Original Article

Incidence and Pattern of Calcaneal Spurs in Relation to the Type of Calcaneum: A Dry Bone and Computed Tomography Based Study

Harinarayanan C[1], Ilakkiya Lingasamy[2], V. Sakthivel[3]

[1]Assistant Professor, Department of Plastic & Reconstructive surgery Arignar Anna cancer Institute, Karapettai, Kancheepuram, Tamil Nadu, India. [2]Tutor, Department of Anatomy, Government medical college & Hospital, Cuddalore, Tamil Nadu, India. [3]Assistant Professor, Department of Plastic & Reconstructive surgery Government Kilpauk medical college & hospital, Chennai, Tamil Nadu, India

Abstract

Background: Calcaneal spurs, or enthesophytes, are bony outgrowths that develop at the sites of attachment of the plantar fascia and the tendocalcaneus on the calcaneum. They are a recognised cause of chronic heel pain and their occurrence has been variably linked to the configuration of the talar articular facets of the calcaneum, age, sex, obesity and biomechanical loading of the heel. Objective of this study was to study the presence, location and pattern of calcaneal spurs in dry bone specimens and computed tomography (CT) images, and to correlate spur occurrence with the morphological type of calcaneum. **Material and Methods:** This descriptive cross-sectional study was carried out in the Department of Anatomy in association with the Department of Radiology of a tertiary care teaching institute. Eighty adult dry calcaneum specimens (40 left, 40 right) and fifty CT images (25 males, 25 female) were examined for the presence of plantar (inferior) and dorsal (posterior) spurs. Each bone/image was classified by talar facet type (Bunning and Barnett) as Type A, Type B (subtypes B1-B4) or Type C, and the presence and site of spur formation were recorded and analysed using SPSS version 21. **Results:** A calcaneal spur was present in 59% of dry bone specimens (31% plantar, 15% dorsal, 13% both) and in 58% of CT images (30% plantar, 14% dorsal, 14% both); spurs were absent in 41-42% of both samples. Spur formation was most frequent in calcanei with fused anterior and middle talar facets (Type B), and plantar spurs were consistently more common than dorsal spurs in both dry bone and CT samples. Right-sided calcanei showed a higher incidence of spur formation than left-sided calcanei, and on CT imaging spurs were marginally more frequent in females (60%) than in males (56%). **Conclusion:** Calcaneal spur formation is common in this population and shows a clear association with the two-facet (Type B) pattern of the calcaneum, with a consistent predominance of plantar over dorsal spurs. These findings support a biomechanical, vertical-compression-related mechanism of plantar spur formation and are of practical relevance to clinicians managing chronic plantar heel pain and to anatomists and forensic scientists using the calcaneum for age and identification purposes.

Keywords: Calcaneal spur; Enthesophyte; Plantar fasciitis; Calcaneum; Talar articular facet; Heel pain.

Received: 20 July 2026 **Revised: 08 August 2026** **Accepted: 26 August 2026** **Published: 31 August 2026**

Introduction

A calcaneal spur is an enthesophyte, an abnormal bony outgrowth that develops at an enthesis - the site of attachment of a tendon, ligament or fascia to bone - and grows in the direction of the causative muscular or fascial pull. On the calcaneum, spurs most commonly develop on the inferior (plantar) aspect at the origin of the plantar fascia, anterior to the calcaneal tuberosity, and on the posterior (dorsal) aspect at the insertion of the tendocalcaneus. The German physician Plettner is credited with the first documented description of the calcaneal spur in 1900, under the name Kalkaneussporn.[1-5]

Calcaneal spurs are a well-recognised cause of chronic heel pain and are frequently encountered incidentally on plain radiographs and CT of the foot. Their pathogenesis remains debated: while spurs have traditionally been attributed to chronic traction stress at the fascial or tendinous enthesis, several authors have proposed that plantar spurs arise instead as an adaptive response to vertical compressive loading of the heel during standing and walking, since their trabecular orientation follows the line of vertical, not longitudinal, stress. Spur formation has also been reported to correlate with the configuration of the talar articular facets on the superior surface of the calcaneum, with several studies noting a higher incidence of spurs in calcanei with fused anterior and middle facets.[6-10]

Given the clinical importance of calcaneal spurs as a cause of heel pain and their forensic relevance in age estimation and identification of skeletal remains, this study was undertaken with the objective of assessing the presence, location and pattern of calcaneal spurs in dry bone and CT samples, and correlating spur formation with the morphological type of the calcaneum.

Address for correspondence: Dr. Harinarayanan C, Assistant Professor, Department of Plastic & Reconstructive surgery Arignar Anna cancer Institute, Karapettai, Kancheepuram, Tamil Nadu, India.

DOI:
10.21276/amit.2026.v13.i2.1004

How to cite this article: Harinarayanan C, Lingasamy I, Sakthivel V. Incidence and Pattern of Calcaneal Spurs in Relation to the Type of Calcaneum: A Dry Bone and Computed Tomography Based Study. Acta Med Int. 2026;13(2):2043-2046.

Materials and Methods

Study design and setting: This descriptive cross-sectional study was conducted in the Department of Anatomy, in association with the Department of Radiology, of a tertiary care teaching institute, using dry calcaneum specimens from the departmental bone bank and CT images obtained from the Department of Radiology.

Ethical approval: Approval was obtained from the Institutional Research Committee (IRC number IRC202020, dated 27 October 2020) and the Institutional Ethics Committee (IEC number 270/IEC-30/PP/2020, dated 12 December 2020) before the study commenced.

Sample size: Eighty dry calcaneum specimens (40 left, 40 right) and 50 CT images (25 male, 25 female) were included. Bones with obscuring pathology or physical damage were excluded from analysis.

Method of examination: Each dry bone specimen and each CT image was inspected individually for the presence of a spur on the plantar and/or dorsal aspect of the calcaneum. Spurs were classified by location as plantar (inferior), dorsal (posterior), both, or absent. Each specimen was also classified by talar facet type - Type A (three separate facets), Type B (two facets; subtypes B1, fused anterior-middle facets; B2, fused facets with an intervening notch; B3, absent anterior facet; B4, fused middle-posterior facets), and Type C (single fused facet) - according to the classification of Bunning and Barnett, to allow correlation between facet pattern and spur occurrence.

Statistical analysis: Data were entered into Microsoft Excel and analysed with SPSS version 21. Categorical data on spur presence, location and calcaneal type were expressed as frequencies and percentages, and compared across sides and sexes.

Results

Among the 80 dry bone specimens, a calcaneal spur was present in 59% overall: a plantar spur alone was seen in 31%, a dorsal spur alone in 15%, and both plantar and dorsal spurs together in 13%, while 41% of specimens showed no spur. On the left side, spurs were present in 57.5% of bones (dorsal 12.5%, plantar 30%, both 15%), and on the right side in 58.25% of bones (dorsal 15%, plantar 42.5%, both 12.5%).

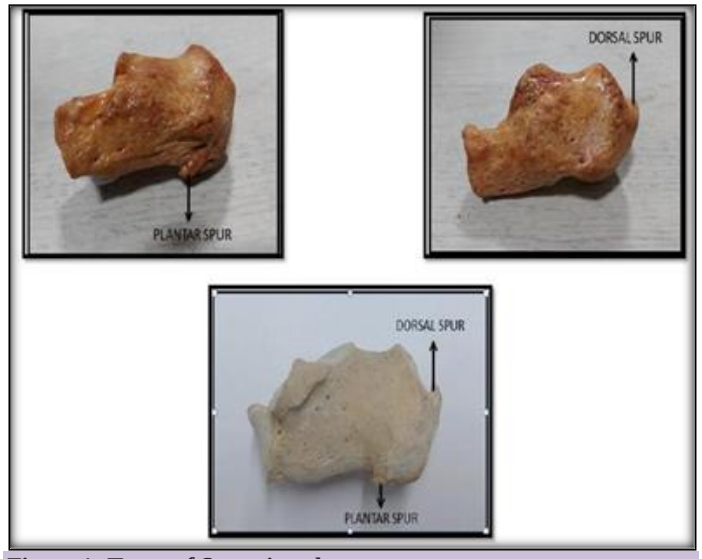

Figure 1: Types of Spurs in calcaneum.

Table 1: Incidence of calcaneal spur by type of calcaneum - left side dry bone samples (n=40)

Type of calcaneum	Dorsal spur	Plantar spur	Both dorsal & plantar
Type A	3 (7.5%)	5 (12.5%)	1 (2.5%)
Type B	2 (5%)	7 (17.5%)	4 (10%)
Type C	0 (0%)	0 (0%)	1 (2.5%)

Table 2: Incidence of calcaneal spur by type of calcaneum - right side dry bone samples (n=40)

Type of calcaneum	Dorsal spur	Plantar spur	Both dorsal & plantar
Type A	2 (5%)	0 (0%)	1 (2.5%)
Type B	4 (10%)	13 (32.5%)	4 (10%)
Type C	0 (0%)	0 (0%)	0 (0%)

On CT imaging, a calcaneal spur was identified in 58% of the 50 images examined (dorsal 14%, plantar 30%, both 14%), while 42% of images showed no spur. Among males, spurs were present in 56% (Type A 24%, Type B 32%), and among females in 60% (Type A 12%, Type B 40%, Type C 8%), indicating a marginally higher spur incidence in females than males in this sample.

Table 3: Incidence of calcaneal spur by type of calcaneum - male CT images (n=25)

Type of calcaneum	Dorsal spur	Plantar spur	Both dorsal & plantar
Type A	1 (4%)	2 (8%)	3 (12%)
Type B	2 (8%)	4 (16%)	2 (8%)
Type C	0 (0%)	0 (0%)	0 (0%)

Table 4: Incidence of calcaneal spur by type of calcaneum - female CT images (n=25)

Type of calcaneum	Dorsal spur	Plantar spur	Both dorsal & plantar
Type A	0 (0%)	3 (12%)	0 (0%)
Type B	4 (16%)	5 (20%)	1 (4%)
Type C	0 (0%)	1 (4%)	1 (4%)

Across both dry bone and CT samples, spur formation was consistently more frequent in Type B calcanei (two talar facets) than in Type A or Type C calcanei, and plantar spurs were consistently more common than dorsal spurs. When the overall incidence of spur formation in the present study was compared with previously published Indian series, the figure of 59% was found to be higher than most reported values, exceeded only by the series of Agarwal et al., and the predominance of plantar over dorsal spur was in keeping with the findings of Rajkohila et al. and Anbumani et al.

Table 5: Comparison of the incidence of calcaneal spur with other published studies

Author (year)	Sample	Spur present	Plantar spur	Dorsal spur
Kullar et al. (2014)	200	26.5%	6.5%	15.5%
Rajkohila et al. (2016)	300	39.3%	15%	12.3%
Agarwal et al. (2016)	580	61.4%	13.8%	26.9%
Anbumani et al. (2017)	110	47%	27%	8%
Present study (dry bone)	80	59%	31%	15%

Discussion

The overall incidence of calcaneal spur in the present study (59% in dry bones, 58% on CT) is higher than that reported by Kullar et al. and by Rajkohila et al., but is closely comparable to the figure of 61.38% reported by Agarwal et al. in a New Delhi population, and is considerably higher than the radiographic incidence of 15.7% reported by Riepert et al. in a Central European population and 38% reported by Toumi et al. in a Welsh series, a difference plausibly related to differences in study methodology, sample age distribution and the greater sensitivity of direct bone examination and CT compared with plain radiography.[11-15]

The predominance of plantar over dorsal spurs observed in this study is consistent with the findings of Bassiouni et al., Rajkohila et al. and Anbumani et al. and stands in contrast to the series of Kullar et al. and Agarwal et al., in which dorsal spurs were more frequent. Plantar calcaneal spurs have traditionally been attributed to chronic traction at the origin of the plantar fascia; however, Menz et al. proposed that plantar spurs represent an adaptive response to vertical compression of the heel during weight bearing rather than to longitudinal traction alone, since their trabecular architecture is oriented vertically rather than along the line of fascial pull. Dorsal spurs, in contrast, are consistently directed superiorly along the line of pull of the tendocalcaneus and are more clearly attributable to traction from repetitive tendon loading. The observed association between spur formation and the two-facet (Type B) pattern of the calcaneum parallels the findings of Kullar et al., Rajkohila et al. and Kori et al., who similarly reported a higher incidence of spurs in calcanei with fused anterior and middle facets. This association may reflect altered load transmission across the subtalar joint in calcanei with reduced articular surface area, predisposing to greater stress at the plantar and dorsal entheses. The higher incidence of spur formation on the right side observed in this study is consistent with the findings of Perumal et al. and may relate to asymmetric weight-bearing and the tendency for the right lower limb to initiate movement and absorb greater impact forces during gait.[16-18]

Obesity, ageing, and repetitive mechanical loading of the heel have all been implicated as contributing factors to enthesophyte formation, and calcaneal spurs are of recognised importance in forensic medicine, where their presence may provide corroborative evidence of an individual's age, occupation and lifestyle in the identification of unknown remains. Clinically, spur-related heel pain arises from local instability and disruption of the normal alignment of soft tissues attached to the medial tubercle of the calcaneum, and awareness of the relationship between spur location, calcaneal type and side is of practical value to foot and ankle surgeons managing chronic plantar heel pain.[19,20]

Conclusion

Calcaneal spurs were a common finding in this study, present in approximately 59% of dry bone specimens and 58% of CT images, with a consistent predominance of plantar over dorsal spurs and a higher incidence in calcanei showing fusion of the anterior and middle talar facets (Type B). These findings support a multifactorial, largely biomechanical basis for spur formation and reinforce the clinical relevance of calcaneal type assessment in the evaluation of patients with chronic heel pain, as well as the continuing value of the calcaneum in forensic anthropological assessment.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Bassiouni M. Incidence of calcaneal spurs in osteo-arthrosis and rheumatoid arthritis, and in control patients. Ann Rheum Dis. 1965;24(5):490-3.
2. 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(6):502-5.
3. 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.
4. Toumi H, Davies R, Mazor M, Coursier R, Best TM, Jennane R, Lespessailles E. Changes in prevalence of calcaneal spurs in men & women: a random population from a trauma clinic. BMC Musculoskelet Disord. 2014;15:87.
5. Kullar JS, Randhawa GK, Kullar KK. A study of calcaneal enthesophytes (spurs) in Indian population. Int J Appl Basic Med Res. 2014;4(Suppl 1):S13-6.
6. Kori D, Prasad G, Rani A, Dewan RK, Singh R, Singh P. Study of variations in talar articular facets of human calcanei and their association with calcaneal spurs in north Indian population. Int J

Anat Res. 2016;4(3):2710-6.
7. Rajkohila J, Daniel P, Suganthy J. Study of calcaneal spurs and lateral tubercular bar in Indian population. J Anat Soc India. 2016;65(1):29-32.
8. Agarwal S, Garg S, Vasudeva N. Subtalar joint instability and calcaneal spurs associated with the configuration of the articular facets of adult human calcaneum in Indian population. J Clin Diagn Res. 2016;10(9):AC05-8.
9. Prakash KG, Viveka S. Morphometric considerations of articular surfaces of calcaneum, occurrence of enthesophytes and evolutionary significance of cuboidal facet. Indian J Clin Anat Physiol. 2016;3(2):61-4.
10. Perumal A, Anand A. Morphometric study of spur formation in dry adult human calcaneae. Int J Curr Res Rev. 2013;5(7):92-6.
11. Biz C, Refolo M, Zinnarello FD, Crimì A, Dante F, Ruggieri P. A historical review of calcaneal fractures: from the crucifixion of Jesus Christ and Don Juan injuries to the current plate osteosynthesis. Int Orthop. 2022;46(6):1413-22.
12. Hall RL, Shereff MJ. Anatomy of the calcaneus. Clin Orthop Relat Res. 1993;(290):27-35.
13. Anbumani S, Sridharan R, Thamarai Selvi A. An anatomical study of morphology and morphometric analysis of calcaneum and its talar articular surfaces. Int J Anat Res. 2017;5(3.2):4223-9.
14. Mosier KM, Asher M. Tarsal coalitions and peroneal spastic flat foot. A review. J Bone Joint Surg Am. 1984;66(7):976-84.
15. Murerwa R, Amuti T, Muuthuri N, Wambui A, Ouko I, Ogeng'o J. Dorsal morphology of the calcaneus - an osteological study. Ann Afr Surg. 2020;17(3):112-5.
16. Gupta SC, Gupta CD, Arora AK. Pattern of talar articular facets in Indian calcanei. J Anat. 1977;124(Pt 3):651-5.
17. Bunning PSC, Barnett CH. Variations in the talocalcanean articulations. J Anat. 1963;97(Pt 4):643.
18. Kulkarni GS. Textbook of Orthopaedics and Trauma. 2nd ed. New Delhi: Jaypee Brothers Medical Publishers; 2008.
19. Sinnatamby CS. Last's Anatomy: Regional and Applied. 12th ed. China: Elsevier; 2011. p. 279-80.
20. Coughlin MJ, Mann RA, Saltzman CL. Surgery of the Foot and Ankle. 8th ed. Philadelphia: Mosby Elsevier; 2007.