

## MORPHOMETRIC STUDY OF HUMAN TALUS - A CROSS SECTIONAL STUDY

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### ABSTRACT

**Background:** The talus is one of the seven tarsal bones in human body. Talus is having a shape like a tortoise with head, neck and body. It is the link between the foot and leg, through the ankle joint. Talus being the key bone of the longitudinal arch; It is responsible for receiving the body weight and transmitting it to the plantar arch below. Talus has unique feature that, it is the only bone which has no muscular and tendinous attachment.

**Materials and Methods:** Present study aims to study the variation in the shape and dimension of the talus bone. The present cross-sectional observational study was carried in Shri Vasant Rao Nike Govt Medical College Yavatmal from October, 2013 to November 2015. Macerated and dried human talus bone of unknown sex were taken for the study. The tali were collected from the Department of Anatomy, and different medical colleges.

**Result:** In the present study out of 140 tali, the right tali 78(55.71%) outnumbered the left tali 62(44.29%). The right tali to left tali ratio was 1.25:1. The mean maximum anteroposterior length of right tali (5.13±0.52) was less as compared to mean maximum anteroposterior length of left tali (5.26±0.56)

**KEY WORDS:** Morphometry, Talus, Surgical intervention, Congenital abnormalities

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### INTRODUCTION

The talus is one of the seven tarsal bones in human body. Talus is having a shape like a tortoise with head, neck and body. It is the link between the foot and leg, through the ankle joint [1]. Talus is the key bone of the longitudinal arch. It is responsible for receiving the body weight and transmitting it to the plantar arch below. In humans talus is the only bone which has no muscular and tendinous attachment [2].

The talus has three articulating surfaces. They

are : 1) Large oval surface on its most posterior aspect, articulating with sustentaculum tali of calcaneum 2) a flat surface on its anterolateral surface articulating with upper surface of calcaneum on its anteromedial surface 3) medial to the above two facets is the third facet articulating with spring ligament which is covered by articular cartilage. It is observed that the talus exhibits variations in the calcaneal articular surfaces [3].

A study done by Ilknur Ari and Ilker Mustafa Kafa

(2009) showed that significant side differences do exist in atleast two parameters for the talus. The long axis of the talus is inclined anteromedially and inferiorly, its distally directed head is medial to the calcaneus and at a higher level. The long axis of the neck, inclined downwards, distally and medially, makes an angle of approximately 150° with that of the body. The medial articular facet of the talar body and part of the trochlear surface may extend onto the neck [4]. In spite of being such an important bone to the anatomist, the orthopedic surgeon and to the anthropologist scanty literature is available on its dimension and morphological features. The study will be helpful to surgeons for surgical interventions during the treatment of talar neck fractures caused by trauma, in designing talar body prostheses, and in aligning the bones in the treatment of congenital talipes equinovarus (CTEV) or club foot. It is also useful for forensic anthropologists.

The present study is taken up to understand these changes further, so as to help in surgical interventions and treatments of congenital abnormalities and trauma to the talus.

**Aims and objectives:** To study the variation in the shape and dimension of the talus bone. To study if there are significant differences in the right and left sided tali.

## MATERIALS AND METHODS

The present cross-sectional observational study was carried in Shri Vasantrao Nike Govt Medical College Yavatmal from October. 2013 to November 2015.

Macerated and dried human talus bone of unknown sex were taken for the study. The tali were collected from the Department of Anatomy, and different medical colleges in and around in the region and from the bone sets from medical students of MBBS (2014-2015).

**Study Sample:** From the literature available for morphometric measurements of tali (MAPL, MTW, TL, CFACP, LST and WST). Most common variation in measurement CFACP (SD: 0.84), 95% confidence level and relative precision of 20%. This information was utilized for the estimation of sample size. So required sample size for study was 140. . There were total 160 tali at

the time of study out of which 140 were included in the study

**Inclusion criteria:** Maximum possible numbers of human talus which is apparently normal, dry, free from any congenital or acquired deformity will be included in the study.

**Exclusion criteria:** Deformed and unossified tali will be excluded from the study After getting Ethical clearance from Institutional Ethics Committee. All dimensions of articular surfaces were recorded using Vernier calliper's. The following parameters were recorded for the present study:

**Morphometric study of dimensions of talus:** All dimensions of calcaneal articular surfaces were recorded using Vernier callipers with known least count. The following parameters will be recorded for the present study:

**Maximum anteroposterior length:** It is the linear distance between the most anterior point on the head and most posterior point on the body of the talus.

**Maximum transverse width:** It is the linear distance between the most medial and most lateral points on the body of the talus.

**Trochlear length:** It is the distance between the most anterior and most posterior point over the trochlear surface.

**Circumference of the facies articularis calcanea posterior:** It was recorded by measuring the sides of the facet using a thread, and then by measuring the length of the thread in cms.

5. Length of the sulcus tali: It is the maximum distance between the two ends of the sulcus tali.

**Width of the sulcus tali:** It is the distance between the edges of the sulcus tali at its maximum width.

## RESULTS

In the present study out of 140 tali, the right tali 78(55.71%) outnumbered the left tali 62(44.29%). The right tali to left tali ratio was 1.25:1. the mean maximum anteroposterior length of right tali (5.13±0.52) was less as compared to mean maximum anteroposterior length of left tali (5.26± 0.56).

Mean maximum transverse width of right tali (3.87±0.34) was more as compared to mean

maximum transverse width of left tali (3.85± 0.31).The mean trochlear length of right tali (2.91±0.35) was less as compared to mean trochlear length of left tali (3.01± 0.30).

In the present study mean Circumference of the facies articularis calcanea posterior of right tali (8.90±0.77) was more as compared to mean Circumference of the facies articularis calcanea posterior of left tali (8.66± 0.84).The length of sulcus tali of right tali (1.99±0.41) was less as compared to mean length of the sulcus tali of left tali (1.96± 0.41).It has been seen that mean width of the sulcus tali of right tali (0.80±0.30) was more as compared to mean width of the sulcus tali of left tali (0.73± 0.31)

**Table 1:** Showing comparison of parameters between right and left tali.

	Side	Number	Mean	Std.deviation	p	Z
MAPL	Right	78	5.13	0.52	0.15	1.42
	Left	62	5.26	0.56		
MTW	Right	78	3.87	0.34	0.71	0.36
	Left	62	3.85	0.31		
TL	Right	78	2.91	0.35	0.07	1.78
	Left	62	3.01	0.3		
CFACP	Right	78	8.9	0.77	0.08	1.76
	Left	62	8.66	0.84		
LST	Right	78	1.99	0.41	0.67	0.43
	Left	62	1.96	0.41		
WST	Right	78	0.8	0.3	0.17	1.35
	Left	62	0.73	0.31		

**DISCUSSION**

The articular and angular dimensions of this study were compared with those parameters studied by various authors. Mean values of MAPL, MTW, TL, and LS of this study were relatively closer to the mean values of the other studies. As far as mean values of WST of this study was concerned, a relatively wide variation can be noted among various studies. The P values of all the parameters in this study showed that there is no statistically significant difference between the parameters of the right and left sides

In the present study, the mean (SD) values of MAPL were 5.13 (0.52) cms on right side and 5.26 (0.56) cms on the left side. According to Ilknur Ali and Ilker Mustafa Kafa, the mean values were 5.72 for right side and 5.64 for left side, which were slightly higher when compared to our study. According to Niladri Kumar Mahato,

it was 5.57 cms on right side and 5.58 on left side. Study from Gautham etal observed mean value of MAPL from right and left side i.e. 5.23 and 5.29 respectively. MAPL mean value 5.42 cm from right and 5.33cm from left side was mentioned in the study done by Manjunath V et al.

**Table 2:** Showing comparison of mean values of parameters of right and left side tali with other studies.

parameters	Ari and Kafa et al 2009 [4]		Mahato and Murthy et al 2011 [5]		Gautham et al 2013 [6]		Manjunath V Motagi et al 2015 [7]		Present study	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
MAPL	5.72	5.64	5.57	5.58	5.23	5.29	5.42	5.33	5.13	5.26
MTW	4.91	4.69	2.9	3.03	3.79	3.68	3.62	3.77	3.87	3.85
TL	3.15	3.08	-	-	3.06	3.04	2.95	3	2.91	3.01
CFACP	10.1	9.85	-	-	8.66	8.66	-	-	8.96	8.66
LST	1.76	2.1	2.46	2.6	2.01	2.04	1.89	1.75	1.99	1.96
WST	0.38	0.48	1.5	1.44	0.68	0.67	0.72	0.72	0.8	0.73

In the present study, the mean values of MTW were 3.87 cms on right side and 3.85 cms on the left side. According to Ilknur Ali and Ilker Mustafa Kafa, the mean values of MTW were 4.91 for right side and 4.69 for left side, which were slightly higher when compared to our study. In the study conducted by Niladri Kumar Mahato, it was 2.90 cms on right side and 3.03 on left side.

In the present study, the mean values of TL were 2.91 cms on right side and 3.01 cms on the left side. According to Ilknur Ali and Ilker Mustafa Kafa, the mean values of TL were 3.15 for right side and 3.01 for left side. In the study conducted by Gautham etal observed mean value of TL from right and left side i.e. 3.06 and 3.04 respectively. The findings of present study were not in accordance with the above studies whereas TL mean value 2.95 cm from right and 3.00 cm from left side was mentioned in the study done by Manjunath V et al were in accordance with present study.

In the present study, the mean values of CFACP were 8.90 cms on right side and 8.66 cm on left side. According to Ilknur Ali and Ilker Mustafa Kafa, the mean values were 10.01 for right side and 9.85 for left side which is slightly higher than the present study whereas Gautham etal reveals the mean values of CFACP as 8.66 on both right side and left side

In the present study, the mean values of LST were 1.99 cms on right side and 1.96 cms on

the left side. According to Ilknur Ali and Ilker Mustafa Kafa, the mean values were 1.76 for right side and 2.10 for left side. Whereas in study conducted by Niladri Kumar Mahato, it was 2.46 and 2.62 cms for right and left side respectively. Study from Gautham et al observed mean value of LST from right and left side i.e. 2.01 and 2.04 respectively. LST mean value 1.89 cm from right and 1.75 cm from left side was mentioned in the study done by Manjunath V et al

In present study, the mean values of WST were 0.80 cms on right side and 0.73 cms on the left side. According to Ilknur Ali and Ilker Mustafa Kafa, the mean values were 0.38 for right side and 0.48 for left side. According to Niladri Kumar Mahato, it was 1.5 and 1.44 cms for right and left side respectively. Findings of the present study were not in accordance with the above studies.

According to Ilknur Ali and Ilker Mustafa Kafa, the LST and WST parameters showed significance for side differences. According to study done by Niladri Kumar Mahato, no significance was found for any of the parameters. The present study showed no significant side differences. These variations could be due to differences in gait or otherwise be influenced by habit.

When the above parameters were correlated with each other, it showed significant inter relationship between almost all variables measured in the study. According to Ilknur Ali and Ilker Mustafa Kafa, the MAPL significantly correlated with MTW, TL, and CFACP.

**Conflicts of Interests: None**

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