

Heel Pain and Calcaneal Enthesophytes: A Radiological Evaluation

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ABSTRACT

Introduction: The calcaneal spur is the leading cause of heel pain. While prior anatomical studies have often utilized cadaveric specimens, there is a dearth of data correlating heel pain with the presence of a calcaneal spur across different age groups and gender.

Aim: To evaluate the association of heel pain with plantar, dorsal, or both calcaneal spur and their correlation with age and gender in the North Indian population.

Materials and Methods: A cross-sectional observational study was conducted at King George's Medical University UP, Lucknow, from January 2023 to March 2023. Informed consent from the patients and ethical approval from the institutional research committee was obtained for this research. Lateral radiographs of ankle joints of 213 patients attending orthopedics OPD with complaints of heel pain were reviewed independently by two observers. The age and sex of the patients were also noted. Data were statistically analyzed using Statistical Package for Social Sciences (SPSS) v23.

Results: In 186 (87.32%) patients with heel pain, Calcaneal spur was present. A maximum number of subjects with heel pain were noticed in the age group 51-60 years for both males and females. Plantar and dorsal spurs were highly prevalent in males than females. Plantar spurs were found to be more common than dorsal spurs.

Conclusion: Most heel pains were associated with a spur, and the prevalence of spur differed between men and women due to differences in their daily activities and occupation. This study provides vital information for orthopedic surgeons treating heel pain patients daily.

KEY WORDS: plantar spur, dorsal spur, heel, pain, calcaneum.

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INTRODUCTION

The term Kalkaneussporn (calcaneal spur) was first coined by German physician Plettner in 1900 who recognized the osseous spurring of the plantar aspect of the calcaneus [1,2]. There are two types of calcaneal spurs i.e. dorsal/posterior/Achilles spurs and plantar/inferior spurs. They can cause intense pain in the heel or remain asymptomatic [3].

They likely represent differences in the calcaneus' natural development [4]. It may occur due to continuous trauma to the dorsal or plantar aspect of the calcaneum. Risk factors like obesity, pes planus, and pes cavus may accelerate the pathology. Scar tissue formation can lead to calcaneal spur due to neovascularization and ossification [5]. Recent studies have shown that calcaneal spur is 75.9-89% in patients complaining of plantar heel pain [6,7].

Calcaneal enthesophytes are one of the most common causes of heel pain. It is interesting to know about the genesis of this notorious spur. Due to unusual pressures on the feet, muscles and ligaments of the foot undergo stretching which progressively may lead to the formation of spur-like growth from calcaneum. This may irritate nearby muscles and soft tissues resulting in pain, swelling, and difficulty walking.

Many studies have been done on dry calcanei to see the presence of spur. Still, radiological evaluation of spur in subjects with heel pain has not been reported in North Indian population till now. Therefore, the present study was planned to evaluate the association of heel pain with plantar, dorsal, or both calcaneal spur and their correlation with age and gender in the North Indian population.

MATERIALS AND METHODS

This cross-sectional observational study was conducted at the Department of Anatomy, in collaboration with the Department of Orthopedics, King George's Medical University, Lucknow, Uttar Pradesh, India, from January 2023 to March 2023. The research was approved by the institutional ethical committee viz. certificate number 119th ECM

IIA/P17. The research was done in accordance with the institutional research committee's ethical criteria and the Helsinki Declaration of 1964. All participants were enrolled in the study only after obtaining their informed consent for collecting and using their data. Consent of the patients was taken for the study. Lateral radiographs of the ankle joint of 213 patients (120 males and 93 females) attending orthopedics OPD with complaints of heel pain were reviewed independently by two observers. The age and sex of the patients were also taken into consideration. Patients complaining of constant heel pain for at least three months and aged 21 to 80 years were included in the study. An experienced radiologist evaluated all X-rays. Patients were categorized into six groups according to age (years) i.e. 21-30, 31-40, 41-50, 51-60, 61-70, and 71-80. The presence or absence of plantar, dorsal (Achilles), or both spurs was assessed (Figure 1a-d). Patients with a previous history of any fracture of bones taking part in the formation of the ankle joint, surgery of any type on the foot, inflammatory joint diseases, tendonitis, and congenital or acquired deformities of the foot were excluded from the study.

Statistical analysis: The Fisher's exact test and chi-square tests were carried out to compare different variables, and the values were considered statistically significant with p value < 0.05. Data were statistically analyzed using Statistical Package for Social Sciences (SPSS) v23. Thereafter, conclusions and interpretations were drawn from the analyzed data.

RESULTS

A total of 213 subjects (120 males and 93 females) presenting with heel pain were included in the study, out of which calcaneal spur of any type was present in 186 (87.32%) patients i.e. 105 males and 81 females. Spur was not found in 27 (12.68%) patients i.e. 15 males and 12 females. A maximum number of subjects with heel pain (n=96) was noticed in the age group 51-60 years for both males and females. A preponderance of spur was also noted in the age group 51-60 years in both sex (n=93, 50%). Males (49.30%) were more likely to have a presence of spur as compared

Table 1: Number of subjects with heel pain having the presence or absence of calcaneal spur.

Age Group (Years)	No. of males with heel pain (n=120)		No. of females with heel pain (n=93)		Total subjects with heel pain (n=213)	Total subjects with calcaneal spur (n=186)
	Presence of calcaneal spur	Absence of calcaneal spur	Presence of calcaneal spur	Absence of calcaneal spur		
21-30	3	9	3	9	24	6 (3.23%)
31-40	0	0	0	0	0	0 (0%)
41-50	12	3	21	0	36	33 (17.74%)
51-60	57	0	36	3	96	93 (50%)
61-70	24	0	21	0	45	45 (24.19%)
71-80	9	3	0	0	12	9 (4.84%)
Total	105 (49.30%)	15 (7.04%)	81 (38.03%)	12 (5.63%)	213 (100%)	186 (87.32%)

Table 2: Association of the plantar spur with different age groups and gender in subjects with heel pain.

	Plantar Spur			p-value
	Male	Female	Total (%)	
21-30	0	3	3 (2.44%)	$\chi^2=4.044$; p=0.0443
31-40	0	0	0 (0%)	
41-50	12	15	27 (21.95%)	
51-60	27	30	57 (46.34%)	
61-70	15	15	30 (24.39%)	
71-80	6	0	6 (4.88%)	
Total	60 (48.78%)	63 (51.22%)	123 (100%)	

Table 3: Association of the dorsal spur with different age groups and gender in subjects with heel pain.

Age Group (years)	Dorsal Spur			p-value
	Male	Female	Total (%)	
21-30	0	0	0 (0%)	p=0.0125
31-40	0	0	0 (0%)	
41-50	0	0	0 (0%)	
51-60	9	3	12 (57.14%)	
61-70	3	6	9 (42.86%)	
71-80	0	0	0 (0%)	
Total	12 (57.14%)	9 (42.86%)	21 (100%)	

Table 4: Association of both plantar and dorsal spur with different age groups and gender in subjects with heel pain.

Age Group (years)	Both Plantar & Dorsal Spur			p-value
	Male	Female	Total	
21-30	3	0	3 (7.14%)	p=0.0011
31-40	0	0	0 (0%)	
41-50	0	6	6 (14.29%)	
51-60	21	3	24 (57.14%)	
61-70	6	0	6 (14.29%)	
71-80	3	0	3 (7.14%)	
Total	33 (78.57%)	9 (21.43%)	42 (100%)	



Fig. 1: Lateral radiographs of ankle joint showing: a: No calcaneal spur b: Plantar calcaneal spur (arrow) c: Dorsal calcaneal spur (arrow) d: Both plantar and dorsal calcaneal spur (arrows).

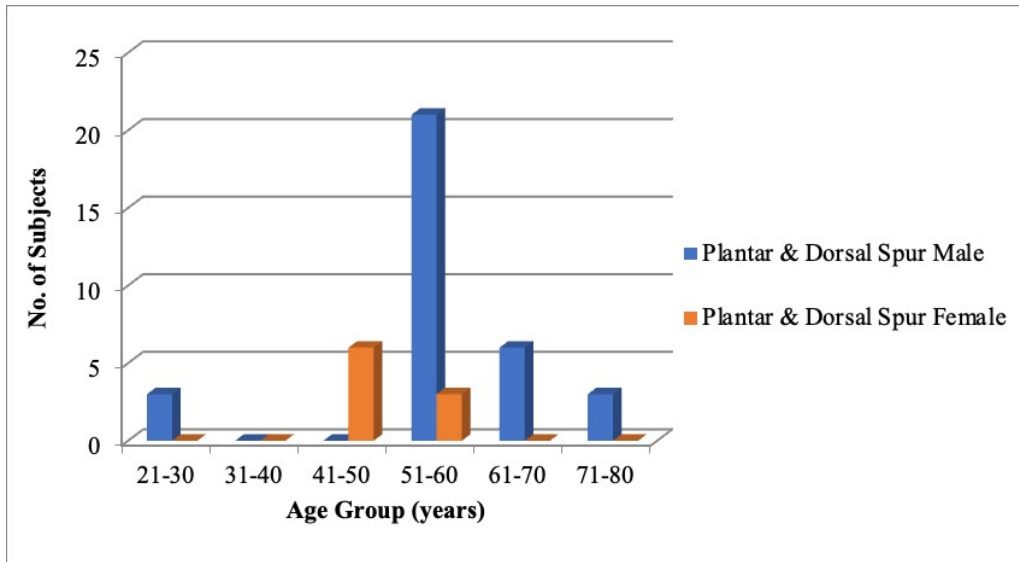


Fig 2: Bar diagram showing the association of plantar and dorsal spur in different age groups and gender.

to females (38.03%) who presented with heel pain (Table 1). It was important to see that none of the subjects presented with heel pain in the age group 31-40 years. Statistical analysis by Fisher’s exact test showed a significant value of $p < 0.0001$ for both male and female subjects having spur with heel pain.

Plantar spur was seen in 123 subjects (60 males and 63 females) and was most commonly encountered (46.34%) in the age group of 51-60. Considering its preponderance gender-wise, it was more common in females (51.22%) than males (48.78%). Using the chi-square test, categorical data were compared (Table 2). A p-value below 0.05 indicated statistical significance. A significant increase in plantar spur was noted till 60 years of age ($p = 0.0443$).

The dorsal spur was observed in 21 individuals (12 men and 9 females) and was most prevalent (57.14 percent) in those aged 51 to 60. It was more prevalent in males (57.14 percent) than in females (42.86 percent). The statistical analysis utilized Fisher’s exact test

(Table 3). A p-value less than 0.05 was judged statistically significant. A significant increase in dorsal spur was noted up to 60 years of age ($p = 0.0125$).

Both plantar and dorsal spurs were noted in 42 subjects (33 males and 9 females), and the highest number (57.14%) was noticed in the 51-60 years of age group. Males (78.57%) were most commonly affected as compared to females (21.43%). Statistical analysis was done by Fisher’s exact test (Table 4, Figure 2). A p-value less than 0.05 was considered significant. A significant increase in the presence of both plantar and dorsal spur was seen till the age of sixty years ($p = 0.0011$) after which it declined.

DISCUSSION

Calcaneal spurs in the Achilles tendon and plantar fascia are well-recognized, although their connection with age and gender remains uncertain [8]. The results of our study indicate that the prevalence of plantar and dorsal spurs varies by age and gender. We want to

highlight here that the present study is the first to depict the association of calcaneal spurs with age and sex in patients with heel pain in the North Indian population.

The pathogenesis of plantar spurs is still up for debate. Bergmann stated that it is caused by the recurrent traction of the plantar fascia insertion into the calcaneus, which results in inflammation and reactive ossification of the enthesis [9]. However, according to Kumai and Benjamin, plantar spurs result from vertical compression and cannot be traction spurs because they do not grow within the plantar fascia itself [10]. As a result, they are essentially distinct from Achilles tendon spurs, as they arise due to degenerative alterations in the plantar fascia enthesis. This description is consistent with findings from earlier research indicating that the bone trabeculae of plantar spurs are vertically orientated, suggesting that the forces responsible for spur development may arise from vertical loading [11]. Similarly, Weiss demonstrated that dorsal spurs are partially the result of prolonged activity, whereas plantar spurs result from prolonged standing and excess weight [12].

Association of calcaneal enthesophytes with heel pain: According to a study by Williams et al. [13], 75% of heels have spurs. Prichasuk and Subhadrabandhu discovered calcaneal spur in 15.5% of the normal population (n = 400) and 65.9% of plantar heel pain patients (n = 82), leading them to conclude that it is one of the causes of heel pain [14]. We discovered spurs of either type in 87.32 percent of patients with heel discomfort, which is comparable to previous research. However, Lourdes and Ram identified a 59 percent incidence of the calcaneal spur in the community of South Indians with heel discomfort [15].

Association of calcaneal enthesophytes with age: In the present study, the prevalence of calcaneal spur was reported to be maximum (n=93, 50%) in the age group of 51-60 years. This data is remarkably similar to that of Bassiouni, who discovered that the frequency of calcaneal spurs increased with age (highest in the 41–60 year age group) in osteoarthritis and rheumatoid arthritis patients compared to healthy controls [16].

The present study also runs parallel with Banadda et al. who observed a 50% frequency of calcaneal spurs among Zimbabwean hospital patients over 51 years of age [17].

Weiss also noted that the occurrence of spurs increased with age [12]. Beytemür and Oncü found that the incidence of plantar calcaneal spur rose with age in the Turkish population, but there was no correlation with gender or location. Over the age of 70, the incidence rate was highest at 41.8 percent. They discovered that the incidence of posterior calcaneal spur rose with age and female gender, but there was no association with the location. The highest prevalence was recorded at 22.3 percent between the ages of 61 and 70 [18].

But in our study, the highest incidence was noted in the age group of 51-60 years while it was very less over 70 years of age. This difference may be due to varied populations as in India, long periods of standing and sustained activities are a part of routine jobs and these spurs take time to develop, therefore their presence are seen maximum in this age group. Toumi et al. [19] showed that the prevalence of spurs peaked at 22 percent in the age span of 60–69 years, but thereafter dropped. But we noted that the maximum prevalence was at 51-60 years and then decreases thereafter.

The present study demonstrated that patients between the ages of 21 and 30 presenting with heel pain have a relatively low incidence of calcaneal spurs, suggesting that spur production is part of a degenerative process leading to osteophyte formation manifesting as a bony growth. The low prevalence of spurs in age groups less than 30 years suggests that spurs require considerable time to develop [20].

Another possible explanation is that the development of such spurs is not primarily due to mechanical stress associated with exercise, as this age group is the most physically active [21,22].

In a comprehensive review, Irving et al. explored factors linked with chronic plantar heel pain. They analyzed 16 publications and concluded that higher weight and age were associated with plantar heel discomfort in the nonathletic group [23].

Association of calcaneal enthesophytes with gender: Toumi et al. [19] showed that the occurrence of spurs (Achilles and plantar) in adults 50 years of age was substantially greater in women than in men. Lourdes and Ram also reported an increased preponderance of females (60%) compared to males in the South Indian population [15]. Beytemür and Oncü showed that the posterior (dorsal) calcaneal spur appears more common in females. However, there was no difference in the frequency of the plantar calcaneal spur between males and females [18]. But the present work reported that males (49.30%) were more likely to have a spur presence than females (38.03%). In India, this difference may be due to occupation with prolonged standing and strenuous activities performed by males as a part of routine jobs. Considering the types of spur, the occurrence of plantar spur was more common compared to dorsal spur in both males and females. According to multiple studies, females had a higher incidence of plantar calcaneal spurs [17,24,25]. Our study also runs parallel with these studies as the incidence of plantar spur was higher in females (51.22%). However, some studies indicate no gender differences [20,26]. Menz et al. discovered spurs to be equally prevalent in both sexes of patients [8].

Numerous systemic disorders, particularly inflammatory diseases, such as rheumatoid arthritis, diffuse idiopathic skeletal hyperostosis, ankylosing spondylitis, Reiter syndrome, acromegaly, and psoriatic arthritis, can be associated with calcaneal spur. Moreover, obesity, age, pes planus, professions requiring extended standing, and sports are risk factors for calcaneal spurs [27-29], and calcaneal spurs are typically bilateral in these conditions. Nevertheless, unilateral spurs are frequently detected in most cases of heel pain [10].

Limitations: The study was not correlated with occupation. Some patients were not subjected to x-rays of both lower limbs due to unilateral heel pain, so laterality could not be compared.

CONCLUSION

The prevalence of calcaneal spur in the North

Indian population with heel pain was 87.32%. As it is one of the commonest causes of heel pain; so regular exercise, lifestyle modification, and proper selection of footwear should be practiced in routine to overcome the degenerative process leading to the formation of a calcaneal spur.

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Author-Co-Author Contribution

AR- Design of study, Concept, Implementation of study protocol, Data analysis;

RKV, AKP, NA- Coordination and Manuscript review and revision, Literature survey;

GS, RKD- Concept, design, Clinical protocol, data collection;

GS, NA- Review Manuscript and Manuscript revision;

NA, AR, GS- Statistical Analysis and Interpretation, Manuscript preparation and Submission of article

Conflicts of Interests: None

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