

# A study of morphological and morphometrical analysis of dry human scaphoid bone in South India

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## Abstract

**Background:** Scaphoid is the largest and most lateral of the proximal row of carpals. It has a unique three-dimensional orientation and forms an important link between the proximal and distal rows of carpal bones on radial aspect of wrist. Scaphoid Fractures heal slowly due to the limited blood circulation of the bone. **Aims of The Study:** To evaluate the morphological and morphometric parameters of human scaphoid bone. **Materials And Methods:** The study was performed on 30 Scaphoid Bones, which were collected from the Department of Anatomy. Morphological and morphometrical parameters of scaphoid bones were measured using digital vernier calipers. **Results:** This study evaluated 30 scaphoid bones. 22 scaphoids had dorsal sulcus irrespective of their sides. There were 9 foramina on left side and 11 foramina on right side of the scaphoid bone. Mean value of the right-side length of the scaphoid bone is  $2.308 \pm 0.171$  and that of the left side is  $2.380 \pm 0.226$ . The Mean value of the right-side breadth of the scaphoid bone is  $1.319 \pm 0.187$  and that of the left side is  $1.293 \pm 0.190$ . However there was no significant difference found in lengths and breadths of the bone. **Conclusion:** This study showed that no significant morphological and morphometric differences were found between right and left sides.

**Keywords:** Morphology, morphometry, scaphoid bone, variation.

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## INTRODUCTION

The scaphoid is one of the significant carpal bones that take part in the wrist joint laterally with lunate. It is situated in the proximal row of carpal bones on the radial side of the wrist. Scaphoid articulates with other carpal bones, namely, lunate, trapezium, and capitate.<sup>1</sup> It is connected with lunate bone by means of the scapholunate ligament. Scapholunate instability can occur when scapholunate ligament gets disturbed. Scaphoid heals slowly due to the

limited blood supply and thus any fracture of this bone must be attended immediately in order to stop malunion. Sometimes, nonunion may result in posttraumatic osteoarthritis. Radial artery is the major blood supply to the scaphoid bone. There is outstanding collateral circulation through the dorsal and volar branches of the anterior interosseous artery. The middle and distal portions of the scaphoid bone are supplied by the lateral and distal branches of the radial artery through its palmar and dorsal branches, while the proximal portion of the bone has poor blood supply.<sup>2</sup> The medial surface has two facets, a flattened semi-lunar facet articulating with the lunate bone and an inferior concave facet articulating with the head of the capitate bone. Infrequently, abductor pollicis brevis may take its origin from the scaphoid tubercle. The position of scaphoid bone is similar to the position of the navicular bone in the foot, hence scaphoid bone was referred as navicular bone of the hand. Scaphoid injury is most common among the other carpal bones. The incidence of malunion afterward surgical fixation treatment has been >12%, particularly in young men.<sup>3</sup> The

waist has several ligamentous attachments. Fracture may take place at any age, even in children. In males, it may occur between age group of 20 and 30 years of age. Surgeons performing operative fixation of scaphoid fractures using a headless compression screw such as the Herbert screw and corticocancellous bone grafting for nonunion need to be familiar with these morphological and morphometric variations of the scaphoid bone.<sup>4-7</sup> This study aims to examine morphological and morphometrical measurements of human scaphoid bone between left and right side in south India.

## METHODS

The materials for the present study comprised of 30 dry scaphoid bones [15 right and 15 left] of unknown sex, obtained from the Department of anatomy during July 2015 to June 2016. The morphometry of scaphoid was measured using the vernier caliper. The number of foramina was observed using a magnifying lens and noted. The shape of tubercle, dorsal sulcus, and foramina on the dorsal sulcus were also observed. Scaphoid with arthrosis, evidence of trauma, or other pathological changes was

excluded from the study. Side determination of the bones was done by anatomical features.

**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.

**Statistical analysis:** The mean, standard deviation and range were calculated. The data were analyzed by Student's t-test for comparison on the right and left side measurements. Correlation analysis was performed between right length and left length and right breadth and left breadth. Statistical analysis was done using SPSS software 14.0, (SPSS, Chicago, IL, USA).

## RESULTS

The presence of various morphological features of scaphoid such as tubercle, waist, dorsal sulcus, nutrient foramina, ridge 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.



**Figure 1:** Superior and inferior views of human scaphoid bone.

The single and double sulcus were observed on the dorsal sulcus of scaphoid bone. 12 scaphoids had single dorsal sulcus and 10 scaphoids had double dorsal sulcus irrespective of their sides. A maximum of 9 foramina was found on the left side of the scaphoid bone. A maximum of 11 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  $2.308 \pm 0.171$  and that of the left side is  $2.380 \pm 0.226$ . The Mean value of the right-side breadth of the scaphoid bone is  $1.319 \pm 0.187$  and that of the left side is  $1.293 \pm 0.190$ . No significant difference was found in lengths and breadths of the bone (table 1). From the correlation analysis of left side and right side, the values were 0.395 and 0.389. However the values were not significant (table 2).

**Table 1:** Mean and standard deviation of lengths and breadths of right and left side

Parameters	Mean	Standard Deviation	P value
Rt Length	2.3080	.17152	> 0. 05 (NS)
Lt Length	2.3800	.22619	
Right breadth	1.3190	.18701	> 0. 05(NS)
Lt Breadth	1.2930	.19022	

NS : not significant

**Table 2:** Correlation analysis between right length and left length and right breadth and left breadth.

Pair	N	Correlation	Significance
Pair 1 - Right Length and Left Length	15	0.395	0.151
Pair 2 - Right Breadth and Left Breadth	15	0.389	0.253

## DISCUSSION

The scaphoid is a unique carpal bone in its shape and as well as it's function. It is so difficult to interpret it's anatomy radiologically in x-rays when the bone gets fractured. Scaphoid is very notorious to go into nonunion and ultimately avascular necrosis. The reasons behind it are the major alteration in the wrist and it's vulnerable blood nourishment.<sup>8</sup> Scaphoid has two major blood vessels along the palmar and dorsal surface. This study analyzed scaphoid bone in the south Indian population with the sample size of 30 bones [15 left and 15 right]. There was no significant difference between right side length and left side length and also between left side breadth and right-side breadth by paired t test. For the correlation of the left side and right side the values are 0.395 and 0.389 but, the values were not significant. 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 were taken in millimeters. In the previous studies, there were no statistically significant differences in the average values of the various dimensions of the scaphoids of the two sides. The various morphometric parameters of scaphoid had been compared. No comparative data pertaining to lengths and breadths of scaphoid bone could be found in the available and accessible literature.<sup>9-14</sup> 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. This study will ultimately improve the understanding of wrist function and promote enhancements to the treatments for wrist dysfunction.

**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. So this further studies on wide range of population with comparison between different age groups are needed.

## CONCLUSION

No significant morphological and morphometric differences were found between right and left sides. This data obtained from the present study will be helpful for the hand surgeons, radiologists and clinical anatomists for

surgical reduction and follow up the reunion of fractured scaphoid bones.

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