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Invasive Pulmonary Aspergillosis Due to Aspergillus Fumigatus: A Fatal Case Report

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Abstract | **Original Research Article**

Background: Invasive pulmonary aspergillosis (IPA) is a severe fungal infection associated with substantial mortality, particularly in patients with impaired immune defenses. Early diagnosis and appropriate antifungal treatment are essential to improve outcomes. ***Case presentation:*** We report the case of a 39-year-old male chronic smoker receiving long-term corticosteroid therapy who presented with progressive respiratory distress and respiratory muscle weakness. At admission, his respiratory rate was 35 breaths/min, and oxygen saturation was 99% while receiving high-flow oxygen. Thoracic computed tomography (CT) showed a halo sign, described as an area of ground-glass opacity. Bronchoscopy was performed, and bronchoalveolar lavage (BAL) fluid was submitted for mycological examination. Direct microscopy revealed septate fungal hyphae with acute-angle branching, and culture findings were compatible with Aspergillus fumigatus. The organism was identified before voriconazole was initiated. Testing for Pneumocystis jirovecii was negative. Serum galactomannan testing was positive. The patient died, with the death attributed clinically to pulmonary aspergillosis according to the available information. Histopathological confirmation and detailed antifungal treatment information were unavailable. ***Conclusion:*** This case highlights the severity of pulmonary aspergillosis and the importance of early mycological investigations in patients presenting with severe respiratory deterioration. The integration of microbiological, clinical, and radiological findings is essential to support the diagnosis and guide management.

Keywords: Invasive pulmonary aspergillosis; Aspergillus fumigatus; case report.

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1. INTRODUCTION

Aspergillosis comprises a spectrum of diseases caused by filamentous fungi of the genus Aspergillus. These diseases range from allergic manifestations and chronic pulmonary aspergillosis to invasive infections, depending on host immune status, underlying pulmonary conditions, and other predisposing factors [1–3].

Invasive pulmonary aspergillosis (IPA) is a potentially life-threatening infection that occurs predominantly in patients with impaired immune defenses. Established risk factors include prolonged neutropenia, hematological malignancies, hematopoietic stem cell transplantation, solid-organ transplantation, and immunosuppressive treatments, particularly systemic corticosteroids [1,4,5]. However, invasive aspergillosis may also occur in critically ill patients without classical risk factors, making diagnosis particularly challenging in intensive care settings [6].

Aspergillus fumigatus is one of the principal species responsible for invasive aspergillosis. Following inhalation of airborne conidia, the fungus may cause pulmonary infection when host defenses are insufficient. Clinical manifestations are often nonspecific and may include respiratory distress, fever, cough, and radiological abnormalities. Diagnosis therefore requires integration of clinical findings, imaging, and mycological investigations [1–3].

Bronchoscopy with bronchoalveolar lavage (BAL) is an important diagnostic procedure in patients with suspected IPA. Respiratory specimens can be investigated using direct microscopy, fungal culture, and complementary methods such as galactomannan detection or molecular testing, depending on availability and clinical context [1,7,8]. Nevertheless, isolation of Aspergillus from respiratory specimens does not independently establish invasive disease because airway

colonization may occur. Consensus definitions therefore incorporate host factors, clinical or radiological criteria, and mycological evidence to classify invasive fungal disease [4,6].

We report a fatal case of pulmonary aspergillosis associated with the detection of A. fumigatus in BAL fluid. This case highlights the contribution of conventional mycological investigations and the diagnostic limitations that remain when assay details and other complementary investigations are incompletely documented.

2. CASE PRESENTATION

A 39-year-old male chronic smoker receiving long-term corticosteroid therapy was admitted for medical management because of progressive respiratory muscle weakness. According to the available clinical information, respiratory deterioration had developed progressively during the five days preceding admission.

At admission, the patient presented with respiratory distress, polyneurological manifestations, and a respiratory rate of 35 breaths/min. Oxygen saturation was reported as 99% while the patient was receiving high-flow oxygen. Respiratory muscle weakness was also documented.

Bronchoscopy was performed to investigate the respiratory deterioration. BAL fluid was collected and submitted to the Central Laboratory of Parasitology and Mycology at Ibn Sina University Hospital, Rabat, Morocco, for mycological investigation.

2.1. Thoracic imaging

Thoracic computed tomography (CT) showed a halo sign, described in the available information as an area of ground-glass opacity. This finding was considered alongside the patient's clinical presentation and mycological results. The halo sign can support suspicion of invasive pulmonary aspergillosis in an appropriate clinical context but is not specific to this infection.

2.2. Direct microscopic examination

The respiratory specimen was processed for mycological examination. Direct microscopic observation revealed fungal filaments, including septate hyphae with acute-angle branching. These morphological characteristics were suggestive of a filamentous fungus belonging to the genus Aspergillus [1,7].

2.3. Mycological culture and identification

The specimen was cultured on Sabouraud medium. After 48 hours of incubation at 37°C, colonies described as powdery and bluish-green, becoming progressively greyish-green, were observed.

Microscopic examination of the colonies revealed conidiophores terminating in vesicles, phialides, and chains of conidia. The macroscopic and microscopic characteristics were compatible with Aspergillus fumigatus.

Testing for Pneumocystis jirovecii was negative. Serum galactomannan testing was positive.

Direct microscopy and culture findings supported the identification of A. fumigatus in the respiratory specimen. The CT halo sign provided additional radiological evidence compatible with IPA in the appropriate clinical context. However, the halo sign is not specific to aspergillosis, and histopathological confirmation was unavailable. The findings should therefore be interpreted together with the clinical presentation and mycological results [4,6].

2.4. Treatment and outcome

Antifungal treatment with voriconazole was initiated. Voriconazole is a recommended primary treatment option for invasive aspergillosis [1,9]. Isavuconazole is another evidence-supported treatment option for invasive mould disease, including disease caused by Aspergillus, although it was not reported as having been used in this case [10].

Despite treatment, the patient's clinical condition deteriorated, and the outcome was fatal. According to the available information, the death was attributed clinically to pulmonary aspergillosis. Detailed information about the antifungal dosage, duration of treatment, and treatment monitoring was unavailable.

3. DISCUSSION

Invasive pulmonary aspergillosis remains a major diagnostic and therapeutic challenge because its manifestations are often nonspecific and disease progression may be rapid. Early recognition is particularly important in patients with recognized risk factors or unexplained respiratory deterioration [1,2,4–6].

3.1. Clinical presentation and predisposing factors

The patient presented with respiratory distress, tachypnea, and respiratory muscle weakness. These manifestations are not specific to IPA and may occur in several pulmonary and systemic conditions. Their interpretation therefore requires correlation with imaging, laboratory investigations, and the patient's underlying medical history.

Long-term corticosteroid therapy was reported and is a recognized risk factor for invasive aspergillosis [1,4,5]. However, the corticosteroid dose, duration, and indication were unavailable, and the specific contribution of smoking cannot be determined from the information provided. Other potentially relevant factors, including the patient's underlying diseases and immune status, were also insufficiently documented.

Severe pulmonary aspergillosis may occur in critically ill patients whose underlying conditions complicate clinical recognition and diagnostic classification. Blot *et al.,* proposed an algorithm to support the diagnosis of IPA in intensive care patients, illustrating the importance of combining clinical, radiological, and mycological evidence [6].

3.2. Contribution of mycological investigations

In this case, direct microscopic examination of BAL fluid revealed septate hyphae with acute-angle branching, while fungal culture produced colonies compatible with A. fumigatus. These findings contributed to the identification of the fungus in the respiratory specimen.

The Infectious Diseases Society of America recommends that respiratory specimens from patients with suspected IPA be submitted for routine culture and cytological examination, together with non-culture-based investigations when available [1]. The European Society of Clinical Microbiology and Infectious Diseases, the European Confederation of Medical Mycology, and the European Respiratory Society also emphasize a structured diagnostic approach incorporating clinical assessment, imaging, and mycological investigations [7].

Respiratory culture must nevertheless be interpreted cautiously because the detection of Aspergillus in respiratory specimens may represent colonization rather than tissue invasion. The revised EORTC/MSGERC definitions integrate host factors, clinical or radiological criteria, and mycological evidence when classifying invasive fungal disease [4].

In the present case, long-term corticosteroid exposure, the CT halo sign, detection of A. fumigatus in BAL fluid, and positive serum galactomannan testing together supported the clinical diagnosis of IPA. However, the halo sign is not pathognomonic, histopathological confirmation was unavailable, and the exact galactomannan index and assay details were not documented. The strength of the retrospective diagnostic classification therefore depends on the full clinical context and the criteria applied [4,6].

3.3. Role of complementary diagnostic tests

Galactomannan is a fungal biomarker used in the diagnostic investigation of invasive aspergillosis. IDSA guidelines support serum and BAL galactomannan testing in selected high-risk populations, particularly patients with hematological malignancies and hematopoietic stem cell transplantation [1]. Test performance can vary according to clinical and methodological factors [8].

In this case, serum galactomannan testing was positive and provided complementary mycological evidence. However, the exact index, assay details, and laboratory threshold were unavailable, limiting further interpretation of the result.

The positive serum galactomannan result should therefore be interpreted alongside the CT halo sign, direct microscopy, fungal culture, and clinical presentation rather than in isolation. Where feasible, combining clinical assessment, thoracic imaging, direct microscopy, fungal culture, and validated antigen or molecular tests can strengthen diagnostic evaluation [1,7,8].

Molecular testing may also contribute to the identification of Aspergillus in clinical specimens. Nevertheless, molecular assay results should be interpreted in conjunction with other diagnostic tests and the clinical context because detection of fungal DNA does not necessarily distinguish colonization from invasive disease [1].

3.4. Treatment and unfavorable outcome

Voriconazole is recommended as primary therapy for invasive aspergillosis. The randomized trial by Herbrecht *et al.,* demonstrated better treatment outcomes with voriconazole than with conventional amphotericin B in patients with invasive aspergillosis, supporting its role in management [9]. Isavuconazole has also been evaluated as a primary treatment option for invasive mould disease in a phase 3 randomized trial [10].

The patient died after voriconazole treatment; according to the information provided, the death was attributed clinically to pulmonary aspergillosis. The available clinical information does not allow the relative contributions of disease severity, treatment response, underlying conditions, or other complications to be assessed independently.

A more detailed assessment would require the timeline of diagnosis and treatment, antifungal dosage and duration, relevant laboratory results, thoracic imaging, and information about the patient's underlying therapies. These data would also help evaluate whether additional factors may have influenced the clinical course.

3.5. Clinical implications and limitations

This case emphasizes the importance of considering fungal infection in the differential diagnosis of severe or unexplained respiratory deterioration. It also illustrates the contribution of direct microscopy and culture to the investigation of respiratory specimens.

A diagnosis of IPA should integrate host risk factors, clinical manifestations, radiological findings, and mycological evidence [1,4,6]. In this case, long-term corticosteroid therapy, a CT halo sign, and detection of A. fumigatus in BAL fluid were mutually supportive findings, although they do not replace histopathological

confirmation where this is required for a definitive diagnosis.

Several limitations must be acknowledged. Histopathological confirmation was unavailable, and the exact serum galactomannan index and assay details were not documented. Information concerning the indication and dosage of corticosteroid therapy, the patient's complete clinical history, and the details of antifungal treatment was also incomplete. Finally, the available data do not allow the contribution of individual clinical factors to the fatal outcome to be determined.

Despite these limitations, the concordance of the clinical presentation, radiological findings, and mycological investigations supported the clinical diagnosis of pulmonary aspergillosis associated with the detection of A. fumigatus. This case underscores the importance of integrating multiple diagnostic findings and documenting clinical and therapeutic information comprehensively in order to improve the interpretation and scientific value of case reports.

4. CONCLUSION

This report describes a fatal case of pulmonary aspergillosis associated with the detection of Aspergillus fumigatus in BAL fluid. Direct microscopy and fungal culture contributed to organism identification, and thoracic CT showed a halo sign described as ground-glass opacity, providing additional but nonspecific radiological support. The absence of histopathological confirmation and the unavailability of the exact serum galactomannan index and assay details limited the completeness of the diagnostic assessment.

The case highlights the importance of early clinical suspicion and integration of host risk factors, radiological findings, and mycological evidence. A CT halo sign can support suspicion of IPA in an appropriate clinical context but is not diagnostic in isolation. Further clinical documentation is needed to characterize the treatment course and factors potentially associated with the unfavorable outcome.

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