The common soil fungus, *Fusarium*, is rarely pathogenic in man but occasionally causes serious disease, particularly in immunocompromised hosts. A case is reported of *Fusarium* brain abscess and meningitis occurring in a patient with chronic infectious mononucleosis syndrome and immunodeficiency. The patient died despite aspiration of the abscess and treatment with amphotericin B. This case demonstrates the importance of identifying the offending pathological organism through abscess aspiration in immunocompromised patients.

**KEY WORDS**  
*Fusarium* □9 brain abscess □9 immunodeficiency □9 computerized tomography □9 chronic infectious mononucleosis syndrome

Case Report

This 17-year-old white girl was well until June, 1980, when she developed symptoms and signs of infectious mononucleosis. This diagnosis was confirmed by a positive serum heterophile antibody test.

**Clinical Course.** The patient's illness resolved after 1 month, but over the next year she continued to have increasingly severe episodes of fever, nausea, vomiting, and diarrhea. During this period her peripheral blood counts gradually decreased and in June, 1981, her hemoglobin was 8.4 mg%, 600 white blood cells (WBC)/cu mm and 26,000 platelets/cu mm. Several bone marrow biopsies demonstrated normal to hypercellular marrow with an excess of bizarre lymphoblastoid cells and progressively rare erythroid, myeloid, and megakaryocytic elements. Epstein-Barr virus (EBV) antibody titers were most consistent with a chronic reactivated EBV infection.

The patient was hospitalized in April, 1981, with a staphylococcal septicemia and in June, 1981, she underwent a splenectomy. Prednisone (60 mg/day) prevented further febrile episodes and resulted in a dramatic increase in her peripheral blood counts. Two months prior to her final admission she developed pustular skin lesions on her axilla, chest, and nostril. These were diagnosed clinically as staphylococcal cutaneous infections and resolved with oral Keflex (cephalexin).

On February 12, 1982, the patient was admitted to Stanford University Children's Hospital with fever, malaise, and decreasing hemoglobin and neutrophil counts. Because of severe headaches, nausea, vomiting, continued fever, and neck stiffness, meningitis was considered. Lumbar puncture showed 104 WBC/cu mm (100% polymorphonuclear cells), 226 red blood cells/cu mm, a glucose level of 26 mg% (peripheral blood 99 mg%), and a protein level of 95 mg%. No organisms were seen with Gram staining, and bacteri-
Fusarium brain abscess

Fig. 1. Computerized tomographic scan of a Fusarium fungal abscess in the right caudate nucleus, 5 minutes after contrast infusion, demonstrating marked enhancement of the well defined rim and a low-density center.

Fig. 2. Photomicrograph of the right caudate Fusarium abscess. Foreign-body giant-cell containing fungal forms with septate hyphae, and surrounded by macrophages and inflammatory cells. H & E and Grocott's methenamine silver, × 320.

Material and fungal cultures showed no growth. Computerized tomography (CT) of the head obtained on the same day demonstrated a low-density mass, 2.7 cm in diameter, with a thin, slightly dense, rim in the head of the right caudate nucleus. The rim enhanced markedly. This CT appearance was thought to be diagnostic of an abscess. The patient was started on a course of intravenous steroids, gentamicin, nafcillin, and chloramphenicol. A repeat CT scan was performed the following day, with sequential delayed scans after contrast infusion to determine the degree of encapsulation. The precontrast scan demonstrated a slightly dense rim, indicative of a capsule. Marked enhancement of the well defined rim was noted at 5 minutes (Fig. 1). A delayed scan at 60 minutes showed no significant diffusion of contrast material into the central portion of the abscess and fading of the enhancement at the rim. Minimal edema was visible surrounding the lesion.

The patient underwent burr-hole aspiration of the abscess. Approximately 4 cc of white purulent material was obtained and the potassium hydroxide preparation revealed fungal forms with septate hyphae. Intravenous amphotericin B was started at a loading dose of 0.75 mg/kg, followed by 1 mg/kg a day. Two days later a culture of the abscess aspirate grew out the fungus Fusarium. The next day the abscess was aspirated again and an Ommaya reservoir was placed to deliver intraventricular amphotericin (0.1 mg every other day). On February 18, the patient became lethargic, confused, and densely hemiplegic on the left side, and developed multiple cranial nerve palsies. A CT scan showed enlargement of the entire ventricular system, a decrease in the size of the abscess cavity, and enhancement of the adjacent ventricular wall, suggesting an ependymitis. The patient continued to worsen despite repeated taps of the Ommaya reservoir, increased intraventricular amphotericin (0.5 mg/day), and continued intravenous amphotericin. The patient died on the 7th postoperative day.

Susceptibility testing data of the Fusarium to various antifungal agents were received after the patient had died. The minimal inhibitory concentrations (MIC's) against amphotericin B, flucytosine, and ketoconazole were 1.56 μg/ml, more than 100 μg/ml, and more than 100 μg/ml, respectively, indicating susceptibility to amphotericin B and resistance to flucytosine and ketoconazole. Speciation of the organism identified it as Fusarium oxysporum.

Pathological Examination. A thick whitish-gray exudate surrounded the entire brain stem. A firm, brownish-green, stellate lesion, approximately 2.5 cm in greatest diameter, was present in the head of the right caudate nucleus bordering the frontal horn of the right lateral ventricle. Microscopically, the right caudate lesion showed findings characteristic of an encapsulated abscess. A necrotic center contained acellular debris, degenerated inflammatory cells, and numerous fungal forms with branched septate hyphae. Surrounding this necrotic center was a thin rim of granulomatous inflammation including foamy macrophages, numerous multinucleated giant cells with associated fungal forms, and smaller numbers of acute and chronic inflammatory cells (Fig. 2). Immediately peripheral to this inflammatory zone was a zone of granulation tissue. Reticulin stain demonstrated a reticulin network surrounding most of the lesion, well formed on the cortical surface but less completely developed on the ventricular surface. Fungal forms were present within the capsule, almost penetrating its...
outer border. There was gliosis and minimal edema surrounding the abscess.

The entire ventricular system showed a prominent ependymitis. The leptomeninges surrounding the brain and spinal cord were infiltrated by chronic inflammatory cells and fungal forms. Branched septate hyphae invaded the walls of the blood vessels throughout the meninges, right basal ganglia, and brain stem, often associated with necrosis of the vessel wall and acute thrombosis. Small recent infarcts were found in the superficial cerebellar cortex. The remainder of the autopsy failed to demonstrate any other focus of *Fusarium* infection.

**Discussion**

*Fusarium* is a genus of Deuteromycetes (fungi imperfecti) and is a common soil saprophyte with a worldwide distribution.6,12 This fungus infects plants, causing spoilage of stored grains. There have been several reports of certain species of *Fusarium* producing outbreaks of leukoencephalomalacia in horses, presumably from ingestion of grains infected with the fungus.11,12,16

Human infections with *Fusarium* are usually confined to keratitis, oncomycosis, or superficial burn wound infections.6,18,20,24 *Fusarium* infections of deep tissues resulting in endophthalmitis, leg ulcers, facial granuloma, and osteomyelitis have been associated with trauma, chronic granulomatous disease, use of corticosteroids, or immunosuppression.2,3,13,20,21 Disseminated disease with *Fusarium* is exceptional, and in most instances has occurred in immunocompromised patients.1,7,10,15,20,22 Of these previously reported patients, only one had *Fusarium* brain abscesses documented at autopsy; no meningitis was found.1 A second patient had seizures, aphony, dysphagia, and mental confusion, but fungal cultures of cerebrospinal fluid (CSF) were negative and no CT brain scan or autopsy was obtained.7

In the present case, the patient's immune system may have been compromised by several mechanisms. Her chronic EBV infection possibly caused her lymphoproliferative disorder, suppression of normal hematopoietic activity, and defects in cellular immune function, as has been demonstrated in patients with this syndrome.14,19 Her splenectomy and treatment with prednisone may also have contributed to her immunocompromised state. At the time of her final hospital admission she had clinical, CT, and CSF evidence of a diffuse meningitis concurrent with a focal brain abscess. It is not known whether one process preceded the other. The source of her *Fusarium* infection is likewise unknown.

Despite the patient's immunodeficiency, pathological examination of the brain revealed an appropriate inflammatory response and early encapsulation of the caudate abscess. This is in contrast to other fungal intracranial infections (*Aspergillus* and *Candida*) observed in immunosuppressed patients.4,8 In these patients the brain was incapable of walling off the encephalitic process through encapsulation. Encapsulation has, however, been found in immunosuppressed patients with bacterial (Klebsiella), Actinomyces (*Nocardia*), and parasitic (Toxoplasma) brain abscesses.4,8 Vascular invasion by *Fusarium* fungal forms, vessel-wall necrosis, and secondary occlusive thrombi with parenchymal infarcts has been noted before in other organs affected by disseminated *Fusarium*.4,20 Invasion of the vessels is also a prominent feature in infections with *Aspergillus*, Zygomycetes (*Rhizopus*, *Mucor*), and sometimes with *Candida*.4,6

The current interest in the conservative management of brain abscess using antibiotics alone is based on obtaining a pathogen from cultures of skin lesions, blood, or CSF.17 Our present case emphasizes the need for definitive microbiological diagnosis through abscess aspiration in immunocompromised hosts.

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**References**

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