

Saccharomyces cerevisiae Pneumonia in a Patient with Acquired Immune Deficiency Syndrome

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The clinical course of a patient with a polymicrobial pneumonia that included *Saccharomyces cerevisiae* infection is described. *S. cerevisiae* was recovered from autopsy cultures of the lungs, spleen, oral mucosa, and small intestine, and organisms morphologically consistent with *S. cerevisiae* were visualized in histologic sections of the lung. The role of this organism as a human pathogen is reviewed.

Saccharomyces cerevisiae is frequently referred to as brewers' or bakers' yeast because of its use in the production of beer, wine, and baked goods. It has also been promoted by health food enthusiasts as a nutritional supplement in the form of brewers' yeast tablets or powder containing viable organisms. Consequently, *S. cerevisiae* is a microorganism that we frequently ingest, and yet this yeast has only rarely been associated with serious human infection. We report a case of *S. cerevisiae* pneumonia, with evidence for dissemination, in a patient with the acquired immune deficiency syndrome.

A 39-year-old homosexual male was admitted for evaluation of progressive weakness in his upper and lower extremities, tingling in the digits of his hands and feet, and lower-back pain. These symptoms were first noted approximately 6 months prior to admission. His medical history was significant for human immunodeficiency virus infection (first documented 17 months prior to admission), hepatitis B infection, herpes esophagitis, oral and esophageal candidiasis, *Staphylococcus aureus* urinary tract infection and septicemia, arthritis, gout, hypertension, irreversible neurological deficit (secondary to human immunodeficiency virus infection), right inguinal hernia repair, and right hiatal hernia repair.

On physical examination, the temperature, pulse, respirations, and blood pressure were 99.4°F (37.4°C) 48/min, 20/min, and 100/70 mm Hg, respectively; noteworthy physical findings included peripheral neuropathy, dementia, myelopathy, and absence of abnormalities on auscultation of the chest. Remarkable laboratory findings included leukopenia with a left shift (2,500 leukocytes per mm³, 75% polymorphonuclear neutrophils, 17% bands, 2% lymphocytes, 1% eosinophils, 2% monocytes, and 3% atypical lymphocytes); sodium, 134 meq/liter; calcium, 8.4 mg/dl; albumin, 3.2 g/dl; alkaline phosphatase, 244 IU/liter; aspartate aminotransferase, 107 IU/liter; and lactate dehydrogenase, 419 IU/liter. Roentgenograms of the chest taken on admission revealed no distinct abnormalities. Blood and urine specimens were collected for bacterial culture (and subsequently found to be negative), and supportive therapy with intravenous fluids was initiated. Empiric antimicrobial therapy (ciprofloxacin, 750 mg orally twice a day) was also initiated. At 2 days after admission, the patient became markedly febrile (peak temperature of 104.2°F [40.1°C] 3 days after

admission), and 6 days after admission, chest X rays revealed diffuse interstitial infiltrates in both lung fields. Blood gases 6 days after admission were characterized by the following: pH, 7.47; pCO₂, 27 mm Hg; and pO₂, 28 mm Hg. Respiratory secretions were not submitted for fungal or mycobacterial cultures at this time. Oxygen and intravenous pentamidine therapy (200 mg once daily) were initiated, but the patient died 7 days after admission.

Gross findings at an autopsy limited to the trunk revealed diffuse and patchy areas of consolidation of both lungs and bilateral pleural effusions with 200 and 100 ml of pleural fluid in the right and left pleural cavities, respectively. Microscopic examination revealed an intra-alveolar frothy exudate with hyaline membranes, alveolar damage, and bronchial cell hyperplasia with luminal exudate. Fungal cultures of tissue collected at autopsy were incubated in an air atmosphere at room temperature following inoculation onto yeast extract phosphate agar, Sabouraud dextrose agar with and without chloramphenicol and gentamicin, and Sabouraud dextrose agar with chloramphenicol and cyclohexamide; cultures for mycobacteria were inoculated onto Lowenstein-Jensen and Middlebrook 7H11 media and incubated at 35°C in an atmosphere of 5% carbon dioxide and 95% air. Autopsy lung cultures yielded *Mycobacterium avium-M. intracellulare* and *S. cerevisiae* on all inoculated mycobacterial and fungal media, respectively, except Sabouraud dextrose agar with chloramphenicol and cyclohexamide. *Pneumocystis carinii* and yeast forms morphologically consistent with *S. cerevisiae* were seen in histologic sections of lung tissue stained with Grocott methenamine silver stain (Fig. 1); acid-fast bacilli were seen in the same sections stained with Night Blue. *S. cerevisiae* was identified by means of ascospore production and carbohydrate assimilation tests (API 20C clinical yeast systems from Analytab Products and yeast identification cartridge from Abbott Diagnostics).

The spleen and lymph nodes were markedly depleted of lymphoid elements, and there was evidence of extramedullary hematopoiesis in the spleen. Acid-fast bacilli were visualized in both spleen and lymph nodes with a Night Blue stain, but no yeast cells were found with Grocott methenamine silver stains. Cultures of splenic tissue, however, revealed both *M. avium-M. intracellulare* and *S. cerevisiae* on all inoculated mycobacterial and fungal media, respectively, except Sabouraud dextrose agar with chloramphenicol and cyclohexamide. Other remarkable autopsy findings included an occlusive organizing thrombus in the right

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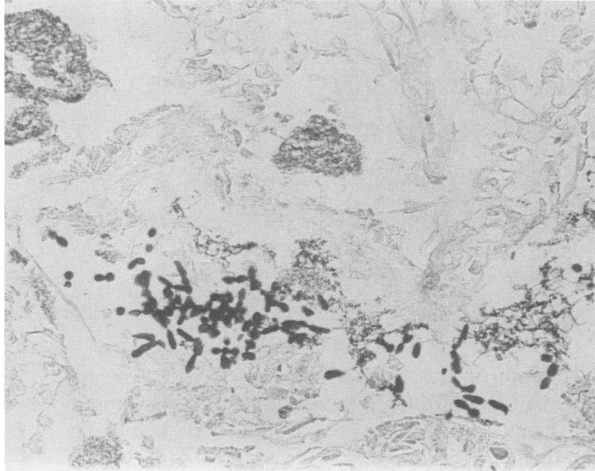


FIG. 1. Histologic section of lung showing yeast cells which morphologically resemble *S. cerevisiae* (Grocott methenamine silver stain). Magnification, $\times 208$.

coronary artery, microscopic evidence of a recent myocardial infarct with reactive pericarditis in the posterior wall of the left ventricle, and approximately 100 ml of serous pericardial effusion. It was concluded that the patient probably died of cardiac arrest secondary to an acute myocardial infarct and respiratory failure due to severe bilateral pneumonia. Additional relevant positive autopsy cultures in-

cluded recovery of *M. avium-M. intracellulare* from the small intestine, oral cavity, bile, and pleura and recovery of *S. cerevisiae* from the oral cavity and small intestinal tissue. Blood was not submitted for fungal or mycobacterial culture at autopsy.

S. cerevisiae is an ascospore-producing yeast that is an occasional commensal on human mucosal surfaces and is not uncommon in clinical specimens; it is, however, rarely associated with serious human infections (4, 7). A literature review revealed eight cases of potentially serious *Saccharomyces* infections including six fungemias, one peritonitis, and one pleural effusion (Table 1). Although three of the eight patients died, *Saccharomyces* infection was not the primary cause of death in two of these cases (one patient died of complications of disseminated intravascular coagulopathy, and the other died of an insulin reaction); the contribution of *Saccharomyces* infection to the death of the third patient cannot be assessed because he died of respiratory failure and had a polymicrobial pleural effusion that included *S. cerevisiae*, *Escherichia coli*, *S. aureus*, a *Streptococcus* sp., and a *Lactobacillus* sp. (2-4). Infections in the surviving patients responded promptly to antifungal chemotherapy and produced little residual morbidity. *Saccharomyces* spp., including *S. cerevisiae*, have also been associated with genitourinary infections in both males and females as well as mild gastrointestinal and respiratory infections (1, 4, 8, 12).

The case we report is noteworthy because our patient clearly had involvement of multiple visceral organs as indicated by positive autopsy cultures of the oral mucosa,

TABLE 1. Characteristics of patients with serious, culture-proven *Saccharomyces* infections^{a,b}

Age (yr) and sex	Predisposing condition	Positive culture site	Leukopenia	Prior antibiotics	Antifungal therapy	Outcome	Comment	Reference
61 (M)	Renal failure; hemodialysis	Blood; central catheter access site	No	Yes	Miconazole flucytosine	Death	Patient died from complications of DIC; autopsy failed to reveal nidus of fungal infection	2
66 (M)	Pancreatic cancer; laparotomy	Peritoneal fluid	No	Yes	Ketoconazole	Death	Death due to insulin reaction; patient failed to complete antifungal therapy	3
52 (M)	COPD; steroids; i.v. drug use; ingestion of brewers' yeast	Pleural fluid	Unk	No	Ketoconazole	Death	<i>Streptococcus aureus</i> , <i>Streptococcus</i> sp., <i>Escherichia coli</i> , and <i>Lactobacillus</i> sp. also recovered from pleural fluid	4
66 (M)	Burns; upper GI hemorrhage; mechanical aspiration	Blood	Yes	Yes	Amphotericin B followed by oral nystatin	Cure	Yeast cells observed in histologic sections of esophageal biopsy	5
68 (M)	Ingestion of brewers' yeast	Blood, bone marrow; urine	No	Yes	None	Cure	Discontinuation of brewers' yeast ingestion produced cure	6
38 (M)	Prosthetic tricuspid valve; i.v. drug use	Blood	Unk	Yes	Amphotericin B	Cure	Probable <i>Saccharomyces</i> endocarditis; patient died of bacterial endocarditis 8 mo after completing antifungal therapy	9
37 (F)	AIDS; i.v. drug use; renal failure; peritoneal dialysis	Blood	Unk	Yes	Amphotericin B	Cure	Ophthalmologic exam revealed frothy yellow exudates and chorioretinal necrosis	10
54 (F)	Prosthetic mitral valve	Blood; urine	No	Yes	Amphotericin B	Cure	Probable <i>Saccharomyces</i> endocarditis	11

^a The species was determined to be *S. cerevisiae* in all studies except one (11), in which it was undetermined.

^b Abbreviations: M, male; F, female; DIC, disseminated intravascular coagulopathy; COPD, chronic obstructive pulmonary disease; i.v., intravenous; Unk, unknown; GI, gastrointestinal; AIDS, acquired immune deficiency syndrome.

intestine, spleen, and lungs and by visualization of yeast cells morphologically consistent with *S. cerevisiae* in histologic sections of the lung. We postulate that *S. cerevisiae* colonized the oropharynx of the patient, was subsequently aspirated into the lungs, and disseminated hematogenously to the spleen. Although our patient clearly had *S. cerevisiae* pneumonia, the contribution of this organism to the morbidity and mortality of the patient cannot be assessed because of concurrent *P. carinii* and *M. avium-M. intracellulare* pneumonia. Multiple organ invasion by this relatively benign organism underscores the profound immunologic incompetence induced by human immunodeficiency virus infection.

LITERATURE CITED

1. Ahnlund, H. O., B. Pallin, R. Peterhoff, and J. Schonebeck. 1967. Mycosis of the stomach. *Acta Chir. Scand.* **133**:555-562.
2. Cimolai, N., M. J. Gill, and D. Church. 1987. *Saccharomyces cerevisiae* fungemia: case report and review of the literature. *Diagn. Microbiol. Infect. Dis.* **8**:113-117.
3. Dougherty, S. H., and R. L. Simmons. 1982. Postoperative peritonitis caused by *Saccharomyces cerevisiae*. *Arch. Surg.* **117**:248-249.
4. Eng, R. H., R. Drehmel, S. M. Smith, and E. J. C. Goldstein. 1984. *Saccharomyces cerevisiae* infections in man. *Sabouraudia* **22**:403-407.
5. Eschete, M. L., and B. C. West. 1980. *Saccharomyces cerevisiae* septicemia. *Arch. Intern. Med.* **140**:1539.
6. Jensen, D. P., and D. L. Smith. 1976. Fever of unknown origin secondary to brewer's yeast ingestion. *Arch. Intern. Med.* **136**:332-333.
7. Kiehn, T. E., F. F. Edwards, and D. Armstrong. 1980. The prevalence of yeasts in clinical specimens from cancer patients. *Am. J. Clin. Pathol.* **73**:518-521.
8. Reiersol, S., and J. Hoel. 1958. *Saccharomyces carlsbergensis*, possibly a pathogenic. *Acta Pathol. Microbiol. Scand.* **44**:313-318.
9. Rubinstein, E., E. R. Noriega, M. S. Simberkoff, R. Holzman, and J. J. Rahal. 1975. Fungal endocarditis: analysis of 24 cases and review of the literature. *Medicine* **54**:331-344.
10. Sethi, N., and W. Mandell. 1988. *Saccharomyces* fungemia in a patient with AIDS. *N.Y. State J. Med.* **88**:278-279.
11. Stein, P. D., A. T. Folkens, and K. A. Hruska. 1970. *Saccharomyces* fungemia. *Chest* **58**:173-175.
12. Wilson, J. D., B. M. Jones, and G. M. Kinghorn. 1988. Bread making as a source of vaginal infection with *Saccharomyces cerevisiae*. *Sex. Transm. Dis.* **15**:35-36.