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A Rare Footprint of TB: Isolated Cuboid Involvement in Skeletal Tuberculosis

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Abstract

Tuberculosis (TB) continues to be a pressing global health issue, with skeletal involvement accounting for a minor proportion of total cases. TB affecting the foot is particularly uncommon, and isolated involvement of the cuboid bone is exceptionally rare. This report discusses the case of a 21-year-old male presenting with pain and swelling in the dorsolateral region of the left midfoot. A CT-guided biopsy followed by histopathological analysis confirmed necrotizing granulomatous inflammation consistent with Mycobacterium tuberculosis. The patient underwent a six-month regimen of anti-koch therapy (AKT) alongside a strict non-weight-bearing protocol, which led to marked clinical improvement. This case underscores the importance of histopathological verification in diagnosing rare extrapulmonary TB presentations and reinforces the efficacy of current treatment strategies.

Keywords: Granulomatous, Tuberculosis, Skeletal TB, swelling

Introduction

Tuberculosis (TB) remains a major public health challenge worldwide and ranks as among the leading cause of mortality due to infectious disease. In 2022, thirty countries accounted for 87% of the global TB burden, with India contributing the highest share at 27%, followed by Indonesia, China, the Philippines, Pakistan, Nigeria, Bangladesh, and the Democratic Republic of the Congo[1].

While pulmonary TB constitutes the majority of cases, extrapulmonary forms—particularly skeletal TB—require clinical attention due to their atypical presentation. Skeletal TB is relatively uncommon, comprising approximately 1–2% of total TB cases. Within this subset, foot involvement is seen in about 10% of cases, and cuboid bone infection is exceedingly rare [2]. This case report documents a rare instance of isolated cuboid tuberculosis in a young male, emphasizing diagnostic challenges, therapeutic response, and relevant literature comparisons.

Case Presentation

A 21-year-old male presented in October 2024 with a history of gradually worsening pain and swelling over the dorsolateral aspect of the left midfoot for the past three months. The pain was insidious in onset, aggravated by walking, and relieved with rest and over-the-counter

analgesics. The swelling increased progressively and was described as firm, non-compressible, and immobile, measuring approximately 5 × 4 × 3 cm. The patient denied any systemic symptoms or underlying medical conditions.

On physical examination, a tender, fixed, non-fluctuant swelling was noted in the lateral midfoot, without any signs of local warmth or skin discoloration. Initial imaging raised suspicion for a benign bone tumor such as chondroma or a giant cell tumor (Figure 1). However, CT-guided biopsy revealed granulomatous inflammation, raising the possibility of tuberculosis. Histopathology subsequently confirmed the presence of necrotizing granulomatous inflammation (Figure 2). A confirmatory open biopsy along with cartridge-based nucleic acid amplification testing (CBNAAT) identified rifampicin-sensitive Mycobacterium tuberculosis.

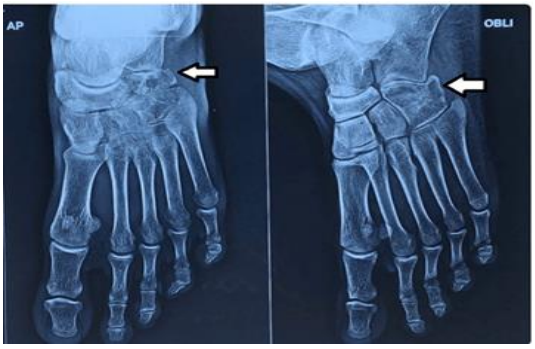

Figure 1: Anteroposterior and oblique radiographs of the left foot at presentation demonstrating an osteolytic lesion involving the cuboid bone.

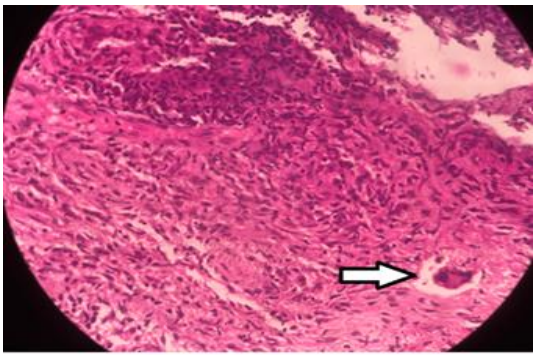

Figure 2: Histopathological section from the CT-guided biopsy of the left cuboid lesion showing necrotizing granulomatous inflammation, indicative of tuberculous etiology.

The patient commenced first-line AKT and was advised complete non-weight-bearing for one month, progressing to partial weight-bearing and eventual full mobilization. By the end of the six-month treatment course, the patient had experienced substantial relief in pain and swelling and was symptom-free at follow-up (Figure 3).

Figure 3: Serial radiographs demonstrating progressive resolution of the cuboid lesion following initiation of anti-koch therapy (AKT).

A, B: Radiographs obtained after one month of AKT showing initial signs of healing.

C, D: Radiographs at two months indicating continued regression of the osteolytic lesion.
E, F: Post-treatment radiographs following completion of the ATT course, revealing significant radiological improvement and near-complete resolution of the lesion.

Discussion

Osteoarticular tuberculosis commonly arises secondary to a primary pulmonary or extrapulmonary focus, which is frequently subclinical or undetectable at the time of diagnosis. Although tuberculosis involving the foot is an uncommon manifestation, it poses distinct diagnostic challenges due to the anatomical complexity and articulatory interconnectivity of the midfoot—particularly the Lisfranc and subtalar joints[3]. The present case of isolated cuboid tuberculosis is consistent with existing literature, which emphasizes that, despite its rarity, foot TB warrants a high index of suspicion owing to its potential for contiguous spread across adjacent joints. Diagnosing foot TB can be particularly difficult, as its radiologic presentation often mimics neoplastic or inflammatory conditions. In our case, initial imaging suggested a differential diagnosis of chondroma or giant cell tumor (GCT), highlighting the critical role of histopathological examination in establishing a definitive diagnosis. The biopsy revealed necrotizing granulomatous inflammation, characteristic of tuberculosis, thereby aligning with the observations of Procopie et al., who underscored the indispensable role of tissue biopsy in differentiating TB from other mimicking pathologies[4]

The favorable clinical outcome observed in our patient following a six-month regimen of anti-tubercular therapy (ATT) aligns with established therapeutic guidelines for skeletal tuberculosis. Standard management typically comprises a combination of first-line agents—isoniazid, rifampicin, pyrazinamide, and ethambutol—administered over an extended duration to ensure both symptomatic relief and microbiological clearance[5]. In this case, the resolution of pain and swelling, coupled with radiological evidence of improvement, supports the efficacy of ATT in managing osteoarticular TB. These findings are consistent with previous reports by Davidson and Horowitz et al., who documented successful treatment outcomes in skeletal TB, including rare presentations involving the foot[6].

The exceptional rarity of tuberculosis involving the cuboid bone is well documented in the literature. Epidemiological data indicate that only approximately 14.1% of skeletal tuberculosis cases involve the foot and ankle, with isolated cuboid involvement representing an even smaller subset. This underscores the diagnostic uniqueness of the present case and reinforces the need for heightened clinical suspicion in atypical presentations. Notably, the incidence of skeletal TB remains disproportionately higher in regions where tuberculosis is endemic, often influenced by socioeconomic conditions that facilitate reactivation of latent infections[7].

The diagnostic approach to tuberculosis includes conventional methods such as culture and direct microscopy, alongside advanced molecular techniques like nucleic acid amplification tests (NAATs) and whole genome sequencing. However, the implementation of these tools is frequently constrained by resource availability, cost, turnaround time, and the need for skilled personnel. Ongoing research aims to enhance the accuracy and accessibility of current diagnostic platforms while also advancing novel technologies.

Therapeutic strategies are guided by the drug susceptibility profile of the *Mycobacterium tuberculosis* isolate. Currently, 16 novel anti-tubercular agents are undergoing evaluation in phase I or II clinical trials, with an additional 22 candidates in preclinical development.

Many of these investigational drugs are oral formulations, and several are being assessed in the context of shortened treatment regimens, which aim to improve adherence, minimize toxicity, and reduce the risk of resistance or relapse.

In parallel, intensified efforts are being made to identify and treat latent TB infection, particularly among high-risk populations, in order to interrupt disease progression and transmission. New pharmacologic regimens for latent TB, as well as promising post-exposure vaccine candidates, are under investigation. Achieving meaningful progress in TB control requires sustained global collaboration, resource sharing, and coordinated research to overcome both diagnostic and therapeutic challenges[8].

This case adds to the limited body of evidence on cuboid tuberculosis by illustrating favorable clinical outcomes achieved through a standard anti-koch therapy (AKT) regimen combined with strict non-weight-bearing protocols. It highlights the necessity of including tuberculosis in the differential diagnosis of atypical midfoot lesions, particularly in endemic regions. Furthermore, the clinical course observed in this patient reinforces current literature supporting the effectiveness of conventional ATT in managing rare skeletal TB presentations.

Conclusions

Cuboid tuberculosis is an extremely rare form of skeletal TB, often mimicking neoplastic or inflammatory bone conditions, which can delay diagnosis and appropriate treatment. This case report presents an 18-year-old male with persistent midfoot pain and swelling, ultimately diagnosed with isolated cuboid TB. Initial radiological assessments suggested a bone tumor; however, histopathological examination and CBNAAT confirmed necrotizing granulomatous inflammation caused by Mycobacterium tuberculosis. The patient responded well to a standard six-month anti-koch therapy (AKT) regimen alongside strict non-weight-bearing management, with complete resolution of symptoms.

This case highlights the importance of considering TB in the differential diagnosis of chronic foot lesions, especially in endemic areas. It reinforces the value of biopsy and molecular testing in distinguishing TB from other musculoskeletal conditions. Despite its rarity, skeletal TB, including atypical sites like the cuboid, can be effectively treated with conventional AKT protocols when diagnosed early.

The report adds to the limited literature on foot TB and underscores the need for continued clinical vigilance and awareness, particularly in resource-limited settings. Early recognition, accurate diagnosis, and prompt therapy are crucial to achieving favorable outcomes and preventing long-term complications in rare presentations of osteoarticular TB.

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