The Reversed Halo Sign on Computed Tomography of Chest in Pulmonary Tuberculosis: A Case Report

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ABSTRACT

The reversed halo sign is characterized by a focal rounded area of ground glass opacity surrounded by a ring of consolidation and it has been described in a variety of pulmonary diseases, including infectious and noninfectious diseases. The authors report the reversed halo sign on computed tomography of chest from pulmonary tuberculosis in a patient with underlying diffuse large B-cell lymphoma.

Keywords: Reversed halo sign, computed tomography, pulmonary tuberculosis, invasive fungal infection

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INTRODUCTION

The reversed halo sign is an uncommon finding on a computed tomography (CT) of chest and is characterized by a focal rounded area of ground-glass opacity surrounded by a more or less complete ring of consolidation.[1] It has also been described as the "daisy flower"[2] or "atoll sign".[3] It was first recognized by Voloudaki AE et al.[4] in cryptogenic organizing pneumonia (COP) and relatively specific to a diagnosis of COP.[5] However, this finding has subsequently been described in a variety of pulmonary diseases, including infectious and non-infectious diseases. The authors report a case of diffuse large B-cell lymphoma and pulmonary tuberculosis which presented the reversed halo sign on CT scan of chest.

CASE REPORT

A sixty-seven year-old male with an underlying disease of diffuse large B-cell lymphoma presented with a mass at his left nasal cavity. He received systemic chemotherapy (R-CHOP regimen) and intrathecal methotrexate. After the first cycle of chemotherapy, he developed a low grade fever with a dry cough and weight loss of 6 kilograms. Physical examination revealed crackles at the right mid lung zone. Chest radiograph demonstrated a mass-like opacity at the right mid lung zone (Fig 1A, B) and CT scan of his chest showed a central area of ground-glass opacity surrounded by a complete ring of consolidation at his right middle lobe (reversed halo sign), size 5.2×4.5 centimeters (Fig 2). Bronchoscopy was performed, and transbronchial lung biopsy demonstrated necrotic tissue containing many acid fast bacilli and fungal hyphae (Fig 3), but the microbiologic study included culture for bacteria, mycobacteria, and fungus which were negative. Pulmonary tuberculosis was diagnosed and the patient was treated with a standard six-month regimen of antituberculous medication. His symptoms and signs were improved and chest radiograph was resolved after complete treatment of tuberculosis.

DISCUSSION

The reversed halo sign was initially thought to be relatively specific for cryptogenic organizing pneumonia and characterized by a focal rounded area of ground-glass opacity surrounded by a ring of consolidation.[1] However, this finding has subsequently been described in a variety of conditions, including infectious and non-infectious diseases. Marchiori E et al.,[6] reported the reversed halo sign on high-resolution CT (HRCT) of seventy-nine patients and this sign was associated with inflammatory diseases, infections, and malignancy (Table 1). Therefore,

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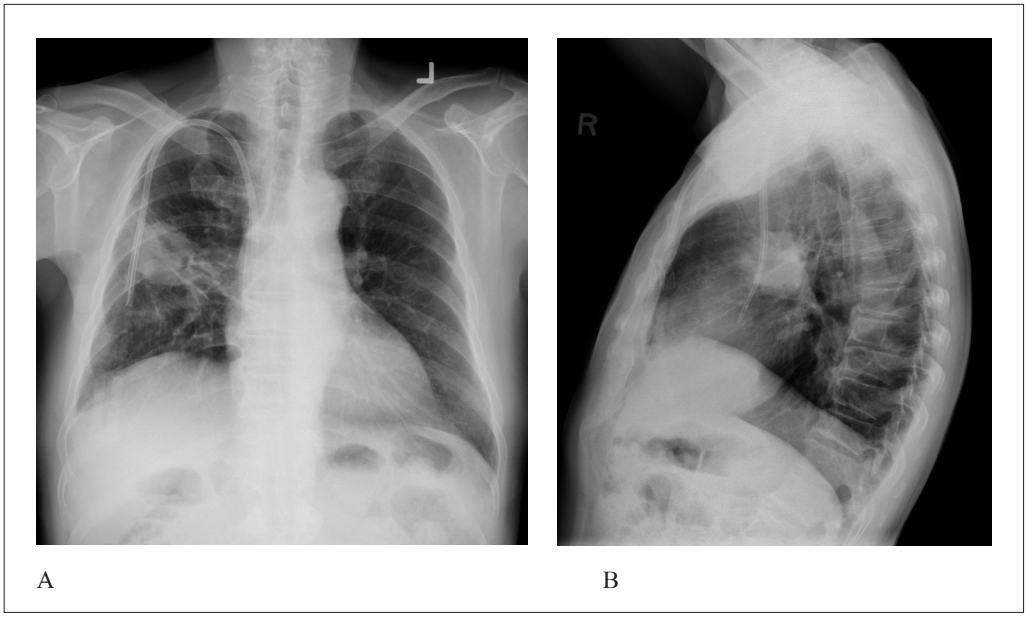

Fig 1A and B. Chest radiograph demonstrates a mass-like opacity with air bronchogram and surrounding fibrosis at right middle lung zone. Also note right hilar enlargement.

the reversed halo sign is a non-specific sign. The most common cause is infectious disease, such as invasive fungal infection, pulmonary tuberculosis, and endemic pulmonary fungal infection.[7] The presence of a halo of ground-glass opacity from HCRT is associated with hemorrhagic nodules from hemorrhagic infarction, necrosis, vasculitis, fragility of neovascular tissue, bronchoarterial fistula[8] with a greater amount of hemorrhaging and infarction at the periphery rather than at the center[9] which can explain the HRCT finding of dense consolidation at the peripheral rim.

In the immunocompromised patients, the reversed halo sign should be suspected as caused from infectious disease, especially pulmonary tuberculosis and invasive fungal infection. The common HRCT findings in pulmonary tuberculosis include centrilobular nodules, tree-in-bud pattern, consolidations, and cavitations. While the reversed halo sign was described only recently, the imaging that suggests pulmonary tuberculosis is the presence of nodular walls or nodules inside the reversed halo[10] and the lesions may be single or multiple.[6] In invasive fungal infection, the reversed halo sign was seen in 4% and it is significantly more common in pulmonary zygomycosis (mucormycosis) than in invasive pulmonary aspergillosis,[11] and the pattern of reversed halo sign in invasive fungal infection is the smooth contours and single lesion.[6] However, this pattern from HRCT is not a definite diagnosis, so an invasive investigation such as bronchoscopy with transbronchial lung biopsy and microbiological study should be performed. In this patient, tissue histopathology demonstrated necrotic tissue with many acid fast bacilli and broad-shaped fungal hyphae. Pulmonary tuberculosis

Fig 2. Axial CT of the chest reveals a rounded area of ground-glass opacity surrounding by a ring of consolidation (reversed halo sign) at lateral segment of right middle lobe.

TABLE 1. Cause of the reversed halo sign on high-resolution CT scan of chest in 79 patients

Cause	Number of patients (percent)
Organizing pneumonia	18 (22.8)
Paracoccidioidomycosis	14 (17.7)
Pulmonary tuberculosis	12 (15.2)
Pulmonary embolism	7 (8.9)
Invasive pulmonary aspergillosis	6 (7.6)
Zygomycosis	6 (7.6)
Sarcoidosis	5 (6.3)
Lepidic predominant adenocarcinoma	3 (3.8)
Pulmonary edema	3 (3.8)
Granulomatous with polyangiitis	2 (2.4)
Histoplasmosis	1 (1.3)
Cryptococcosis	1 (1.3)
Pneumocystis pneumonia	1 (1.3)
Total	79 (100)

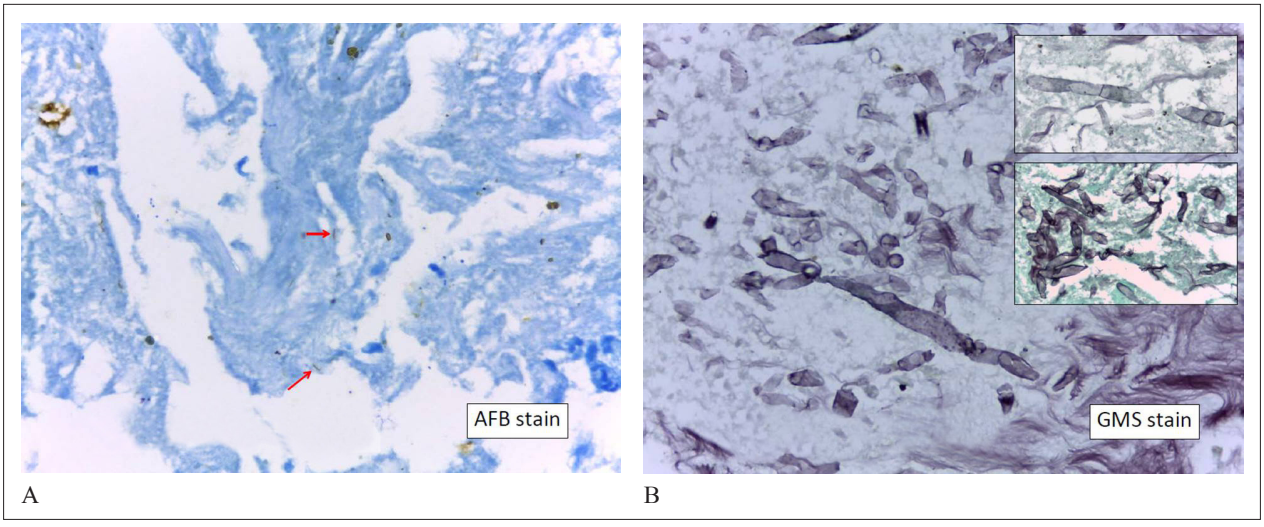

Fig 3. Histologic finding from transbronchial lung biopsy demonstrated acid fast bacilli (red arrow) and fungal hyphae.

was diagnosed and the standard six-month regimen of antituberculous medication according to World Health Organization recommendation was started,[12] while an antifungal drug was not started because there was no evidence of tissue invasion from fungus and serum galactomannan, thus the fungal hyphae may be a colonization. His clinical signs and symptoms improved and chest radiograph was resolved after he completed treatment for tuberculosis.

In conclusion, the reversed halo sign from CT of chest can be found in a variety of conditions. However, this finding in immunocompromised patients should be further investigated for its etiology, especially infectious diseases such as pulmonary tuberculosis and invasive fungal infection.

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