

Occupational protein contact dermatitis from shiitake mushroom and demonstration of shiitake-specific immunoglobulin E

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Shiitake are popular edible mushrooms all over the world, and eating raw shiitake may lead to relatively common 'shiitake dermatitis' or toxicodermia. Workers involved in shiitake cultivation and marketing have distinct occupational respiratory and skin diseases unrelated to 'shiitake dermatitis'. There are no previous reports of protein contact dermatitis (PCD) from shiitake, and there is only 1 report of shiitake-specific immunoglobulin (Ig) E. We report 2 shiitake growers who developed work-related eczematous eruption on their hands. Both of the patients had small prick test reactions to fresh shiitake, and specific IgE to shiitake was detected in their sera by immunospot. One of the patients had a large prick test reaction to dry shiitake and also a positive wheal reaction to fresh shiitake in an open application test. Neither of the patients had noticed any symptoms of contact urticaria at work. Both of the patients had immediate IgE-mediated allergy to shiitake, and the diagnosis of occupational PCD was made. There are no commercial *in vitro* tests for shiitake-specific IgE. Tests for immediate allergy are important when shiitake contact dermatitis is investigated.

Key words: immediate allergy; immunospot; mushroom worker; occupational; open application test; prick test; protein contact dermatitis; specific IgE. © Blackwell Munksgaard, 2005.

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Background

Shiitake mushrooms are popular in Japanese and Chinese cuisine. 'Shiitake dermatitis' or toxicodermia is a cutaneous eruption that occurs after eating raw shiitake (1–3). Occupational diseases, contact urticaria (2), allergic contact dermatitis (2, 4), asthma (5), rhinitis (5), conjunctivitis (3, 5) and hypersensitivity pneumonitis (mushroom workers lung) (2, 6) have been reported in workers involved with shiitake cultivation and marketing. The prick test to shiitake mushroom is positive in patients with contact urticaria (2), asthma (5) and rhinoconjunctivitis (5). Specific immunoglobulin (Ig) E to shiitake has been demonstrated by the CAP method in one patient with allergic asthma and rhinoconjunctivitis (5). Patients with hypersensitivity pneumonitis, in turn, may have shiitake-specific IgG (2, 6). The patch test to shiitake is positive in patients with allergic contact dermatitis (2, 4). The diagnosis of toxicodermia is based on the typical clinical picture of an itchy papular eruption appearing 1–2 days after eating raw shiitake. Allergy skin tests are usually negative (1),

but some patients develop a delayed reaction after a prick test (2, 3).

There are no previous reports of protein contact dermatitis (PCD) from shiitake mushrooms. We describe 2 shiitake growers with eczematous contact eruption from shiitake and immediate allergy.

Own Cases

Case no. 1

Patient no. 1 was a 42-year-old female shiitake grower with a history of asthma, dermatitis from contact with metal and intermittent eczema on her hands and legs. In spring 2003, after a half-year part-time employment in a shiitake plant, she developed vesicular dermatitis on her palms and fingers. She had also fever and dry cough. In December 2003, she presented with dermatitis on her palms, the backs of her fingers, knuckles and sides of her hands. The symptoms improved considerably when she did not work in the shiitake plant and exacerbated after returning there. She

was not able to continue her work, and the dermatitis cleared.

In prick tests, there were small reactions (3 mm) to shiitake gill and stalk and a positive reaction to mugwort pollen. On patch testing, she had an allergic reaction to nickel sulphate (shiitake was not tested).

Case no. 2

Patient no. 2 was a 54-year-old female shiitake grower with no personal or family history of atopic diseases. After 12 months' employment in a shiitake plant, she developed dermatitis on the backs of her hands, fingers and wrists, and also cough. Both the respiratory and skin symptoms disappeared completely during holidays. The dermatitis reappeared after 1–2 days of being in contact with shiitake.

In prick tests, she had a positive reaction to dry shiitake (8 mm) and small reactions (3 mm) to fresh shiitake gill and stalk, and also to *Dermatophagoide farinae*. Control prick tests in 5 non-exposed individuals were negative. Open skin application of fresh shiitake to the flexor side of her forearm induced 2 wheals after 20 min. In a patch test, she had an irritant reaction to shiitake.

Detection of Specific IgE

The in-house immunospot method was used to detect specific IgE antibodies to shiitake in the 2 sera (7). For this, extracts made of 2 fresh (1:2 w/v) and 2 dried (1:10 w/v) shiitake samples and 2 twofold dilutions thereof were applied to a nitrocellulose sheet. Mugwort pollen skin prick test extract (Soluprick, ALK, Horsholm, Denmark) was used as a control antigen. IgE binding was detected by radio-labelled anti-IgE (Pharmacia, Uppsala, Sweden) in autoradiography.

The sera of both patients showed specific IgE binding to shiitake (Fig. 1). Patient 1 had a more distinct IgE binding to the extracts from dried shiitake as compared with the extracts from fresh shiitake. Patient 1 also displayed IgE to mugwort pollen. Patient 2 showed distinct IgE binding to all shiitake extracts used but not to the control pollen extract. No significant binding was detected when serum from a non-atopic subject and a serum pool from pollen-allergic atopics were used (not shown).

Discussion

PCD is a dermatitis that appears after contact with proteinaceous material such as fruits, vegetables, spices, plants, animal proteins, grains,

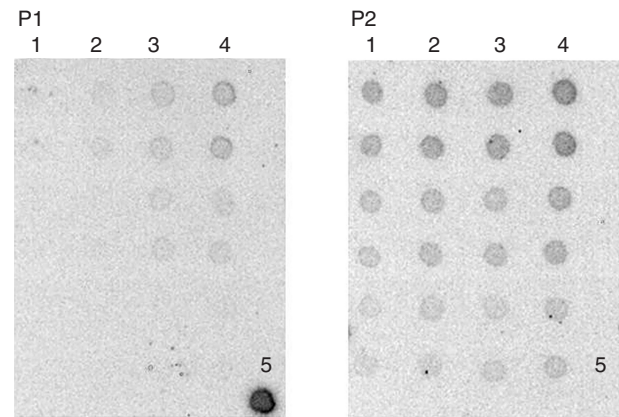


Fig. 1. Serum immunoglobulin E (IgE) toshiitake from patients 1 and 2 (P1, P2). Dilutions of extracts from fresh (1, 2) and dried (3, 4) shiitake, and mugwort as a control (5).

enzymes or natural rubber (8). Patch tests with the responsible allergen are usually negative, and the diagnosis can only be made by means of prick tests (8). The mechanism behind PCD is not yet completely understood (8–10).

In the skin, immediate hypersensitivity to protein-containing materials is manifested either as contact urticaria and PCD or both (8). Both of our patients had dermatitis in contact with shiitake mushroom, but they had not noticed any symptoms consistent with contact urticaria at work. Their immediate allergy to shiitake was shown in prick tests and by demonstrating specific IgE to shiitake in immunospot. Patient no. 2 had also a wheal reaction to shiitake in an open application test.

The distinction between allergic contact dermatitis and PCD is not very clear. Patients with the diagnosis of PCD from shiitake have not previously been reported, but the first shiitake contact dermatitis (2) was combined contact urticaria and allergic dermatitis with positive reactions in both prick and patch tests. In this case, the diagnosis of PCD might well have been used instead of delayed allergic contact dermatitis, because the patient had immediate allergy. The significance of a positive patch test reaction in connection with immediate allergy to the same test material is controversial. It may be an irritant or can result from true delayed-type sensitization to some chemical substance in the test material. It is also possible that immediate allergy leads to an eczematous patch test reaction in which the cell-mediated delayed type IV allergy is not involved (9). One of our patients was also patch-tested, and she had a reaction, which was interpreted as irritant on the basis of its appearance and diminishing evolution from day 2 to day 4. It may be questionable whether true allergic contact

dermatitis from shiitake even exists, as the second previously reported patient was not tested for immediate allergy (4).

We conclude that both of our patients had occupational PCD from shiitake mushroom. The diagnosis is based on the clinical symptoms and the demonstration of immediate IgE-mediated allergy. The concept of PCD as a clinical entity is widely accepted, although the mechanism is still unclear. Tests for immediate IgE-mediated allergy are of utmost importance when contact dermatitis from protein-containing material is investigated. In our opinion, the diagnosis of PCD from such material should be preferred to delayed-type allergic contact dermatitis, when the diagnostic criteria of PCD are fulfilled (8), and no known contact allergens such as sesquiterpene lactones are involved.

To our knowledge, specific IgE antibodies to shiitake have so far been demonstrated in one asthmatic patient (5). Commercial test extracts are not available for evaluating IgE-mediated allergy to shiitake.

In conclusion, in mushroom workers, shiitake may cause immediate IgE-mediated allergy that is manifested in the skin as contact urticaria, PCD or both. These skin symptoms are different from 'shiitake dermatitis' (toxicodermia) that is caused by eating raw shiitake. Like many other protein-containing materials, shiitake may also cause occupational asthma and rhinoconjunctivitis by the IgE-mediated mechanism. Skin tests for immediate allergy and detection of specific IgE are important when contact dermatitis from shiitake is investigated.

References

1. Nakamura T. Shiitake (*Lentinus edodes*) dermatitis. *Contact Dermatitis* 1992; 27: 65–70.
2. Tarvainen K, Salonen J P, Kanerva L, Estlander T, Keskinen H, Rantanen T. Allergy and toxicodermia from shiitake mushrooms. *J Am Acad Dermatol* 1991; 24: 64–66.
3. Lippert U, Martin V, Schwertfeger C, Junghans V, Ellinghaus B, Fuchs T. Shiitake dermatitis. *Br J Dermatol* 2003; 148: 178–179.
4. Ueda A, Obama K, Aoyama K et al. Allergic contact dermatitis in shiitake (*Lentinus edodes* (Berk) Sing) growers. *Contact Dermatitis* 1992; 26: 228–233.
5. Senti G, Leser C, Lundberg M, Wuthrich B. Allergic asthma to shiitake and oyster mushroom. *Allergy* 2000; 55: 975–976.
6. Sastre J, Ibanez M D, Lopez M, Lehrer S B. Respiratory and immunological reactions among Shiitake (*Lentinus edodes*) mushroom workers. *Clin Exp Allergy* 1990; 20: 13–19.
7. Makinen-Kiljunen S. Banana allergy in patients with immediate-type hypersensitivity to natural rubber latex: characterization of cross-reacting antibodies and allergens. *J Allergy Clin Immunol* 1994; 93: 990–996.
8. Janssens V, Morren M, Doms-Goossens A, Degreef H. Protein contact dermatitis: myth or reality? *Br J Dermatol* 1995; 132: 1–6.
9. Lehto M, Koivuluhta M, Wang G et al. Epicutaneous natural rubber latex sensitization induces T helper 2-type dermatitis and strong prohevein-specific IgE response. *J Invest Dermatol* 2003; 120: 633–640.
10. Kanerva L. Skin contact reactions to foods and spices. In: *Food Allergy and Intolerance*, Brostoff J, Stephen J C. (eds). London: Saunders 2002: 635–637.

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