Variations of Calcaneal Articular Facets in Thais Related to Navicular Facet

ความแตกต่างของชนิดข้อต่อบนกระดูกแคลคาเนียสและความเกี่ยวข้องกับข้อต่อบนกระดูกนาวิคูลาร์ในคนไทย

Thanyathorn Artkengkla (ธัญธร อาจเก่งกล้า)* Dr.Sitha Piyawinijwong (ดร.สิทธา ปิยะวินิจวงศ์)**

ABSTRACT

The present study aims to study the correlation between calcaneal articular facets types and navicular facet in Thais and also comparison among genders and sides. One hundred feet form Thais cadaver (50 males and 50 females) were used and provided by Department of Anatomy, Siriraj Hospital. After all the soft tissue was removed to leave out only the bony structure, the calcaneal articular facets were photographed. The area of articular facet was measured by using the UTHSCSA Image tool program (The University of Texas Health Science Center at San Antonio Image tool program, USA) and Aluminium foil imprint for navicular facet. Statistical analysis was done by independent t-test. RESULTS: The calcaneal articular facet was classified into 4 types, type A as three distinct facets, type B as fusion of anterior and middle facets , type C as anterior facet is missing and type D as fusion of all three facets. Type B is the most common in this study. There was significantly different of total articular area between genders and sides (p<0.05), between anterior-middle articular area to gender and type (p<0.05) and between navicular facet area between genders, side and type (p<0.05)

บทคัดย่อ

การศึกษานี้มีจุดประสงค์เพื่อบอกความแตกต่างของชนิดข้อต่อบนกระดูกแคลคาเนียสและความเกี่ยวข้องกับข้อต่อบนกระดูกนาวิคูลาร์ในคนไทย และศึกษาความสัมพันธ์ระหว่างพื้นที่ของข้อต่อกับเพศ, ข้าง และชนิดของข้อต่อ โดยทำการศึกษาจากกระดูกเท้าอาจารย์ใหญ่คนไทยจำนวนหนึ่งร้อยข้าง (เพศชาย 50 ข้างและเพศหญิง 50 ข้าง) จากภาควิชากายวิภาคศาสตร์ คณะแพทยศาสตร์ศิริราชพยาบาลหลังจากทำการนำเนื้อเยื่อต่างๆออกจนเหลือเพียงกระดูก นำกระดูกมาถ่ายรูปและทำการวัดพื้นที่ด้วยโปรแกรม UTHSCSA Image tool (The University of Texas Health Science Center at San Antonio Image tool, USA) และวัดด้วยฟลอยด์อลูมิเนียม จากนั้นทำการวิเคราะห์ทางสถิติด้วย independent t-test พบว่าสามารถแบ่งความแตกต่างของชนิดข้อต่อบนกระดูกแคลคาเนียสได้ 4 ชนิด ชนิดA มีสามข้อต่อแยกออกจากกัน, ชนิดB พบการเชื่อมต่อระหว่างข้อต่อด้านหน้าและส่วนกลาง, ชนิดC ไม่พบข้อต่อส่วนหน้า และชนิดD พบการเชื่อมต่อกันของทั้งสามข้อต่อ จากการศึกษาพบว่าข้อต่อชนิดB พบได้มากที่สุดและมีความแตกต่างอย่างมีนัยสำคัญทางสถิติระหว่างขนาดพื้นที่ข้อต่อทั้งหมดกับเพศและข้าง(p<0.05), ขนาดพื้นที่ข้อต่อด้านหน้าและส่วนกลางกับเพศและชนิดของข้อต่อ (p<0.05), ขนาดพื้นที่ข้อต่อนาวิคูลาร์กับเพศ ข้าง และชนิดของข้อต่อ (p<0.05)

Key Words: Calcaneal articular facet, Navicular facet, Subtalar

คำสำคัญ: พื้นผิวสัมผัสกระดูกส้นเท้า พื้นผิวสัมผัสกระดูกนาวิคูลาร์ ข้อต่อใต้กระดูกทาลัส

** Student, Master of Science Program in Anatomy, Department of Anatomy, Faculty of Medicine Siriraj Hospital, Mahidol University*

*** Associate Professor, Department of Anatomy, Faculty of Medicine Siriraj Hospital, Mahidol University*

Introduction

Subtalar joint is a synovial joint, plane type. also known as Talocalcaneal joint consists of talus and calcaneus which together with the talocalcaneo-navicular joint are clinically defined as subtalar joint (Saadeh et al., 2000). The function of subtalar joint facilitates pronation and supination of the foot (Moore et al., 1992 and Walter et al., 2008). Generally, it composes of three facets on calcaneus as: anterior, middle and posterior facets. The body of talus articulates with the middle third of the superior surface of the calcaneus, while the lower surface of talar head articulates with the anterior third of the calcaneus (Rohin et al., 2013). Standard textbook also classified superior articular surface of calcaneus into anterior and middle articular facets which varies in sex and race (Williams, 1995). Variation of the articular surface has been reported among various ethnic population (Saadeh et al., 2000 and Rohin et al., 2013 and Bunning et al., 1965) and also related to the stability of the joint (Verhagen, 1993). The main objective of this study was to examine the types of articular facet related to navicular facet in Thais and to measure the area of articular facets in relation to genders, side and types of facets.

Objective of the study

The purpose of this study are to examine various types of calcaneal articular facets related to navicular facets and study the relationship between articular facets area according to genders, side and types of facets.

Materials and Methods

One hundred Thais cadavers feet were used (50 males and 50 females), the age group between 36 - 103 years. (mean age of 66.99 years). The formalin embalmed cadavers was conducted in the Department of Anatomy, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand. Exclusion criteria were pathological changed or fracture of the talus and calcaneus. All soft tissue and muscles were removed to leave out only the bony structure of midfoot and rarefoot. The calcaneal articular surface was classified, recorded and photographed for analysis. Subsequently, The area of the calcaneal articular facets was measured by using image tool program (UTHSCSA) while navicular facet was imprinted with aluminum foil and measured with image tool later. Then the articular surface area compare among gender, sides and types of facets. Statistical analysis was taken from independent samples t-test with the significant level at $p<0.05$.

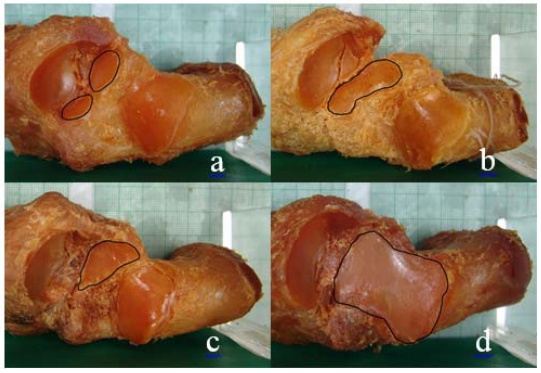

Fig.1 Calcaneal articular facets was classified as;
(a) Three distinct separated facets
(b) Fusion of anterior and middle facets
(c) The anterior facet is missing
(d) Fusion of all three facets

Results

Calcaneal articular surface was classified into type A as three distinct separated facets, type B as fusion of anterior and middle facets, type C as

anterior facet is missing and type D as fusion of all three facets (Fig. 1). Total 200 feet, Type B is the most common type (109, 54.5%) following by type A (88,44%), type C(2,1%) and type D(1,0.5%)(Table 1).

The total articular area showed significant larger in male (p = 0.000*) and on the right side (p = 0.001*) but no different between type A and B (Table 2).

The articular area of anterior and middle facets in male was significantly larger than female and also larger on the type B facet which is fused form (Table 3).

The articular area of navicular found significant larger in male, on the right side and in the type A (nonfused form) of calcaneal facet (Table 4).

Table 1 Percentage of various types of calcaneal articular facets.

Type	Male (n=50)		Female (n=50)	
	Left	**Right**	**Left**	**Right**
Type A (n=88 , 44.0%)	28 (56%)	27 (54%)	17 (34%)	16 (32%)
Type B (n=109 , 54.5%)	22 (44%)	23 (46%)	31 (62%)	33 (66%)
Type C (n=2 , 1.0%)	-	-	1 (2%)	1 (2%)
Type D (n=1 , 0.5%)	-	-	1 (2%)	-

Table 2 Total area of calcaneal articular facets compared between genders, side and types of facets. (* significantly different).

	Total articular area (mean ± SD)	***p*-values (Sig. p<0.05)**
Gender		
Male (N = 100)	7.50 ± 1.06	0.000*
Female (N = 100)	6.07 ± 0.78	
Side of foot		
Left (N = 100)	6.52 ± 1.14	0.001*
Right (N = 100)	7.05 ± 1.15	
Articular type		
Type A (N = 88)	6.86 ± 1.29	0.433
Type B (N = 109)	6.73 ± 1.08	

Table 3 The area of anterior and middle articular facets compared between genders, side and types of facets. (* significantly different).

	Anterior and middle articular area (mean ± SD)	***p*-values (Sig. p<0.05)**
Gender		
Male (N = 100)	2.23 ± 0.39	0.001*
Female (N = 100)	1.98 ± 0.67	
Side of foot		
Left (N = 100)	2.07 ± 0.68	0.355
Right (N = 100)	2.14 ± 0.41	
Articular type		
Type A (N = 88)	1.97 ± 0.43	0.001*
Type B (N = 109)	2.17 ± 0.40	

Table 4 Navicular articular area compared between genders, side and types of facets. (* significantly different).

	Navicular articular area (mean ± SD)	***p*-values (Sig. $p<0.05$)**
Gender		
Male (N = 100)	4.43 ± 0.84	0.000*
Female (N = 100)	3.72 ± 0.71	
Side of foot		
Left (N = 100)	3.74 ± 0.70	0.000*
Right (N = 100)	4.41 ± 0.87	
Articular type		
Type A (N = 88)	4.31 ± 0.84	0.001*
Type B (N = 109)	3.89 ± 0.84	

Discussion and Conclusion

The fused form of anterior and middle calcaneal articular facet (Type B) was frequently found in this study and also corresponding to other study which indicated that type B, was most common in Indian or easterner (Rohin et al., 2013 and Gupta et al., 1977 and Shahabpour et al., 2011). *Verhagen et al. (1993)* and *Shweta et.al. (2013)* also stated that Type B had larger articular area but least stability.

This study showed that male tend to have larger articular area than female which related to the fact that bony structure of male are larger than female. The total area on the right is larger which could be related to the weight distribution and dominant limb.

Future Directions

Result from this study will be benefit for further study of a correlation between calcaneal articular facets pattern and race, correlation with the surrounding structures biomachanics study in Thais.

Acknowledgements

I would like to thanks to my advisor, Assoc.Prof. Dr.Sitha Piyawinijwong for suggestion, and all staffs from Department of Anatomy, Faculty of Medicine Siriraj Hospital, Mahidol University.

References

Saadeh FA, Fuad AH, Mahmoud SMI, Marwan EE. Patterns of Talar Articular Facets of Egyptian Calcanei. Journal of the Anatomical Society of India 2000; 49(1): 6-8.

Moore K. Clinically oriented Anatomy. 3rd ed. Baltimore: Williams & Wilkins; 1992.

Walter CH. Fundamental Anatomy. Lippincott: Williams & Wilkins; 2008.

Rohin G, Neha DS, K., Sushila S. Study of patterns of talar articular facets of human calcanei and their clinical implications in population of Rajasthan. Indian journal of Basic & Applied Medical Research 2013; 2(7): 643-50.

Williams P. Grey's Anatomy. In skeletal system. RW Edn, London: Churchill; 1995.

Bunning PS, Barnett CH. A Comparison of Adult and Foetal Talocalcaneal Articulations. Journal of anatomy 1965; 99: 71-6.

Drayer-Verhagen F. Arthritis of the subtalar joint associated with sustentaculum tali facet configuration. Journal of anatomy 1993; 183: 631-4.

Gupta SC, Gupta CD, Arora AK. Pattern of talar articular facets in Indian calcanei. Journal of anatomy 1977; 124: 651-5.

Shahabpour M, Deville A, Van Roy P, Vaes P, De Mey J, De Maeseneer M. Magnetic resonance imaging of anatomical variants of the subtalar joint. Surgical and radiologic anatomy: SRA 2011; 33(7): 623-30.

Shweta JP, Rashvaita KP, Krunal RC, Meenakshi B. Patterns of talar articular facets on calcaneum and its clinical implication. International Joirnal of Anatomy and Physiology 2013; 2(4): 23-6.