EXPERIMENTAL INDUCTION OF AEROGENIC FUNGAL ALLERGY

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In the opinion of some authors, the aerial-dust fungal flora serve as a cause for the widespread sensitization of the population [1]. Among the allergic diseases produced by fungi are bronchial asthma and rhinitis [2]. It is hypothesized that the yeasts which produce this type of allergy are members of the Cladosporium and Alternaria families [4-6].

The first experiments which produced the symptoms of bronchial asthma in animals were carried out by Kallos and Pagel [7]. E. S. Rozovskaya and F. N. Shterenson [3], with the same aim, sensitized guinea pigs with a 25% suspension of egg white. At the height of sensitization the animals were placed in a chamber and subjected to the effects of the same protein suspension atomized as a mist. In 37 out of 40 experimental guinea pigs itching, scratching the snout and rumpling of the fur were noted. The present investigation was undertaken to develop a model for the aerogenic fungal allergies in guinea pigs.

EXPERIMENTAL

Saprophytic fungi of the family Cladosporium were isolated from atmospheric air by inoculating the microflora on Sabouraud's medium containing biomycin. Guinea pigs weighing 250 g were used for the experiments. All experimental animals were placed into four groups. The guinea pigs of the first group were sensitized by two injections of an extract of Cladosporium fungi mixed with an equal volume of a filtrate of a 24-h broth culture of β-hemolytic streptococci which contained hyaluronidase in a volume of 0.1-0.2 ml. Injections were made into the pharyngeal mucous membrane. Animals in the second group were sensitized in the same manner, but the fungal extract lacked hyaluronidase. To prepare the extract, four parts of physiological solution were added to one part of fungal spores and the mixture was kept at ten °C for three days. The liquid was filtered through cheesecloth and Seitz filters.

Animals in the third group were given orally 0.5 ml of a mixture of spores from Cladosporium fungi, at a concentration of 500 million/ml. The fungal spores were introduced into the gastrointestinal tract with a probe two times at five-minute intervals. These guinea pigs underwent twofold chilling at −25° for one to two hours.

Animals in the fourth group were injected subcutaneously with 0.1 ml of 20% solution of horse serum.

To provoke reactions which are formed in the process of sensitization, skin and keratoconjunctival tests were performed with homologous allergens.

The main experiment was performed at 20 days after the end of sensitization. The guinea pigs were placed in a chamber with a volume of 20 liters; 2 ml of allergin representing a suspension of fungal (Cladosporium) spores in physiologic solution (500 million/ml) were dispersed with a Kober "Vademecum" atomizer. The animals were exposed in the chamber for one hour. Some of the animals displayed an acute allergic reaction during inhalation of the fungal antigen and these were killed; histologic preparations were made from their lungs.

Results of Experiments on Inhalation of an Aerosol of Cladosporium Spores by Sensitized Guinea Pigs

Material for sensitization	No. of animals	Degree of reaction			Positive skin test	Positive keratoconjunctival test
		acute positive	positive	negative		
Extract of spores plus streptococcal hyaluronidase	20	3	9	8	12	17
Extract of spores without hyaluronidase	20	–	5	15	10	14
Spores administered orally	20	–	3	17	–	2
20% horse serum	20	–	–	20	–	–

RESULTS

When sensitization was performed by injecting the pharyngeal mucosa with an extract of Cladosporium spores mixed with filtrate from β-hemolytic streptococcus culture and hyaluronidase, a positive reaction was noted in 12 guinea pigs. In these animals restlessness, scratching of the snout, ruffling of the fur and in some cases expiratory wheezing occurred (see the table).

The pathological changes in the lungs were expressed as muscle spasms of the bronchi. In the peribronchial connective tissue there was an abundant infiltrate consisting mainly of plasma cells and histiocytes.

There were positive reactions in five instances, in guinea pigs sensitized by intrapharyngeal mucosal administration of fungal spores without streptococcal hyaluronidase. From these data it follows that streptococcal hyaluronidase increases the permeability of the mucosae in the respiratory tract, as a result of which sensitization to the fungal allergen was observed in the majority of experimental animals in the first group.

Guinea pigs which received two oral doses of Gladosporium spore suspension and then were chilled gave positive reactions in three cases. The sensitization of these animals took place, evidently, as the result of the penetration of the allergen through the gastrointestinal tract. However, for similar sensitization certain conditions were necessary, such as chilling the animals, disturbing the integrity of the intestinal mucosa, and others.

In animals sensitized with 20% horse serum, no reaction to fungal antigen was noted.

The results of the skin tests showed that reagin could be found during the sensitization process by using homologous allergen. The skin allergy tests were positive in 12 guinea pigs which underwent sensitization with a fungal extract mixed with streptococcal hyaluronidase, and in ten guinea pigs sensitized only with a Cladosporium extract.

The keratoconjunctival tests were positive in 17 guinea pigs of the first, and 14 guinea pigs of the second group. This reaction possesses high specificity and may be successfully used for determining increased sensitivity of the animals to the corresponding allergen.

Thus, sensitization of guinea pigs with extract made from the spores of saprophytic fungi mixed with streptococcal hyaluronidase, and subsequent inhalation of the spores of homologous fungi, may provoke an aerogenic fungal allergy.

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