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Use of adjuvant hyperbaric oxygen therapy in a patient with traumatic inoculation of mucormycosis resulting in extremity amputation

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CASE PRESENTATION

A 64-year-old man with uncontrolled diabetes mellitus presented to the emergency department with worsening left lower extremity pain, hypotension, fever and altered mental status (figure 1). Eleven days prior, he was involved in a motorcycle collision wherein he underwent internal fixation of his distal left fibula and pinning of his left metatarsals. Given his overlying cellulitis and septic shock, our surgical team was consulted immediately for the presumptive diagnosis of necrotizing fasciitis. He was started on broad spectrum antibiotics and taken for emergent surgical debridement. The underlying suspicion was that the infection had spread to his knee joint, so the proximal extent of his subcutaneous debridement extended to his femur. His cultures grew *Enterococcus faecalis*; however, despite culture-directed antibiotic therapy and multiple subsequent debridements, his infectious course persisted, and he even required an above knee amputation. Below is a photograph of his wound.

What would you do next?

A. More aggressive debridement and hip disarticulation if needed.
B. Topical rifampin powder and antibiotic beads.
C. Broadened antibiotic coverage with no further surgical debridements.
D. Histopathology for fungal etiologies with empiric antifungal therapy.

What we did and why:

Multiple cultures were obtained from the soft tissue infection and specimens sent for pathology. These showed infiltration of fungal organisms with ribbon-like hyphae morphically consistent with mucormycosis. The patient was started on amphotericin B and underwent several hyperbaric oxygen (HBO) treatments. Within 72 hours, he was able to have successful closure of the amputation stump. He did not require further debridements and was discharged to a rehabilitation facility.

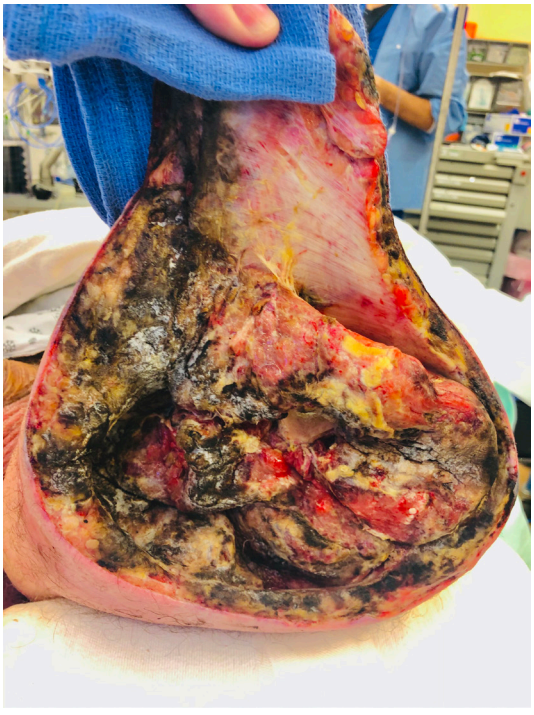

Figure 1 Lower extremity amputation stump site.

DISCUSSION

Mucormycosis is a rare aggressive fungal infection from the order of Mucorales caused by Zygomycetes.[1 2] It can result in five different manifestations including cutaneous, pulmonary, disseminated, rhino-orbito-cerebral and gastrointestinal involvement.[3 4] This fungal infection typically affects those with immunocompromising states such as diabetes mellitus, corticosteroid use, hematological malignancy, solid organ or blood stem cell transplantation.[4 5] Transmission can occur from inoculation, inhalation or ingestion of spores from the environment.[4] Diagnosis is based on tissue biopsy and culture on Sabouraud dextrose agar resulting in fluffy white, gray or brownish color. Microscopically examined on periodic acid-Schiff or Gomori methenamine silver nitrate staining, mucormycosis will show as broad, aseptate hyphae with right angle branching.[4 5]

Mucormycosis has a strong ability to invade blood vessels leading to endothelial damage resulting in thrombosis, infarction and tissue destruction.[6] This can manifest as necrotizing cellulitis around the wound that is unresponsive to antibiotics resulting in a rapidly progressive and extensive tissue necrosis from delay in diagnosis. Medical therapy for mucormycosis has been shown successful with lipid formulas of amphotericin B at 5 mg/kg/day. New therapies such as isavuconazole have also been approved for treatment if amphotericin B is not feasible. Posaconazole has been looked at as a salvage therapy or unresponsive to amphotericin B.[6] Survival of mucormycosis infections if not treated has shown to be 3%, for those treated with amphotericin B was 61%, for surgery alone was

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57% and those with combination of surgery and amphotericin B was 70%.[7] Since mucormycosis is highly angioinvasive, HBO therapy is being used as an adjunctive therapy in stable patients to improve vascularity and angiogenesis therefore oxygen delivery.[6 8] In a review of 28 cases, HBO was shown to be beneficial in patients with diabetes mellitus with a survival of 94% but not in patients with malignancies or transplants.[6] However, since this infection is rare, a randomized control trial has not been conducted to assess the impact of this adjuvant therapy.[8]

Often if patients survive mucromycosis, this leads to disfigurement due to surgical debridement as did in our case. This patient underwent multiple surgical take backs for debridements including above the knee amputation due to suspicion of necrotizing fasciitis from the highly progressive nature of disease. However, the patient was unresponsive to broad spectrum antibiotics and surgical intervention. Due to mechanism, immunocompromised state, unresponsive to debridement and broad spectrum antibiotics, a high suspicion for alternative diagnosis was considered. A tissue culture also resulted in Mucor species, and his treatment became much more effective. Despite delay in diagnosis and initiation of amphotericin B, the combination therapy of medical and surgical treatment resulted in survival, and hip disarticulation was avoided.

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