

Extrinsic allergic alveolitis caused by spores of the oyster mushroom *pleurotus ostreatus*

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ABSTRACT: Four mushroom workers have developed an extrinsic allergic alveolitis, after working with the oyster mushroom (*Pleurotus ostreatus*). After provocation with aerosolized spores under laboratory conditions, the four patients showed the complaints of an extrinsic allergic alveolitis; a rise of body temperature, leucocytosis and changes of lung function parameters were observed. Antibodies against the spores were assessed in the blood of these patients.

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In Western Europe the popularity of the edible mushroom *Pleurotus ostreatus* (oyster mushroom) is increasing rapidly. Few people know about the health drawbacks of this culinary attraction. In a period of two years we saw four people with severe complaints following work with this mushroom. Three patients were engaged in the harvesting and one in the working-up of the mushroom. In Western Europe oyster mushrooms are cultivated on straw, either on bales or in trays. The relative air humidity in the cultivation room is high and sometimes a mist of spores can be seen. The mushrooms are harvested by handpicking and cutting off the stipes. Thereafter the mushrooms are weighed and sorted in boxes. These procedures set free additional quantities of spores.

Case histories

Subject 1: a 44-yr-old woman, who had been working in a centre for mushroom culture for two months, sorting and weighing the mushroom *Pleurotus ostreatus*. She repeatedly had symptoms of dyspnoea, chills, fever (39.3°C) and muscle pain starting about 6 h after work.

Subject 2: a 28-yr-old woman, who had been engaged in cultivating the mushroom *Pleurotus ostreatus* for four months. She had symptoms of fever, dyspnoea, chills and headaches, 6 h after exposition.

Subject 3: a 37-yr-old man, who worked as a nurse and in his spare-time had been cultivating the mushroom *Pleurotus ostreatus* for three months. He repeatedly had symptoms of dyspnoea, cough, chills and nausea, starting 6-10 h after contact with the mushroom.

Subject 4: a friend of subject 3, a 29-yr-old ambulance driver, who had been cultivating the

mushroom *Pleurotus ostreatus* in his spare-time for three months. Seven hours after contact with the mushroom he repeatedly showed symptoms of fever, cough, wheezing, chills, perspiration and sputum production.

Investigations

Before exposition the four patients had no pulmonary complaints, normal chest roentgenographs, normal lung function tests: inspiratory vital capacity (IVC), total lung capacity (TLC), forced expiratory volume in one second (FEV₁), FEV₁% and transfer factor of the lungs for carbon monoxide (TLCO), normal laboratory blood findings, normal body temperature and lung auscultation. One patient (subject 1) was exposed under working conditions, the other patients (subjects 2-4) under clinical conditions. The latter inhaled a nebulized solution with suspended spores of *Pleurotus ostreatus* by mouth breathing. The solution contained 5 gm of spores in 10 ml saline, and was nebulized in a Wright nebulizer with an output of 0.13 ml/min. The exposition lasted for 10 min.

Results

Response to the bronchial provocation test:

Subject 1 developed complaints of fever, chills, arthralgia, muscle pain and dyspnoea, 6-7 h after provocation. The body temperature rose from 37.3 to 39.2°C, the leucocyte count increased from 7.1 to 16.0 × 10⁹ · l⁻¹. Lung function showed a decrease in IVC from 3.85 to 3.35 l, in TLC from 5.65 to 5.05 l and no decrease in TLCO (see also figure 1). Chest X-rays showed no abnormalities.

Subject 2 developed complaints of fever, chills and dyspnoea, 7-8 h after provocation. The body temper-

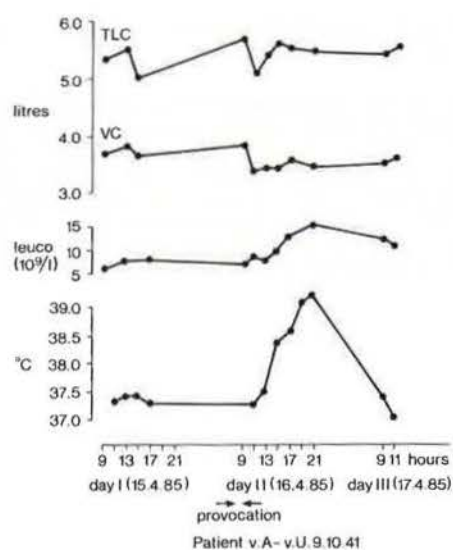


Fig. 1. TLC, VC, leucocytes and body temperature for subject 1 on the control day (day I), the provocation day (day II) and the day after the provocation (day III).

ature rose from 36.9 to 38.2°C, the leucocyte count from 5.8 to $20.7 \times 10^9 \cdot l^{-1}$. Lung function tests showed a decrease in IVC from 3.7 to 3.45 l and TLC from 5.1 to 4.8 l; TLCO and chest X-rays showed no change. On auscultation of the chest the patient had late inspiratory crackles.

Subject 3 developed complaints of fever and dyspnoea, 7 h after provocation. The body temperature rose from 36.8 to 37.9°C, the leucocyte count from 10.5 to $17.5 \times 10^9 \cdot l^{-1}$. The IVC decreased from 4.2 to 3.8 l, the TLC from 5.5 to 5.3 l and the TLCO from 34 to $24 \mu\text{mol} \cdot \text{s}^{-1} \cdot \text{kPa}^{-1} \cdot l^{-1}$. No changes were seen in the chest X-rays.

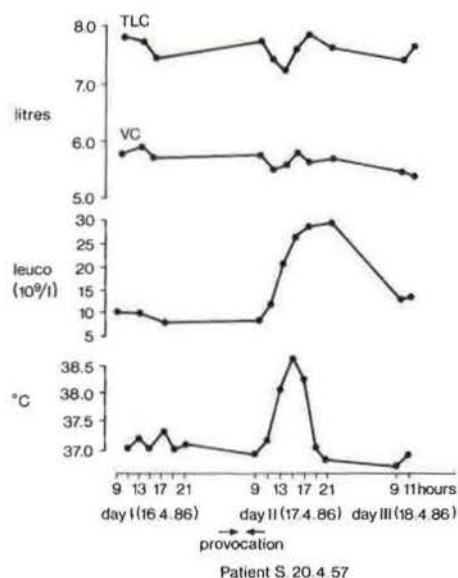


Fig. 2. TLC, VC, leucocytes and body temperature for subject 4 on the control day (day I), the provocation day (day II) and the day after the provocation (day III).

Subject 4 developed complaints of chills, muscle pain and cough, 6 h after provocation. The body temperature rose from 37.0 to 38.7°C, the leucocyte count from 8.4 to $30.0 \times 10^9 \cdot l^{-1}$. The IVC decreased from 5.75 to 5.5 l, the TLC from 7.7 to 7.2 l and the TLCO from 32 to $26 \mu\text{mol} \cdot \text{s}^{-1} \cdot \text{kPa}^{-1} \cdot l^{-1}$. On auscultation of the chest the patient had late inspiratory crackles (fig. 2). No changes were seen in the chest X-ray.

All mentioned indices were normal 24 h after provocation. In the blood of all patients, antibodies against *Pleurotus* spores were found by using the immunoblot technique (IgG antibodies).

Discussion

Four patients, two males and two females, working with the mushroom *Pleurotus ostreatus*, had symptoms of extrinsic allergic alveolitis; 6–8 h after inhalation-provocation tests all patients showed flu-like complaints, chills, muscle pain, dyspnoea and cough. The body temperature rose in all patients. With regard to the lung function tests, restrictive changes in lung function were seen in two patients; in one patient restrictive changes and a decrease in diffusion were observed; one patient showed only a decrease in diffusion (TLCO). No obstructive abnormalities in lung function were found. The leucocytes in the peripheral blood always showed a considerable increase of up to $30 \times 10^9 \cdot l^{-1}$. There were no changes in chest X-rays after provocation. The provocation tests in patients 2–4 proved that the spores of *Pleurotus ostreatus* were responsible for the extrinsic alveolitis in these patients.

Apparently this type of allergic alveolitis develops after a rather short exposition of only a few months. The exposition must not necessarily be very intensive: growing this mushroom as a hobby is sufficient to create a hypersensitivity.

In 1974 and 1976 NOSTER and co-workers [1–3] described the symptoms of extrinsic alveolitis in two patients engaged in the cultivation of the oyster mushroom. They did not perform inhalation-provocation tests nor did they show the existence of antibodies in their patients' blood. The cultivation of this edible mushroom may increase the frequency of this illness in the future. This emphasizes the importance of careful history-taking in a patient, to include professional as well as spare-time activities. The delayed appearance of complaints, several hours after contact with the antigen, hinders the diagnosis.

Protective measures, like wearing a face mask (3-M non-toxic particle masks Nos 6985 and 8500 showing an efficiency of 99% for particles with a diameter of 10 μ and more), are advised when working with this mushroom. We have shown that, in contrast to the well-known clinical entity of 'the mushroom-worker's lung', this type of allergic alveolitis is probably caused by the spores of this mushroom, whereas the classical mushroom-worker's lung is probably caused by

thermophilic actinomycetes in the soil on which the mushrooms (*Agaricus bisporus*) are grown.

References

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RÉSUMÉ: Quatre champignonnistes travaillant avec le Pleurote en huitre (*Pleurotus ostreatus*) ont développé une alvéolite allergique extrinsèque. Après provocation avec des spores en aérosol dans des conditions de laboratoire, les quatre patients présentaient les symptômes d'une alvéolite allergique extrinsèque. Ainsi qu'une élévation de la température, une leucocytose et des changements des paramètres de fonction pulmonaire. Des anticorps contre les spores ont été démontrés dans le sang des patients.