Cureus
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Open Access Case Report

CT Diagnosis of a Plantar Calcaneal Enthesophyte Fracture Following Initially Negative Radiographs

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Review began 10/13/2026
Review ended 10/16/2026
Published 10/19/2026

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DOI: 10.7759/cureus.118201

Abstract

Fracture of a plantar calcaneal enthesophyte is an uncommon injury that may be difficult to detect on radiographs. A 50-year-old woman presented with sharply localized plantar heel pain after direct axial trauma to the right heel. Initial right-foot radiographs and subsequent contralateral comparison radiographs were interpreted as negative for acute fracture. Persistent focal pain prompted repeat evaluation approximately 24 hours later. Noncontrast computed tomography demonstrated an isolated minimally displaced fracture confined to the plantar calcaneal enthesophyte, without extension into the calcaneal tuberosity, calcaneal body, or adjacent joints. Orthopedic consultation recommended nonoperative management with short-term immobilization, analgesia, and protected weight-bearing. This case demonstrates that a plantar enthesophyte fracture may remain occult on initial radiographs despite focal post-traumatic symptoms. Persistent, well-localized plantar heel pain after negative radiographs should prompt consideration of computed tomography to establish the diagnosis and exclude more extensive calcaneal injury.

Categories: Radiology, Emergency Medicine, Orthopedics
Keywords: calcaneal spur fracture, computed tomography, minimally displaced fracture, occult fracture, plantar calcaneal enthesophyte

Introduction

Plantar calcaneal enthesophytes, commonly termed plantar heel spurs, are osseous proliferations arising from the plantar calcaneal tuberosity in relation to the plantar fascia and adjacent soft-tissue attachments [1-3]. Although these enthesophytes are frequently encountered on imaging, their relationship to plantar heel pain is variable, and they may represent incidental findings [1,3]. The published literature on acute plantar calcaneal enthesophyte fractures consists largely of individual case reports and brief communications describing traumatic injuries [4-14]; the true incidence of this injury is unknown.

Because an enthesophyte is usually a chronic finding, a subtle nondisplaced fracture may be difficult to distinguish radiographically from its pre-existing irregular morphology. Published reports have described these fractures as easily missed [13]. In our narrative assessment of published cases with accessible imaging details, diagnosis generally relied on radiography, and cross-sectional imaging was infrequently discussed [4,7-14].

We report an isolated minimally displaced plantar calcaneal enthesophyte fracture diagnosed with computed tomography (CT) after an initially negative radiographic examination, illustrating a diagnostic pitfall and the value of cross-sectional confirmation.

Case Presentation

A 50-year-old woman presented to the emergency department approximately two hours after falling and landing directly on her right heel. She was evaluated by the emergency physician and subsequently by an orthopedic fellow during the initial visit. Although comfortable at rest, she walked with an antalgic gait, avoiding heel strike. Examination revealed mild plantar heel swelling and sharply localized tenderness over the plantar medial calcaneal tuberosity at the site of the enthesophyte. There was no skin compromise, deformity, or tenderness over the posterior calcaneus, Achilles insertion, malleoli, or midfoot. Calcaneal squeeze testing elicited minimal pain, ankle and subtalar motion were preserved, and the foot was neurovascularly intact.

Anteroposterior, oblique, and lateral radiographs of the right foot demonstrated a plantar calcaneal enthesophyte but were interpreted as negative for acute fracture (Figure *1*). Dedicated calcaneal radiographic views were neither considered nor obtained. At the emergency physician's request, three-view radiographs of the left ankle were obtained for comparison. The plantar enthesophytes appeared similar on the lateral radiographs, reinforcing the initial impression that no acute fracture was present (Figure *2*). A heel contusion was documented as the provisional diagnosis. At discharge, the patient was advised to rest, elevate, and apply ice to the affected heel, and maintain protected weight-bearing as tolerated, with

crutches if needed. Acetaminophen, with or without a nonsteroidal anti-inflammatory drug if not contraindicated, was recommended for analgesia.



FIGURE 1: Initial Right-Foot Radiographs

Initial anteroposterior (A), oblique (B), and lateral (C) radiographs of the right foot obtained approximately two hours after injury demonstrate a plantar calcaneal enthesophyte (open arrow, C). No fracture line is identifiable, even on retrospective review. The examination was initially interpreted as negative for acute osseous injury.

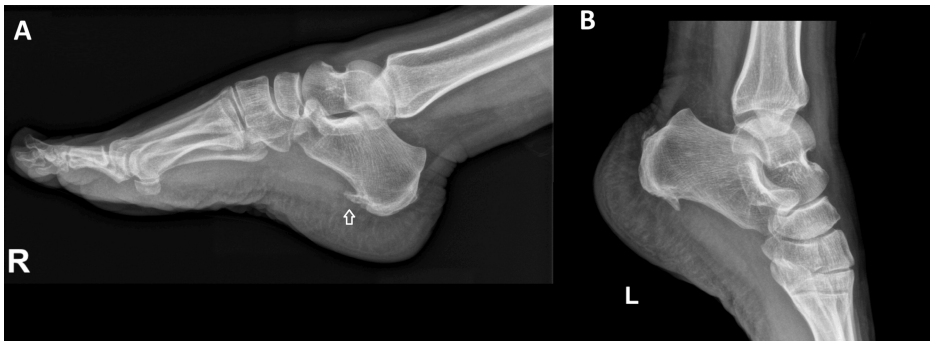


FIGURE 2: Comparison Lateral Radiographs

Comparison lateral radiographs of the injured right foot (A) and contralateral left ankle (B) demonstrate similar plantar calcaneal enthesophytes bilaterally. The open arrow in panel A indicates the plantar calcaneal enthesophyte on the symptomatic side. The minimally displaced fracture of the right plantar calcaneal enthesophyte was not identified on the initial radiographic interpretation.

The patient returned approximately 24 hours later and was reassessed in the emergency department. Her focal plantar heel pain remained unchanged, and she reported no additional trauma since the initial presentation. Noncontrast CT of the right hindfoot, performed with a slice thickness of 0.625 mm and sagittal and coronal multiplanar reconstructions, demonstrated a minimally displaced linear fracture confined to the plantar calcaneal enthesophyte (Figure 3). Maximum fragment displacement measured approximately 1 mm on the CT workstation. The fracture margins were sharp and non-corticated, supporting an acute injury rather than chronic enthesophyte fragmentation in the context of recent trauma. There was no extension into the calcaneal tuberosity, calcaneal body, subtalar joint, calcaneocuboid joint, or other articular surface, and no additional acute fracture was identified. The diagnosis was an isolated, minimally displaced right plantar calcaneal enthesophyte fracture that was radiographically occult on the initial examination.

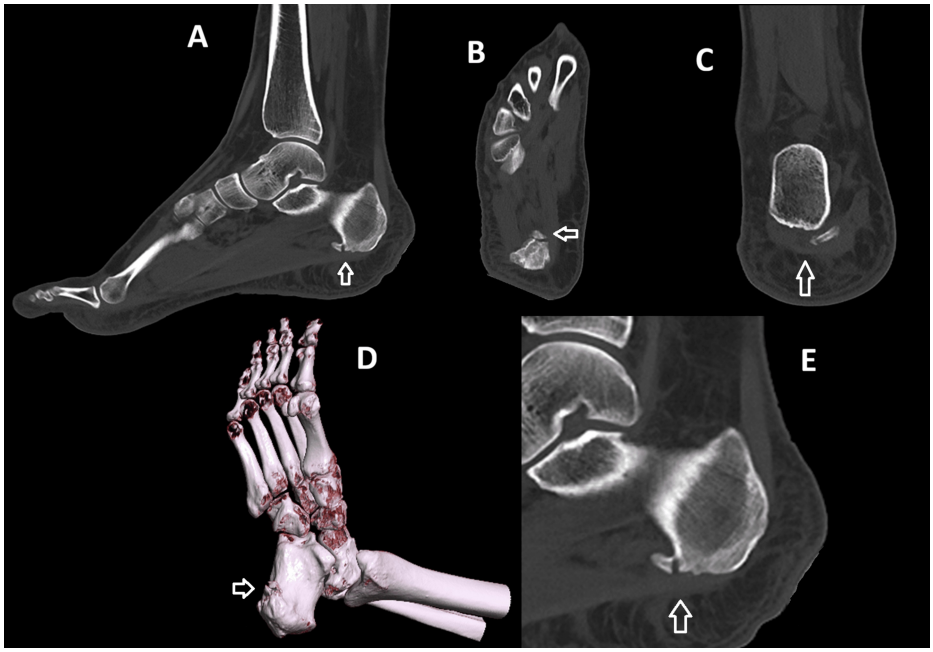


FIGURE 3: CT Findings

Noncontrast CT of the right hindfoot obtained at the second emergency department presentation. Sagittal (A), axial (B), coronal (C), and magnified sagittal (E) bone-window CT images demonstrate a minimally displaced fracture of the plantar calcaneal enthesophyte (open arrows). The three-dimensional volume-rendered reconstruction (D) provides supplementary visualization of the fracture location (open arrow). The fracture is confined to the enthesophyte without extension into the calcaneal tuberosity, calcaneal body, subtalar joint, or calcaneocuboid joint.

Following CT confirmation of the fracture, orthopedic consultation recommended nonoperative management with immobilization in a controlled ankle motion (CAM) walking boot for approximately four to six weeks, elevation, ice, analgesia, and protected weight-bearing with crutches as tolerated, followed by gradual progression to full weight-bearing. Whether the patient received or adhered to these recommendations was not documented. She did not attend the scheduled three-week follow-up appointment, and no subsequent telephone contact or medical-record follow-up was attempted. Consequently, treatment adherence, symptom resolution, fracture healing, and longer-term clinical outcomes could not be assessed.

Discussion

This case demonstrates a minimally displaced fracture confined to a plantar calcaneal enthesophyte that was radiographically occult and subsequently identified on CT. The principal diagnostic features were persistent, precisely localized plantar heel pain after direct trauma and CT confirmation of a fracture without extension into the calcaneal tuberosity, calcaneal body, or adjacent joints. The case therefore illustrates the limited radiographic conspicuity of a minimally displaced enthesophyte fracture and the complementary value of cross-sectional imaging in acute heel trauma.

Although plantar calcaneal enthesophytes are common imaging findings, fractures involving them have been described in a limited number of published case reports and brief communications; their true incidence remains unknown [4-14]. Reported mechanisms include direct heel impact, falls, and sudden plantar loading [4-14]. Plantar calcaneal enthesophytes arise at a complex attachment region involving the plantar fascia and adjacent soft-tissue structures rather than representing conventional joint-margin osteophytes [2,3]. Accordingly, the term plantar calcaneal enthesophyte fracture is anatomically more precise than osteophyte fracture, although calcaneal spur fracture is commonly used in previous reports [4-14].

In this patient, the fracture was not identifiable on the initial radiographs, even after retrospective review. The lack of a visible fracture line may relate to the minimal displacement, the irregular contour of the pre-existing enthesophyte, and superimposition at the plantar calcaneal margin. The similar appearance of the contralateral enthesophyte reinforced the initial impression that no acute fracture was present. However, differences in positioning and projection between the right-foot and contralateral left-ankle radiographs limit direct morphological comparison. Importantly, bilateral similarity of the underlying enthesophytes does not exclude an acute unilateral fracture through the symptomatic side, as a chronic enthesophyte may coexist with an acute traumatic injury.

In our narrative assessment of accessible published reports, plantar calcaneal enthesophyte fractures were generally demonstrated on radiographs [4,7-14], although at least one report described the injury as easily missed [13]. Published cases include unilateral and bilateral injuries, nondisplaced fractures, displaced fragments, and a reported case of subsequent nonunion [7,8,11-14]. In the reports reviewed, CT was not commonly emphasized as the examination establishing the initial diagnosis. The present case therefore provides a radiology-focused example in which CT established the diagnosis after an initially negative radiographic examination and confirmed that the fracture was confined to the enthesophyte.

CT demonstrated a linear fracture confined to the enthesophyte and excluded involvement of the calcaneal tuberosity, calcaneal body, subtalar joint, and calcaneocuboid joint. These findings established that the injury was isolated and helped exclude a more extensive calcaneal fracture. Multiplanar bone-window CT allowed assessment of the sharp, non-corticated fracture margins and orientation without the superimposition inherent to radiography, supporting an acute fracture rather than chronic fragmentation in the context of recent trauma. The three-dimensional reconstruction provided supplementary spatial visualization of the fracture location, whereas the multiplanar CT images established the diagnosis.

The imaging differential includes chronic enthesophyte fragmentation, an ununited previous fracture, ossification related to the plantar fascial attachment, and a fracture extending from the enthesophyte into the calcaneal tuberosity [2,3,8]. Acute plantar fascial avulsion should not be assumed solely from the location of the fracture because the attachment anatomy is complex and the mechanism cannot be established without corresponding soft-tissue imaging [2,3]. In this case, the acute traumatic presentation, focal tenderness, and CT-demonstrated fracture line supported an acute enthesophyte fracture. The absence of extension into the calcaneus distinguished it from injuries with potentially different clinical implications.

Earlier reports have generally described conservative management using immobilization, restricted or protected weight-bearing, analgesia, and gradual return to activity [7-9,11-14]. Nonunion and persistent symptoms have occasionally been reported, indicating that these injuries should not invariably be regarded as clinically insignificant [8]. In the present case, orthopedic consultation recommended nonoperative management, including immobilization in a CAM walking boot for approximately four to six weeks and protected weight-bearing. Whether these recommendations were followed was not documented. The patient did not attend the scheduled three-week follow-up, and no subsequent telephone contact or medical-record follow-up was attempted. Consequently, symptom resolution, fracture healing, and longer-term functional outcomes could not be assessed. The absence of follow-up is the principal limitation of this report. Additional limitations include the absence of MRI or ultrasonography to assess associated plantar fascial or soft-tissue injury and the inherent inability of a single case to determine diagnostic performance or optimal management.

The principal clinical learning message is that persistent, well-localized plantar heel pain after trauma should not be dismissed solely because initial radiographs are negative, particularly when tenderness corresponds to a pre-existing plantar enthesophyte. Careful clinical-radiologic correlation remains essential. CT should be selectively considered when persistent focal post-traumatic findings remain unexplained by radiography and clinical suspicion of an underlying fracture remains high, as it can confirm an isolated enthesophyte fracture and exclude more extensive calcaneal involvement.

Conclusions

An isolated plantar calcaneal enthesophyte fracture may be radiographically occult despite focal heel pain after trauma. In this case, CT demonstrated a minimally displaced fracture confined to the enthesophyte, without extension into the calcaneal tuberosity, calcaneal body, or adjacent joints. Persistent, well-localized post-traumatic plantar heel pain despite negative radiographs warrants careful clinical-radiologic correlation; CT may be selectively considered when clinical suspicion of an underlying fracture remains high.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Mohammed A. AlJarie

Acquisition, analysis, or interpretation of data: Mohammed A. AlJarie, Maha M. AlDhilan

Critical review of the manuscript for important intellectual content: Mohammed A. AlJarie, Maha M. AlDhilan

Supervision: Mohammed A. AlJarie

Drafting of the manuscript: Maha M. AlDhilan

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Not applicable issued approval Not applicable. Institutional Review Board approval was not required for this single-patient case report in accordance with institutional policy. Written informed consent for publication of the case report and accompanying images was obtained from the patient. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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