

The pattern of talar articular facets in Northeastern Thai calcanei

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The variations of the talar articular facets in 230 Northeastern Thai calcanei were studied and classified. The specimens were 100 wet calcanei and 130 dry calcanei. Three types were considered: type A (calcanei with two articular facets for the talar head, with four subtypes); type B (calcanei with the anterior and middle talar articular facets coalescing into a common articular facet for the talar head, with two subtypes); type C (calcanei with the anterior, middle and posterior talar articular facets coalescing into a single facet for the talus). It is interesting that our studies of the two groups of specimens yielded similar percentages of calcaneal types, 40% of type A, 59% of type B, and 0.1% of type C. Therefore, the overall results reflect the type distribution of both wet and dry groups. In 230 calcanei we found 40% (93 cases) of type A calcanei, 59% (136 cases) of type B calcanei and 0.43% (1 case) of type C calcaneus. The incidence of type B was significantly higher than type A ($P < 0.05$). Comparing the sexes (in wet calcanei), we found that the incidence of type B in females was significantly higher than in males ($P < 0.05$).

Introduction

In standard anatomy textbooks the superior surface of the calcaneus is described as having two articular facets for the talus : an anteromedial and a posterior. In the *Nomina Anatomica*, however, three articular surfaces are referred to : *facies articularis talaris anterior*, *facies articularis talaris media* and *facies articularis talaris posterior* (anterior, middle and posterior talar articular facets). Laidlaw (1904)⁽⁶⁾ analyzed 750 calcanei and described different types. Later, Bunning and Barnett (1963, 1965)^(1,2) described the common variations in the talar articular facets of the calcanei in Veddahs, Africans, Europeans and Indians. E1-Eishi (1974)⁽⁴⁾ described the variations in the talar articular facets in Egyptian calcanei.

Gupta et al. (1977)⁽⁵⁾ described the pattern of talar articular facets in Indian calcanei. Sarrafian (1983)⁽⁷⁾ described the variations in the talar articular facets in a small sample. Campos and Pellico (1989)⁽³⁾

described the talar articular facets in Spanish calcanei. As previously reported, the relative distribution of type A and type B bones varies with race and sex. However, there is no study in the variations of the talar articular facets in Thai. It was decided, therefore, to carry out the present investigation to record the variations that may be encountered in the talar articular facets in Thai calcanei.

Materials and Methods

We observed 230 human calcanei (100 wet calcanei and 130 dry calcanei) to describe the possible variations of the talar articular facets. The age, sex and other characteristics of the 130 dry calcanei were unknown. Additionally, 100 wet calcanei were studied in the cadavers in the dissecting room. The sexes of the wet calcanei were recorded.

For the distribution of the specimens, we have included the classifications of Bunning and Barnett (1963, 1965)^(1,2) and Gupta et al. (1977)⁽⁵⁾. We classified the calcanei into 3 types: type A, type B and

type C. In type A, which is the calcanei with two articular facets (anterior and middle talar articular facets) for the talar head, we find four subtypes: in A₁, the separation between the facets is less than 2 mm (Fig.1); in A₂, the separation between the facets ranges from 2 mm to 5 mm (Fig.2); in A₃, the separation between the facets exceeds 5 mm (Fig.3); in A₄, there is only one single middle facet on the sustentaculum tali (Fig.4). In type B, which is the calcanei with the anterior and middle talar articular facets coalescing into a common articular facet for the talar head, we find two subtypes: B₁, which has constricted facet (Fig.5) and B₂, which has an unconstricted facet (Fig.6). In type C, the anterior, middle and posterior talar articular facets coalesce into a single facet for the talus (Fig.7).

The patterns of the talar articular facets were studied and accordingly classified. The separation between the two facets in type A was measured by the sliding caliper (Figs.8,9). The statistical significance of the data was tested by the proportional T-test.

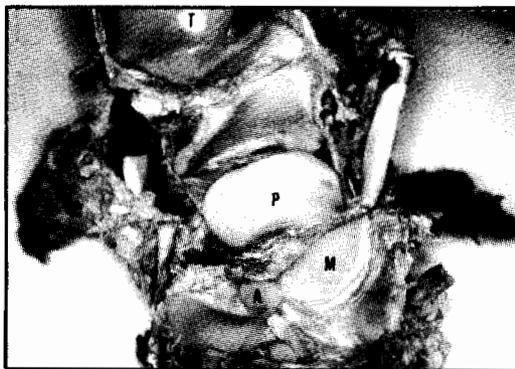


Fig.1 Subtype A₁ talar articular facet : The degree of separation between the anterior and middle facets is less than 2 mm.

A = Anterior talar articular facet

M = Middle talar articular facet

P = Posterior talar articular facet

T = Talus



Fig.2 Subtype A₂ talar articular facet : The degree of separation between the anterior and middle facets ranges from 2 mm to 5 mm.

A = Anterior talar articular facet

M = Middle talar articular facet

P = Posterior talar articular facet



Fig.3 Subtype A₃ talar articular facet : The degree of separation between the anterior and middle facets exceeds 5 mm.

A = Anterior talar articular facet
M = Middle talar articular facet
P = Posterior talar articular facet

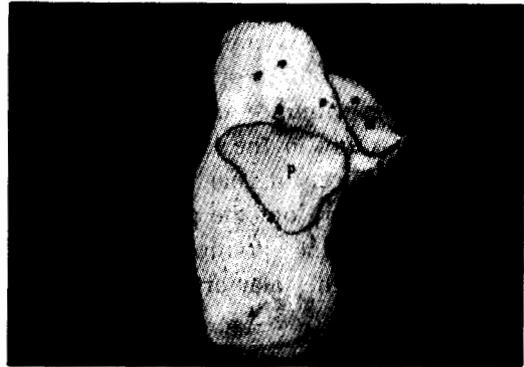


Fig.4 Subtype A₄ talar articular facet : There is only one single middle facet on the sustentaculum tali.

M = Middle talar articular facet
P = Posterior talar articular facet
S = Sustentaculum tali

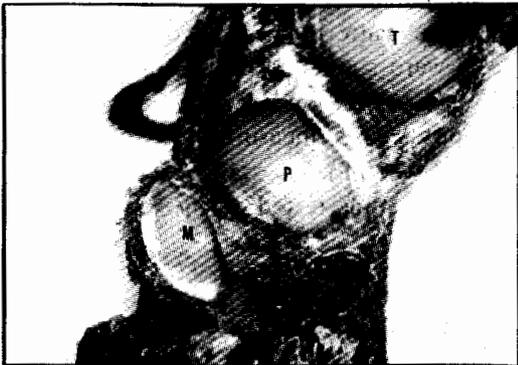


Fig.5 Subtype B₁ talar articular facet : The anterior and middle facets coalesce into a common articular facet for the talar head with a constricted facet.

A = Anterior talar articular facet
M = Middle talar articular facet
P = Posterior talar articular facet
T = Talus

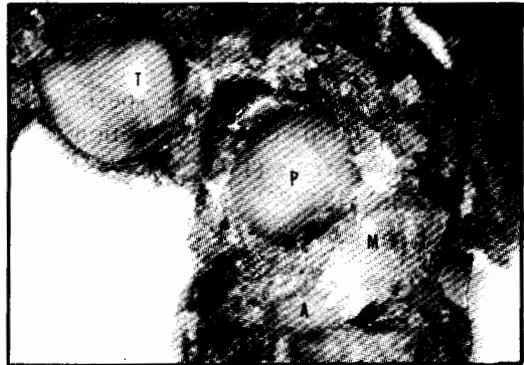


Fig.6 Subtype B₂ talar articular facet : The anterior and middle facets coalesce into a common articular facet for the talar head with an unconstricted facet.

A = Anterior talar articular facet
M = Middle talar articular facet
P = Posterior talar articular facet
T = Talus

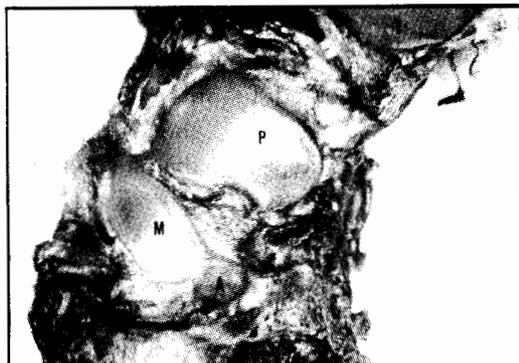


Fig.7 Type C talar articular facet : The anterior, middle and posterior facets coalesce into a single facet for the talus.

- A = Anterior talar articular facet
- M = Middle talar articular facet
- P = Posterior talar articular facet
- T = Talus

Results

The study of the incidence of calcaneal types on the right and left sides was performed in both wet and dry calcanei, as shown in Tables 1 and 2. There was no statistically significant difference between the incidence of type A on the right side and type A on the left side. There was also no statistically significant difference between the incidence of type B on the right side and type B on the left side. Only one case of type C was found among all the specimens.

Table 3 shows the incidence of the calcaneal types in wet and dry specimens. Comparing the two groups of specimens, we found similar percentages of calcaneal types (type A= 40% in wet and dry calcanei, type B = 59% in wet and dry calcanei, type C = 0-1%). Combining both wet and dry specimens together (N=230) yielded similar percentages (type A=40%, type B=59% and type C=0.43%). The incidence of type B was significantly higher than type

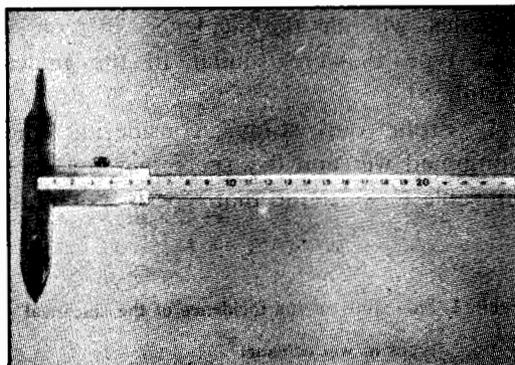


Fig.8 Shows the sliding caliper.

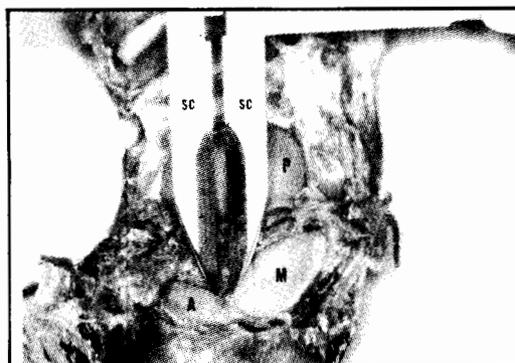


Fig.9 Shows the measurement of the distance between the anterior and middle talar articular facets by using the sliding caliper.

- A = Anterior talar articular facet
- M = Middle talar articular facet
- P = Posterior talar articular facet
- SC = Sliding caliper

A ($P<0.05$), as shown in Tables 3 and 5. The distribution of subtype A varied between the two groups of specimens (Table 3). The distribution of subtype B, however, between the two groups of specimens remained the same ($B_1=19%$ in wet and dry specimens, $B_2=40%$ in wet and dry specimens).

The distribution of calcaneal types based on sexes was studied only in wet specimens as shown in Table 4. We found that the incidence of type B was significantly higher than type A ($P<0.05$) in the

females, whereas the incidences of type A and type B were similar in the males (Table 5).

From our study, considering the combined wet and dry specimens together in Table 6, we found that type B was more

predominant than type A. The distribution of subtype A varied from 2% to 19% and subtype A₂ seemed to predominate. The distribution of subtype B showed a higher incidence of subtype B₂ than of subtype B₁.

Table 1 Side study of the incidence of the calcaneal types in wet calcanei

Type	Cases	
	n	%
Right calcanei (n=50)		
A	19	38
A ₁	9	18
A ₂	7	14
A ₃	3	6
A ₄	-	-
B	31	62
B ₁	10	20
B ₂	21	42
C	-	-
Left calcanei (n=50)		
A	21	42
A ₁	13	26
A ₂	4	8
A ₃	3	6
A ₄	1	2
B	28	56
B ₁	9	18
B ₂	19	38
C	1	2

Table 2 Side study of the incidence of the calcaneal types in dry calcanei

Type	Cases	
	n	%
Right calcanei (n=65)		
A	24	37
A ₁	2	3
A ₂	14	21.5
A ₃	7	11
A ₄	1	1.5
B	41	63
B ₁	14	21.5
B ₂	27	41.5
C	-	-
Left calcanei (n=65)		
A	29	44
A ₁	2	3
A ₂	20	31
A ₃	5	7
A ₄	2	3
B	36	55
B ₁	11	17
B ₂	25	38
C	-	-

Table 3 Incidence of calcaneal types

Types	Wet Calcanei n=100	Dry Calcanei n=130	Total n=230
A	40 (40%)	53 (40%)	93 (40%)
A ₁	22 (22%)	4 (3%)	26 (11%)
A ₂	11 (11%)	34 (26%)	45 (19%)
A ₃	6 (6%)	12 (9%)	18 (8%)
A ₄	1 (1%)	3 (2%)	4 (2%)
B	59 (59%)	77 (59%)	136 (59%)
B ¹	19 (19%)	25 (19%)	44 (19%)
B ₂	40 (40%)	52 (40%)	92 (40%)
C	1 (1%)	0 (0%)	1 (0.43%)

Table 4 Type distribution of calcaneal types in males and females (Wet calcanei)

Types	Males (n=68)		Females (n=32)	
	n _m	%	n _f	%
A	32	47	8	25
A ₁	17	25	5	15.6
A ₂	10	14.7	1	3.1
A ₃	4	5.8	2	6.3
A ₄	1	1.5	-	-
B	35	51.5	24	75
B ₁	11	16.2	8	25
B ₂	24	35.3	16	50
C	1	1.5	-	-

Table 5 Significant difference of calcaneal types

Types	Specimens	Proportion n/total	Z	P-Value
A	WC + DC	93/230	-4.01	3.038x10 ⁻⁵
B	WC + DC	136/230		
A	Males	32/68	-0.515	0.3034
B	Males	35/68		
A	Females	8/32	-4.000	3.167x10 ⁻⁵
B	Females	24/32		

WC = Wet Calcanei

DC = Dry Calcanei

WC + DC = Wet calcanei + Dry calcanei

Discussion

We found that there was a significantly greater incidence of type B talar articular facets than type A among North-eastern Thai. Our results are similar to the studies of Laidlaw (1904)⁽⁶⁾, Gupta et al. (1977)⁽⁵⁾, Sarrafian (1983)⁽⁷⁾, Campos & Pellico (1989)⁽³⁾ and Bunning and Barnett (1965)⁽²⁾. Those studies were performed in Indian, African and Veddah calcanei, which showed a significant preponderance of the type B pattern. The incidence of type A bones, however, was significantly higher than type B in European and Egyptian calcanei (Bunning and Barnett 1965, El-Eishi 1974). Hence, the distinct distribution of calcaneal types seems to be determined by racial differences.

Our study revealed that each group of wet and dry specimens yielded similar percentages of calcaneal types. Therefore, the overall results reflect the type distribution of each group. Our results suggest that the talar articular facets can be studied either in wet and dry specimens or in a combined group.

Table 6 Comparison of talar articular facets in calcanei by different authors

Author, population	Cases	Type %									
		A	A ₁	A ₂	A ₃	A ₄	B	B ₁	B ₂	C	
Laidlaw [1904]	750	32					68				-
Bunning and Barnett [1963,1965], Veddahs	10	-					60				40
Bunning and Barnett [1963,1965], Africans	492	36					63				1
Bunning and Barnett [1963,1965], Europeans	194	67					33				-
Bunning and Barnett [1963,1965], Indians	78	22					78				-
El-Eishi [1974], Egyptians	200	51					49				-
Gupta et al. [1977], Indians	401	31	9	4	13	5	67	28	39		2
Sarrafiian [1983]	50	34					64				2
Campos and Pellico [1989], Spanish	176	46	3	21	16	6	54	29	25		-
Present study, Northeastern Thai	230	40	11	19	8	2	59	19	40		0.43
Wet calcanei (cadaver)	100	40	22	11	6	1	59	19	40		1
Dry calcanei (dry bone)	130	40	3	26	9	2	59	19	40		-

When sexes were recorded, the incidence of type B was higher than type A in females. But there was no difference in incidence between type A and type B in males. It is possible that in combining both sexes together, the higher incidence of type B in females overwhelms the whole, and causes a higher incidence of type B than type A.

From Table 6, the percentage of subtype A₂ is the highest of the subtypes of type A. This result is similar to the report of Campos and Pellico (1989)⁽³⁾. In type B, the percentage of subtype B₂ is higher than subtype B₁. This result agrees with the observation of Gupta et al. (1977)⁽⁵⁾ whose study was performed in Indians. However, Campos and Pellico (1989)⁽³⁾ showed a higher incidence of subtype B₁ than subtype B₂ in Spanish bones. The variation among talar articular subtypes may be a consequence of external factors and also of anthropological factors which need further investigation.

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