



## MORPHOLOGICAL AND MORPHOMETRIC STUDY OF DRIED HUMAN SCAPHOID BONE AND ITS CLINICAL SIGNIFICANCE IN TELANGANA REGION

### Anatomy

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### ABSTRACT

**INTRODUCTION:** Scaphoid is the largest and most lateral bone of the proximal row of carpal bones [1]. It is roughly cuboidal in shape, presenting six surfaces, dorsal, palmar, proximal, distal, medial and lateral. The palmar surface is proximally flat and faces anteriorly. On the distolateral part of the palmar surface there is a projection known as tubercle (Tuberculum ossis scaphoidei) [1].

**AIM AND OBJECTIVE:** To study the morphological & morphometric details of dried adult human scaphoid bones.

**METHODOLOGY:** The study was done on 50 dried adult human scaphoid bones (25 right and 25 left) of unknown sex available in the Department of Anatomy, Osmania Medical College, koti, Hyderabad. Damaged bones were omitted from the study. The morphometry of scaphoid was measured using the digital vernier callipers. The circumferences was measured using a thread. The number of foramina was observed using a magnifying lens and noted. The shape of tubercle, number of dorsal sulcus, and foramina on the dorsal sulcus, tubercle and waist were observed and ridge for origin of Scaphocapitate interosseous ligament and sulcus for Flexor carpi radialis was observed. The results were analysed and compared to previous studies. Side determination of the bones was done by anatomical features. [2,3]

**RESULTS:** The tubercle was present in all the scaphoid bones. Among the left scaphoid bones, 16 were of conical shape and 9 were pyramidal shape. Similarly 11 right scaphoid tubercles were of conical shape and 14 were of pyramidal shape. Tubercle in the left side scaphoid showed a range of 2-8 foramina with minimum 2 foramina and right scaphoid showed 2-10 foramina with minimum 2 foramina. Waist in the left side scaphoid showed a range of 1-2 foramina and right scaphoid showed 1-3 foramina. The 28 scaphoids had single dorsal sulcus and 22 scaphoids had double dorsal sulcus irrespective of the sides.

**CONCLUSION:** Scaphoid fracture preferred treatment is surgical reduction with internal fixation. Internal fixation has become a well-established alternative to casting for acute scaphoids fractures. Screw design has evolved, and several different types of screws of varying sizes are now available. The morphological and morphometric data obtained in the present study may help the orthopedicians, hand surgeons, morphologists, anatomists, and radiologists for surgical reduction with internal fixation to follow-up the reunion of fractured scaphoid bones.

### KEYWORDS

Scaphoid, Dorsal Sulcus, Foramina, Waist Of Scaphoid, Tubercle Of Scaphoid.

### INTRODUCTION:

Scaphoid (Os Scaphoideum) is one of the important carpal bones that take part in the wrist joint along with lunate. It is situated in the proximal row of carpal bones on the radial side of the wrist.<sup>[4]</sup> Scaphoid articulates with other carpal bones, namely, lunate, trapezium, and capitate. It is connected with lunate bone by means of the scapholunate ligament. Scapholunate instability can occur when scapholunate ligament gets disrupted. Scaphoid heals slowly due to the limited blood supply and thus any fracture of this bone should be attended immediately in order to prevent malunion. Sometimes, nonunion may result in posttraumatic osteoarthritis.<sup>[5]</sup> Radial artery is the major blood supply to the scaphoid bone. There is excellent collateral circulation through the dorsal and volar branches of the anterior interosseous artery.<sup>[6]</sup> 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, whereas the proximal portion of the bone has poor blood supply.<sup>[7]</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. Occasionally, abductor pollicis brevis may take its origin from the scaphoid tubercle.<sup>[8]</sup>

### AIM AND OBJECTIVE:

To study the morphological & morphometric details of dried adult human scaphoid bones.

### MATERIAL AND METHODS:

The study was done on 50 dried adult human scaphoid bones (25 right and 25 left) of unknown sex available in the Department of Anatomy, Osmania Medical College, koti, Hyderabad. Damaged bones were omitted from the study. The morphometry of scaphoid was measured using the digital Vernier Callipers. The circumferences was measured using a thread. The number of foramina was observed using a magnifying lens. The results were analysed and compared to previous studies. Side determination of the bones was done by anatomical features.<sup>[2,3]</sup>

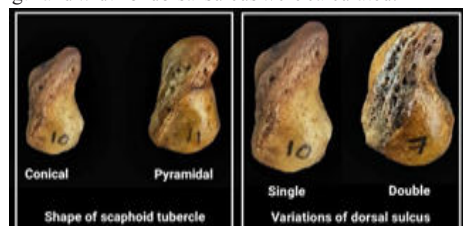
The following parameters were measured and noted:

#### (A) Morphological Parameters :-

- (i) Shape of scaphoid tubercle: either conical or pyramidal
- (ii) Dorsal sulcus: either single or double sulcus
- (iii) Number of Nutrient foramina: on Dorsal sulcus, and other parts such as tubercle, waist.
- (iv) Ridge for origin of scaphocapitate interosseous ligament (SCIL) – presence or absence of ridge was observed.
- (v) Sulcus for Flexor Carpi Radialis (FCR) – presence or absence of sulcus was observed.

#### (B) Morphometric Parameters :-

- (i) Length : distance between the most prominent points of proximal articular surface and tubercle.
- (ii) Proximal width: maximum width towards the proximal articular surface.
- (iii) width of the waist : measured at the narrowest angle of waist.
- (iv) Distal width: calculated at the widest part of the distal part of bone.
- (v) Primary height of tubercle: defined as the distance between the most prominent point of the tubercle and the intersection of the anterior and superior ridges of the scapholunate articular surface.
- (vi) Secondary height of tubercle: defined as the most prominent point of the tubercle and the deepest point of the waist.
- (vii) Circumference of tubercle: measured at its base
- (viii) Circumference of the waist: measured at its narrowest part
- (ix) Length and width of dorsal sulcus were calculated.



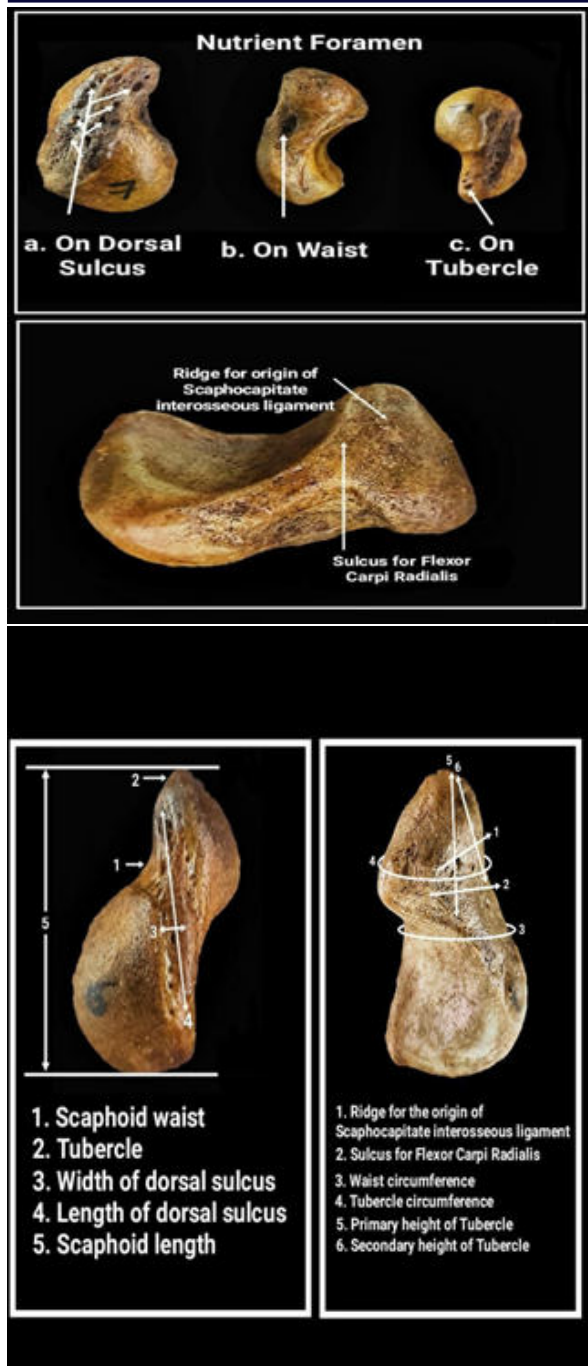


Fig:1 and Fig:2 - Morphological features of scaphoid and Morphometric parameters of scaphoid.

**RESULTS:**

**(A) Morphological Parameters:**

MORPHOLOGICAL FEATURES PRESENT	RIGHT n = 25	LEFT n = 25	TOTAL n = 50
TUBERCLE	25	25	50
DORSAL SULCUS	25	25	50
WAIST	25	25	50
SULCUS FOR FCR	23	20	43
RIDGE FOR SCIL	24	22	46

The tubercle was present in all the scaphoid bones. Among the left scaphoid bones, 16 were of conical shape and 9 were pyramidal shape. Similarly 11 right scaphoid tubercles were of conical shape and 14 were of pyramidal shape. Tubercle in the left side scaphoid showed a range of 2-8 foramina with minimum 2 foramina and right scaphoid showed 2-10 foramina with minimum 2 foramina. Waist in the left side scaphoid showed a range of 1-2 foramina and right scaphoid showed

1- 3 foramina. The dorsal sulcus of scaphoid bone was observed for single or double sulcus and in 13 scaphoid dorsal sulcus were single and in 12 were double on the left side with foramina in the range of 2-10 present in it, whereas 15 sulcus were single and 10 were double on the right side scaphoid dorsal sulcus with foramina in the range of 2-12 present in it. The 28 scaphoids had single dorsal sulcus and 22 scaphoids had double dorsal sulcus irrespective of the sides.

**(B) Morphometric Parameters:**

MORPHOMETRIC PARAMETERS	Mean ± S.D	
	LEFT	RIGHT
LENGTH	23.13±2.25	23.29±2.56
PROXIMAL WIDTH	11.71±1.68	12.34±1.52
WAIST WIDTH	7.46±1.69	7.88±3.92
DISTAL WIDTH	10.57±1.31	10.18±1.32
PRIMARY HEIGHT OF TUBERCLE	10.73±1.16	11.17±1.77
SECONDARY HEIGHT OF TUBERCLE	7.98±1.25	8.18±1.20
TUBERCLE CIRCUMFERENCE	21.64±2.27	23.33±2.55
WAIST CIRCUMFERENCE	27.91±2.04	28.17±2.64
LENGTH OF DORSAL SULCUS	16.68±1.98	17.94±3.07
WIDTH OF DORSAL SULCUS	2.05±0.89	2.15±1.89

**DISCUSSION:**

The findings of the present study were compared with findings of other similar studies.

-In a study done by Chandra et al., the waist was absent in one scaphoid of the right side, and other features were present in all the bones.<sup>[2]</sup>

In the present study, all the scaphoids have tubercles, waist, and dorsal sulcus.

-A study was done on 100 unknown human scaphoids in Sikkim of Northeastern Indian population- On the left side, scaphoid tubercles were conical in (44%) and pyramidal shape in 28 (56%). On the right side, scaphoid tubercles were conical in 36 (72%) and pyramidal shape in 14 (28%).<sup>[3]</sup> In another study, on the left side, 7 scaphoid tubercles were conical and 8 were pyramidal in shape. Similarly, on the right side, 9 scaphoid tubercles were conical and 6 were pyramidal in shape.<sup>[2]</sup> All the scaphoids had waist except one.<sup>[3]</sup>

In the present study, the shape of the scaphoid tubercle was observed. In the left scaphoid, 16 tubercles were conical in shape and 9 were pyramidal in shape, whereas in the right scaphoid, 11 tubercles were conical in shape and 14 were pyramidal in shape. Tubercle in the left side scaphoid showed a range of 2-8 foramina with minimum 2 foramina and right scaphoid showed 2-10 foramina with minimum 2 foramina. The foramina in the scaphoid waist were observed in the present study. Waist of left scaphoid showed 1-2 foramina and waist of right scaphoid showed 1-3 foramina. Earlier studies have not reported regarding the foramina in waist.

-The dorsal sulcus contains numerous nutrient foramina,<sup>[9]</sup> the foramina in the dorsal sulcus are related to the vascular supply of scaphoid.<sup>[10]</sup> In a study, all the scaphoid had a minimum of one foramen in the main dorsal sulcus and 92% had more than one foramen. The scaphoids presented with secondary sulci had more than one foramen in it.<sup>[12]</sup> Ceri et al. <sup>[10]</sup> in their study found at least one foramen in the main dorsal sulcus and 88% had more than five foramen, 18% had no foramen in the proximal region.

In the present study, the dorsal sulcus of scaphoid bone was observed for single or double sulcus and in 13 scaphoid dorsal sulcus were single and in 12 were double on the left side with foramina in the range of 2-10 present in it, whereas 15 sulcus were single and 10 were double on the right side scaphoid dorsal sulcus with foramina in the range of 2-12 present in it. The 28 scaphoid has single dorsal sulcus and 22 scaphoids had double dorsal sulcus irrespective of the sides. The foramina which were assessed at proximal region were present only in 13%, this may explain the occurrence of nonunion and avascular necrosis after proximal fracture.<sup>[2]</sup>

-The ridges for origin of SCIL were present in 41 scaphoids of the left side and 40 of the right side.<sup>[3]</sup> Ceri et al. <sup>[10]</sup> observed SCIL ridge in 80 specimens of the right and 83 in the left side of a total of 200 scaphoids.

In the present study, the ridges were found on 22 on the left and 24 on the right.

-Sulci of FCR were present in 38 scaphoids of the left side and 42 of the

right side.<sup>[3]</sup>

In the present study, the sulcus was found on 20 on the left and 23 on the right. Comparison of morphological features of both sides other than shape of tubercles were not significant.<sup>[2]</sup>

Comparison of morphometry of scaphoid from the previous studies with the present study:

MORPHOMETRIC PARAMETERS	Chandra et al. [2] 2014 (n=30)		Purushothama et al. [3] 2011 (n=100)		Babu SK. [11] 2018 (n=100)		Present study (n=50)	
	Left	Right	Left	Right	Left	Right	Left	Right
LENGTH	21.97	22.42	22.33	22.65	23.7	24.1	23.13	23.29
PROXIMAL WIDTH	11.23	11.53	11.53	12	10.4	10.2	11.71	12.34
WAIST WIDTH	6.97	6.91	6.88	7.06	6.2	7.4	7.46	7.88
DISTAL WIDTH	10.66	10.56	10.92	10.69	11.3	11.1	10.57	10.18
PRIMARY HEIGHT OF TUBERCLE	9.34	9.34	9.41	9.18	13.1	13.1	10.73	11.17
SECONDARY HEIGHT OF TUBERCLE	6.52	6.31	6.45	5.96	6.4	6.9	7.98	8.18
TUBERCLE CIRCUMFERENCE	25.41	25.13	25.67	26.23	34.4	36.5	21.64	23.33
WAIST CIRCUMFERENCE	30.57	30.47	30.06	31.35	32.4	41.2	27.91	28.17
LENGTH OF DORSAL SULCUS	16.46	16.5	16.12	17.92	19.4	19.9	16.68	17.94
WIDTH OF DORSAL SULCUS	1.82	1.79	1.83	2.56	1.82	2.43	2.05	2.15

#### CONCLUSION:

The present study observed that tubercles were present in all scaphoids and the height and circumference of base of the tubercle were strongly correlating with each other. This may explain the relatively low incidence of fractures of tubercles,<sup>[10]</sup> which provides insertion for the flexor retinaculum and few fibres of abductor pollicis brevis muscle.<sup>[12]</sup>

The waist serves as an important anchoring point for several ligamentous attachments.<sup>[13]</sup> As the waist provides several ligamentous attachments in its absence the attachments could be weak, this may explain in the absence of waist there could be more ligamentous injuries.

The foramina which were assessed at proximal region were present only in 13%, this may explain the occurrence of non union and avascular necrosis after proximal fracture.<sup>[14]</sup>

The absence of ridge could indicate weak attachment of SCIL ligament or absence of this ligament, further making the scaphocapitate joint weak.

Internal fixation has become a well-established alternative to casting for acute scaphoids fractures.<sup>[15]</sup> Screw design has evolved and several different types of screws of varying sizes are now available. Knowing the mean length in a population helps in knowing to assess the screw length for internal fixation pre operatively. Considering the fact that most population are right dominant, this may also explain the mean length of right scaphoids to be more than left in the present study.

Hence the morphological and morphometric data obtained in the present study help the orthopedicians, hand surgeons, morphologists, anatomists, and radiologists.

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