

Case report

Pharyngeal edema caused by occupational exposure to cellulase enzyme

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Enzymes can cause allergic asthma and rhinitis. Although patients sometimes complain of symptoms in their throat, we have not been able to find any published report of pharyngeal edema caused by exposure to enzymes. We present the case of a maintenance foreman who worked in a factory producing enzymes, and who had pharyngeal edema, asthma, and rhinitis at work. Prick tests for cellulase enzyme and cellulase RAST were positive. The causal association between his pharyngeal symptoms and cellulase was demonstrated with inhalation provocation tests in an exposure chamber.

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New methods in biotechnology have led to a rapid increase in industrial-scale production and use of enzymes (2, 8). Enzymes are allergens which cause asthma, rhinitis, and dermatitis (3, 9, 10, 13). Some patients allergic to enzymes complain of a sensation of swelling in their throat (11). However, we were unable to find any published report of enzyme allergy with pharyngeal edema. Here we present the case of a maintenance foreman who had pharyngeal edema caused by occupational exposure to cellulase enzyme.

Case report

The patient was a 46-year-old man without atopic history. He had been employed for 19 years in a factory producing yeast, alcoholic solvents, and enzymes. He was the foreman of a group which overhauled the machinery by which dry enzymes were produced. He did not handle enzymes himself but had visited enzyme production areas several times per week for 4 years. He was in good physical condition. For 17 years he had suffered from nonallergic, eosinophilic rhinitis which only occasionally required medication.

During the last 2 years, his rhinitis had worsened, and he had regularly used oral phenylpropanolamine hydrochloride and nasal beclomethasone. He had

noticed a worsening of the symptoms at work. For 4 months before our investigation, he had developed a sensation of swelling of the throat, and shortness of breath. The symptoms started at work, continued at home, and sometimes lasted until early morning.

A general practitioner prescribed a salbutamol aerosol, which eased his asthma symptoms. During a 2-week vacation, he was symptomless and required no medication.

Laboratory tests

In prick tests, mugwort, timothy, oat, rye, formaldehyde (1% formaldehyde aqueous solution), and cellulase gave positive results. Cellulase radioallergosorbent test (RAST) was 2.3 (negative value <0.35). Oat, rye, formaldehyde, and alpha-amylase RAST were negative. Mild bronchial hyperreactivity in histamine provocation, and mild obstruction in spirometry were noted. The exercise ergometry test was normal.

A commercial cellulase (Econase CEP®, Alko Ltd, Finland) was used for the tests. The protein concentration in the enzyme preparation was about 50% of the dry weight. For the skin prick test, cellulase was diluted with Coca solution to achieve a protein concentration of 50 µg/ml. The Coca-glycerol

solution served as a negative prick control. For determining specific IgE antibodies, RAST was used. Proteins of Econase CEP were conjugated to cyanogen bromide-activated paper disks by the method of Ceska et al. (1).

Inhalation provocation tests

The patient was exposed to a dry-powder aerosol mixture of cellulase (10 g) and lactose (100 g) in a 6-m³ exposure chamber. During the provocation, he developed nasal, pharyngeal, and bronchial symptoms like those at work. After the provocation, there were redness and edema on the posterior wall of the pharynx and severe edema around the uvula and the lateral bands. The peak expiratory values decreased 36% immediately after the provocation. Because the patient had breathing difficulties and severe edema, he was given rimiterol aerosol and methylprednisolone orally. His breathing difficulties eased in 2 h, and the pharyngeal edema decreased gradually during the following hours. By the next day, the edema had disappeared.

The patient wished to continue his work in the same factory. For assessment of whether he could tolerate any further exposure, he underwent repeated inhalation provocations 7 months later.

In the exposure to lactose, no changes were noted in the status or in the total nasal resistance (0.25 and 0.27 Pa/ccm/s, respectively), as measured with anterior active rhinomanometry (Mercury, Glasgow, UK), the Broms radius 200 method, before or after the challenge.

After the provocation with 30 mg of cellulase powder (+ 100 g lactose) on the second day, he had some rhinorrhea but no change in the nasal resistance (0.40 and 0.38 Pa/ccm/s, respectively) and no pharyngeal symptoms.



Fig. 1. Edematous uvula is seen after exposure to 300 mg of cellulase. Picture was taken 20 min after 30-min exposure.

During the provocation with 300 mg of cellulase (+ 100 g lactose), the patient developed nasal and bronchial symptoms like those experienced at work. The total nasal resistance increased significantly from 0.37 to 0.89 Pa/ccm/s. Fifty minutes after the exposure, redness and edema on the posterior wall of the pharynx and edema around the uvula were seen (Fig. 1). The edema continued to increase in the lateral bands toward the lateral wall during the next 2 h, after which it began to decrease. The next day the swelling had disappeared.

Since returning to work, the patient has totally avoided the department where enzymes are handled. He has been symptomless, and there has been no need for asthma or rhinitis medication. His bronchial reactivity has returned to normal.

Discussion

Cellulase is used as an additive in baking, in animal feeds, and in the textile, pulp, and paper industries. The commercial enzyme preparation is either liquid or dry powder. The use of cellulases and hemicellulases has greatly increased since the mid-1980s (2), and allergies caused by these enzymes have been reported.

We report a case of occupational pharyngeal edema, rhinitis, and asthma caused by cellulase IgE allergy. Our patient did not handle enzymes himself, but as the foreman of a maintenance group, he had been exposed to cellulase concentration high enough to cause sensitization.

Symptoms of asthma and rhinitis are well documented in connection with many allergens, occupational and nonoccupational. The pharynx of allergic patients may also be affected, but mostly these changes have been thought to be secondary, and to be caused by nasal congestion (4, 7). An allergic reaction with elongated, edematous uvula is sometimes seen in food allergy (6). Occupational pharyngeal irritation is usually considered to be chronic pharyngitis caused by industrial fumes (4). There are only a few reports in the literature describing acute allergic reactions in the pharynx caused by occupational allergens (5, 12). This may partly be due to a different vulnerability of the mucous membrane to react to allergens in various parts of the respiratory system. However, there may also be a tendency to underestimate the allergic reactions in the pharynx because of the lack of reliable methods for diagnosing the allergic reactions in this region.

Patients complaining of throat symptoms are common in medical practice. If no infection or tumor is seen, the patient may be suspected of having a globus syndrome. However, in some patients reporting a recurrent "lump in the throat", attention should be paid to a possible occupational cause.

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