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Case Report

Atypical presentation of nontuberculous mycobacterial pulmonary infection in a patient with interstitial lung abnormality: A case report

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ABSTRACT

Nontuberculous mycobacterial (NTM) infection is a common and important cause of chronic pulmonary disease, typically characterized by fibrocavitary and nodular-bronchiectatic forms on computed tomography (CT) of the chest. Structural lung disease and the host's immune status can affect NTM pulmonary infections. Herein, we report a rare case of an NTM pulmonary infection with multiple nodules and masses (with internal cavitation) in an immunocompetent patient exhibiting interstitial lung abnormality on a chest CT.

1. Introduction

Nontuberculous mycobacterial (NTM) species are a group of ubiquitous, low-grade pathogens that cause pulmonary infections even among immunocompetent people worldwide [1]. The prevalence of NTM infections has rapidly increased in developing countries since their pathogenic potential was first reported in the 1950s [2]. The *Mycobacterium avium complex* and *Mycobacterium kansasii* are known common NTM pathogens [3]. Host factors, such as genetic susceptibility, immune status, and the presence of chronic lung disease, may influence the development of NTM pulmonary infection [3,4].

Typical radiologic findings of computed tomography (CT) in patients with NTM pulmonary infection include two patterns: fibrocavitary and nodular-bronchiectatic forms [5]. The fibrocavitary form of NTM pulmonary infection, which commonly affects the upper lobes, is associated with cavities, volume loss, pleural thickening, and bronchiectasis. The nodular-bronchiectatic form is frequently characterized by bronchial dilatation with nodules and tree in bud opacities in the middle lobe and lingular segment.

Interstitial lung abnormalities (ILAs) are increasingly being recognized as a common feature on chest CT in older individuals, occurring in 2 %–7 % of nonsmokers and 4 %–9 % of smokers [6]. ILAs are defined solely by CT findings and refer to subtle or mild parenchymal abnormalities, such as ground-glass or reticular abnormalities, lung distortion, and traction bronchiectasis/bronchiolectasis. Also, the parenchymal abnormalities affect more than 5% of any lung zone on CT scans of individuals in whom interstitial lung disease is not suspected [6,7].

NTM pulmonary infections that are newly detected in patients with underlying idiopathic interstitial pneumonia during follow-up chest CT can manifest as atypical CT features, such as lobar or segmental consolidations with or without cavities [8]. To the best of our knowledge, there has been no report to date of atypical features of NTM pulmonary infections showing multiple masses in a patient with an ILA. Herein, we report a case of a patient with an ILA who developed an NTM pulmonary infection with multiple nodules and masses with internal cavitation on chest CT.

2. Case presentation

An 80-year-old woman presented to an outside hospital with fever and a dry cough. The patient's vital signs were as follows: respiratory rate, 20 breaths/min; blood pressure, 123/57 mmHg; heart rate, 85 beats/min; blood oxygen saturation, 96 %; and body temperature, 38.5 ℃. Based on her medical history, the patient was diagnosed with hypertension, without diabetes mellitus, and connective tissue disease. She had not taken any medications, except those for hypertension. She was a nonsmoker with no family history of interest. An outside posteroanterior chest radiograph performed 3 weeks before showed multiple consolidations and ground-glass opacities in both the mid and lower lung zones (Fig. 1). A subsequent chest CT scan showed multiple pulmonary nodules and masses with internal cavitation in both lungs (Fig. 2). There was no evidence of pulmonary thromboembolism, mediastinal or hilar

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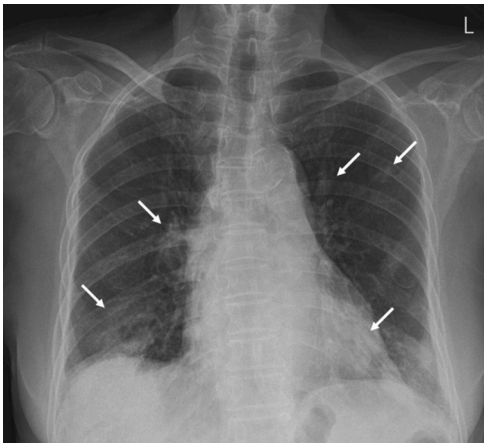

Fig. 1. Initial posteroanterior chest radiograph performed at another hospital showing multifocal consolidations and ground-glass opacities in both mid and lower lung zones (arrows).

lymphadenopathy, or pleural or pericardial effusion. Based on the impression of septic pneumonia or necrotizing pneumonia, empiric antibiotic treatment with vancomycin, tazolactam, and ertapenem was administered. However, she did not respond to antibiotics, and fever persisted. Therefore, the patient was referred to our hospital for further investigation.

At our hospital, the patient complained of fever and a cough without any clinically significant comorbidities. Laboratory data showed leukocytosis, (13,360/uL [normal, 4800–10,800 /uL]: 82.6 % neutrophils, 10.4 % lymphocytes, 3.9 % monocytes, and 2.0 % eosinophils), increased C-reactive protein levels (10 mg/dL [normal, <0.5 mg/dL]), an increased erythrocyte sedimentation rate (86 mm/h [normal, 0–20 mm/h]), and an increased procalcitonin levels (0.346 ng/mL [normal, 0–0.100 ng/mL]). Her renal and liver function tests were within the normal range. Considering the ineffectiveness of antibiotics at the outside hospital, our first impressions were of vasculitis, such as granulomatosis with polyangiitis (GPA), fungal pneumonia, pulmonary tuberculosis, or an NTM pulmonary infection. The tests for antinuclear antibodies, myeloperoxidase antibodies, and proteinase-3 antibodies were all negative. Moreover, blood cultures for fungi and bacteria were also negative. Blood, sputum, and bronchoalveolar lavage samples tested negatively for *Mycobacterium tuberculosis* and acid-fast bacilli on an interferon-gamma release assay and polymerase chain reaction. An ultrasound-guided percutaneous needle biopsy of the mass in the right lower revealed a chronic granulomatous inflammation, inflammatory cell infiltration, and distortion of the lung architecture (Fig. 3). One month later, a sputum culture showed growth of *Mycobacterium intracellulare*, confirming an NTM pulmonary infection.

Following treatment with anti-mycobacterial medications (ethambutol, rifampicin, and azithromycin), her symptoms and radiological findings greatly improved (Fig. 4). However, the previously hidden reticular densities in both lower lung zones were detected on a posteroanterior chest radiograph. Two years after the anti-mycobacterial treatment, a follow-up chest CT showed an improvement of the previously observed multiple masses and ground-glass opacities. Furthermore, it showed a predominant lower lobe pulmonary fibrosis with mild

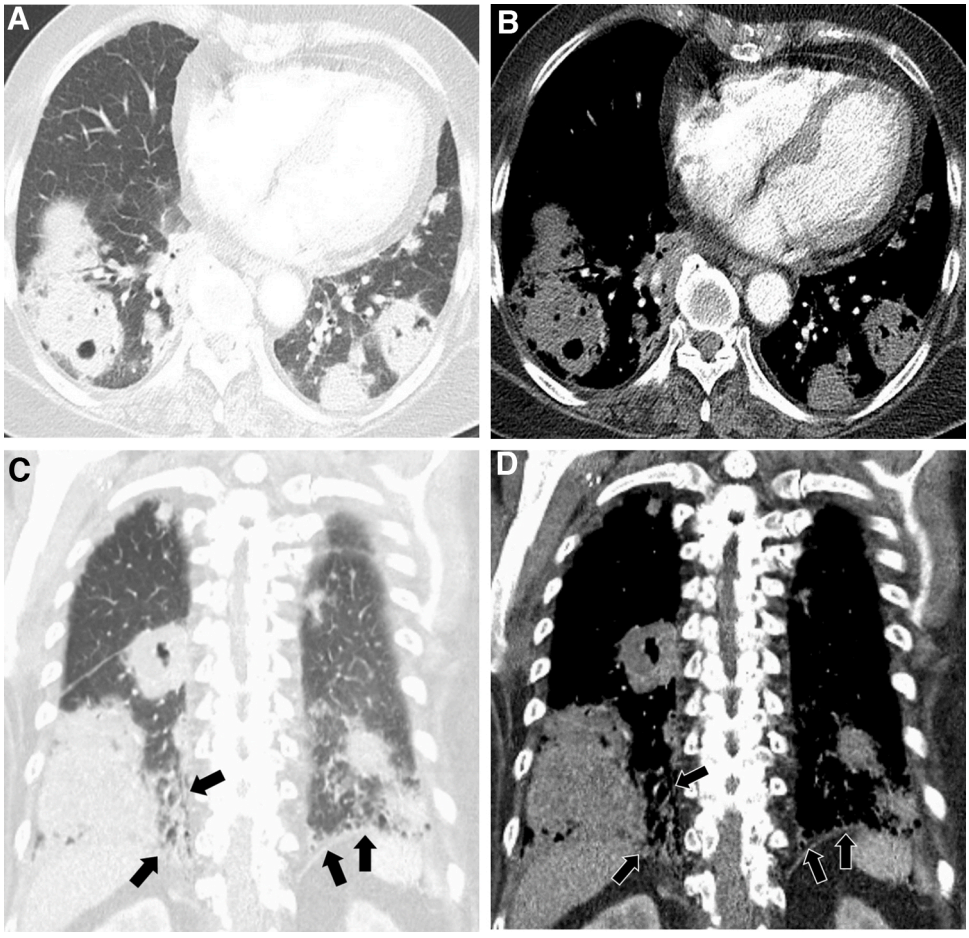

Fig. 2. A subsequent chest CT shows multiple nodules and masses with internal cavitation in both lungs. Pulmonary thromboembolism and pleural effusion were not observed; however, reticulation and ground-glass opacities with traction bronchiectasis were detected in the posterior basal segment of the right lower lobe (arrows).

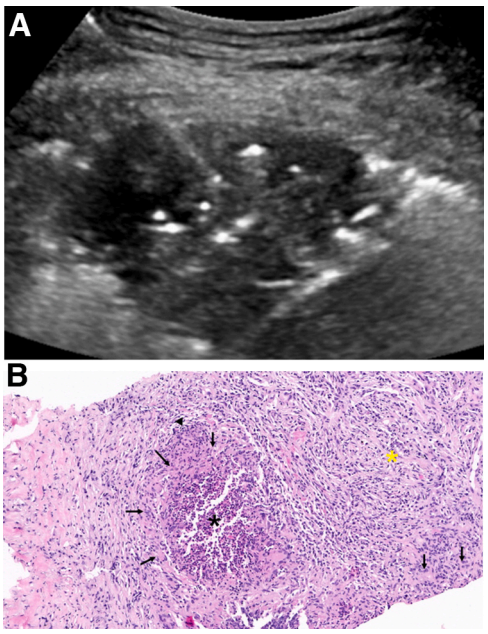

Fig. 3. A. Ultrasound-guided percutaneous needle biopsy of the mass in the right lower lobe.
B. Corresponding microscopic features (hematoxylin and eosin stain, ×200) showed a peripheral rim of granuloma (arrows) and Langerhans giant cells (arrowheads) surrounding the inflammatory cells, including neutrophils (black asterisk). Alveolar septa thickened by the inflammatory cell infiltration and mild interstitial fibrosis with distortion of lung architecture (yellow asterisk).

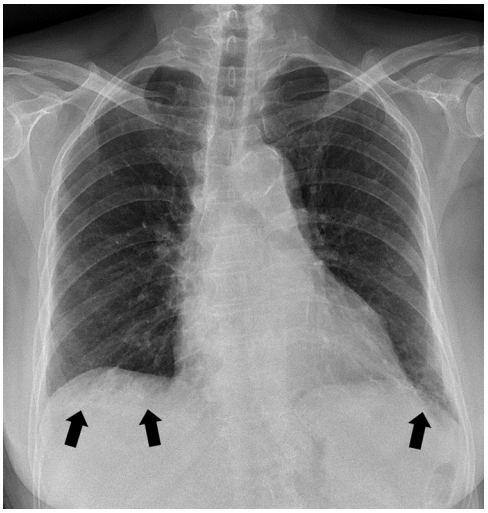

Fig. 4. A posteroanterior chest radiograph after anti-mycobacterial treatment. Multiple consolidations and ground-glass opacities were improved. Reticular opacities were noted in both lower lung zones (arrows).

ground-glass opacity, reticulation, and traction bronchiectasis that was not identified on the initial chest CT (Fig. 5). She is now on outpatient follow-up with no clinical symptoms.

3. Discussion

NTM infection is a common and important cause of chronic pulmonary infection, with continuously increasing prevalence [3]. Typical CT findings of NTM pulmonary infection include a fibrocavitary form and a nodular-bronchiectatic form [5]. We here reported a case of an 80-year--old woman with an ILA complicated by an NTM pulmonary infection

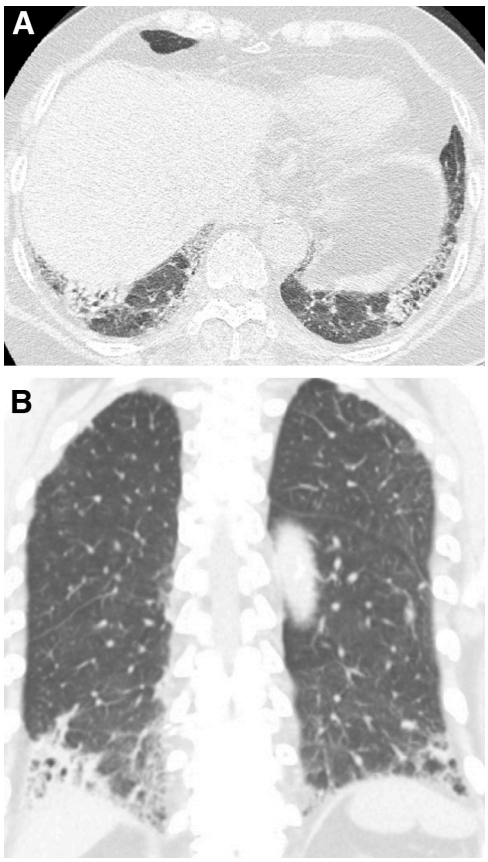

Fig. 5. Follow-up chest CT performed after 2 years of anti-mycobacterial treatment shows improvement in multiple nodules and masses in both lungs. The underlying lung parenchyma revealed subpleural reticulation with traction bronchiectasis in both lungs with basal and peripheral predominance.

that presented as multiple nodules and masses with internal cavitation on a chest CT.

Follow-up chest CT after treatment showed a pulmonary fibrosis, mild ground-glass opacity, reticulation, and traction bronchiectasis with lower lobe predominance previously not identified on a CT scan. According to the position paper from the Fleischner society, these parenchymal abnormalities are consistent with an ILA [9]. Interestingly, after careful review of the initial chest CT images, reticulation, and ground-glass opacities with traction bronchiectasis not obscured by the masses were demonstrated in both lower lobes. In addition, parenchymal lesions other than NTM pulmonary infection did not show significant changes between the initial and follow-up chest CT scans. Therefore, we supposed that a structural lung disease existed prior to the NTM pulmonary infection.

An NTM pulmonary infection is associated with the immune status of the patient and structural lung damage, such as bronchiectasis, COPD, cystic fibrosis, or pneumoconiosis [4]. Our patient was immunocompetent with no medical problems affecting her immune status. After treatment for an NTM pulmonary infection, a chest CT revealed a reticular pattern and mild ground-glass opacities with peripheral bronchiectasis dominant in the lower lobes. Therefore, the NTM pulmonary infection was noted to be associated with an underlying lung disease rather than the immune status of the patient. Considering the distribution of the NTM pulmonary infection lesions, which predominantly involve the lower and peripheral lung, an ILA may be associated with an NTM pulmonary infection. Damage to the lung caused by an ILA promotes susceptibility to an NTM pulmonary infection and can provide a favorable environment for NTM growth.

A previous study showed unusual CT manifestations of NTM

pulmonary infections in patients with idiopathic interstitial pneumonia, characterized by lobar or segmental consolidations with or without cavity formation [8,10]. An NTM pulmonary infection may also present as a solitary nodule, mass, or mass-like consolidation that mimics malignancy [11]. However, the initial chest CT of our patient showed multiple nodules and masses with internal cavitation predominantly in both lower lobes. Therefore, NTM pulmonary infection was not included in the initial differential diagnosis.

On chest CT, differential diagnoses for multiple masses with internal cavitation include necrotizing pneumonia, fungal pneumonia, such as invasive pulmonary aspergillosis, and vasculitis, such as GPA. The radiologic feature of invasive pulmonary aspergillosis usually includes infarct-shaped consolidations. However, our case showed cavitary nodules or masses [12]. GPA typically features ground-glass opacities or ill-defined margins surrounding the nodule or consolidation because of the tendency toward alveolar hemorrhage [13]. Other radiologic characteristics of GPA include linear scaring, pleural tags, and speculation. These radiologic findings can be useful in differentiating an NTM pulmonary infection from GPA. Clinical information, including antibiotic response, immune status, and upper respiratory tract involvement, also plays an important role in distinguishing an NTM pulmonary infection from other diseases.

According to the guideline for NTM pulmonary disease, the diagnosis of NTM pulmonary disease requires clinical and/or microbiologic criteria [3]. With regard to the clinical criteria, nodular or cavitary opacities on a chest radiograph or bronchiectasis with multiple small nodules on a chest CT are essential features for diagnosis. Our case met the radiologic diagnostic criteria for the fibrocavitary form of the disease, according the chest radiograph findings. However, the radiograph showed multiple nodules and masses predominantly in the lower lobe with internal cavitation, unlike the fibrocavitary form located in the upper lobe. Our case also met the microbiologic diagnostic criteria, with pathologic confirmation of granulomatous inflammation from a lung biopsy and NTM-positive sputum culture.

In summary, we report an atypical CT manifestation of an NTM pulmonary infection in a patient with an ILA. We also demonstrate that NTM pulmonary lesions may mask underlying lung disease and can mimic other diseases.

4. Conclusion

When assessing nodules and masses on chest CT, radiologists should consider the possibility that these lesions may obscure existing structural lung disease. Moreover, if radiologists encounter multiple nodules and masses in patients with an ILA, NTM pulmonary infection could be considered as a differential diagnoses.

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Transparency document

The Transparency document associated with this article can be found in the online version.

Declaration of Competing Interest

The authors have no conflicts of interest.

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