

Study on types of facets on the superior articular surface of dried human calcanei at RIMS, Imphal

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Abstract: The calcaneus is a weight bearing tarsal bone of the proximal row. It also forms the posterior pillar of the two longitudinal arches of the foot. Normally there are three facets for synovial joints between calcaneus and talus, namely anterior, middle and posterior. There is considerable variation in the number and arrangement of these facets. This study assumes significance for science of anatomy, treatment and diagnostic procedures in orthopedic surgery. In this study 120 adult dry human calcanei of unknown sex and age were collected from Department of Anatomy, Rims, Imphal, Manipur. The types of facets on the superior aspect of the calcanei and anteroposterior length was observed and measured using a digital vernier calliper. A total of 120 (Right- 60, Left- 60) specimens were examined. These calcanei were classified according to Nagar SK into type A, B, C, D and E depending on the type of articular facets on the superior surface of the calcanei. The percentage incidence of Type A on the Right as 30%, Left as 25%; Type B Right as 70% and on Left as 75%. There are no calcanei belonging to type C, D and E. Total A-P length of calcanei of both side ranged from 6 to 10cm. In the present study, type B was found commonest, followed by type A.

Key words: Calcanei, Articular surface

Date of Submission: 01-02-2018

Date of acceptance: 17-02-2018

I. Introduction

The calcaneus, the largest tarsal bone, projects posterior to the tibia and fibula as a short lever for muscles of the calf attached to its posterior surface. It is irregularly cuboidal, its long axis inclined distally up and laterally.

The superior or proximal surface is divisible into three: the posterior third is rough, concavoconvex, the convexity transverse; it supports fibroadipose tissue between the calcanean tendon and ankle joint; the middle third carries the posterior talar facet, oval and convex anteroposteriorly; the anterior third is partly articular.¹

Normally there are three facets for synovial joints between calcaneus and talus, Anterior, Middle and Posterior. The anterior and the posterior facets are situated on the body and middle is situated on the sustentaculum tali. There is considerable variation in the number and arrangement of these facets.

Bunning and Barnett (1963) have observed that there are three types of variations in the arrangement of facets. They have classified these variations as follows:

Type-A: There are three facets separated by variable intervals.

Type-B: There are two facets anterior and middle which are either continuous or have a notch between them.

Type-C: There is only one facet i.e. the three form a continuum.

Gupta et al (1977) have classified the calcanei in numerical types as follows:

Type-I (1): Corresponds to type-B of the Bunning and Barnett classification (1963).

Type-II (2): Corresponds to type-A of the Bunning and Barnett classification (1963).

Type-III (3): Has only two facets, not corresponding to any type of Bunning and Barnett. The anterior facet is absent. Only the middle and the posterior facets are present.

Type-IV (4): Corresponds to type-C of the Bunning and Barnett classification (1963).²

Calcaneus is the most frequently fractured tarsal bone with calcaneal fractures accounting for about 60% of all major tarsal injuries. The majority of fractures are intra-articular with sub talar joint involvement. Although a talocalcaneal coalition may occur at any of the three facets, the majority of the osseous fusions involve the middle facet. Tarsal coalition is a frequent cause of painful flatfoot.³

In this study we aimed to analyse the various patterns of talar articulating facets in the calcanei.

II. Material And Method

One hundred twenty grossly normal adult human calcanei were procured from the departments of Anatomy, Regional Institute of Medical Sciences, Imphal, Manipur. Sexual dimorphism was not considered. Any pathological or damaged bones were excluded from the study. A digital vernier calliper of 0.01 mm accuracy was used in this study and photos were taken from Nikon camera 18.5 mega pixels. The data obtained from the bones were analysed from patterns of talar articulating facets and were compared with different investigators. Classification used in present study was based on Nagar SK.²

Table 1: classification of calcaneal articular facets.

Group	Feature
Type-A	Presence of three separate articular facets anterior, middle and posterior on superior surface.
Type-B	Presence of two articular facets where anterior and middle are continuous with each other. The posterior facet is separate.
Type-C	All the three facets i.e. anterior, middle and posterior are continuous with each other.
Type-D	In this group, the anterior facet is absent and only the middle and posterior articular facets are present
Type-E	Anterior articular facet is absent and the middle and the posterior articular facets are continuous with each other.

III. Observation

The total numbers of calcanei were 120, out of these 60 were of the right side and 60 were of the left side. These calcanei were classified into type A, B, C, D and type E according to the configuration of the superior talar articular facets.

Table 2: Percentage Incidence of the type of calcanei

Type of calcaneum	Right side bones (%) (n=60)	Left side bones (%) (n=60)	Total bones (%) (n=120)
Type-A	18 (30%)	15 (25%)	33 (27.5%)
Type-B	42 (70%)	45 (75%)	87 (72.5%)
Type-C	-	-	-
Type-D	-	-	-
Type-E	-	-	-

From the Table 2, it is clear that the pattern of facets of type -B is commonest. The percentage of incidence on the right side is 70 and that on the left side, it is 75. The difference is 5. The next common type is the type -A group. On the right side the percentage incidence is 30 and that on the left side is 25%. The incidence of type-A facet is higher by 5% on the left side than the right side. There are no calcanei belonging to type-C, type-D and type-E.

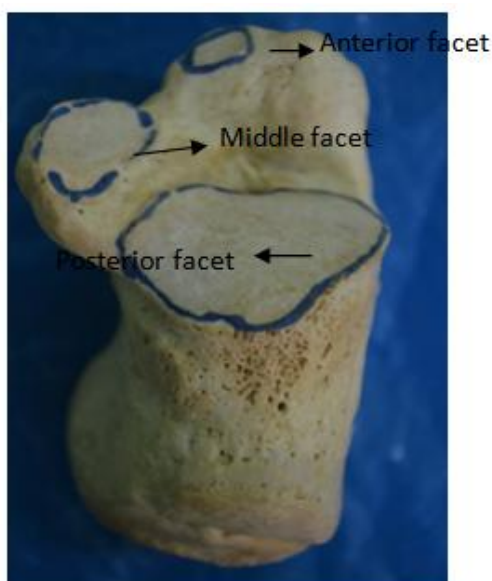


Fig. 1: Type A (Right side) shows anterior, middle and posterior facets are separate & found in 18 (30%)

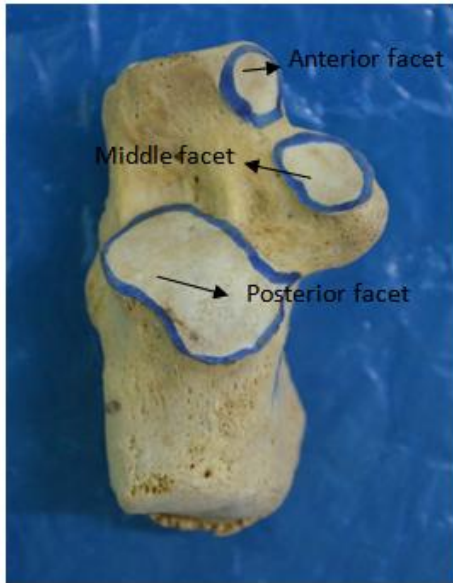


Fig. 2: Type A (Left side) shows anterior, middle and posterior facets are separate & found in 15 (25%)

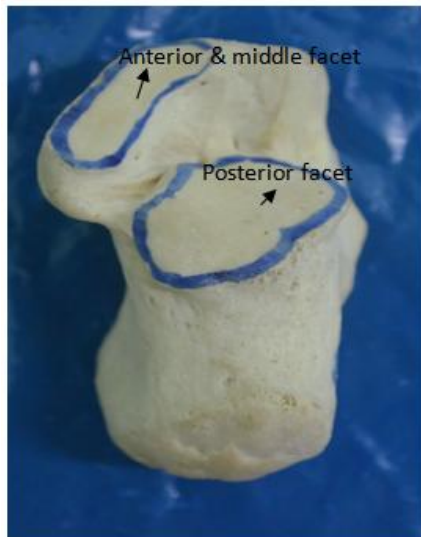


Fig. 3: Type B (Right side) shows Anterior and middle facet are continuous with each other & found in 42 (70%)

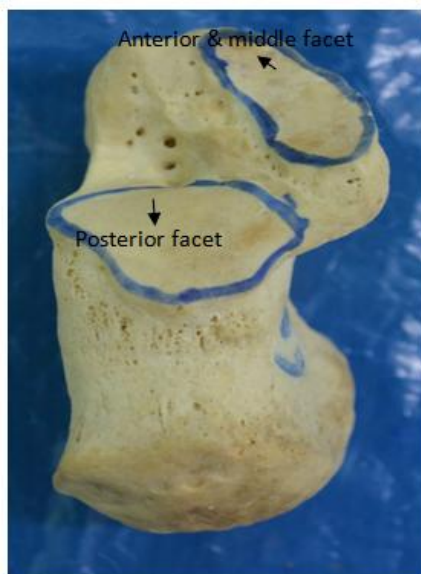


Fig. 4: Type B (Left side) shows Anterior and middle facets are continuous with each other & found in 45(75%)

IV. Discussion

Table 5: comparison of results of different calcaneal studies including the present study

STUDY	YEAR	COUNTRY	NO.	A (%)	B (%)	C (%)	D (%)	E (%)
Burning & Barnett	1965	Britain	194	67	33	-	-	-
	1965	Veddah	10	00	60	40	-	-
	1965	Indian	78	22	78	-	-	-
	1965	African	492	36	63	1	-	-
Jha & Singh	1972	Indian	1600	37.5	62.37	0.125	-	-
El-Eishi	1974	Egyptian	200	40.0	49.0	-	11	-
Gupta et al	1977	Indian	401	26	67	2	5	-
Forriol & Gomez	1989	spanish	176	42	54	-	4	-
Saadeh et	2000	Egyptian	300	30.0	63.0	2.0	4.7	-
Muthukumar Netal	2011	South India	237	33.33	65.82	0.42	-	0.42
Nagar SK	2012	Gujarat	529	22.3	76.4	-	1.1	0.2
Rohin Garg	2012	Rajasthan	310	24.52	72.26	1.6	1.3	0.32
Present	2016	Indian	120	27.5	72.5	-	-	-

Burning & Barnett (1965) studied 194 adult British calcanei for the variation of talar articular facets on its superior surface. According to their classification, 67% of calcanei were type-A which is much higher than in the present study which is 27.5%, showing a difference of 39.5%, while in the British type-B calcanei the incidence was 33% which in the present study it is 72.5%, which gives a difference of 39.5%. In the British calcanei there were no type-C, type-D and type-E calcanei. In the present study also no type-C, D and E were found.

In Veddah (1965), 6 calcanei were of type-B and 4 were of type-C, out of 10 bones reported by them. This small number was not considered in the present study for comparison to arrive at any positive conclusion.

In their study of 78 Indian calcanei the type-A was 22%, type-B was 78% and there was no type-C, D and E calcanei. Comparing the findings with the present study, it is observed that the incidence of various types of calcanei is very much close to findings in the present study.

In their study of 492 African calcanei the type-A was 36%, type-B was 63%, type-C was 1% and there was no type-C, D and E calcanei. This is very much close to types of calcanei found in the present study except in type-C which was absent in the present study.⁴

Jha & Singh (1972) studied 1600 adult Indian calcanei for the variation of talar articular facets on its superior surface. According to their classification, 37.5% were type-A, 62.37% were type-B, 0.125% were type-C and absent of type-D and type-E. In the present study type-A was 27.5% and type-B was 72.5% which corresponded to their study, except type-C which was absent in the present study.⁵

El-Eishi (1974) studied 200 adult Egyptian calcanei for the variation of talar articular facets on its superior surface. Sex and sides of the calcanei were not considered by him. According to his classification, 40% of calcanei were of type-1, which corresponded to type-A of the present study, 49% calcanei were of type-2 which corresponded to type-B of the present study. In the present study, absence of type-C, type-D and type-E.⁶

Gupta et al (1977) studied 401 adult Indian calcanei for the variation of talar articular facets on its superior surface. In their study 26% was type-A, 67% was type-B which corresponded to type-A and type-B of the present study. They found 2% on type-C, 5% was on type-D, which didn't correspond to type-C and type-D of the present study, but in both no type-E was found.⁷

Forriol & Gomez (1989) studied 176 calcanei of the Spanish population irrespective of sex and side. They reported that 42% of calcanei belonged to type-A, 54% of them belonged to type-B and 4% of them belonged to type-D. They found no type-C and E calcanei. In the present study there was no type-D calcanei found.⁸ Saadeh et al (2000) studied 300 calcanei of the Egyptian. They reported 30% type-A, 63% type-B, which corresponded to the present study. 25% of type-C, 4.7% was type-D and type-E was not found. In the present study no type-C, type-D and type-E was found.⁹

Muthukumar (2011) studied 237 calcanei of the South India. They reported 33.33% type-A, 65.82% type-B, which corresponded to the present study. 0.42% of type-C, 0.42% was type-D and type-E was not found. In the present study no type-C, type-D and type-E was found.¹⁰

Nagar SK (2012) studied 529 calcanei of the Gujarat population irrespective of sex and side. They reported that 22.3% of calcanei belonged to type-A, 76.4% of them belonged to type-B, 1.1% of them belonged to type-D and 0.2% belonged to type-E. They found no type-C calcanei. In the present study there was no type-C, type-D and type-E calcanei found.²

Rohin Garg (2012) studied 310 calcanei of the Rajasthan. They reported 24.52% type-A, 72.26% type-B, which corresponded to the present study. 1.6% of type-C, 1.3% was type-D, 0.32% was type-E. In the present study no type-C, type-D and type-E was found.¹¹

V. Conclusion

In our study Type-B was found commonest, followed by Type-A. The variation in various types of facets on calcanei can result from difference in race, gait and habit of shoe wearing.

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Dr. Leon Ranjoline Guria "Study on types of facets on the superior articular surface of dried human calcanei at RIMS, Imphal. "IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), Volume 17, Issue 2 (2018), PP 14-18.