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CASE REPORT

Heterotopic Ossification of the Hindfoot: A Case Report

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ABSTRACT

We present a case of heterotopic ossification that spontaneously developed on the plantar surface of the left heel of a 38-year-old Filipino man. The diagnosis was made using plain radiography and a CT scan. Grossly, the mass resected was composed of discrete, mature bone tissue surrounded by extra-skeletal soft tissue, typical of heterotopic ossification. Histopathologic examination revealed a benign appearing bony tissue admixed with cartilaginous, fibromuscular, fibrocollagenous, and adipose tissues, further confirming the diagnosis

Keywords. ossification, heterotopic, foot diseases, soft tissue calcification, ectopic ossification, pathologic ossification

INTRODUCTION

Heterotopic ossification (HO) is a pathological condition characterized by the formation of mature lamellar bone in soft tissues where bone does not normally exist. It has been associated with trauma, surgery, neurologic injury, and genetic disorders, but can also occur spontaneously without clear predisposing factors. Although frequently observed in larger joints such as the hip, elbow, and knee, its occurrence in the foot, particularly the hindfoot, is rare. HO can present with pain, swelling, decreased range of motion, and in some cases, functional disability depending on its size and location. Diagnosis typically involves radiographic imaging and histopathological confirmation, while management ranges from conservative therapy to surgical excision in symptomatic cases. This report describes a rare case of heterotopic ossification on the plantar aspect of the heel in an otherwise healthy adult male, emphasizing the diagnostic approach, surgical management, and favorable outcome.

CASE

A 38-year-old, Filipino, city hall employee with an insignificant medical and surgical history, presented at the emergency room (ER) with a painful mass in the plantar aspect of the left heel. He reported that the mass appeared about four years ago, initially painless, without other associated symptoms. He tolerated his condition and did not consult. Eventually, the mass grew in size, causing difficulty in ambulation and, later, pain in the left foot; thus, prompting consultation and eventual admission.

Upon examination at the ER, a hard and tender mass was appreciated grossly on the left heel (Figure 1). We noted hyperkeratosis of the left heel, no draining sinus, no motor

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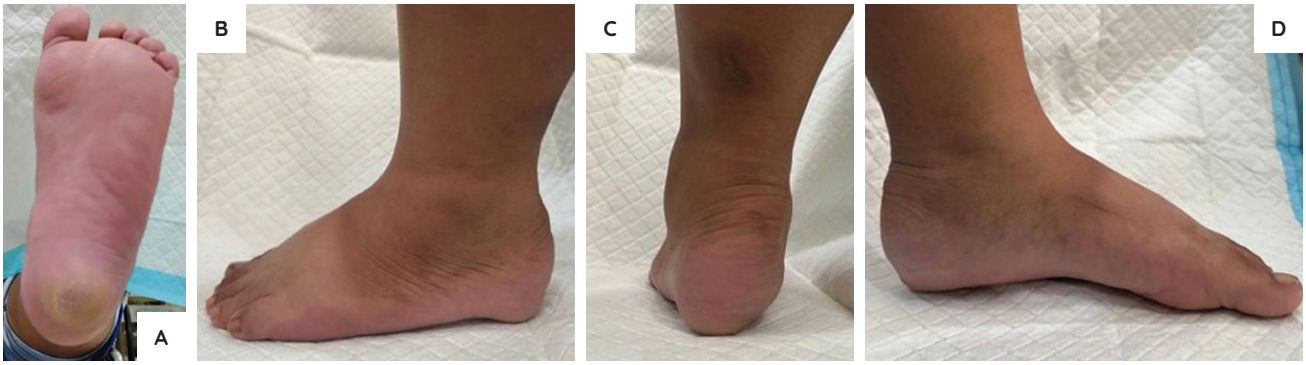

Figure 1. Gross images of the left foot showing a visible tyloma/skin callus on the plantar aspect of the heel **(A)**, lateral view **(B)**, posterior view **(C)**, and medial view **(D)**.

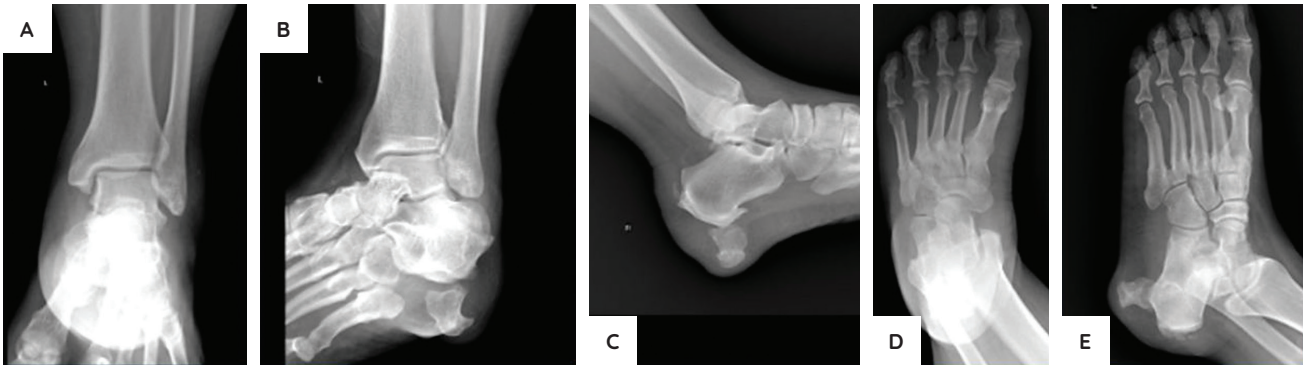

Figure 2. Radiographs of the patient's left ankle and foot showing the anterior-posterior view of the left ankle **(A)**, mortise view of the left ankle **(B)**, lateral view of the ankle clearly showing an extraosseous lesion inferior to the calcaneal tuberosity **(C)**, anterior-posterior view of the left foot **(D)**, and oblique view of the left foot **(E)**.

or sensory deficits, a capillary refill time (CRT) <2s, and strong peripheral pulses. Plain radiographs of the affected foot revealed an osseous lesion and several linear calcific densities on the plantar surface of the left foot. Mature heterotopic ossification was considered (Figure 2).

Computed tomography (CT) scan with 3D reconstruction of the affected foot revealed an irregularly-shaped extra-skeletal bony lesion on the plantar surface of the left foot, suggestive of heterotopic ossification as well as a large left calcaneal spur and calcification within the plantar fascia (Figure 3), strengthening the impression of heterotopic ossification.

We opted for surgical excision of the left pedal mass. In the surgical theater, the patient was placed in right lateral decubitus under anesthesia. We marked a curvilinear incision overlying the lateral border of the calcaneus and performed a modified lateral approach to the calcaneus, straight to the calcaneal periosteum and bone. The periosteum was incised along the line of the skin incision and was subsequently elevated as a whole tissue flap (Figure 4). The mass was exposed by subperiosteal elevation to minimize trauma to the heel fat pad. The soft tissue covering the mass was bluntly dissected, revealing a discrete, ossified formation with no noted bony connection between the lesion and the calcaneus. Yellowish fluid was noted in between the gaps. Additionally, fibrotic ligamentous tissue was discovered adherent to the lesion. The fibrotic ligament was sharply incised and was removed together with the mass en bloc with wide surgical margins. The surgical site was copiously irrigated, closed in layers, dressed loosely, and immobilized with a short leg splint.

Grossly, the mass was approximately 2.5 x 2.5 x 1.7 cm, solid, firm, composed of skeletal tissue, and encased in a capsule with fluid. Small bony outgrowths on the superior and inferior borders covered with hyaline-like tissue were also noted (Figure 5). The lesion was resected along with the small fibro-muscular tissue attached to the lesion and was sent for biopsy.

An immediate postoperative radiograph showed the absence of the previous calcaneal mass and any residual lesion (Figure 6). At postoperative day two, the surgical site was dry and well-apposed, with minimal redness and reduced swelling, signifying resolving postoperative inflammation. Furthermore, the patient reported eventual loss of pain and noted comfort and ease of movement in all ranges of motion of the left heel. Toe touch ambulation was advised to protect the wound bed temporarily. Fourteen days postoperatively, the wound was well-coaptated with no discharge, erythema, or any visible sign of infection. Minimal pain was noted around the wound (Figure 8). Twenty days postoperatively, the wound was completely healed, and sutures were removed. The patient further demonstrated the ability to stand on heel with comfort and without pain. Histopathology reported, grossly a pale tan bone fragment with attached soft tissue and cartilage, 2.5 x 2.5 x 1.7 cm

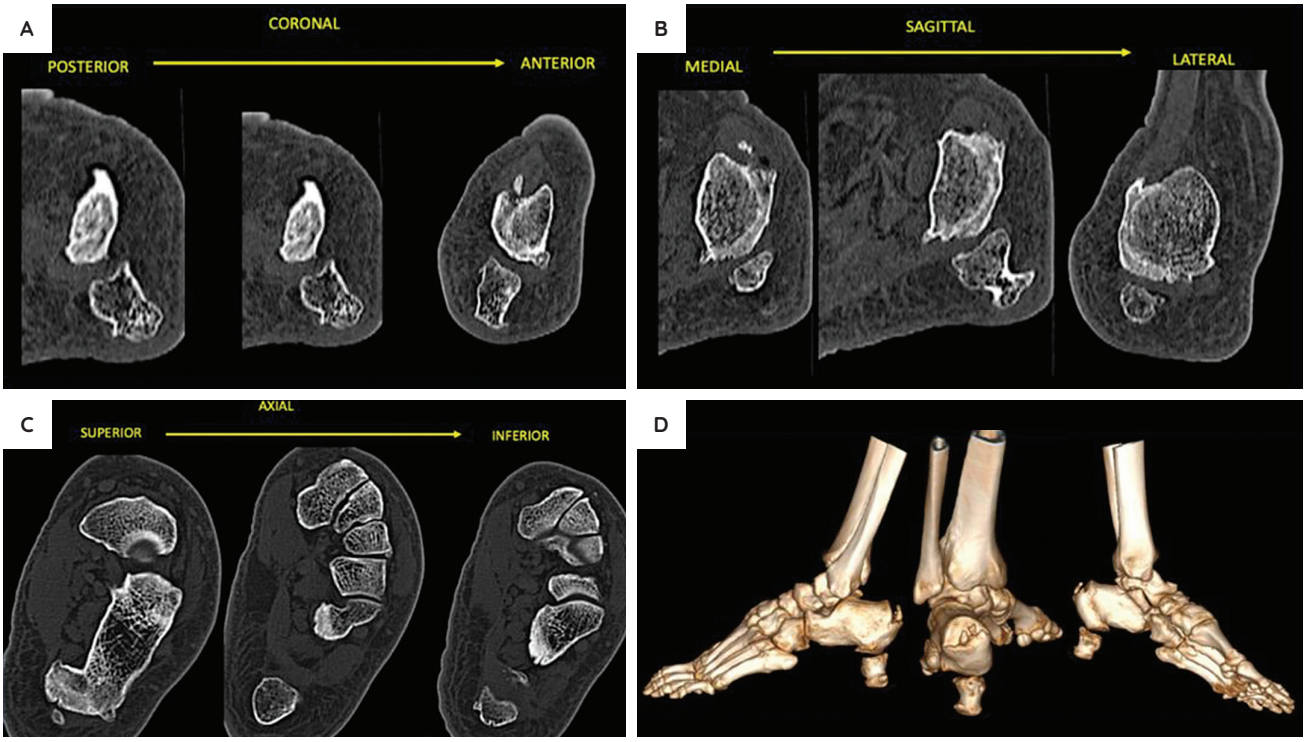

Figure 3. Diagnostic computed tomography scan of the patient's left foot showing coronal plane cuts from posterior to anterior **(A)**, axial plane cuts from superior to inferior **(B)**, sagittal plane cuts from medial to lateral **(C)**, and 3D reconstruction of the foot **(D)**.

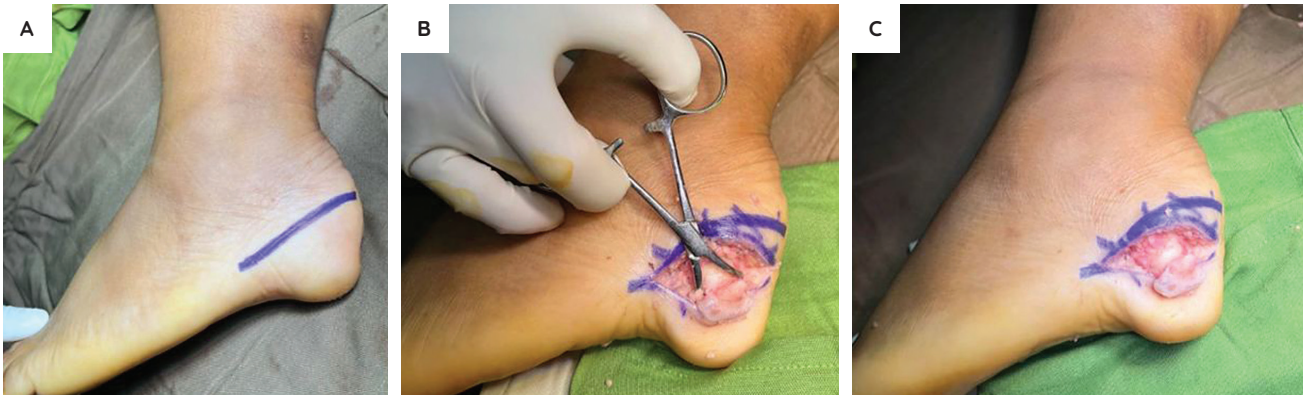

Figure 4. Incision and Exposure showing the marked incision overlying the lateral border of the calcaneus **(A)**, surgical tenaculum grasping the bony outgrowth **(B)**, and exposure of the lesion with the periosteum subperiosteally elevated and incised **(C)**.

in size. On sectioning, the specimen revealed a pale tan, homogenous, solid cut surface. Microscopic examination showed mature lamellar bone admixed with fibrocollagenous connective tissue, cartilaginous tissue, skeletal muscle fibers, and adipose tissue. However, there were no cytologic atypia or pleomorphism suggestive of a neoplastic process (Figure 10). These microscopic findings are suggestive of heterotopic ossification.

DISCUSSION

Heterotopic ossification (HO) is defined as the formation of mature lamellar bone within soft tissues where bone is not normally present, such as muscle, fascia, and adipose tissue.[1,2] Unlike dystrophic calcification, HO represents true ossification with organized lamellar architecture and, in mature stages, may contain marrow elements.[3] Although most commonly reported around large joints such as the hip and elbow, involvement of the foot and ankle has also been documented, including the hindfoot.[4,5]

Acquired HO is thought to arise from aberrant differentiation of mesenchymal progenitor cells in response to local inflammation, tissue injury, or altered microenvironmental signaling, leading to osteogenic activity.[1,6] Bone morphogenetic proteins and other signaling pathways play key roles in promoting endochondral ossification. Common triggers include trauma, surgery, fractures, burns, neurologic injury, and systemic conditions, although idiopathic cases have been reported.[7-10] The condition is broadly classified into acquired and hereditary forms, with acquired cases being more frequent.[11]

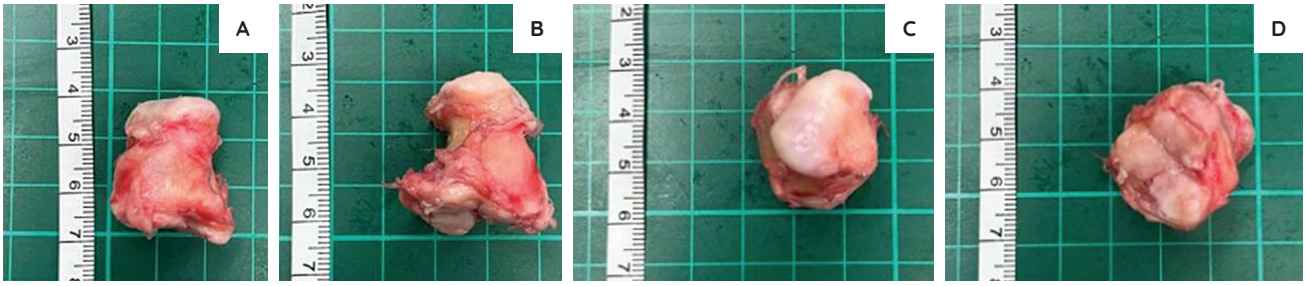

Figure 5. Gross morphological appearance of the excised lesion showing the medial view **(A)**, lateral view **(B)**, inferior view **(C)**, and superior view **(D)** demonstrating that it is discontinuous with the cortex of the calcaneus.

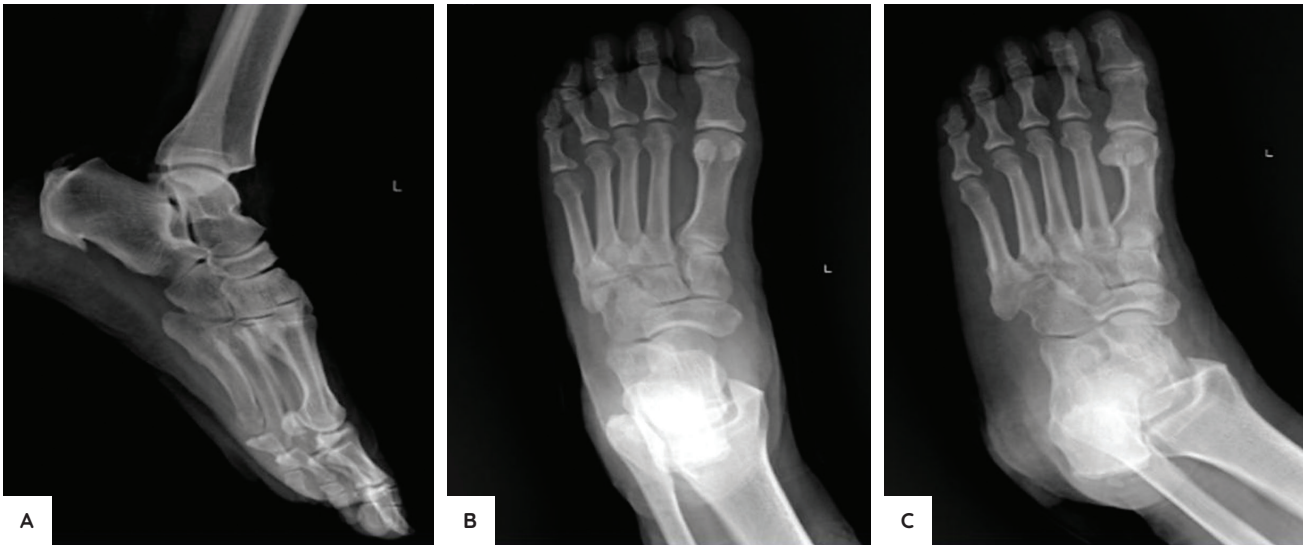

Figure 6. Immediate post-operative foot radiographs showing the lateral view **(A)**, anterior-posterior view **(B)**, and oblique view **(C)**.

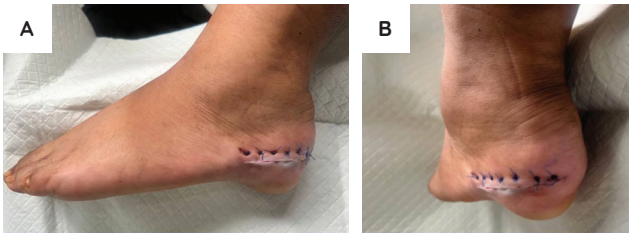

Figure 7. Post-operative Day 1 gross images showing the lateral view **(A)** and posterior view **(B)**.

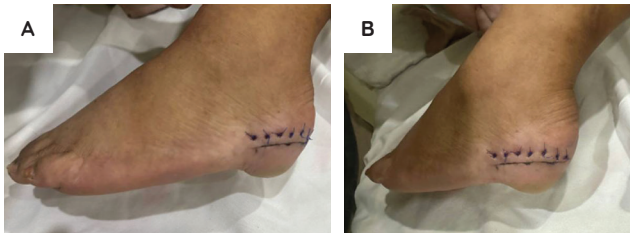

Figure 8. Post-operative Day 14 gross images showing the lateral view **(A)** and posterior view **(B)**.

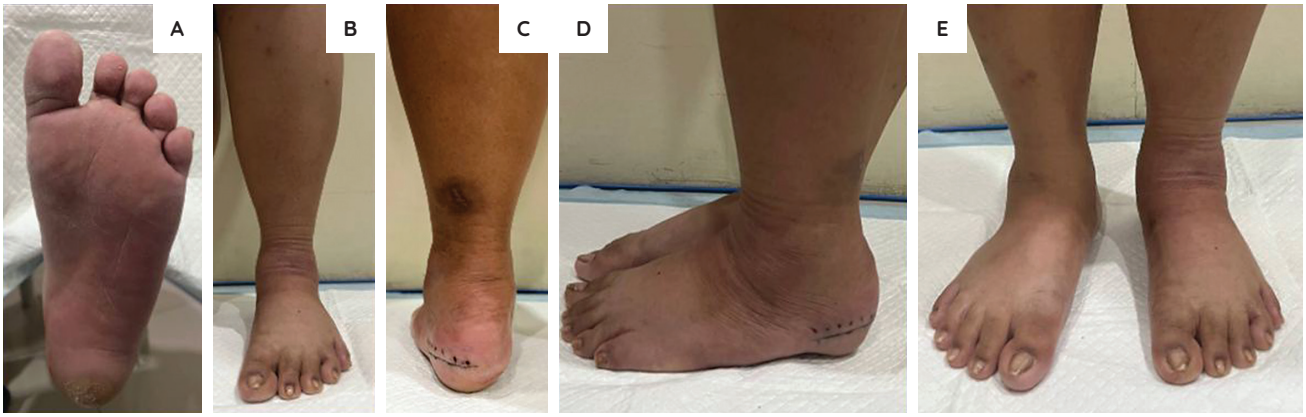

Figure 9. Post-operative Day 19 gross images showing the plantar view **(A)**, anterior view **(B)**, posterior view **(C)**, lateral view **(D)**, and bilateral foot anterior weight-bearing view **(E)**.

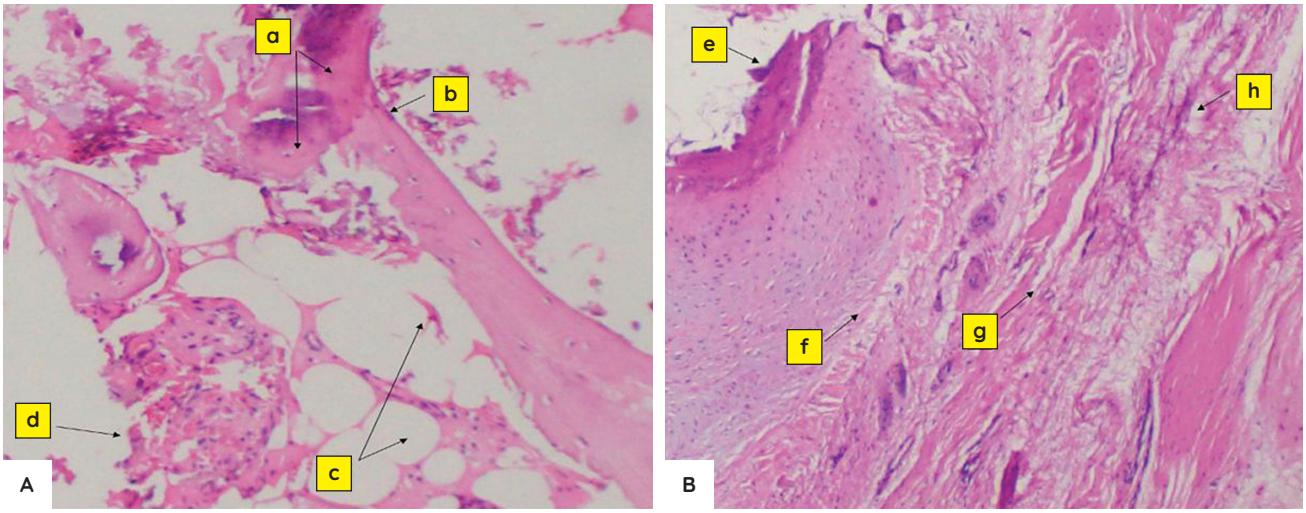

Figure 10. Histopathologic features of the excised plantar heel mass. **(A)** Low-power objective (LPO) showing heterotopic mature compact bone formation (a), prominent osteoblastic rimming (b), surrounding adipose and fibromuscular tissue (c), and areas of granulation tissue (d). **(B)** Scanning power showing zonal architecture identified, including the peripheral zone (outer–most mature) with well-formed lamellar bone and evident osteoblastic rimming (e), the intermediate zone (middle) with osteoid deposition with woven bone formation (f), the central zone (inner–least mature) with spindle-shaped fibroblastic proliferation and fibro-collagenous and fibromuscular tissue (g), and background myxoid stroma with no cytologic atypia or pleomorphism (h).

In this case, HO occurred in the hindfoot without a history of trauma, surgery, neurologic disease, or systemic disorder. Although molecular studies were not performed, the lesion is best classified as acquired HO of uncertain etiology. Repetitive mechanical stress at the plantar heel may have contributed to a localized pro-osteogenic environment due to chronic traction at the plantar fascia enthesis, an area subjected to high biomechanical loading.[1,12] The absence of multifocal lesions and family history makes hereditary HO unlikely.

Radiographically, HO typically demonstrates peripheral ossification with relative central lucency during maturation. Plain radiography is useful once mineralization is established, while computed tomography provides superior delineation of zonal maturation and lesion boundaries. Magnetic resonance imaging may assist in distinguishing HO from malignant soft-tissue tumors in early stages.[4,11,13]

In this case, imaging revealed a well-circumscribed calcified mass separate from the calcaneus, with CT demonstrating peripheral maturation and absence of cortical destruction or aggressive periosteal reaction, findings consistent with mature HO.

Histologically, HO shows characteristic zonal maturation with a central fibroblastic zone and peripheral trabecular or lamellar bone formation.[1] Mature lesions lack cytologic atypia and infiltrative growth, distinguishing them from malignant bone-forming tumors.[3] The present case demonstrated mature lamellar bone within fibrocollagenous, fibrocartilaginous, and adipose tissue without atypia, supporting a benign ossifying process.

The differential diagnosis included myositis ossificans (MO), fasciitis ossificans, soft-tissue osteosarcoma, calcific tendinopathy, and fibro-osseous pseudotumor. MO is a benign fibro-osseous lesion with zonal architecture and is associated with COL1A1::USP6 rearrangements.[14] Although often post-traumatic, it may occur without a clear inciting event. Molecular testing was not performed in this case, limiting definitive exclusion of MO. However, the absence of malignant cytologic features and the overall clinico-radiologic correlation favored HO. Soft-tissue osteosarcoma was unlikely due to the lack of atypia, malignant osteoid, and infiltrative growth. Calcific tendinopathy was excluded based on the presence of organized lamellar bone rather than amorphous calcification.

The presence of a calcaneal spur and plantar fascia calcification suggested that chronic plantar fasciopathy and repetitive traction forces may have contributed to reactive ossification. Mechanical loading at the plantar fascia enthesis is known to be associated with spur formation and may promote a localized osteogenic environment.[15-18]

Surgical excision, with careful preservation of surrounding soft tissues, was performed to treat the progressive pain and functional limitation. The patient had a good postoperative recovery without recurrence, consistent with previously reported successful outcomes in localized HO of the foot and ankle.[4,5]

Overall, this case highlights an unusual presentation of acquired HO in the hindfoot. Diagnosis required integration of clinical, radiologic, and histopathologic findings, and although molecular confirmation was not available, the combined features supported a diagnosis of acquired HO of uncertain etiology.

CONCLUSION

This case demonstrated a rare presentation of heterotopic ossification in the hindfoot without identifiable predisposing factors. Diagnosis was established through careful clinical, radiologic, and histopathologic correlation. Surgical excision proved effective, relieving symptoms and restoring function. The favorable outcome highlights the importance of individualized management in cases with low suspicion for hereditary disease and supports surgical intervention as a safe and definitive treatment for symptomatic, non-genetic HO.

ETHICAL CONSIDERATION

Patient consent form was obtained before manuscript submission.

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STATEMENT OF AUTHORSHIP

All authors certified fulfillment of ICMJE authorship criteria.

CREDIT AUTHOR STATEMENT

JDDC and MCG: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing – original drat preparation, Writing – review and editing, Visualization, Supervision, Project administration, Funding acquisition.

DATA AVAILABILITY STATEMENT

The datasets generated and analyzed in this study are included in the published article.

AUTHOR DISCLOSURE

The authors declared no conflict of interest.

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None.

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