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Original Research Paper

Effect of Laterality on Morphometric Measurements of Calcaneum

Anatomy

KEYWORDS : Calcaneum, Morphometry, Laterality.

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ABSTRACT

Aims of the study: As calcaneum is the most commonly fractured tarsal bone, so the knowledge of its morphometric features in different populations is imperative for doing external and internal fixation and also for designing prosthesis. Therefore the present study was conducted to measure the morphometric parameters of calcaneum in UP region. Materials and methods: The study was conducted on 1000 calcaneum bones available in osteology section of Department of Anatomy, KGMU. 500 left and 500 right calcaneum bones were measured for maximum length, anterior breadth, middle breadth, and posterior breadth. Mean± SD were calculated for all the measurements of left and right side and were compared to see the effect of laterality. Statistical analysis was done by version SPSS 15.0.

Results and conclusion: Calcaneum of left side (75±5.78 mm) was longer than right side (74.24±6.13mm) and the difference was statistically significant (p value=0.001). Anterior width on left side was 28.52±1.95 mm and right side was 28.02±2.11mm;middle width on left side was 41.56±1.95 mm, on right side was 40.82±2.17mm and posterior width of left and right side was 29.93±2.08 mm and 29.31±2.25 mm respectively. At all the three levels observed, calcaneum was wider on left side as compared to right and the difference was statistically highly significant (p value <0.001). In present study left dominant pattern in all the measurements of calcaneum was observed.

INTRODUCTION

Calcaneum is the largest and strongest tarsal bone. As calcaneum is the most commonly fractured tarsal bone, so the knowledge of its morphometric features in different populations is imperative for doing external and internal fixation and also for designing prosthesis.

AIMS OF THE STUDY

Aim of the study was to calculate morphometric measurements of calcaneum in reference population

MATERIALS AND METHODS

study was conducted on 1000 calcaneum bones (500 left and 500 right),available in the osteology sections of department of anatomy, measured for length, anterior breadth, middle breadth, and posterior breadth. Statistical analysis was done by version SPSS 15.0. mean±sd were calculated for left and right side.

OBSERVATION AND RESULTS

Table 1.Descriptive Statistics of different Dimensional parameters of Calcaneum

	N	Minimum	Maximum	Mean	SD
Length (mm)	1000	41.24	91.62	74.85	5.99
Ant width (mm)	1000	20.11	36.11	28.27	2.05
Mid width (mm)	1000	29.86	54.11	41.19	2.09
Post width (mm)	1000	19.41	42.76	29.62	2.19

Table 2.Morphometric measurements left vs. Right

Parameter	Left (n=500)		Right (n=500)		Statistical significance	
	Mean	SD	Mean	SD	t′	p′
Length (mm)	75.46	5.78	74.24	6.13	3.233	0.001
Ant width (mm)	28.52	1.95	28.02	2.11	3.894	<0.001
Mid width (mm)	41.56	1.95	40.82	2.17	5.635	<0.001
Post width (mm)	29.93	2.08	29.31	2.25	4.526	<0.001

RESULTS

Calcaneum of left side (75±5.78 mm) was longer than right side (74.24±6.13mm) and the difference was statistically significant (p value=0.001).

Anterior width on left side was 28.52±1.95 mm and right side was 28.02±2.11mm.

middle width on left side was 41.56±1.95 mm, on right side was 40.82±2.17mm .

posterior width of left and right side was 29.93±2.08 mm and 29.31±2.25 mm respectively.

At all the three levels observed, calcaneum was wider on left side as compared to right and the difference was statistically highly significant (p value <0.001). In present study left dominant pattern in all the measurements of calcaneum was observed.

Table 3. Comparative analysis of results

Author	length		Ant width		Mid width		Post width		COMMENTS (Lt VS.Rt)
	L	R	L	R	L	R	L	R	
David et al,(2015)[1]	75 mm		-		-		-		-
Grover et al,(2015)[2]	73.12	72.90	25.16	24.90	29.29	29.19	30.63	30.59	Highly significant
Kumar et al, (2004)[3]	79.21	74.34	-	-	-	-	-	-	Highly significant
Emanuela et al, (2007),Italian[4]	81.6	81.5	-	-	43.7	43.7	-	-	significant
Boonma et al, 2010), Thai[5]	79.9	-	24.7		41.8				significant
Present study,2016	75.46	74.24	28.52	28.02	41.56	40.82	29.93	29.31	Highly significant

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DISCUSSION

David et al(2015)[1], Grover et al (2015)[2] and Kumar et al (2004)[3] observed almost same mean length of calcaneum. In consensus with the findings of present study, Grover et al (2015)[2] and Kumar et al (2004)[3] found left sided dominance with highly significant p value. In Italian and Thai population, the mean length of calcaneum was more as compared to Indian population Emanuela et al,(2006)[4], Boonma et al,(2010)[5] and left dominance was observed in Italian population.

The findings of present study are in consensus with others as far as laterality is concerned showing left dominant pattern. The knowledge of mean length of calcaneum of both the sides is of paramount importance for treatment of fracture of calcaneum and for making implants, as restoration of length is important for normal biomechanics of foot (Anjaneyulu et al, 2014)[6].

Boonma et al (2010)[5] in Thai and Grover et al (2015)[2] in Indian population observed smaller anterior width as compared to present one, may be because the points used for measurement were different and there sample size was very small. Both the studies reported left dominant pattern. Anterior width of calcaneum is functionally important because anterior part of calcaneum bears weight of body during propulsive phase of walking. If the anterior width is wider, it means that larger area is available for calcaneocuboid articulation, which in turn will result in greater mobility of forefoot. In view of its functional importance, restoration of normal anterior width in fracture of calcaneum, plays important role in foot rehabilitation. This value is of vital importance while designing prosthesis.

Boonma et al (2010)[5] calculated almost same middle width (41.8±2.4 mm) in males whereas Krmek et al (2011)[7]and Grover et al (2015)[2] measured quite less mid width because they calculated mid width at the middle point of the bone and not at the level of maximum span of sustentacular tali.

Emanuela et al (2007)[4] studied calcaneum of modern northern Italian region. The middle width of calcaneum on right side was 43.7±2.4 mm in males and 38.3±2.0 mm in females. On left side width was 43.7±2.3 mm in males and 38.2±2.0 in females. They did not observe any dominance, but in the work of Grover et al (2014) and in present study, highly significant left dominance was observed.

Span of the bone at the level of sustentacular tali seems to be mechanically important because this area provides support to head of talus along with spring ligament.

Grover et al (2015)[2] reported posterior width 30.63±2.32mm on left and 30.59±2.56mm on right. Both the studies showed statistically significant asymmetry in posterior width.

Width of posterior part of the bone is clinically significant in osteotomy procedures because, posterior part of calcaneum rests on the ground and bears weight of body in standing position. It provides stability and is the first part of the foot which strike on the ground during walking cycle therefore restoration of normal width is of great functional importance (Maceira et al, 2015)[8]

CONCLUSION

These measurements shows higher values on left side than right .

These facts should be kept in mind for making prosthesis and treatment of fracture of calcaneum bone.

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