

# A study of calcaneal enthesophytes (spurs) in Indian population

Jagdev Singh Kullar, Gurpreet Kaur Randhawa<sup>1</sup>, Keerat Kaur Kullar<sup>2</sup>

Departments of Anatomy, and <sup>1</sup>Pharmacology, Government Medical College, <sup>2</sup>MBBS Student, SGRD Medical College, Amritsar, Punjab, India

## ABSTRACT

**Introduction:** Calcaneus or os calcis forms a major component of the skeleton of foot providing posterior pillars for bony arches of the foot. It is largest of seven tarsal bones of foot and forms prominence of heel. Many times anterior to calcaneal tuberosity an osteophytic outgrowth has been observed (calcaneal or heel spur) extending along entire width, for about 2-2.5 cm. The apex of spur seen embedded in plantar fascia, directly anterior to its origin. Hence, the study of calcaneal spurs has been undertaken. **Materials and Methods:** The material for the study consisted of 200 dry (100 right and 100 left), adult calcanei of unknown age and sex obtained from Department of Anatomy. The calcaneal enthesophytes/spurs were studied in detail and classified according to types of calcaneum. **Results:** Maximum incidence of calcaneal spurs were found in Type I calcanei (11%) and no calcaneal spurs were found in Type III calcanei. Total incidence of dorsal calcaneal spurs in all types of calcanei was maximal (15.5%). The incidence of plantar spurs was 6.5% being highest in Type I calcanei (4%). The incidence and type of calcaneal spurs were compared with those of previous studies and etiology of heel pain has been discussed. Correlation between type of calcanei and spurs has been studied for the 1<sup>st</sup> time. **Conclusion:** Calcaneal spurs are related to type of calcanei with the highest frequency in Type I and least in Type III (no spurs seen in Type III and least in Type IV). Other factors, which contribute toward increase in incidence of spurs, are increasing age and weight, concurrent orthopedic diseases, and heel pain.

**Key words:** Dorsal spur, plantar spur, talar articular facets

**Submission** 09-09-2013 **Accepted:** 28-03-2014

## INTRODUCTION

Calcaneus or heel bone or os calcis forms a major component of the skeleton of foot providing posterior pillars for bony arches of the foot. The calcaneum is the strongest, largest, and longest of the seven tarsal bones and forms the prominence of the heel.<sup>[1]</sup> It supports the body's weight and acts as a calf muscle lever. It is the

Address for correspondence: Dr. Jagdev Singh Kullar,  
338-D Block, Ranjit Avenue, Amritsar, Punjab, India.  
E-mail: g.kullar@rediffmail.com

first bone of the foot to ossify. The plantar or inferior surface is rough, as the calcaneal tuberosity, the lateral and medial processes extend distally, separated by a notch. Anterior to calcaneal tuberosity is an osteophytic outgrowth (calcaneal or heel spur or enthesophytes) extending along entire width, for about 2-2.5 cm. The apex of the spur is embedded in the plantar fascia, directly anterior to its origin. Enthesophyte formation occurs at the site of ligament and tendon insertions into bone. It tends to grow in the direction of natural pull of ligaments and tendons involved.<sup>[2]</sup>

Osseous spurring of the plantar aspect of the calcaneus was first documented in 1900 by the German physician Plettner, who coined the term Kalkaneussporn (calcaneal spur).<sup>[3]</sup> Calcaneal spurs are of two types: Dorsal/posterior spurs and plantar/inferior spurs. Clinically, it may remain asymptomatic or produce disabling pain in the heel.<sup>[4]</sup> They probably represent variations in the normal development of the calcaneus.<sup>[5]</sup>

Access this article online	
Quick Response Code:	Website: www.ijabmr.org
	DOI: 10.4103/2229-516X.140709

This study was undertaken to assess the incidence of calcaneal spurs and the type of calcaneum commonly associated with them in the Indian cadavers. Correlation between type of calcanei and spurs has been studied for the 1<sup>st</sup> time. Probable etiology of calcaneal spurs and morbidity associated with it will also be discussed.

## MATERIALS AND METHODS

A total of 200 dry (100 right and 100 left), adult calcanei of unknown sexes obtained from the Department of Anatomy, comprised the material for the study. Any calcaneum looking pathological on general examination was discarded from the study. Calcanei were labeled from 1 to 200 with suffix R (right) or L (left). Morphological study of posterior (dorsal spurs) and inferior (plantar spurs) surfaces of the calcanei was done. The calcanei were classified on the basis of talar articular facets (present on the middle-third of superior or proximal surfaces). The incidence of calcaneal spurs were studied in detail.

## RESULTS

The body of the talus articulates in a regular manner with the posterior facet of the calcaneus, while the head articulates with facet (s) on the anterior third of the calcaneus. Various calcaneal facets were classified into four types [Table 1] based on talar articular facets (constricted and not constricted), with incidence as follows:

The incidence of Type I calcanei is maximum (72.5%) in the Indian population with least incidence of Type IV calcanei (0.5%).

Further the presence or absence of the calcaneal spur, an important feature on the posterior (dorsal) and inferior (plantar) surfaces, was studied in detail [Table 2]. Total incidence of calcaneal spurs was found in 26.5% of calcanei studied.

The incidence of only dorsal spurs was 15.5%, being the highest in Type I calcanei (11%) followed by Type II calcanei (4.5%). No dorsal spurs were found in Type III and IV calcanei. The dorsal spurs varied in the height (range: 3-11 mm) and were always directed superiorly due to pull of tendo calcaneus.

The incidence of only plantar spurs was 6.5% being highest in Type I calcanei (4%) followed by Type II (2.5%). No plantar spurs were found in Type III and IV calcanei. The plantar spurs also varied in length (range: 2-8 mm), but were always directed anteriorly due to the traction of the planter fascia.

Both dorsal and plantar spurs [Figure 1] were encountered in 4.5% calcanei being 3% in Type I, 1% in Type II, and 0.5% in Type IV calcanei. None of the Type III calcanei had either dorsal or plantar spurs.

Therefore, most frequently encountered Type I calcanei is also associated with the highest frequency of calcaneal spurs whether dorsal or plantar or both.

In this study, the incidence of presence of calcaneal spurs was higher (26.5%) compared to above workers [Table 3], except Menz et al.<sup>[9]</sup> (55.1%) and Perumal and Anand<sup>[10]</sup> (56% in Tamil Nadu). The exceptionally high incidence in the study by Menz et al.<sup>[9]</sup> could be due to the selected elderly (62-94 years) patients. The incidence of plantar spurs was lowest (6.5%) in our study and that of dorsal spurs was highest (15.5%) as compared to Resnick et al.<sup>[6]</sup> and Riepert et al.<sup>[8]</sup> figures of 16% and 11% and 11.2% and 9.3%, respectively. Similarly, Weiss<sup>[11]</sup> also found an increased incidence of dorsal spurs. The incidence of

**Table 1: Classification of calcanei on the basis of talar articular facets**

Classification	Talar articular facets present on middle third of superior/proximal surface	Incidence (%)		
		Total	Right	Left
Type I	One continuous anterior and middle facet	72.5	37.5	35
Sub type cn	The facet was constricted	30	12	18
Sub type NC	The facet was not constricted	42.5	25.5	17
Type II	Separate anterior and middle facet	25.5	11	14.5
Sub type A	With moderate separation 5-10 mm	10.5	4.5	6
Sub type B	With narrow separation <5 mm	15	6.5	8.5
Sub type C	With wide separation >10 mm	0	0	0
Type III	Single facet present limited to sustentaculum tali and no anterior facet	1.5	1	0.5
Type IV	Posterior, middle and anterior facets confluent	0.5	0.5	0

NC: Not constricted; cn: Constricted

**Table 2: Incidence of calcaneal spurs according to calcaneal type**

Spurs	Type of calcanei								Total	
	Type I		Type II		Type III		Type IV		n	%
	n	%	n	%	n	%	n	%		
Plantar	8	4	5	2.5	0	0	0	0	13	6.5
Dorsal	22	11	9	4.5	0	0	0	0	31	15.5
Both	6	3	2	1	0	0	1	0.5	9	4.5
Total	36	18	16	8	0	0	1	0.5	53	26.5

**Table 3: Comparison of incidence and type of calcaneal spurs in different studies**

Workers (year)	No. of calcanei studied	Plantar spurs (%)	Dorsal spurs (%)	Both spurs (%)	Total spurs (%)
Resnick et al. <sup>[6]</sup> (1977)	-	16	11	4	22
Prichasuk and Subhadrabandhu <sup>[7]</sup> (1994)	-	-	-	-	15.5
Riepert et al. <sup>[8]</sup> (1995)	-	11.2	9.3	-	15.70
Menz et al. <sup>[9]</sup> (2008)	216	55	48	-	55.1
Perumal and Anand <sup>[10]</sup> (2013)	218	-	-	-	56
Present study (2013)	200	6.5	15.5	4.5	26.5

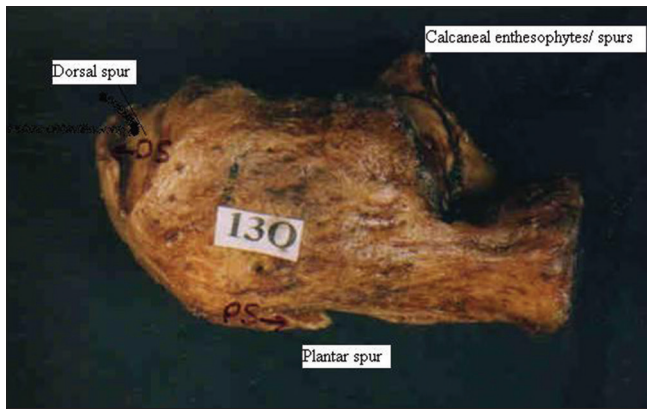


Figure 1: Calcaneum showing both dorsal and plantar spurs

both spurs was comparable with the study of Resnick *et al.*<sup>[6]</sup> Bassiouni<sup>[12]</sup> found the incidence of inferior spurs to be more common than posterior spurs. Menz *et al.*<sup>[9]</sup> observed that plantar calcaneal spurs were more likely to have Achilles tendon spurs (odds ratio = 2.0, 95% confidence interval: 1.2-3.5).

### Probable etiology of calcaneal spurs

#### Age

Riepert *et al.*<sup>[8]</sup> found that plantar spurs were more common (11.2%), though later to appear as compared with dorsal spurs (9.3%). Bassiouni<sup>[12]</sup> found that the frequency of calcaneal spurs rose with age (maximum in 41–60 year of age group) in patients of osteoarthritis and rheumatoid arthritis than controls. Banadda *et al.*<sup>[13]</sup> have reported 50% prevalence of calcaneal spurs in Zimbabwean hospital patients aged over 51 years. Weiss<sup>[11]</sup> also reported an increased frequency of spurs with age.

#### Sex

Riepert *et al.*<sup>[8]</sup> found that plantar spurs were more in females, while dorsal spurs were commoner in males. They also found that dorsal spurs were more common in males up to the age of 70 years. Riepert *et al.*<sup>[14]</sup> have reported prevalence of plantar heel spur as 16.3% and 6.5% (increasing with age) for males and females, respectively, being significantly more frequent in females. Bassiouni<sup>[12]</sup> found no significant intersexual difference in the incidence of calcaneal spurs. Menz *et al.*<sup>[9]</sup> found equal prevalence of spurs in either sex of the patients.

#### Obesity

Menz *et al.*<sup>[9]</sup> found that participants with plantar calcaneal spurs were more likely to be obese.

#### Ethnicity

A high incidence of calcaneal spurs was found in Victoria, Australia<sup>[9]</sup> (55.1%) and in the Indian state of Tamil Nadu<sup>[10]</sup> (56%). Calcaneal spurs were found in 26.5% calcanei with incidence of 15.5% for dorsal spurs in the Punjab state of India (present

study). Comparatively a lesser and similar incidence was seen in Thailand<sup>[7]</sup> (15.5%) and the Caucasian population<sup>[8]</sup> (15.7%).

### Abnormal development

Robinson<sup>[5]</sup> presented three cases of unrelated children aged 9 months, 3 years and 7 years, who had asymptomatic, symmetrical, posteriorly directed plantar calcaneal spurs. He further opined that these probably represent variations in the normal development of the calcaneus.

### Type of calcanei

The incidence of calcaneal spurs has been directly linked to type of calcanei in this study. Type I calcanei has been found to be most frequently associated with spurs (dorsal - 15.5%, plantar - 6.5% and both in 4.5% calcanei), while no spurs were found in Type III calcanei.

### Association with physical activity and profession

Li and Muehleman<sup>[15]</sup> studied the elderly cadaveric specimens, using radiographic, gross morphological, and histological investigations to find the probable factor for the development of heel spur (calcaneal exostosis). They found that the bony trabeculae of the spur were not aligned in the direction of soft-tissue traction, but rather in the direction of stress on the calcaneus during walking and standing. Thus, substantiating the hypothesis of development of heel spur, which might be a skeletal response to stress. It may serve to protect the bone against the development of microfractures. Cosentino *et al.*<sup>[16]</sup> found that persons who have to stand for long hours in their profession experience more heel pain.

### Orthopedic diseases

Bassiouni<sup>[12]</sup> found that 81% patients of osteoarthritis had calcaneal spurs as compared with 21.6% of rheumatoid arthritis and 16.1% of control patients. Gerster *et al.*<sup>[17]</sup> found that the incidence of calcaneal spurs was maximum in patients of osteoarthritis (56%), followed by Reiter's syndrome (37.4%), ankylosing spondylitis (31.2%) and rheumatoid arthritis (24%). Resnick *et al.*<sup>[6]</sup> worked on calcaneal abnormalities in articular disorders and found that calcaneal spurs were present on plantar or posterior surface of calcanei in 22% of the general population (normal control), as compared with 36% of rheumatoid arthritis patients, 41% of psoriatic arthritis patients, 44% of Reiter's syndrome patients, and 33% of ankylosing spondylitis patients. Prichasuk and Subhadrabandhu<sup>[7]</sup> studied 400 normal subjects and 82 patients of plantar heel pain for incidence of the calcaneal spur. Incidence was found to be 15.5% and 65.9% in these two categories respectively, which was a highly significant result. Menz *et al.*<sup>[9]</sup> found that participants with plantar calcaneal spurs have a history of osteoarthritis and also current or previous heel pain. Weiss<sup>[11]</sup> also reported a positive correlation between calcaneal spurs and osteoarthritis.

### Association with heel pain

Williams et al.<sup>[18]</sup> found on plain X-ray, that 39 out of 52 painful heels (75%) and 24 out of 38 opposite nonpainful heels (63%) showed plantar spurs, compared with 5 of 63 (7.9%) heels in 59 age- and sex-matched controls. Prichasuk and Subhadrabandhu<sup>[7]</sup> found the calcaneal spur in 15.5% of the normal population ( $n = 400$ ) and 65.9% of patients with plantar heel pain ( $n = 82$ ) leading them to suggest it to be one of the causes of heel pain, others being excessive weight gain, ageing and gender. In contrast, Lu et al.<sup>[19]</sup> could not find any clear relationship between heel pain and the length, shape and direction of the calcaneal spur. They attributed heel pain to thickened plantar soft-tissues, patients' age and sex. Chundru et al.<sup>[20]</sup> also reported a higher frequency of the calcaneal spur formation in individuals with abductor digiti minimi atrophy.

## CONCLUSION

Calcaneal spurs are related to the type of calcanei with the highest frequency in Type I and least in Type III (no spurs seen in Type III and least in Type IV. Please refer to observations). Other factors, which increase the incidence of spurs are increasing age and weight, concurrent orthopedic diseases and heel pain. Gender might be a cofactor leading to spur formation and plantar heel pain. These findings support the theory that plantar calcaneal spurs may be an adaptive response to vertical compression of the heel rather than longitudinal traction at the calcaneal entheses. Therefore, calcaneal spurs are one of the cofactors/associations for heel pain.

## REFERENCES

1. Snell RS. Bones of the foot. In: Clinical Anatomy for Medical Students. 6<sup>th</sup> ed. Philadelphia, Baltimore, New York, London, Buenos Aires, Hong Kong, Sydney, Tokyo: Lippincott, Williams and Wilkins, A Wolters Kluwer Company; 1993. p. 551-2.
2. Rogers J, Shepstone L, Dieppe P. Bone formers: Osteophyte and enthesophyte formation are positively associated. *Ann Rheum Dis* 1997;56:85-90.
3. Micke O, Seegenschmiedt MH, German Cooperative Group on Radiotherapy for Benign Diseases. Radiotherapy in painful heel spurs (plantar fasciitis) - Results of a national patterns of care study. *Int J Radiat Oncol Biol Phys* 2004;58:828-43.
4. Healey JE Jr, Seybold WD. A Synopsis of Clinical Anatomy. 1<sup>st</sup> ed. Philadelphia, London, Toronto: WB Saunders Company; 1969. p. 286.
5. Robinson HM. Symmetrical reversed plantar calcaneal spurs in children. A normal variant? *Radiology* 1976;119:187-8.
6. Resnick D, Feingold ML, Curd J, Niwayama G, Goergen TG. Calcaneal abnormalities in articular disorders. Rheumatoid arthritis, ankylosing spondylitis, psoriatic arthritis, and Reiter syndrome. *Radiology* 1977;125:355-66.
7. Prichasuk S, Subhadrabandhu T. The relationship of pes planus and calcaneal spur to plantar heel pain. *Clin Orthop Relat Res* 1994;306:92-6.
8. Riepert T, Drechsler T, Urban R, Schild H, Mattern R. The incidence, age dependence and sex distribution of the calcaneal spur. An analysis of its x-ray morphology in 1027 patients of the central European population. *Rofo* 1995;162:502-5.
9. Menz HB, Zammit GV, Landorf KB, Munteanu SE. Plantar calcaneal spurs in older people: Longitudinal traction or vertical compression? *J Foot Ankle Res* 2008;1:7.
10. Perumal A, Anand A. Morphometric study of spur formation in dry adult human calcaneae. *Int J Curr Res Rev* 2013;5:92-6.
11. Weiss E. Calcaneal spurs: Examining etiology using prehistoric skeletal remains to understand present day heel pain. *Foot (Edinb)* 2012;22:125-9.
12. Bassiouni M. Incidence of calcaneal spurs in osteo-arthritis and rheumatoid arthritis, and in control patients. *Ann Rheum Dis* 1965;24:490-3.
13. Banadda BM, Gona O, Vaz R, Ndlovu DM. Calcaneal spurs in a black African population. *Foot Ankle* 1992;13:352-4.
14. Riepert T, Drechsler T, Schild H, Nafe B, Mattern R. Estimation of sex on the basis of radiographs of the calcaneus. *Forensic Sci Int* 1996;77:133-40.
15. Li J, Muehleman C. Anatomic relationship of heel spur to surrounding soft tissues: Greater variability than previously reported. *Clin Anat* 2007;20:950-5.
16. Cosentino R, Falsetti P, Manca S, De Stefano R, Frati E, Frediani B, et al. Efficacy of extracorporeal shock wave treatment in calcaneal enthesophytosis. *Ann Rheum Dis* 2001;60:1064-7.
17. Gerster JC, Vischer TL, Bennani A, Fallet GH. The painful heel. Comparative study in rheumatoid arthritis, ankylosing spondylitis, Reiter's syndrome, and generalized osteoarthritis. *Ann Rheum Dis* 1977;36:343-8.
18. Williams PL, Smibert JG, Cox R, Mitchell R, Klenerman L. Imaging study of the painful heel syndrome. *Foot Ankle* 1987;7:345-9.
19. Lu H, Gu G, Zhu S. Heel pain and calcaneal spurs. *Zhonghua Wai Ke Za Zhi* 1996;34:294-6.
20. Chundru U, Liebeskind A, Seidelmann F, Fogel J, Franklin P, Beltran J. Plantar fasciitis and calcaneal spur formation are associated with abductor digiti minimi atrophy on MRI of the foot. *Skeletal Radiol* 2008;37:505-10.

**How to cite this article:** Kullar JS, Randhawa GK, Kullar KK. A study of calcaneal enthesophytes (spurs) in Indian population. *Int J App Basic Med Res* 2014;4:13-6.

**Source of Support:** Nil. **Conflict of Interest:** None declared.