Allergic bronchopulmonary mycosis caused by Penicillium luteum

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1. Introduction

Aspergillus fumigatus is the most common cause of Allergic bronchopulmonary mycosis (ABPM). However, even though Penicillium species are among the most common fungi in the environment, ABPM due to Penicillium species is rare, accounting for only 1.9% of ABPM cases other than Aspergillus fumigatus [1]. In particular, only one case of Penicillium-associated ABPM for which the species was identified (P. digitatum or P. rubrum) has been reported [2]. Here, we present a rare case of Penicillium-associated ABPM, which was caused by P. luteum.

2. Case

A 65-year-old Japanese male had severe bronchial asthma had increased mold-containing sputum. Serum total IgE level had increased to 798 IU/mL and antigen-specific precipitating antibodies to P. luteum and P. notatum were present but not those reactive toward any species of Aspergillus. Chest computed tomography revealed central bronchiectasis and bronchial wall thickening. After antigen-specific provocation with 10 mg/mL of P. luteum, the patient developed asthma exacerbation, but not with A. fumigatus. We present a rare case of Penicillium-induced allergic bronchopulmonary mycosis caused by P. luteum.

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ABSTRACT

A 65-year-old Japanese male had severe bronchial asthma had increased mold-containing sputum. Serum total IgE level had increased to 798 IU/mL and antigen-specific precipitating antibodies to P. luteum and P. notatum were present but not those reactive toward any species of Aspergillus. Chest computed tomography revealed central bronchiectasis and bronchial wall thickness. After antigen-specific provocation with 10 mg/mL of P. luteum, the patient developed asthma exacerbation, but not with A. fumigatus. We present a rare case of Penicillium-induced allergic bronchopulmonary mycosis caused by P. luteum.

When the patient was 54 years old, resection of nasal polyps followed by daily treatment with 1600 μg inhaled fluticasone propionate and 5 mg of prednisolone decreased the number of asthma exacerbations annually. At age 64 years (day 0), the patient had increased mold-containing sputum, the percentage of eosinophils as 13.8% (cells) and his serum total IgE level had increased from 259 IU/mL at age 39 years to 798 IU/mL. At this time (day 28), we again measured antigen-specific serum IgE levels as described and serum antigen-specific precipitating antibodies by Ouchterlony double immunodiffusion testing. Antigen of P. chrysogenum for measurement of IgE or P. luteum for precipitating antibodies was derived from Torii Pharmaceutical Co., Ltd, Tokyo, Japan. In contrast to his earlier results, the patient now had antigen-specific IgE antibodies to Aspergillus and Penicillium. In addition, antigen-specific precipitating antibodies to P. luteum and P. notatum were present but not those reactive toward any of 9 species of Aspergillus. Penicillium species was separated from mold-containing sputum at age 64 years, but more detailed species was not identified. Chest computed tomography revealed bronchial wall thickness, central bronchiectasis, and mucoid impaction (Fig. 1) (day 84).

We obtained written informed consent from the patient to perform bronchial provocation tests using P. luteum and A. fumigatus. At bronchial provocation testing using Penicillium l10 min after antigen-
A specific provocation with 10 mg/mL of *P. luteum* (Torii Pharmaceutical Co., Ltd., Tokyo, Japan), the patient developed wheezing and chest tightness, and his peak expiratory flow decreased to 83.5% of that before antigen administration (day 98). He experienced a delayed hypersensitivity reaction 12 h after last provocation (day 99). However, inhalation of *A. fumigatus* (Torii Pharmaceutical Co., Ltd., Tokyo, Japan) did not elicit any changes in lung function or cause asthma exacerbation (Fig. 2) (day 105).

To collect particulate aerosolized from the patient’s room or environment (day 133), we left open Petri dishes (plain coated with potato dextrose agar) plastic, 90×15 mm; SH90-15; Asahi Glass Co., Ltd., Tokyo, Japan) throughout the patient’s bedroom for 10 min and recorded. A decrease of more than 15% (horizontal line) from baseline was defined as a positive reaction to the provocation protein fraction. We elucidate a crossreactivity of *Penicillium* and *Aspergillus* species than *Penicillium* fungi. We did not examine precipitating antibodies to other *Penicillium* species than *P. luteum* or *P. notatum*. Furthermore, we performed bronchial provocation tests using *P. luteum*, but not *P. notatum*, and any other *Penicillium* species than *P. luteum*. Because we could not get commercially available antigens or not purified from environment or sputum. We considered the possibility for crossreactivity in *P. luteum* or *P. notatum* or other *Penicillium* species. We could not find *P. luteum* in his sputum or his living spaces. We consider *P. luteum* may be mixed in *Penicillium* species. Many kind species of *Penicillium* were resembling similar and it was difficult to identify each *Penicillium*. However, this patient exacerbated asthma after provocation of *P. luteum* but not *A. fumigatus*. We consider one of some causes for ABPM in this patient is due to *P. luteum*.

We elucidate a crossreactivity of *P. luteum* and *Penicillium* species in the future.

Here, we presented a rare case of *Penicillium*-specific ABPM, which was due to *P. luteum* and was not associated with *Aspergillus*, the most common cause of the disease. Despite our inability to isolate *P. luteum* from our patient’s living spaces, we surmised that it was present among the *Penicillium* spp. in the soil of a potted pothos plant. Alternatively, the patient may have harbored antigen-specific antibodies for species...
closely related to \( P. \text{luteum} \) that may cross-react with \( P. \text{luteum} \) antigen. In this study, we isolated several strains (noted as “\( P. \text{spp.} \)” in Table 1) that are morphologically or molecularly similar to \( P. \text{luteum} \). The patient’s sensitization to \( P. \text{luteum} \) but not \( \text{Aspergillus} \) may reflect his exposure to higher counts of, and more, \( P. \text{luteum} \) species compared with \( \text{Aspergillus} \) species.

**Conflict of interest**

The authors report no conflicts of interest in this work.

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| Table 1 | Molecular identification of \( P. \text{spp.} \) species from patient’s sputum and living environment. |
|---|---|
| Spum | Environment |
| P. brevicompactum | P. carvenium |
| P. citrinum | P. glabrum |
| P. italicum | P. luteum |
| P. steckii | Penicillium |
| \( \text{Talaromyces} \) spp. |  |
| ++ | ++ |
| + | ++ |
| ++ | ++ |
| ++ | + |
| ++ | + |
| ++ | + |
| ++ | + |
| Parents’ house | ++ |

++ present in 1 sample only, ++ present in 2 or more samples.