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Successful Salvage of Complicated Calcaneal Blastomycosis in Disseminated Disease with Staged Surgical Reconstruction and Local–Systemic Antifungal Therapy

Christopher Bibbo, DO, DPM, FACFAS [1], Jeanne Spellman, MD [2]

[1] Department of Orthopaedics, Marshfield Clinic, Marshfield, WI
[2] Department of Infectious Disease, Marshfield Clinic, Marshfield, WI

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ABSTRACT

Disseminated blastomycosis can be a devastating disease, affecting multiple organ systems, including the musculoskeletal system. Osteomyelitis from disseminated disease can be difficult to eradicate but is particularly important to successfully manage in the load-bearing bones of the lower extremity. We present a staged protocol for salvage of blastomycotic calcaneal osteomyelitis in the presence of disseminated disease.

Blastomycotic osteomyelitis is a systemic complication of the disseminated form of blastomycosis, caused by infection with the fungus *Blastomyces dermatitidis*. The management of blastomycotic osteomyelitis requires intensive antifungal therapy and surgical debridement and reconstruction of symptomatic, vital, weightbearing bony structures. We report a staged reconstruction technique consisting of initial debridement and local–systemic antibiotic therapy, followed by reconstruction of the calcaneus using an ingrowth bone graft substitute that also acted as a vehicle for local antibiotic delivery in a young male with disseminated blastomycosis and blastomycotic osteomyelitis. A late distant site methicillin-resistant *Staphylococcus aureus* (MRSA) abscess complicated the course, requiring a third-stage reconstruction to ensure salvage. The epidemiology, pathogenesis, and clinical diagnosis of disseminated blastomycosis are discussed.

Case Report

A 44-year-old white male smoker and drinker, who was also a former intravenous substance abuser (not human immunodeficiency virus positive), had initially been diagnosed with pneumocystis pneumonia and treated with outpatient trimethoprim/sulfamethoxazole. He was subsequently admitted to an outside institution because of an increasing productive cough and hypoxemia. The patient was then transferred to our institution because of worsening hypoxemia, sepsis, and severe foot pain. For 2 months before admission, the patient had experienced the onset of shortness of breath, unexplained weight loss, and low-grade heel pain. The patient was an avid outdoorsman, frequenting the river basin areas in north central Wisconsin, and his hunting partner's dog had died of disseminated blastomycosis 2 years earlier. The laboratory data revealed a white blood cell count of 19.7 K, erythrocyte sedimentation rate of 36 mm/hr, C-reactive protein of 22.5 mg/L, and temperature of 102°F. The blood and sputum cultures yielded *B. dermatitidis.* Chest radiographs and chest computed tomography revealed pulmonary lesions consistent with pulmonary blastomycosis. The foot and ankle service was consulted for the workup and management of his foot pain. The lower extremity examination demonstrated exquisite heel tenderness and edema, with focal erythema of the overlying skin along the lateral wall of the calcaneus (Fig. 1). Plain radiographs of the right calcaneus were deceptively unremarkable; however, magnetic resonance imaging of the calcaneus revealed extensive T_1- and T_2-weighted signal changes within the calcaneus, loss of the integrity of the lateral calcaneal wall, and inflammation focally within the peroneal tendons (Fig. 2), consistent with blastomycotic osteomyelitis of the calcaneus. The patient also exhibited several cutaneous abscesses on the posterior thoracic skin. Culture of these skin abscesses yielded *B. dermatitidis.* Thus, the findings from the patient's workup were consistent with a diagnosis of disseminated blastomycosis of the skin, lungs, and bone (calcaneus).

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Address correspondence to: Christopher Bibbo, DO, DPM, FACFAS, Department of Orthopaedics, Marshfield Clinic, 1000 North Oak Avenue, Marshfield, WI 54449.
E-mail address: bibbo.christopher@marshfieldclinic.org (C. Bibbo).

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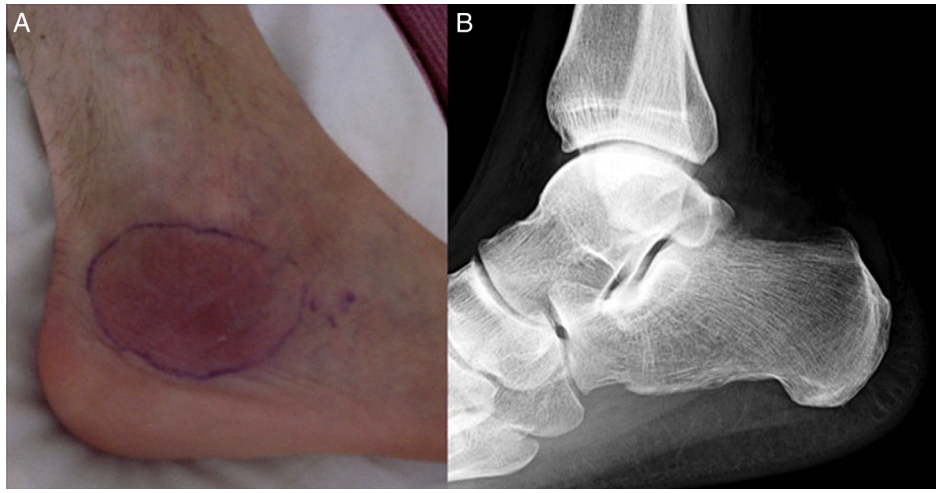

Fig. 1. (*A*) Clinical photograph and (*B*) plain radiograph at patient presentation. Note the overall unremarkable appearance of the calcaneus, except for very mild diffuse osteopenia. Pain in any bony area requires evaluation for osteomyelitis in disseminated blastomycosis.

Medical management included reversal of hypoxemia by the administration of supplemental oxygen and parenteral liposomal amphotericin-B. A staged medical and surgical management plan was selected, first, to obtain maximal overall medical health and decrease the total body fungal burden and then to control the osseous disease source within the calcaneus, followed by final bony reconstruction.

Surgical Technique

A staged approach was used for the operative management of the blastomycotic calcaneal osteomyelitis after the patient had been medically stabilized.

Stage 1

Stage 1 consisted of debridement, cultures, and local antifungal delivery devices. Using a tourniquet and a modified McReynold approach, the calcaneus was approached with direct visualization of the peroneal tendon sheaths, which contained infected necrotic debris. The tendon sheaths were extensively debrided. The lateral wall of the calcaneus was opened; debridement of the calcaneus produced copious amounts of necrotic bone (Fig. 3). Debridement was followed by copious irrigation with normal saline (6 L) and placement of antifungal-impregnated polymethacrylate beads (150 mg amphotericin-B plus 200 mg voriconazole/20 mg polymethylmethacrylate) into the calcaneal defect (Fig. 4). Voriconazole, a new triazole antifungal agent, was used for potential synergy. It is manufactured as a lyophilized powder, making it a suitable agent to be incorporated into local antibiotic delivery devices. The wound incision was closed over a drain. The intraoperative cultures were only positive for *B. dermatitidis.* The patient continued to receive parenteral liposomal amphotericin-B.

Stage 2

One week later, after significant systemic clinical improvement (normalization of temperatures, negative blood cultures), a second debridement was performed. The peripheral bone stock demonstrated adequate integrity to proceed with temporary reconstruction of the calcaneus, despite a defect in the lateral wall of the calcaneus. Previously implanted polymethylmethacrylate antifungal beads were cultured along with the bone, which were ultimately negative on fungal cultures, with negative results also obtained with polymerase chain reaction testing for bacterial DNA (16S polymerase chain reaction) and fungal DNA (18S polymerase chain reaction). At this second operative setting, after debriding the bone and irrigating with 6 L of normal sterile saline, the bony void within the calcaneus was reenforced using a temporary load-bearing bone ingrowth graft substitute material, which also acted as a local antibiotic delivery vehicle. Amphotericin-B (200 mg) was mixed with 20 mL of PRO-DENSE™ (Wright Medical, Memphis TN; Fig. 5); no other agent was used. In the lead author's experience, PRO-DENSE™ mixes and sets up best with smaller volumes of admixed antibiotics. The bone graft and antibiotic delivery mixture was placed into the calcaneal defect and allowed to set and harden. GRAFTJACKET™ (Wright Medical) was used to reconstruct the peroneal sheaths and as an external scaffold to recreate a lateral calcaneal wall (Fig. 6). Standard layered closure was performed; no drains were required. Postoperatively, the patient remained nonweightbearing for 4 weeks, followed by progressive, protected weightbearing. By 8 weeks, the patient was weightbearing to tolerance in a controlled ankle motion boot and crutches. The patient continued to receive outpatient itraconazole therapy for his visceral disease.

Stage 3

Approximately 12 months after stage 2 reconstruction, the patient developed cellulitis of the ipsilateral posterior leg and a deep leg abscess caused by skin irritations sustained from iontophoresis treatment, which was treated by an outside facility with a first-generation cephalosporin. Because of the deterioration of his clinical condition, the patient was again transferred to our facility. Cultures from surgical drainage revealed MRSA. The foot and ankle service was consulted again for the patient's foot edema, serous drainage from his previous surgical incision site, and severe pain in his heel. Radiographs demonstrated an ovoid lucency of the calcaneus around the previously placed antibiotic-loaded PRODENSE™ (Wright Medical; Fig. 7). Because of the patient's recent MRSA cellulitis and abscess, new-onset heel pain, drainage from his previous incision, and suboptimal radiographic findings, irrigation and debridement of the calcaneus were performed. All previously placed PRODENSE™ material was easily removed and cultured and was MRSA positive. After 8 weeks of parenteral vancomycin, a normalized erythrocyte sedimentation rate and C-reactive protein, and negative findings from repeat operative cultures, owing to the resulting bone void, the decision to bone graft the calcaneus as a final reconstructive effort was undertaken. With the patient under general anesthesia, irrigation and debridement was performed again (these intraoperative cultures also proved to be negative). The calcaneal body had developed a thin