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The reverse halo sign and spontaneous pneumothorax due to pulmonary mucormycosis

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Abstract

Pulmonary mucormycosis (PM) is a rare opportunistic fungal infection that commonly affects immunocompromised patients. Early diagnosis and initiation of appropriate anti-fungal therapy are crucial, as delay in diagnosis leads to increased mortality. However, the diagnosis is often challenging because of the lack of utility of serum markers and low culture sensitivity. Definitive diagnosis often requires invasive tissue sampling, which may delay treatment. Therefore, chest imaging findings play an important role in the diagnosis of suspected cases. This case highlights the importance of classic reverse halo sign and presence of necrotizing cystic changes resulting in spontaneous pneumothorax in a patient who was later found to have invasive PM.

Introduction

Pulmonary mucormycosis (PM) is a rare but aggressive opportunistic fungal infection that commonly affects immunocompromised hosts. Devastating rhino-orbital-cerebral and pulmonary infections are the most common syndromes caused by these fungi. PM is a rapidly progressive infection that often manifests as pneumonia with infarction and necrosis. Early recognition of chest imaging findings is crucial for the timely diagnosis and start of appropriate anti-fungal therapy. We present the unfortunate case of a young female who presented with an atypical radiographic presentation of invasive PM in the form of necrotizing cystic changes leading to spontaneous pneumothorax in addition to reverse halo sign on chest imaging.

Case Report

A 48-year-old female with history significant for poorly controlled diabetes mellitus (HbA1c = 11%) and bipolar disorder presented to the emergency room with chest pain and haemoptysis. Initial chest imaging (Figs 1, 2) revealed moderate-sized spontaneous pneumothorax, along with a large cystic area in the left lung with surrounding ground glass. She was a lifetime non-smoker and had no risk factors

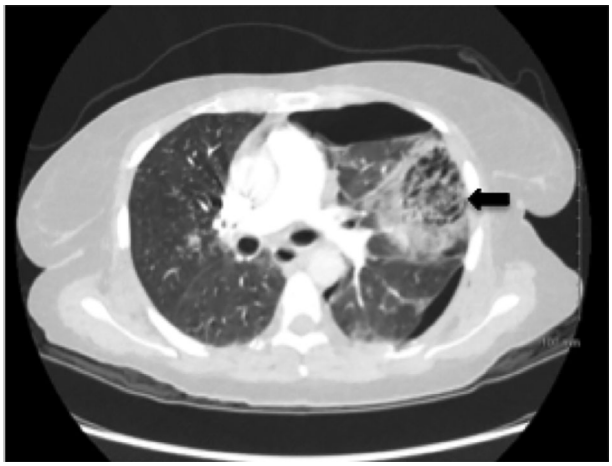

Figure 1. Axial computed tomography (CT) chest image with large cystic area and ground-glass opacification, surrounded by crescent of dense consolidation on the left (black arrow).

for pneumothorax. A pigtail chest tube catheter was placed and she was initiated on broad-spectrum antibiotics for presumed necrotizing pneumonia with haemorrhage. Her respiratory status rapidly declined requiring intubation with subsequent pulseless electrical activity (PEA) arrest. Due to concern for tension pneumothorax, two additional chest tubes were emergently placed in the left pleural space. Given the continuous air leak from all three chest tubes and the expiratory volume loss on the ventilator, a significant bronchopleural fistula was suspected. Attempts to improve ventilation by isolating the right lung via selective intubation of the right main stem bronchus and later double-lumen endotracheal tube were unsuccessful. Given her refractory hypoxia and multiple cardiac arrests, a decision was made to eventually withdraw care. Final autopsy pathology results (Fig. 3) showed diffuse severe acute pneumonia with lung parenchymal haemorrhage and necrosis. Grocott methenamine silver (GMS) stain demonstrated abundant fungal elements invading lung parenchyma and vessel walls. These fungi have broad non-septated hyphae with irregular angulated branches (some are 90°). The morphology of these fungi is characteristic for mucormycosis. The overall histology and GMS stain findings are diagnostic of invasive PM.

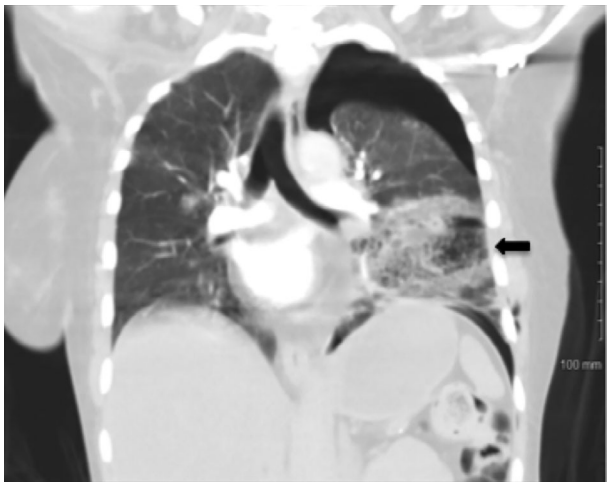

Figure 2. Coronal computed tomography (CT) chest image with large left-sided area of central ground glass surrounded by crescent of dense consolidation, described as reverse halo sign (black arrow).

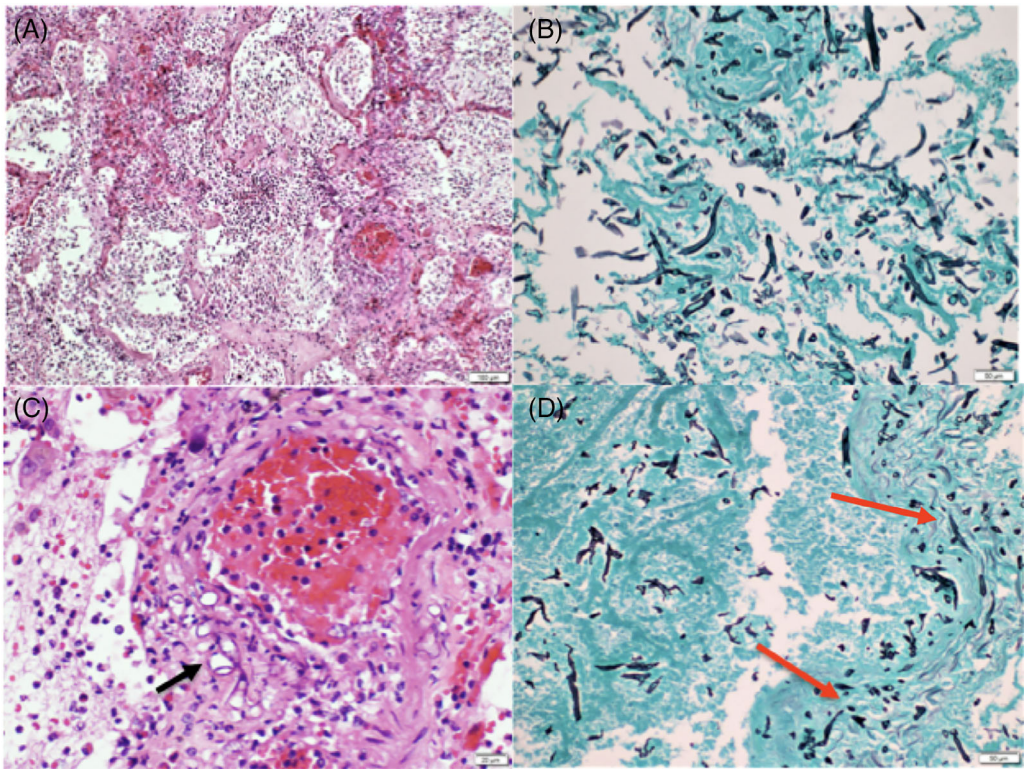

Figure 3. Histopathology of lung in autopsy. (A, C) Haematoxylin and eosin (H&E) stain; (B, D) Grocott methenamine silver (GMS) stain. (A) Severe acute pneumonia with lung parenchymal haemorrhage and necrosis; (C) Fungi invading vessel wall (black arrow); GMS stain demonstrates abundant fungal elements invading lung parenchyma (B) and vessel wall (D, red arrows).

Discussion

Mucormycosis is a life-threatening fungal infection and occurs most commonly in patients with haematological malignancies, solid organ transplantation, or poorly controlled diabetes mellitus [1].The diagnosis of PM is challenging because of the lack of utility of serum markers including galactomannan and 1,3-beta-D-glucan assay, low culture sensitivity, and resemblance of clinical presentation with other angio-invasive fungal infections including invasive aspergillosis. Definitive diagnosis often requires invasive tissue sampling, which may delay treatment. Thus, imaging findings play an important role in the evaluation of these patients.

Our patient presented with the classic "reverse halo sign" or "atoll sign" on chest imaging, which has been shown to be a relatively specific sign of PM in immunocompromised hosts. The central ground-glass component corresponds to alveolar septal inflammation, cellular debris, and areas of haemorrhage. One of the common imaging feature is peripheral location of reverse halo sign in the majority of cases [2,3].

However, the presence of necrotizing cystic changes resulting in spontaneous pneumothorax is an uncommon imaging feature associated with PM [4]. To date, there have been a few documented cases of pneumothorax in PM, some of which were iatrogenic during mechanical ventilation or bronchoscopic intervention and only one prior reported case of spontaneous pneumothorax due to PM [4,5].

Recommended treatment options include anti-fungal treatment with IV amphotericin B (lipid formulation), emergent surgical debridement, and correction of risk factors [6].

Presence of spontaneous pneumothorax in addition to reverse halo sign on chest imaging should raise the possibility of PM, particularly in an immunocompromised host. This case highlights both the typical and atypical radiographic presentations of PM, which are important in order to maintain a high index of suspicion to deliver timely management of this deadly opportunistic infection.

Disclosure Statement

Appropriate written informed consent was obtained for publication of this case report and accompanying images.

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