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Case Report

A silent spore: when fungi take over the lung

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ABSTRACT

Pulmonary mucormycosis is a rare but aggressive opportunistic fungal infection, predominantly affecting immunocompromised individuals such as those with poorly controlled diabetes mellitus. This case report describes a 65-year-old diabetic woman who presented with fever, cough, haemoptysis, and rapidly progressing dyspnoea. Initial misdiagnosis as bacterial pneumonia delayed appropriate treatment. High-resolution computed tomography (CT) revealed the reverse halo sign and cavitary lesions, raising suspicion for an invasive fungal infection. Microbiological testing showed broad, aseptate hyphae with right-angle branching on potassium hydroxide (KOH) mount, consistent with mucormycosis, despite negative fungal cultures. She was treated with liposomal amphotericin B and later switched to oral posaconazole due to financial limitations. This case underscores the importance of early imaging and microbiological assessment in high-risk patients, especially those with uncontrolled diabetes. It also highlights diagnostic limitations in resource-constrained settings and the critical need for timely antifungal therapy to improve outcomes in pulmonary mucormycosis. Multimodal diagnosis and clinical vigilance remain essential for survival.

Keywords: Diabetes, Fungal infection, Haemoptysis, Silent spore, Pulmonary mucormycosis

INTRODUCTION

Invasive fungal infections of the lungs represent a growing threat, particularly among immunocompromised individuals such as those with poorly controlled diabetes mellitus (DM). These infections, including pulmonary aspergillosis and mucormycosis, are associated with high morbidity and mortality due to their aggressive nature and diagnostic challenges.[1,2] The clinical presentation often mimics bacterial pneumonia or tuberculosis, leading to delays in appropriate treatment.[3] This case report describes a 65-year-old diabetic female presenting with fever, cough, haemoptysis, and progressive dyspnoea, ultimately diagnosed with invasive fungal pneumonia, highlighting the critical role of early radiological and microbiological diagnosis in guiding therapy.

Diabetes mellitus, particularly when poorly controlled, predisposes patients to invasive fungal infections due to impaired neutrophil function, hyperglycaemia-induced immune dysfunction, and microvascular damage facilitating fungal angioinvasion.[4,5] The radiological hallmark of invasive fungal pneumonia such as the reverse halo sign (a focal ground-glass opacity surrounded by a ring of consolidation) raises suspicion for angioinvasive fungal pathogens like Aspergillus or Mucorales.[6] However, definitive diagnosis often requires histopathological or microbiological confirmation, as cultures may remain negative despite active infection.[7]

Serum biomarkers such as galactomannan aid in diagnosing invasive aspergillosis, while direct microscopic examination (e.g., KOH mount) revealing broad, aseptate hyphae with right-angle branching strongly suggests mucormycosis.[8,9] Early initiation of liposomal amphotericin B (L-AmB), followed by oral posaconazole, is crucial for improving outcomes.[10] Nevertheless, mortality remains high (40–80%), particularly in patients with delayed diagnosis or uncontrolled comorbidities.[11]

This case underscores the importance of maintaining a high clinical suspicion for fungal infections in diabetic patients with unresolved pneumonia, as timely intervention can be life-saving.

CASE REPORT

A 65-year-old woman from Thiruverkadu presented with a one-week history of persistent fever and productive cough. The cough was accompanied by whitish, mucoid sputum without foul odor, along with a single episode of blood-streaked haemoptysis. Over the preceding three days, she had developed progressively worsening shortness of breath, advancing from grade II to grade III dyspnoea. On the morning of admission, she experienced three episodes of non-bilious, non-bloody vomiting.

Her past medical history was significant for poorly controlled type 2 diabetes mellitus of 10 years' duration, complicated by systemic hypertension and dyslipidaemia. On physical examination, her vital signs were within normal limits, though she exhibited mild tachypnoea and dyspnea. Respiratory auscultation revealed decreased vesicular breath sounds over the left lung base, accompanied by crepitations. The remainder of her systemic examination was unremarkable.

Diagnostic workup

Initial laboratory investigations demonstrated poorly controlled diabetes (HbA1c 16.6%) with marked systemic inflammation (CRP 275 mg/l, ESR 60 mm/hour). Chest radiography revealed bilateral upper zone infiltrates (Figure 1). Due to respiratory distress, she was admitted to the ICU and managed with nasal oxygen, intravenous antibiotics, nebulization therapy, and subcutaneous insulin. However, her failure to improve clinically after 48 hours prompted suspicion of fungal infection.

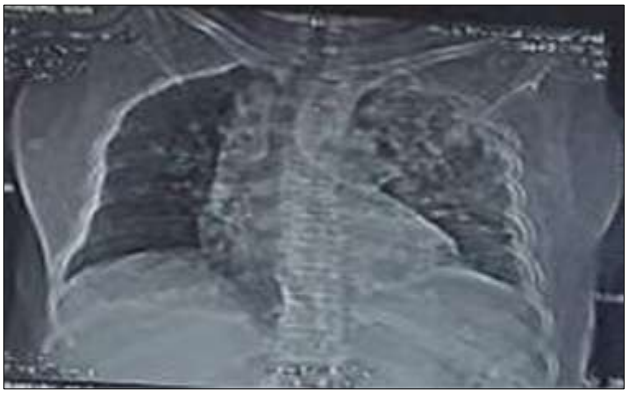

Figure 1: Chest X-ray (PA view) showing bilateral upper zone infiltrates.

Arterial blood gas analysis on admission showed a normal pH (7.4) with respiratory alkalosis (pCO_2 22.4 mmHg) and metabolic compensation (HCO_3-17.2 mmol/l). Serial laboratory monitoring demonstrated progressive anaemia (haemoglobin declining from 11.6 to 10.2 g/dl), resolving leucocytosis (18.36 to 11.18×10^3/µl), and acute kidney injury (serum creatinine rising from 0.64 to 1.0 mg/dl). Significant electrolyte disturbances included hyponatremia (124 mmol/l) that corrected to 138 mmol/l with treatment. Cardiac evaluation revealed elevated troponin I (304→471 ng/l) and sinus tachycardia with poor R-wave progression on electrocardiogram (ECG) (Tables 1 and 2).

Advanced imaging and microbiological findings

High-resolution CT of the chest demonstrated characteristic features of invasive fungal pneumonia: a reverse halo sign in the left upper lobe, consisting of central ground-glass opacity surrounded by consolidation; thin-walled cavitary lesions with air-fluid levels in both lungs; multifocal consolidations with air bronchograms; and minimal pleural effusion. Microbiological workup excluded tuberculosis (negative Xpert MTB/RIF, MGIT culture, and AFB smears), while bacterial culture grew Klebsiella pneumoniae. Fungal evaluation revealed a positive galactomannan assay (index 0.96), and KOH preparation of tissue samples demonstrated broad, aseptate hyphae with right-angle branching, consistent with mucormycosis. Cytological examination showed acute suppurative inflammation (Figure 2).

Table 1: Patients serial investigations.

Investigation	Day 0 (14/01/25)	Day 2 (16/01/25)	Day 3 (17/01/25)	Day 5 (19/01/25)
Hb	11.6	10.3	10	10.20
WBC	18.36	18.64	14.4	11.18
Platelet count	3.74	3.79	3.98	3.98
B. urea	19	20	45	
S. creatinine	0.64	0.7	1.0	
Na	124	133	131	138
K	4.13	3.34	3.32	4.3
Cl	93	98	98	102

Table 2: Patient's other investigation.

Test	Result
CRP	275
ESR	60
HBA1C	16.6
Serum lipase	24
Serum amylase	28
TROP I	304 > 471
ECG	Poor R-wave progression, sinus tachycardia

Treatment and follow-up

The recommended antifungal regimen consisted of induction therapy with liposomal amphotericin B (5-10 mg/kg/day for 3-6 weeks) followed by maintenance

posaconazole (300 mg daily for 3-6 months). Due to financial constraints, the patient was transferred to a government hospital where she completed her antifungal treatment and continues maintenance therapy with posaconazole. This case highlights the diagnostic challenges and therapeutic considerations in managing invasive fungal infections in immunocompromised diabetic patients.

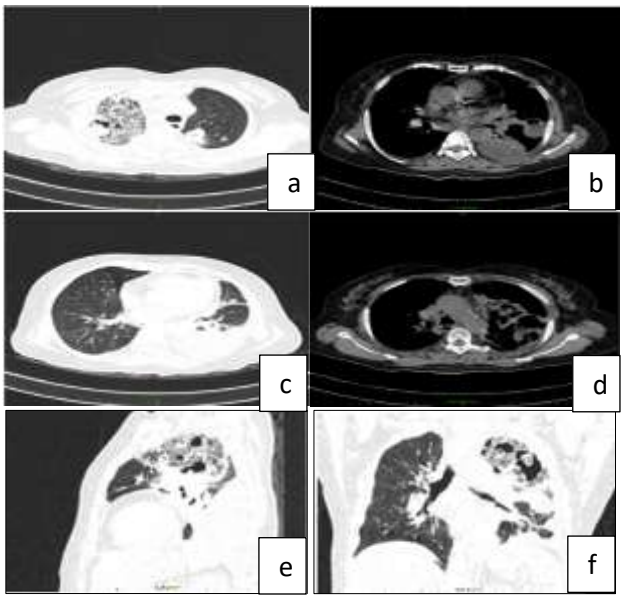

Figure 2 (a-f): CT images showing reverse halo sign.

DISCUSSION

This case presents a 65-year-old diabetic female with poorly controlled glycemia (HbA1c 16.6%) who developed invasive pulmonary fungal infection, likely mucormycosis given the KOH findings of broad, aseptate hyphae with right-angle branching.[1] The clinical presentation with fever, haemoptysis, and rapidly progressive dyspnoea, coupled with characteristic HRCT findings of reverse halo sign and cavitary lesions, strongly suggests an angioinvasive fungal process.[2] This discussion will analyse the key aspects of this case in relation to current literature on pulmonary fungal infections in diabetic patients.

The patient's poorly controlled diabetes served as the critical predisposing factor for this invasive fungal infection. Chronic hyperglycaemia creates an immunocompromised state through multiple mechanisms: impaired neutrophil chemotaxis and phagocytosis, reduced oxidative burst activity, and dysfunctional cell-mediated immunity, as demonstrated by Spellberg and colleagues.[3] Additionally, the acidic, high-glucose environment in ketoacidosis promotes fungal growth and impairs transferrin-mediated iron sequestration, a crucial host defense mechanism identified by Ibrahim et al.[4] These factors explain the particular vulnerability of our patient, whose HbA1c of 16.6% indicated prolonged poor glycaemic control.

Our patient's presentation aligns with typical cases of pulmonary mucormycosis reported by Chamilos et al in their retrospective study of 70 cases, where 86% of patients presented with fever, 54% with cough, and 30% with haemoptysis - all features present in our case.[5] The rapid progression from grade II to III dyspnoea within three days mirrors the subacute but aggressive course described by Roden et al in their large case series.[6] Notably, our patient lacked pleuritic chest pain, which Tedder and colleagues reported in only 25% of cases.[7]

The HRCT findings in our case are particularly noteworthy. As Georgiadou et al have established, the reverse halo sign is highly suggestive of angioinvasive fungal infection.[8] Wahba et al found this sign in 94% of pulmonary mucormycosis cases and 70% of invasive aspergillosis cases in their radiological study.[9] The additional findings of thin-walled cavities and air-fluid levels correlate with the necrotizing, angioinvasive nature of the infection, as described by Jung and coworkers.[10]

The diagnostic challenges in this case reflect well-documented difficulties in fungal infection diagnosis. While the KOH mount provided rapid identification, Cornely et al note that negative fungal culture is not uncommon, with sensitivity ranging from 30-50% for mucormycosis.[11] The galactomannan index of 0.96 must be interpreted cautiously as Arvanitis et al demonstrated this assay has lower sensitivity (30-38%) for non-Aspergillus molds.[12] This underscores the importance of multimodal diagnostic approaches emphasized in current guidelines.

The treatment approach followed current guidelines from Walsh et al recommending liposomal amphotericin B as first-line therapy.[13] The transition to posaconazole for maintenance therapy reflects evidence from Marty et al showing 60% success rates with this approach.[14] The financial constraints faced by our patient highlight a significant real-world challenge in resource-limited settings, as documented by Prakash and Chakrabarti.[15]

CONCLUSION

Pulmonary mucormycosis represents a rapidly progressive and often fatal opportunistic infection, particularly in patients with poorly controlled diabetes mellitus and other immunocompromised states. This case highlights the diagnostic and therapeutic complexities associated with invasive fungal lung disease, including its non-specific clinical presentation, overlapping radiological features with other infections, and limited sensitivity of conventional diagnostic tests. The presence of hallmark imaging findings—such as the reverse halo sign—combined with microbiological evidence of broad, aseptate hyphae with right-angle branching on KOH mount, facilitated a presumptive diagnosis despite negative fungal cultures. Early suspicion, prompt initiation of liposomal amphotericin B, and subsequent maintenance with posaconazole are critical for improving survival,

although access to these therapies remains a challenge in resource-limited settings. This case highlights the importance of maintaining high clinical vigilance for fungal infections in patients with unresolved pneumonia and uncontrolled diabetes. Multimodal diagnostic strategies, timely antifungal therapy, and public health measures addressing affordability and access to care are essential in curbing the high morbidity and mortality associated with pulmonary mucormycosis.

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