Emerging Pathogenicity of *Purpureocillium lilacinum*: A Rare Case of Cavitary Lung Disease

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ABSTRACT

BACKGROUND: *Purpureocillium lilacinum* is an emerging opportunistic pathogen that can cause a variety of infections, including pulmonary disease, particularly in immunocompromised individuals. Its rare pulmonary involvement presents significant diagnostic challenges due to nonspecific symptoms and imaging findings.

CASE PRESENTATION: We present the case of a 60-year-old male with a history of severe chronic obstructive pulmonary disease (COPD), diabetes mellitus, and smoking, who presented with chronic cough and weight loss. Imaging revealed a cavitary lesion in the left lung apex. Despite initial antibiotic treatment, his symptoms persisted, prompting further investigation. Bronchoscopy and bronchoalveolar lavage (BAL) led to the identification of *Purpureocillium lilacinum* infection. The patient was treated with oral voriconazole 200 mg twice daily for four weeks, with notable clinical and radiographic improvement.

CONCLUSION: *Purpureocillium lilacinum* should be considered as a potential cause of cavitary lung disease in patients with persistent respiratory symptoms, particularly those with predisposing factors. Early diagnosis and antifungal therapy, such as voriconazole, are crucial for effective treatment and improved outcomes.

KEYWORDS: *Purpureocillium lilacinum*; cavitary lung disease; pulmonary infection; voriconazole; opportunistic pathogen

INTRODUCTION

Purpureocillium lilacinum, formerly known as *Paecilomyces lilacinus,* is a saprobic, hyaline hyphomycete found globally in diverse environments, including soil and decomposing matter.[1] While recognized for its role as a biological control agent against nematode pests, it can also act as an opportunistic pathogen.[1,2] The first reported case of *P. lilacinum* pathogenicity was described in 1977 by Takayasu et al.[3] It is being increasingly reported to cause opportunistic infections in immunocompetent and immunocompromised individuals, with clinical manifestations ranging from superficial mycoses to life-threatening systemic infections affecting different organ systems.[4] We present the case of a patient with a cavitary lung disease caused by *P. lilacinum* effectively treated with voriconazole therapy.

CASE PRESENTATION

A 60-year-old male presented to the clinic with a chief complaint of chronic, nonproductive cough and progressive weight loss spanning several months. His past medical history was significant for Chronic Obstructive Pulmonary Disease (COPD), diabetes mellitus, pre-existing pulmonary nodules, bronchiectasis, and hyperlipidemia. His pertinent social history included a significant 86-pack-year smoking history, and his occupational history revealed prior employment as a demolition worker. On physical examination, the patient appeared cachectic, and pulmonary auscultation revealed diffuse coarse breath sounds throughout all lung zones, accompanied by mild expiratory wheezing, consistent with his underlying obstructive lung disease.

Given the persistent respiratory symptoms and the presence of a chronic cough unresponsive to initial conservative measures, a Computed Tomography (CT) of the chest was pursued. CT scan revealed the presence of a distinct cavitary process located within the medial left lung apex along with emphysematous changes [**Figure 1**]. Given the presence of a cavitary lesion, further investigations were ordered to differentiate between infectious, inflammatory, and neoplastic etiologies.

Initial laboratory investigations revealed that the complete blood count (CBC) and basic metabolic panel (BMP) were unremarkable. Inflammatory markers, including erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), were also within normal limits. To help exclude

Figure 1. Cavitary lesion in the left upper lobe

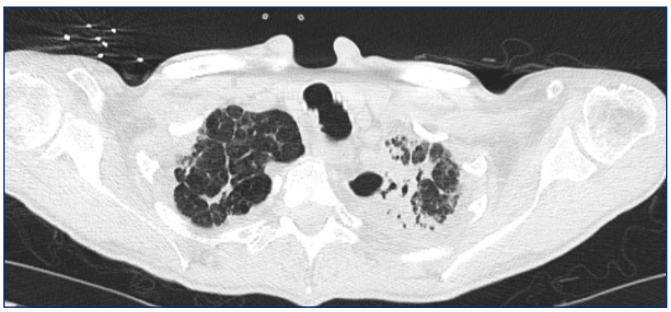
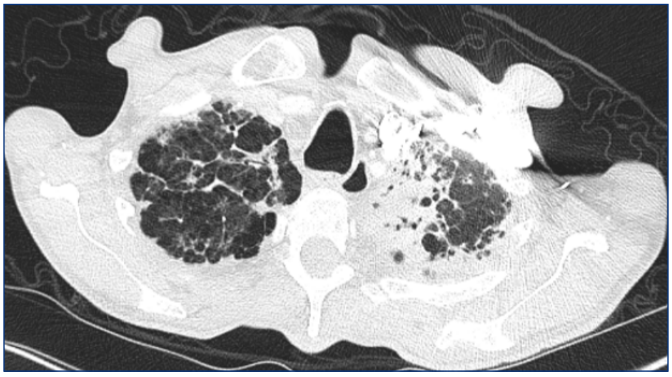


Table 1. Laboratory Investigations

CBC, BMP	Unremarkable
ESR, CRP	Unremarkable
ANCA, ANA,MPO-Ab,PR3-Ab,CCP-Ab, Anti Ro and Anti La Ab	Negative
Rheumatoid Factor	248 (Elevated)
IgA,IgG, IgM	Normal
HIV, Quantiferon, Blood Cultures	Negative

Figure 2. Stabilization and improvement of cavitary process after treatment



autoimmune conditions that can present with cavitary pulmonary manifestations, a comprehensive panel of autoantibodies, including ANCA, ANA, MPO-Ab, PR3-Ab, CCP-Ab, Anti Ro, and Anti La Ab, was performed, all yielding negative results. Notably, the rheumatoid factor (RF) was elevated at 248 IU/mL; however, in the absence of other clinical or serological evidence of rheumatoid arthritis, this finding was considered non-specific in the context of his primary pulmonary complaint. Infectious disease screening was also undertaken, with negative results for HIV, QuantiFERON Gold, and routine blood cultures [**Table 1**].

Initially, the patient was empirically treated with Augmentin for presumed bacterial cause, particularly given his refusal of initial diagnostic procedures such as sputum samples and bronchoscopy. However, despite this empiric therapy, his symptoms persisted along with worsening clinical status requiring oxygen therapy. Consequently, he consented to undergo bronchoscopy with bronchoalveolar lavage (BAL). The fungal cultures from the bronchoscopy subsequently tested positive for *Purpureocillium lilacinum* in two different samples, definitively identifying the causative fungal pathogen. Following this result, the patient was initiated on targeted antifungal therapy with oral voriconazole 200 mg twice daily for a duration of four weeks. Subsequent radiographic imaging demonstrated significant improvement in the cavitary lesion [**Figure 2**], confirming the efficacy of the specific antifungal treatment and the accuracy of the diagnosis.

DISCUSSION

Purpureocillium lilacinum is an increasingly recognized opportunistic pathogen capable of causing a wide spectrum of clinical manifestations in both immunocompromised and immunocompetent individuals.[4] This agent is predominantly known to cause ocular and subcutaneous infections, with pulmonary infections being reported in rare cases.[2,5]

P. lilacinum is considered to have moderate virulence, but its pathogenicity and dissemination can be heightened by predisposing factors such as immunosuppression (potentially due to depletion of macrophages, neutrophils, interleukin, and nitric oxide synthase in tissues)[6] or the presence of implants and foreign materials.[7] Common gateways for infection include a breach of the skin barrier via inoculation or inhalation.[8]

A review of 101 cases with invasive *P. lilacinum* infection by Sprute et al[4] suggested that the main predisposing factors were hematological and oncological disease, steroid treatment, solid organ transplant, and diabetes mellitus. The most prevalent sites of infection were consistently the skin followed by the lungs.[4] Clinical manifestations of *P. lilacinum* infection frequently include malaise, fever, cough, pleuritic pain, and dyspnea. Radiographic presentations are varied, encompassing lung nodules, cavitary pulmonary disease, pleural effusion, lung abscess, solitary pulmonary lesions, and lung consolidation.[4,9]

Diagnosis of *P. lilacinum* can be challenging because of the similarity in morphology when compared with Aspergillus and other agents of hyalohyphomycosis.[10] Diagnosis is typically confirmed by histological or direct examination of a biopsy coupled with positive fungal cultures.[11] On Sabouraud glucose agar, *P. lilacinum* exhibits rapid growth, forming colonies that are initially white and gradually turn lilac or vinaceous. Microscopic features comprise septate, branching hyaline hyphae, distinguished by phialides tapering towards their distal ends.[12,13] Microscopic observation with Lactophenol cotton blue (LPCB) staining reveals characteristic reproductive structures: the budding of a mother cell gives rise to short septate hyphae that carry phialides, which in turn produce unicellular oblong conidia. This explains the cellular mechanism of the agent's ability to sporulate in infected tissues.[14,15] Due to the complexity of identifying fungal agents based solely on morphological structures, confirmation of species identification by DNA sequencing or specific Polymerase Chain Reaction (PCR) amplification of the 18S ribosomal ribonucleic acid (18S RNA) is recommended.[11,16] This is particularly important because of observed differences in antifungal sensitivity even between closely related species, such as *Purpureocillium variotii* and *P. lilacinum*.[15]

Given the limited number of clinical cases, no standard antifungal regimens for *P. lilacinum* currently exist. By analyzing clinical isolates of infected cases, Sprute et al[4] reported Amphotericin B, fluconazole, flucytosine, and itraconazole to have the least active in vitro in susceptibility testing; Posaconazole and voriconazole had the lowest

MIC and Echinocandins showed contrasting data with variable in vitro activity. There are reports that voriconazole has been used to treat *P. lilacinum* successfully in a wide variety of clinical presentations (including pulmonary involvement) thus being first choice treatment.[17] In the present case, voriconazole 200 mg twice daily for four weeks proved effective in treating the cavitary lung lesion, leading to radiographic and clinical improvement. This case highlights the increasing awareness needed for timely diagnosis and management of *P. lilacinum* as a significant pathogen.[18]

CONCLUSION

P. lilacinum can cause rare pulmonary infections with atypical signs and symptoms, and imaging findings, complicating diagnosis and treatment due to antifungal resistance. In our patient, voriconazole was effective, but further research is needed to determine optimal treatment. Increased awareness of *P. lilacinum* as a significant pathogen is essential for timely diagnosis and management.

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