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Corynebacterium striatum as a Rare Cause of Acute Calcaneal Osteomyelitis and Bacteremia: A Case Report and Literature Review

Woo Young Chun[1*], Thomas O'Brien[2], Hadeel Zainah[2]

[1]Foot and Ankle Surgical Department, Kent Hospital, Warwick, RI, USA
[2]Infectious Disease Department, Kent Hospital, Warwick, RI, USA
Email: *cjsgodaos2@gmail.com

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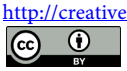

Abstract

Corynebacterium striatum is commonly regarded as part of the normal skin flora, leading many clinicians to overlook its presence in wound or blood cultures. However, the severity of infections caused by *C. striatum* should not be underestimated particularly in immunocompromised individuals or those with prosthetic valves. In this case report, we present a 33-year-old diabetic patient with a left plantar heel ulcer who underwent partial calcanectomy with bone biopsy and was found to have both *C. striatum* bacteremia and osteomyelitis. The patient received appropriate antibiotic therapy, including intravenous vancomycin or oral linezolid, during different hospital admissions. The concurrence of *C. striatum* bacteremia and osteomyelitis is rarely documented in current literature. This case highlights the potential pathogenesis of *C. striatum,* causing bacteremia and osteomyelitis, emphasizing the need for increased clinical awareness of this emerging pathogen.

Keywords

Corynebacterium Striatum, Osteomyelitis, Bacteremia

1. Introduction

Corynebacterium striatum (C. striatum) is one of the corynebacterium species and is considered an opportunistic pathogen. It is commonly found as part of the normal human nasopharyngeal and skin flora, primarily residing on the skin of the cheek, forehead, and upper part of the trunk [1]. While it possesses limited intrinsic virulence factors, such as pili and iron uptake mechanisms, its clinical significance primarily arises from its association with antibiotic resistance due to

misuse and early biofilm formation. As a result, *Corynebacterium striatum* infections can be particularly detrimental to immunocompromised individuals and those with prosthetic valves, leading to severe conditions such as bacteremia, osteomyelitis, endocarditis, and pneumonia [2]. It was first recognized as a potential pathogenic organism in 1980 by Bowstead and Santiago, who reported a case of pleuropulmonary infection in a patient with chronic lymphocytic leukemia [3].

Despite its association with various infections, *C. striatum* is rarely reported as a causative organism of osteomyelitis. A case of lumbar vertebral osteomyelitis caused by *Corynebacterium striatum* was first reported by Fernández-Ayala in 2001 [4]. There are limited case reports that documented concurrent presentation of *C. striatum* bacteremia and osteomyelitis. Our case report describes a patient with a heel ulcer who presented with both *Corynebacterium striatum* bacteremia and osteomyelitis, a rare occurrence in the current literature.

2. Case Report

The patient is a 33-year-old male with a medical history of diabetes, hypertension, lymphedema, and morbid obesity. He presented to the hospital with complaints of subjective fever and chills with left plantar heel ulcer. He reported worsening erythema and pain around the heel ulcer but denied any purulent drainage at home. He was hospitalized for a similar condition about two months previous. At that time, wound culture grew *Serratia*, and he was subsequently discharged with oral levofloxacin. An MRI was not performed due to body habitus.

Upon arrival to the emergency room, the patient's vital signs were stable, including a baseline blood pressure of 151/85 mmHg, a heart rate of 65 bpm, and a respiratory rate of 22 breaths per minute. However, the patient was febrile, with a temperature of 39.1˚C. On physical examination, cardiac auscultation revealed regular rate and rhythm without any murmur, lungs were clear to auscultation, and the abdomen was soft and nontender. General joint examination was unremarkable. Left dorsalis pedis pulse was palpable, while the left posterior tibial pulse was not palpable due to edema but had triphasic signals with doppler machine. His left plantar heel ulcer was measured approximately as 2.3 cm × 3.5 cm × 2.2 cm with fibronecrotic wound bed (30%/70%) and mild macerated edges. His left ulcer was probed to calcaneal bone, but did not reveal any purulent drainage, fluctuance, or crepitus. Nail exam was unremarkable including no sign of splinter hemorrhage. Due to his large body habitus, advanced imaging including MRI was limited, resulting in suboptimal image quality. With the support of radiology, a series of three bone scans were performed, suggesting possible partial calcaneal osteomyelitis. Consequently, the patient underwent a partial calcanectomy with a bone biopsy from both proximal and distal margin of the resected calcaneus. The heel wound did not have dehiscence or necrosis after the surgery (**Figure 1** and **Figure 2**).

Cultures of both proximal and distal bony margins and one set of blood cultures grew *Corynebacterium striatum*. Susceptibility testing was done on the blood isolate

and showed that *C. striatum* was sensitive to daptomycin (Minimum inhibitory concentration (MIC) value of 1 mcg/ml), Linezolid (MIC value of <1 mcg/ml) and Vancomycin (MIC value of 0.5 mcg/ml). Due to associated bacteremia, a transthoracic echocardiogram was performed, which was negative for vegetations. *Intraoperative proximal bony margin cultures grew Staphylococcus epidermidis*, *Corynebacterium striatum*, *and coagulase-negative Staphylococcus*. The *C. Striatum* was considered a pathogenic organism given the concomitant bacteremia and a prolonged course of antibiotic therapy was indicated. As a result, a transesophageal echocardiogram was deferred at that time. The patient was initiated on broad-spectrum intravenous antibiotics, including vancomycin and cefepime, and was discharged with a six-week course of vancomycin via a peripherally inserted central catheter. Pathology showed benign bone containing fatty bone marrow with foci of normal hematopoiesis and focally scattered inflammatory cell infiltrate.

Figure 1. Plantar view of the left heel after partial calcanectomy.

Figure 2. Lateral view of the left heel after partial calcanectomy.

Ten months later, he was re-admitted with complaints of subjective fever. Following the previous partial calcanectomy, his surgical incision had healed completely;

however, due to non-compliance with ambulation using orthotics, the heel wound recurred. His diabetes was well-managed with oral metformin, as evidenced by his A1c level ranging from 6.3 to 6.5, but his other comorbidities such as morbid obesity and lymphedema added challenges on weight-bearing compliance and wound healing, increasing the risk of further infection. Upon physical evaluation, the wound was found to be superficial without bone exposure but was associated with signs of cellulitis, including erythema, edema, and warmth of the surrounding soft tissue. He was treated with broad-spectrum intravenous antibiotics, including vancomycin and piperacillin-tazobactam. Eventually, two sets of blood cultures grew *Corynebacterium striatum*, prompting discharge with a two-week course of oral linezolid to target *Corynebacterium striatum*.

3. Discussion

Corynebacterium striatum (*C. striatum*) is one of several species within the Corynebacterium genus, which also includes *C. aurimucosum*, *C. amycolatum*, *C. jeikeium*, *C. urealyticum*, *C. diphtheriae*, *C. minutissimum*, *C. accolens*, among others [5]. Historically, these species have been considered as part of the normal human flora, leading many clinicians to overlook their potential role in infection, particularly in immunocompromised patients or those with prosthetic valves. However, emerging evidence suggests that these bacteria may be more clinically significant than previously thought.

Over the past two decades, there has been an increasing number of case reports linking Corynebacterium species to osteomyelitis. In 2010, Wong *et al.* was the first to report pelvic symphysis osteomyelitis associated with *C. accolens* [5]. Similarly, Ansari *et al.* described a case of tibial osteomyelitis caused by *C. minutissimum* [6]. More recently, in 2024, Trivedi *et al.* documented multiple cases of *C. striatum*-associated osteomyelitis, including infections of the sternoclavicular joint, a trans-metatarsal amputation dehisced site, the calcaneus, and the hallucal toe [7]. Notably, three out of his seven reported cases involved calcaneal osteomyelitis, suggesting a potential predilection of *C. striatum* for this anatomical site [7]. However, several case reports of heel ulcer with similar clinical presentation overlooked *Corynebacterium striatum* in bony cultures, resulting in its exclusion from the initial antibiotic regimen. Once the regimen was adjusted to include appropriate coverage, wound healing was achieved [7]. These findings highlighted the need for further research to understand the pathogenic role of *C. striatum* in bone infections, particularly in calcaneal osteomyelitis.

The association between *C. striatum* bacteremia and immunocompromised patients is well-documented in the current literature. Chen *et al.* (2011) reported a case of *C. striatum* bacteremia in a patient experiencing acute deterioration of chronic renal failure, with a central venous catheter as the suspected portal of entry [8]. Marino *et al.* (2022) described *C. striatum* bacteremia in a patient hospitalized due to SARS-CoV-2 infection, though the portal of entry remained unidentified [9]. Similarly, Elkayam *et al.* reported a case in a patient with cirrhosis,

where the infection likely originated from lower extremity cellulitis [10].

Many clinicians have historically overlooked *Corynebacterium striatum* as a true pathogen, which may contribute to cases where patients return to the emergency department with worsening symptoms. Milosavljevic (2021) reported that fatal outcomes from *C. striatum* infections occurred in nearly 20% of patients in a systematic review, even with antibiotic treatment [11]. Given its susceptibility profile, vancomycin is the preferred targeted monotherapy for *C. striatum* infections but can be combined with piperacillin-tazobactam [7] [11]. Alternative options include linezolid, teicoplanin, or daptomycin, while amoxicillin-clavulanate may be appropriate for mild infections but resistance is reported [11]. There is a trend for multidrug resistance in *C. striatum* isolates. Zhang *et al.* showed that nearly all isolates tested from respiratory samples (96.2%, 250/260) were multidrug resistant, retaining sensitivity to vancomycin or Linezolid [2]. Of the *C. striatum* strains, 77.7% showed primary resistance to aminoglycosides, tetracycline, lincomycin, macrolides, and streptomycin [12]. Another study reported that 54 *C. striatum* isolates exhibited multidrug resistance to three or more antibiotics, with a resistance rate of 85.2% to lincomines and 93.5% to quinolones and tetracyclines. Sensitivity to vancomycin and linezolid was 100% [13]. Reports of daptomycin-resistant *C. striatum* strains have emerged [14]. Dalbavancin may serve as an alternative for *C. striatum* infection especially in skin and soft tissue [15]. Lastly, CSP1, a novel temperate bacteriophage and the first phage identified to target *C. striatum* strains could offer new possibilities in bacteriophage therapy research [16]. In conclusion, *C. striatum* seems to be resistant to drugs with oral bioavailability [17].

Our case report describes a patient with a heel ulcer with suspected calcaneal osteomyelitis based on clinical and radiographic findings, including bone scan. The patient underwent partial calcanectomy and was diagnosed with *Corynebacterium striatum* bacteremia.

This case is unique as it presents a rare occurrence of *C. striatum* bacteremia and osteomyelitis in a patient with a heel ulcer, a condition infrequently documented in current literature. It highlights the need for clinicians to recognize the potential association between *C. striatum* bacteremia and osteomyelitis while ensuring it is neither overlooked nor overestimated in clinical practice. In future clinical practice, we suggest using appropriate antibiotics, such as intravenous vancomycin or oral/intravenous linezolid, as a first-line regimen if *Corynebacterium striatum* is identified in bony margins or blood cultures.

Informed Patient Consent

Complete informed consent was obtained from the patient for the publication of this study and accompanying images.

Disclosure

No known competing financial interests or personal relationship that could have

appeared to influence the work reported in this chapter.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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