



## Case report

## An onion farmer with a case of hypersensitivity pneumonitis caused by *Aspergillus niger*



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## ABSTRACT

A 62-year old man was admitted to our hospital with a 2-week complaint of a dry cough, general fatigue, and dyspnea on effort. He has been an onion farmer for several years and developed these symptoms after cleaning up onion peels with air compressors. A chest roentgenogram and computed tomography showed a ground glass shadow in the bilateral upper lung field. Cellular analysis of the bronchoalveolar lavage fluid showed elevated total cell numbers and lymphocytes. Transbronchial lung biopsies revealed a non-caseating granuloma with both epithelioid cells and Langhans giant cells. After the admission, these symptoms and radiological findings gradually improved without any treatment. Then, a returning-home provocation test was positive only when he worked cleaning up onion peels with air compressors. *A. niger* was cultured from his workplace and black mold from the onion peels. The precipitation antibody and the antigen were both positive for *Aspergillus*. Therefore, we diagnosed this case as hypersensitivity pneumonitis caused by inhalation of *A. niger*.

Although hypersensitivity pneumonia caused by *A. niger* is rare, physicians should aware the possibility of this condition in farmers because *A. niger* is ubiquitously present in several vegetables and fruits.

## 1. Introduction

Hypersensitivity pneumonia (HP), or extrinsic allergic alveolitis, is caused by various antigens, such as proteins, bacteria, and fungi. Among the fungi, *Aspergillus fumigatus* sometimes causes farmer's lung [1], while *A. niger* is rarely the causative antigen for HP. Here, we report on an onion farmer with a case of HP caused by *A. niger*.

## 2. Case report

A 62-year-old male, an onion farmer for several years, was referred to our department with a 2-week complaint of a dry cough, general fatigue, and dyspnea on effort. He has been treated for hypertension and had smoked for 35 years. He never had any pets. Physical examination of the head, neck, and abdomen was unremarkable, but fine crackles were heard during late inspiration on the back of his chest. His chest roentgenogram showed a ground glass shadow in the upper lung field. His chest computed tomography revealed ground glass opacity in the bilateral lung field, which was predominantly in the upper lung field. A mosaic perfusion pattern and small nodules were also observed in the peripheral lung field (Fig. 1).

His vital capacity (VC) was within normal limits (%VC was 92.5%). His diffusing capacity for carbon monoxide (DL<sub>CO</sub>) could not be measured because he had difficulty taking a deep breath. White blood cell counts, red blood cell counts, and platelet counts were within normal limits. C-reactive protein was 0.58 mg/dl. Blood chemistry tests for renal and liver function were within normal limits. The test for anti-nuclear antibody was negative. Angiotensin converting enzyme was 16.9 U/L. Air blood gas analysis in room air showed decreased oxygen pressure with normocapnia (pH 7.408, pCO<sub>2</sub> 38.0 Torr, pO<sub>2</sub> 69.9 Torr, AaDO<sub>2</sub> 38.5 Torr).

He was admitted to our hospital for further evaluation. Bronchoalveolar lavage fluid (BALF) obtained from the right S<sup>5</sup> showed elevated total cell counts (442 x 10<sup>3</sup>/ml) with an increased number of cells and an increased percentage of lymphocytes (87.0%), and the ratio of CD4/CD8 lymphocytes was decreased to 0.5. The BALF culture was negative for both fungus and mycobacterium. Transbronchial lung biopsies obtained from the right S<sup>4</sup> revealed a non-caseating granuloma with both epithelioid and Langhans giant cells.

After the admission to our hospital, his clinical symptoms gradually improved in a week without any treatment. His chest CT showed improvement of the ground glass shadow. Air blood gas analysis showed

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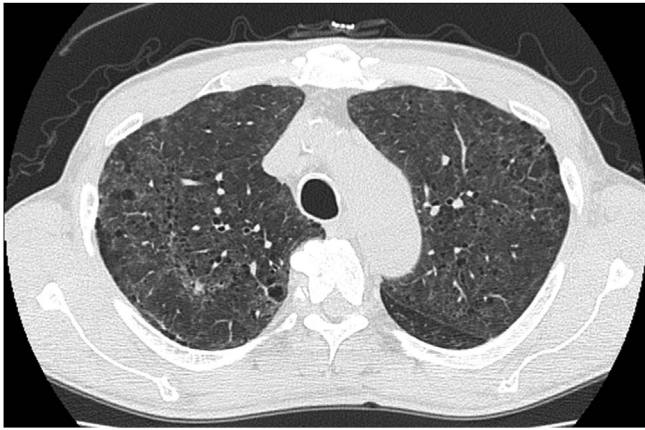


Fig. 1. Chest CT showed a mosaic perfusion pattern and small nodules in the peripheral lung field.

improvement of oxygen pressure (pH 7.378, pCO<sub>2</sub> 40.8 Torr, pO<sub>2</sub> 92.5 Torr, AaDO<sub>2</sub> 11.5 Torr), white blood cell counts were 7400/mm<sup>3</sup>, and CRP was 0.13 mg/dl. The precipitated antibody for *Trichosporon Asahi* was negative, but the precipitated antibody for *Aspergillus* was positive. The *Aspergillus* antigen was also positive. Since hypersensitivity pneumonitis due to the *Aspergillus* species at either his home or workplace was suspected, a returning-home provocation test was performed. We asked the patient to stay at home on the first day, to perform cleaning the onion peels by air compressors on the second day, and to return to our hospital on the third day. He returned to our hospital on the third day complaining of a cough, and he reported that he had had a low-grade fever 3 h after working with the onions. His white blood cell counts were elevated to 10,600/mm<sup>3</sup> and his CRP was also elevated to 1.18 mg/dl. A chest CT showed worsening of the ground glass opacity in the lower lung field.

We suspected that this case was fungi-induced hypersensitivity pneumonitis since the home-returning provocation test was positive. We surveyed for environmental fungi in his home. Black colonies were formed in the Sabouraud's medium left overnight in his workplace (Fig. 2) and detected *Aspergillus fumigatus* and *Aspergillus niger*, while



Fig. 2. Black colonies were formed in the Sabouraud's medium from onion peels at his patient's workplace.

only *Aspergillus niger* was identified from black mold on the onion peels. Then, we had the patient perform a second home-returning provocation test without cleaning the onion peels at his workplace. After returning to our hospital, he had no respiratory symptoms or fever. His chest CT and other laboratory findings did not decline after returning home. Therefore, we diagnosed this case as HP caused by *A. niger*.

He was discharged from the hospital and was advised to avoid direct inhalation of onion peels. He has been doing well with no respiratory symptoms or fever for three years.

### 3. Discussion

Hypersensitivity pneumonitis (HP) or extrinsic allergic alveolitis is caused by inhalation of several organic particles. Bird proteins and bacteria *Saccharopolyspora* are the most frequent antigens that cause HP [1]. Several species of fungi also cause HP, including *Trichosporon Asahi* which can cause summer type HP, especially in Japan. Humidifier lung can be caused by both *Penicillium* and *Cephalosporidium* [2,3]. *Aspergillus fumigatus* can cause farmer's lung which is an occupational hypersensitivity pneumonitis. While other *Aspergillus* species, such as *Aspergillus niger*, which was used at a biotechnology plant for producing citric acid, did not cause any symptoms of hypersensitivity pneumonia in 325 workers at the plant [4]. *A. niger* has been reported to be safe [5,6]. However, Haraguchi et al. reported a case of hypersensitivity pneumonitis in a citrus fruit farmer induced by inhalation of *A. niger* [7]. They speculated that *A. niger* on the citrus fruit was spread in the workplace by air compressors and then the patient repeatedly inhaled the fungi. Yasui et al. also reported three cases of hypersensitivity pneumonitis in citrus farmers possibly induced by either *Penicillium* or *Aspergillus*. In our case, *A. niger* and *A. fumigatus* were cultured from the home, and *A. niger* was cultured from the workplace as well as from the onion peels. Furthermore, the second home-returning provocation test when the patient was working with air compressors and onion peels was positive. Although culture of fungi is not simple and various kind of fungus might coexist and cause HP in this case, we diagnosed this case as HP caused by *A. niger* from the second home-returning provocation test. However, there is a possibility that other fungus could induce HP.

In our case, the antigen for *Aspergillus* and the precipitation antibody were positive. We have not checked the antigenicity of *A. niger* obtained from his workplace, mainly because there is immune cross-reactivity between *A. fumigatus* and *A. niger* [7].

Hypersensitivity pneumonitis is categorized into a chronic type and an acute/subacute type [8]. The acute type HP generally shows a good prognosis while the chronic type HP shows a poor prognosis because of persistent, low grade exposure of the pathogenic antigen, which sometimes is not detected or recognized by HP patients or by physicians [9]. In our case, the patient generally wore a thick filtered mask while working. However, he did not wear a mask when he developed the symptoms. Therefore, we asked the patient to wear a thick filtered mask and to filter the air while working. Although the most important therapy for HP is avoidance of the pathogenic antigen, we did not ask patient to quit his job. We should carefully monitor the progress of the patient to be sure that he does not to develop the chronic type of HP in the future.

Here, we report a case of HP caused by *A. niger*. Although HP caused by *A. niger* is not common, physicians should aware the possibility of pathogenic antigens of *A. niger* because this pathogen is universally present in vegetables and fruits.

### Patient consent

Written informed consent for the publication of this report was obtained from the patient.

## Conflicts of interest

The authors report no conflict of interest.

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