characteristics compatible with *Histoplasma capsulatum*. *Histoplasma capsulatum* grew from four blood cultures (Isolator system; Dupont, USA) and one urine culture taken on admission and in the following days. The microorganism was also cultured subsequently from autopsy material obtained from the lungs and spleen.

To the best of our knowledge, this is the first case of autochthonous histoplasmosis in an HIV-positive individual observed in Italy, where symptomatic histoplasmosis is a very rare disease despite a small focus of endemicity that seems to exist in the Po valley (A. Mazzoni, personal communication). Pulmonary and mucocutaneous lesions may be the initial feature or a subsequent manifestation of disseminated histoplasmosis and of several other systemic fungal infections in HIV-positive patients (5). Disseminated histoplasmosis should be considered in febrile, pancytopenic HIV-infected individuals, including those in European countries. Concomitant cutaneous lesions, although present in only about 20% of patients, are very helpful in addressing the clinical suspicion. Culture is highly sensitive in obtaining the definitive diagnosis but requires three to six weeks for growth and identification. Radioimmunoassay for *Histoplasma* antigen is a very rapid and sensitive test but is not available outside the USA (6, 7).

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Pneumonia Caused by *Micrococcus* Species in a Neutropenic Patient with Acute Leukemia

Micrococcus spp. are cocci of the family *Micrococcaceae* that are usually considered contaminants or nonpathogenic saprophytes of human skin. Recently, however, these organisms have been implicated in infections associated with indwelling intravenous lines, peritoneal dialysis fluids, ventricular shunts, and prosthetic material (1–4). We report here a case of fatal pneumonia caused by *Micrococcus* spp. in a neutropenic patient with acute leukemia.

A 22-year-old man was hospitalized because of progressive fatigue and weight loss. Physical examination was normal except for cutaneous pallor and mucous membrane bleeding. His leukocyte count was 2,000/mm^3 with 60% blastic forms, a hemoglobin level of 7.8 g/dl and a platelet count of 76,000/mm^3. Microscopical examination of a bone marrow aspirate revealed acute lymphoblastic leukemia. He received induction chemotherapy consisting of vincristine, prednisone, adryamicin, and cytosine arabinoside. Oral prophylaxis with norfloxacin and fluconazole was also given.

On the first day of chemotherapy-induced neutropenia (leukocyte count 200/mm^3), the patient's temperature rose to 39°C. Ceftazidime and amikacin were given intravenously. Twenty-four hours after beginning empirical antibiotic therapy, he became afebrile. Blood cultures were negative.

Nine days later, while still neutropenic and receiving ceftazidime, the patient developed a cough and a sharp pain at the left upper thorax. Hemoptoic sputum was noted. A chest radiograph showed a nodular infiltrate in the left upper lobe. Empirical

Table 1: Data from published reports of *Micrococcus* pneumonia.

Reference (no.)	Patient age/sex	Underlying condition	Neutropenia	Specimen cultured	Outcome
Tobin (7)	43/F	none	no	blood, sputum	recovery
Souhami et al. (8)	69/M	AML	yes	BAL	recovery
Young et al. (9)	NR	renal transplant	NR	BAL	recovery
Young et al. (9)	NR	ALL + BMT	NR	BAL	recovery
Adang et al. (10)	26/F	AML	yes	BAL	death
Present case	22/M	ALL	yes	BAL	death

ALL, acute lymphoblastic leukemia; AML, acute myeloid leukemia; BMT, bone marrow transplant; BAL, bronchoalveolar lavage; NR, not reported.

therapy with amphotericin B was initiated. The patient remained afebrile, but progressive dyspnea occurred the following day. A thoracic computed tomography scan revealed bilateral nodules, some of them cavitated. A bronchoscopy with bronchoalveolar lavage (BAL) was performed, as invasive fungal infection was suspected. One day later, respiratory failure developed and tracheal intubation with mechanical ventilation was initiated, but the patient died after two episodes of cardiac arrest and unsuccessful cardiopulmonary resuscitation.

Culture from BAL grew > 10^4 cfu/ml of *Micrococcus* spp. Antibiotic susceptibility was determined. The strain was resistant to penicillin (MIC = 2 μg/ml), amoxicillin/clavulanate (MIC = 4 μg/ml), oxacillin (MIC > 2 μg/ml) and clindamycin (MIC > 2 μg/ml) and showed susceptibility to cephalothin (MIC < 2 μg/ml), imipenem (MIC < 4 μg/ml), vancomycin (MIC < 1 μg/ml), teicoplanin (MIC < 1 μg/ml), ciprofloxacin (MIC < 1 μg/ml), gentamicin (MIC < 1 μg/ml), and rifampin (MIC < 1 μg/ml). Cultures for virus, mycobacteria, and fungi were negative.

The postmortem examination revealed acute necrotizing inflammatory reaction with evidence of cocci forms in the lungs, liver, spleen, adrenal gland, kidney, and heart. Cultures of lung, liver and spleen tissue grew *Micrococcus* spp. Neither hyphae nor evidence of leukemia cells was found.

Micrococcus spp. are recognized with increasing frequency as a cause of infection associated with medical devices (1–4). Opportunistic infections in immunocompromised patients have also been observed, but to our knowledge only five cases of pneumonia caused by *Micrococcus* spp. have been reported previously in the English literature (Medline 1965–1995)(5–10). These five cases, along with our case, are summarized in Table 1.

Our review shows that *Micrococcus* pneumonia occurs mainly in immunocompromised patients with neutropenia. With one exception, all cases reported have been diagnosed by bronchoscopy and BAL. Four patients were cured following appropriate antimicrobial therapy, but two patients with hematologic malignancy and profound neutropenia died.

Micrococcus spp. exhibit varying patterns of antibiotic susceptibility. Resistance to a broad spectrum of antimicrobial agents has been noted (5, 10), although all strains remain susceptible to vancomycin. Because of the different spectrum of resistance to antimicrobial agents, antibiotic susceptibility testing should be performed to optimize treatment.

Because *Micrococcus* pneumonia may mimic fungal pulmonary infection, as in the case reported here, it should be included in the differential diagnosis of pulmonary infiltrates in immunocompromised patients.

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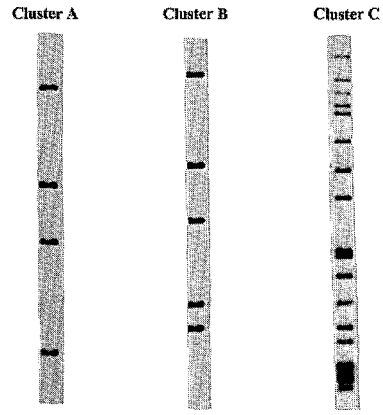

	Cluster A	Cluster B	Cluster C
No. of IS 6110 elements	4	5	19
No. of patients in cluster	6	5	11
Isoniazid MIC, μg/ml	10	10	10
Catalase, mm (H37Rv:45mm)	8	4	0
katG gene mutation	Codon 315	–	Codons 315, 463

Figure 1: Clusters of drug-resistant *Mycobacterium tuberculosis* isolates. Strains from cluster B had the wild type *katG* gene. DNA fingerprint analysis with the IS6110 probe, determination of isoniazid MICs, quantitation of catalase activity, and analysis of *katG* gene mutations were done according to previously published procedures (5).

Transmission of Multidrug-Resistant Strains of *Mycobacterium tuberculosis* in a High Incidence Community

It is believed by some that drug-resistant strains of *Mycobacterium tuberculosis* are less virulent than susceptible strains. This hypothesis originally arose from the classical studies of Mitchison et al. (1), who observed that a significant number of isoniazid-resistant *Mycobacterium tuberculosis* strains, isolated from patients in India, tended to be of low virulence in the guinea pig infection model. These observations were mainly ascribed to reduced catalase activity in these strains, and we now know that to survive during infection, isoniazid-resistant *katG* mutants (reduced catalase) have apparently compensated for the loss of catalase-peroxidase activity by a second mutation, resulting in hyperexpression of alkyl hydroperoxidase (2). Recently it has been shown that drug-resistant strains of *Mycobacterium tuberculosis* exhibit a range of virulence in mice (3). However, these observations have been made in animal models and may not reflect the level of virulence in humans, where different mechanisms to control mycobacterial growth may be active. In the absence of a human model, it has been suggested that the minimum inhibitory concentration (MIC) of isoniazid may be an indicator of strain virulence in humans (4). In this regard, strains resistant to relatively high levels of isoniazid (10 μg/ml) were considered to be of low virulence (4). This hypothesis may be interpreted to imply that highly resistant strains are not necessarily a threat to society due to their inability to be transmitted and cause disease. This hypothesis can be tested by molecular epidemiological studies performed on defined communities and may provide some answers to the virulence of drug-resistant strains. IS6110 and MTB484 DNA fingerprinting of *Mycobacterium tuberculosis* isolates originating from a community experiencing a high incidence of tuberculosis in South Africa (incidence exceeding 700/100,000 per annum) has identified clusters of identical drug-resistant strains (5, 6). Drug sensitivity testing showed these clustered isolates to be highly resistant to isoniazid (MICs 10 μg/ml). Resistance could be correlated with point mutations in the *katG* gene in most cases and associated reduced catalase activity (Figure 1). Drug susceptible cluster sizes (average 4 patients per cluster; 100 clusters analysed) in patients in the same defined