements of human scaphoid bone between left and right side in the south indian population.

2. MATERIALS AND METHODS

The materials for the present study comprised of 20 dry scaphoid bones [10 right and 10 left] of unknown sex, obtained from the department of anatomy, Chennai. Fractured and pathological bones were excluded from the study. The following instruments were used for the study vernier callipers for measuring lengths and breadths of various parts of scaphoid bone. The determination of sides were done by anatomical features. The morphometric parameters were measured using digital vernier callipers. All the parameters were evaluated by two observers to avoid any bias in the measurements.

Morphological Parameters: The origin of scaphocapitate ligament is due to the presence of tubercle, waist, dorsal sulcus and ridge. In the main sulcus and secondary sulcus foramen was noted. The shape of the scapholunate joint surface was noted as half moon or crescent. Nutritive foramina was also noted on the dorsal surface of scaphoid bone.

Morphometrical Parameters: Length is measured between the two prominent points on the proximal articular surface. At three different regions the width of the scaphoid bone was measured. The dorsal sulci width and length was also measured. At the narrowest point the

circumference of the waist was measured. The tubercle's primary and secondary heights were measured. The statistical analysis of the morphometric parameters was performed by using paired sample statistics and paired sample tests, each variable was investigated and correlated individually with reference to the side.

3. RESULTS

The presence of various morphological features of scaphoid such as tubercle, waist, dorsal sulcus, nutrient foramina, ridges were observed. In the left scaphoid 6 tubercles were conical in shape and 7 were pyramidal in shape. Tubercles in the left side of the scaphoid bone showed 2 to 4 foramina. The superior and inferior view of scaphoid bone was shown in Fig. 1.

The single and double sulcus was observed on the dorsal sulcus of scaphoid bone. 7 scaphoids had single dorsal sulcus and 8 scaphoids had double dorsal sulcus irrespective of their sides. A maximum of 6 foramina was found on the left side of the scaphoid bone . A maximum of 8 foramina was found on the right side of the scaphoid bone.

The morphometric comparison was done on both the sides of the bones. Mean value of the right side length of the scaphoid bone is 2.44 ± 0.18 and that of the left side is 2.39 ± 0.17 . The Mean value of the right side breadth of the scaphoid bone is 1.33 ± 0.24 and that of the left side is 1.25 ± 0.20 . No significant difference was found in lengths and breadths of the bone.



Fig. 1. Superior and inferior views of scaphoid bone

Table 1. Showing the mean values and standard deviation of lengths and breadths of right and left side

Parameters	Minimum	Maximum	Mean	Std. Deviation
Rt Length	2.22	2.74	2.4480	.18152
Rt Breadth	1.02	1.74	1.3390	.24619
Lt Length	2.13	2.65	2.3900	.17701
Lt Breadth	1.01	1.66	1.2530	.20022

Table 2. Showing the correlation between right length and left length and right breadth and left breadth

Pair	N	Correlation	Significance
Pair 1 - Right Length & Left Length	10	0.490	0.151
Pair 2 - Right Breadth & Left Breadth	10	0.399	0.253

4. DISCUSSION

The scaphoid is a unique carpal bone in its shape and as well as its function. It is so difficult to interpret its anatomy radiologically in x-rays when the bone gets fractured [2]. Scaphoid is very notorious to go into nonunion and ultimately avascular necrosis. The reasons behind it are the major alteration in the wrist and its vulnerable blood nourishment [32]. Scaphoid has two major blood vessels along the palmar and dorsal surface [33,34]. Analysis of scaphoid bone in the south Indian population with the sample size of 20 bones [10 left and 10 right]. Right side length mean value is 2.44 ± 0.18 and the right side breadth value is 1.33 ± 0.24 . Left side length mean value is 2.39 ± 0.17 and the left side breadth mean value is 1.25 ± 0.20 . The standard deviation for right side length and left side length are not significant. The standard deviation for left side breadth and right side breadth are not significant.

By using paired sample T tests the right side length and left side breadth mean value is 0.058 and right side breadth and left side breadth mean value is 0.08. For the correlation of the left side and right side the values are 0.49 and 0.39 so, the values were not significant. The standard deviation for right side length and left side length is 0.18 and for right side breadth and left side breadth the value is 0.24. The presence of tubercle, waist, lateral sulcus in all specimens and the presence of dorsal sulcus and secondary sulcus. The measurements for the length and breadth of scaphoid bone are taken in millimeters. This study therefore sought to describe the lengths and breadths of the scaphoid bone and correlation of this information.

In the previous study, there were no statistically significant differences in the average values of the various dimensions of the scaphoids of the two sides [34]. The various morphometric parameters of scaphoid had been compared [34,35]. No comparative data pertaining to lengths and breadths of scaphoid bone could be found in the available and accessible literature. The differences observed between the parameters in our study and the previous study may differ due to the place, living habits of the population studied by them. The mean value of this study was given in Table 1. The correlation between right length and left length and right breadth and left breadth of this study was given in Table 2. The statistical analysis of this study was done by using paired sample T tests.

5. CONCLUSION

This study showed that no significant morphological and morphometric differences were found between right and left sides. The data obtained in the present study will be helpful for the hand surgeons, radiologists and clinical anatomists for surgical reduction to follow up the reunion of fractured scaphoid bones. This study will ultimately improve the understanding of wrist function and promote enhancements to the treatments for wrist dysfunction.

6. LIMITATIONS OF THE STUDY

The limitations of this study include unique challenges because of the particular geometry of the features and the tenuous vascular pattern of the scaphoid bone. Initial radiological examination of capels may fail to give confirmation of a fracture. The study is limited to only a small number of populations.

FUTURE SCOPE

It can be done for a wide range of populations. Comparison between different age groups can also be done. The study can be carried out in other populations and age groups in future.

CONSENT

It is not applicable.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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