

Invasive Synergistic Fungal Infection After Motor Vehicle Collision

CPT Michael Jude Welsch, MC, USA; CPT Charles M. Moon, MC, USA;
COL Dirk M. Elston, MC, USA; LTC Paula Vogel, MC, USA

Primary invasive fungal infections occur after direct contact or direct inoculation of the skin with fungal spores. Rhizopus species and Aspergillus terreus are opportunistic fungal species that rarely cause disease in immunocompetent hosts. In susceptible patients, infection may progress rapidly. Aggressive surgical debridement and use of systemic antimycotic agents may successfully control disease and prevent systemic dissemination. We describe the case of a patient with a scalp infection, caused by Rhizopus species and A terreus, that occurred after contact with pavement during a motor vehicle collision. Control was achieved with repeated debridement and use of systemic antifungal therapy.

Invasive zygomycosis (mucormycosis or phycmycosis) is a rare disease most commonly seen in patients with diabetes. The host typically has decreased immunologic function. *Aspergillus terreus* may be a pathogenic fungus in susceptible hosts. Primary cutaneous infections can occur after direct inoculation. These opportunistic infections can cause rapid and extensive cutaneous damage.

Case Report

A 45-year-old man sustained multiple injuries after being thrown from his motor vehicle during a collision. He suffered fractures to the T12 vertebrae and right maxilla, lacerations to both ears and forehead, and abrasions to the left lateral parietal and frontal areas of the scalp. Injury management included use of intravenous (IV) corticosteroids,



Figure 1. Mycelia growth on necrotic scalp.

T12–L2 vertebral fusion, suturing of lacerations, and debridement of abrasions. On hospital day 14, a dermatologic consultation was sought for scalp lesions that developed rapidly.

The obtunded febrile patient was on ventilatory support. Results of a physical examination revealed multiple 1- to 2-cm foul-smelling plaques with fluffy mycelia growth on the patient's scalp (Figure 1). The lesions resembled fungal colonies on a culture dish.

Results of direct examination with 10% potassium hydroxide showed multiple hyphal elements. A biopsy specimen from the necrotic scalp contained both septate and nonseptate hyphae. Nonseptate hyphae with broad refractile irregular walls

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From the Department of Dermatology, San Antonio Uniformed Services Health Education Consortium, Texas.

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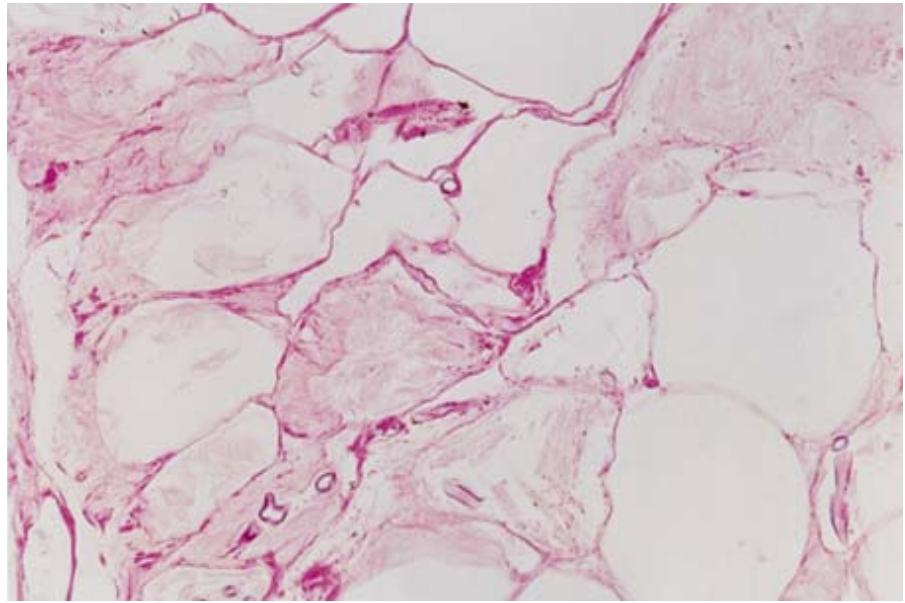


Figure 2. Zygomyces fungi are easily visualized with routine Gram stain and do not require traditional fungal stains (original magnification $\times 40$).

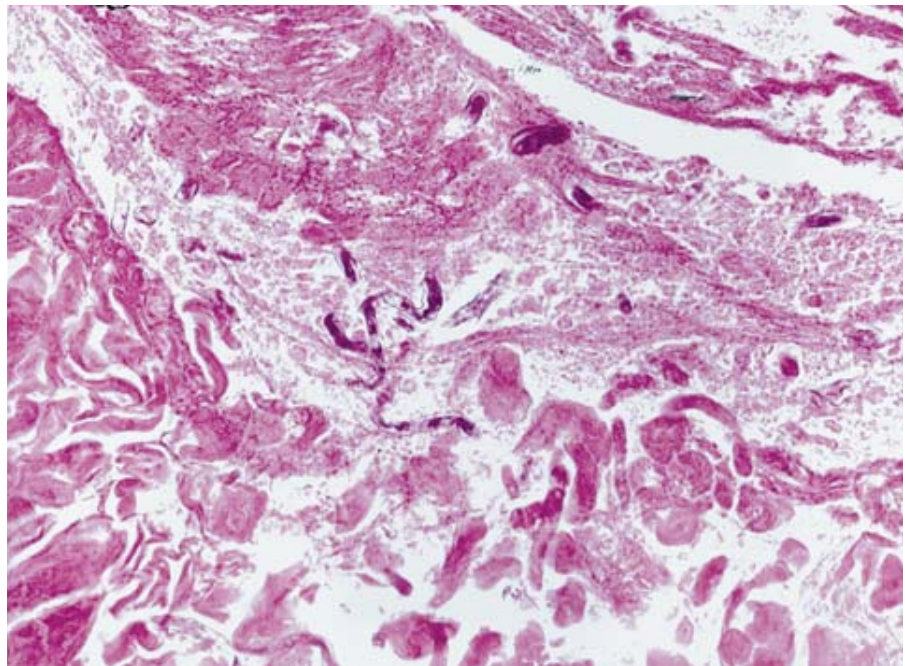


Figure 3. Hyphae with dichotomous branching and bubbly cytoplasm are suggestive of *Aspergillus* or *Fusarium* (H&E, original magnification $\times 40$).

and branches at right angles were suggestive of zygomycosis (Figure 2). These hyphae stained well with tissue Gram stain and poorly with periodic acid–Schiff and Gomori methenamine–silver stains. Delicate septate hyphae with dichotomous branching and bubbly cytoplasm were suggestive of *Aspergillus* or *Fusarium* (Figure 3). Budding yeast and pseudohyphae were evident in superficial tissue. Refractile septate hyphae suggestive of phaeo-hyphomycosis were also evident.

Surgical debridement was performed on the necrotic scalp and periosteum (Figure 4). Amphotericin was initiated via IV, and, later, itraconazole was added for empiric coverage against phaeo-hyphomycosis. Additional surgical debridement was necessary to remove residual necrotic tissue. The patient improved with resolution of fever. Later, he developed gastrointestinal hemorrhage secondary to bowel necrosis. Despite multiple transfusions, he developed cardiogenic shock and died on hospital

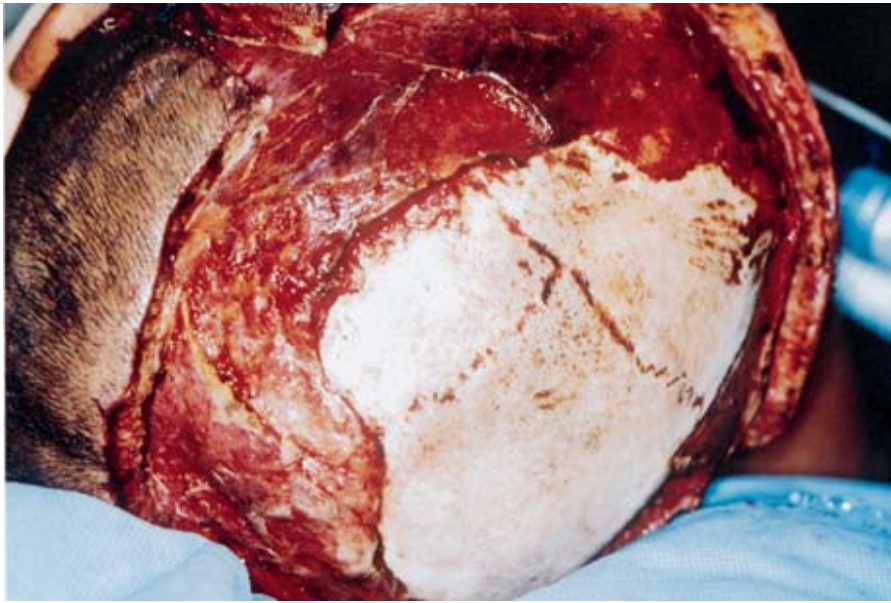


Figure 4. Initial surgical debridement.

day 65. Tissue culture results revealed a mixed infection with *Rhizopus*, *A terreus*, and *Candida parapsilosis*. Results of multiple blood cultures were negative during the hospital course.

Comment

Synergistic opportunistic fungal infections can occur in susceptible hosts when the organisms contact the skin by inoculation injury. Broad-spectrum antibiotic therapy and alteration of normal flora predispose to opportunistic fungal infections of the skin.¹ Contaminated wound dressings, elasticized dressings on wounds, cloth tape securing endotracheal tubes, cast materials, IV catheter insertion, skin maceration, and IV armboards have all been implicated in primary skin infections with *Aspergillus* and *Rhizopus*.¹⁻⁵

Zygomycosis, an uncommon and often fatal infection caused by fungi of the order Mucorales (class Zygomycetes), is the most rapidly progressive fungal disease.⁶ The fungi are ubiquitous; they are readily found in soil, decaying seeds, vegetables, fruit, and animal excreta. Conditions that predispose to zygomycosis include diabetic ketoacidosis, leukemia, lymphoma, severe malnutrition, high-dose corticosteroid therapy, and organ transplantation.^{7,8} A burn wound or extensive local injury to the skin and subcutaneous tissue may be associated with primary skin infection.^{9,10} Zygomycetes fungi tend to invade blood vessels and may cause widespread infection. Visceral organs can be extensively involved.^{6,11} Lesions resulting from primary inoculation are

characterized by hemorrhagic necrosis, black discoloration of tissue, and black pus.^{12,13} Secondary skin lesions may resemble those of ecthyma gangrenosum.^{8,14} Characteristically, hyphal elements are broad (6–20 μm) and nonseptate, have refractile walls and inconspicuous cytoplasm, and branch at right angles.¹²

Aspergillus species are the most commonly encountered fungi in the environment¹⁵ and are easily isolated from soil, decaying vegetation, and air.¹² Weakened host defenses (including disruption of the mucocutaneous barrier) predispose to infection. Risk factors include therapy with corticosteroid or cytotoxic drugs, neutropenia, functional impairment of neutrophils or macrophages, and tissue damage caused by earlier bacterial infections.¹⁶ Most human infections are caused by *Aspergillus fumigatus*, fewer are caused by *Aspergillus flavus* and *Aspergillus niger*.¹² In the environment, *A terreus* is widespread but only rarely infects humans.¹⁷ This fungus is usually considered a saprophyte colonizing the respiratory tract but may be a true pathogen in susceptible hosts. Pathogenicity is considered when the organism is repeatedly isolated from sterile tissues or fluids, when fungal structures isolated from the specimen are microscopically compatible with the morphologic character and color of *A terreus*, and when histopathologic features of the biopsy specimen indicate tissue invasion.¹⁸ Results of the pathologic examination show characteristic septate hyphae with acute-angle branching elements, delicate inconspicuous walls, and prominent bubbly cytoplasm.

The case reported here is one of rapid destruction caused by primary cutaneous fungal infections that may occur after trauma involving close contact with soil. Early recognition, immediate surgical debridement, correction of underlying predisposing conditions (eg, diabetes mellitus), discontinuation of immunosuppressive therapy, and early aggressive systemic antifungal therapy are essential in preserving tissue and preventing dissemination.

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