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Causal relationship between allergy and seborrheic dermatitis

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ABSTRACT

Seborrheic dermatitis is a chronic relapsing inflammatory skin disease associated with overproduction of sebum and activation of the fungal skin microbiota characterized by the presence of erythematous pruritic patches and plaques with greasy scales in areas rich in sebaceous glands.

Aim. To study the spectrum of sensitization to food, pollen, and indoor and fungal allergens in patients with seborrheic dermatitis.

Materials and methods. The study researched features of the spectrum of sensitization to food, pollen, and fungal and indoor allergens in patients with seborrheic dermatitis (n = 40, aged 15–59 years) based on the data of an objective examination and the results of an allergen-specific test, including skin prick testing.

Results. It was determined that the most significant food allergens in seborrheic dermatitis are chicken eggs and grains. The incidence of polyvalent sensitization to food allergens was 40.0%. Additionally, high incidence of sensitization to pollen allergens, most often to weed and poaceae pollen, was revealed in patients with seborrheic dermatitis. Among indoor allergens, the highest incidence of sensitization was determined to house dust and *Dermatophagoides pteronyssinus*. Among fungal allergens, the highest incidence of sensitization was detected to *Candida albicans*.

Conclusion. It was found that patients with seborrheic dermatitis are often sensitized to food, pollen, and indoor and fungal allergens. Therefore, allergy can be considered a risk factor for the development of pathology.

Keywords: seborrheic dermatitis, allergens, sensitization, *Candida albicans, Dermatophagoides pteronyssinus, Malassezia*

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Аллергия и себорейный дерматит – причинно-следственная взаимосвязь

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РЕЗЮМЕ

Себорейный дерматит – хроническое рецидивирующее воспалительное заболевание кожи, связанное с гиперпродукцией кожного сала и активацией грибковой микрофлоры кожи, характеризующееся наличием эритематозных зудящих пятен и бляшек с жирными чешуйками в зонах с большим скоплением сальных желез.

Цель – изучить спектр сенсибилизации больных себорейным дерматитом к пищевым, пыльцевым, бытовым и грибковым аллергенам.

Материалы и методы. Изучены особенности спектра сенсибилизации больных себорейным дерматитом (n = 40, возраст 15–59 лет) к пищевым, пыльцевым, грибковым и бытовым аллергенам на основании данных объективного осмотра и результатов специфического аллергологического обследования, включая кожное тестирование (prick-тест).

Результаты. Определено, что наиболее значимыми пищевыми аллергенами при себорейном дерматите являются куриное яйцо и пищевые злаки. Частота встречаемости поливалентной сенсибилизации к пищевым аллергенам обнаружена в 40% случаев. Также определена высокая частота сенсибилизации больных себорейным дерматитом к пыльцевым аллергенам, чаще всего к аллергенам пыльцы сорных и злаковых трав. Среди бытовых аллергенов наиболее высокая частота встречаемости сенсибилизации определена к домашней пыли и *Dermatophagoides pteronyssinus*, среди грибковых аллергенов – к *Candida albicans*.

Заключение. Установлено, что больные себорейным дерматитом нередко сенсибилизированы к пищевым, пыльцевым, бытовым и грибковым аллергенам, и, следовательно, аллергию можно рассматривать как фактор риска развития патологии.

Ключевые слова: себорейный дерматит, аллергены, сенсибилизация, *Candida albicans, Dermatophagoides pteronyssinus, Malassezia*

Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

Источник финансирования. Авторы заявляют об отсутствии финансирования при проведении исследования.

Соответствие принципам этики. Все пациенты подписали информированное согласие на участие в исследовании. Исследование одобрено локальным этическим комитетом НИИ МПС (протокол № 12 от 10.12.2013).

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INTRODUCTION

Seborrheic dermatitis (SD) is a chronic relapsing inflammatory skin disease associated with overproduction of sebum and activation of fungal skin microbiota, characterized by the presence of erythematous pruritic patches and plaques with greasy scales in areas rich in sebaceous glands on the scalp, face (forehead, nasolabial triangle), trunk, and intertriginous areas [1–3]. In severe cases of scalp lesions in patients with SD, thinning and loss of hair with the formation of alopecia are observed [4, 5]. A steady increase in the incidence of SD with a growing number of severe forms, torpidity to local treatment, and a negative impact on the quality of life in patients determine the relevance of studying this problem.

The etiology and pathogenesis of SD are not fully understood. It is believed that the development of SD is promoted by the activation of the lipophilic yeasts *Malassezia spp.*, increased secretion of sebum, and a change in its qualitative composition against the background of psychoemotional overstrain, stressful situations, hormonal, immune and neuroendocrine disorders, and taking certain medications [4]. A recent study found that in patients with SD, high colonization of *Staphylococcus epidermidis* is determined in comparison with the controls [6]. The literature describes an increase in the incidence of SD in patients with HIV and Parkinson's disease, which indicates the presence of an immune imbalance in this pathology [4, 5].

Therefore, SD is a multifactorial disease, the pathogenesis of which involves immune and environmental factors. The role of nutrition in the development of SD is undeniable. There is an opinion that skin diseases are often associated with changes in the intestinal microbiota accompanied by the impaired mucosal barrier [3, 7]. Food allergens can easily penetrate through the damaged intestinal mucosal barrier and trigger skin rashes [3, 8]. In addition, damage to the epidermal barrier in SD can contribute to the percutaneous penetration of aeroallergens and sensitization of patients. At the same time, data on the spectrum of sensitization to various groups of allergens in SD are extremely scarce, which determines the relevance of the study.

The aim of the study was to analyze the spectrum of sensitization to food, pollen, and indoor and fungal allergens in patients with SD.

MATERIALS AND METHODS

The study included patients with SD (n = 40) aged 15–59 years. The average age of patients was 31.6 ± 1.5 years. The average duration of the disease was 6.2 ± 0.9 years. The average age of the onset of SD was 25.3 ± 1.7 years. The diagnosis of SD was based on the presence of specific clinical signs: rashes on the skin of the scalp, face, and trunk (in the chest and interscapular region), represented by round, oval or irregular-shaped foci of hyperemia with fuzzy boundaries and grayish-yellow scales on the surface. A specific allergological examination (allergological history, skin testing) was carried out to diagnose allergy.

The study of the sensitization spectrum to food, pollen, and indoor and fungal allergens was carried out by skin prick testing, taking into account the size of the blister and the magnitude of hyperemia: weakly positive reaction – 3–5 mm (+), positive – 6–9 mm (++), strongly positive – 10–14 mm (+++), hyperergic – 15 mm and more (++++). We used the following allergens (Allergopharma, Germany): food allergens – cow's milk (cow's milk protein, casein), beef, chicken egg (protein, yolk, whole egg), chicken meet, food grains (wheat and rye flour, barley, and oatmeal); pollen allergens – mixtures of tree pollen (birch, oak, maple, hazel, alder), cereals (prickly thrift, bonfire, foxtail, bluegrass, fescue, wheat grass, ryegrass, rye), and weed grass (orach, wormwood, sunflower); indoor allergens – *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, house dust; fungal allergens – *Candida albicans*, *Cladosporium herbarum*, *Penicillium notatum*.

Statistica 6.0 software package (StatSoft Inc., USA) was used for statistical analysis. Statistical processing of the results was carried out with the calculation of generalized coefficients: the mean value (M) and the error of the mean (m). When analyzing qualitative characteristics, the relative frequency of the feature (prevalence) p was assessed, and the average error for the sample fraction m was determined [9]. The differences were considered statistically significant at $p < 0.05$.

RESULTS AND DISCUSSION

The main clinical manifestations of seborrheic SD are erythematous foci covered with yellowish scales and crusts. Pruritus was observed in 82% of patients (n = 33). 42% of patients (n = 17) had manifestations of SD on the facial skin, and 7% of patients (n = 3) had SD manifestations on the skin of the trunk.

In 75% of cases (n = 30), patients had an aggravated allergy history (drug allergy, atopic dermatitis, allergic rhinitis, and urticaria). Thus, manifestations of perennial allergic rhinitis were identified in 50% of patients (n = 20), and signs of atopic dermatitis were detected in 35% of patients (n = 14). An aggravated family history

of allergic diseases in patients with SD was detected in 40% of cases (n = 16). Aggravated heredity for SD was noted in 15% of cases (n = 6).

The analysis of the results of skin testing revealed hypersensitivity to food allergens in 95% of patients (n = 38); sensitization was strongly positive in 42% of cases and positive in 39% of cases. It was determined that the most significant food allergens in SD patients were chicken eggs and grains, sensitization to which was determined in 74.3% and 75.0% of cases, respectively (Table).

Table

Features of the spectrum of sensitization to food, pollen, indoor, and fungal allergens in patients with seborrheic dermatitis

Allergen	Number of examined patients, (n / N)	Prevalence of sensitization, %, $M \pm m$
Food allergens		
Cow's milk	25/40	62.5 ± 7.6
Beef	17/35	48.6 ± 8.4
Chicken egg	29/39	74.3 ± 6.9
Chicken meat	15/37	40.5 ± 8.1
Grains	30/40	75.0 ± 6.8
Pollen allergens		
Meadow grass	20/35	57.1 ± 8.4
Trees	19/34	55.9 ± 8.5
Weed grass	21/35	60.0 ± 8.3
Poaceae	21/35	60.0 ± 8.3
Indoor allergens		
Dermatophagoides pteronyssinus	13/20	65.0 ± 10.9
Dermatophagoides farinae	11/21	52.4 ± 11.2
House dust	16/21	76.2 ± 9.5
Fungal allergens		
Candida albicans	18/39	46.2 ± 8.0
Cladosporium herbarum	12/29	41.4 ± 9.3
Penicillium notatum	8/29	27.6 ± 8.4

Note: N – the number of tested patients, n (%) – absolute (relative) number of sensitized patients.

According to the literature, food allergy to chicken eggs is one of the most common in the world, therefore, high sensitization to this allergen in patients with SD was expected [10]. To a lesser extent, sensitization to cow's milk was widely determined in 62.5% of cases. According to the literature, cow's milk is one of the main causes of food allergy in the first year of life, however, it is rare in adults. Meanwhile, it is known that the presence of food allergy to cow's milk in adults is manifested by severe clinical forms of the disease [11].

The literature data on the incidence of monovalent and polyvalent sensitization (to 3 or more allergens) to food allergens are different [10]. The incidence of polyvalent sensitization to food allergens in our study was 40% (n = 16 / 40), bivalent sensitization was revealed in 37% of cases (n = 15 / 40), monovalent sensitization – in 17% of cases (n = 7 / 40).

According to the results of skin testing, all patients were prescribed an elimination diet in combination with standard topical therapy. In 85% of cases, patients noted a significant improvement in skin processes by the 3rd week of treatment: reduction of itching, hyperemia, and peeling in the foci of SD.

High incidence of sensitization to pollen allergens, most often to weed and poaceae pollen, was determined in patients with SD (Table). Classical manifestations of hay fever in the form of seasonal allergic rhinoconjunctivitis in patients with SD were noted in 12% of cases (n = 5 / 40). High incidence of sensitization to pollen allergens in patients with SD can be due to common antigenic determinants with food allergens and, as a consequence, development of cross-reactivity.

Skin testing with indoor allergens showed the highest incidence of sensitization to house dust and *Dermatophagoides pteronyssinus* in patients with SD: 76.2% and 65.0%, respectively (Table). It is known that the development of SD is associated with the activation of fungal skin microbiota, which may result in the development of fungal sensitization [3]. As a result of skin testing with fungal allergens, the highest incidence of sensitization in patients with SD was noted to *Candida albicans* (46.2% of cases (n = 18 / 39)) (Table).

CONCLUSION

The study showed high incidence of sensitization to food, pollen, indoor, and fungal allergens in patients with SD. The most significant food allergens in SD were chicken eggs and grains. Despite the fact that the incidence of food allergy among adults is only about 2% [10, 12], the defined spectrum of sensitization to food allergens and the positive effect of the elimination diet in patients with SD proves the important role of food allergens as triggers of the disease. According to experts, every year there is an increase in the incidence of food allergy in the world, which is associated with a change in the nature of nutrition in the population of various countries and the emergence of new food processing technologies [12].

Sensitization to pollen allergens in patients with SD can be the result of common antigenic determinants with food allergens. It is known that patients with hay fever have cross-reactivity to fruits and vegetables, as the result of the presence of homologous proteins with

plant pollen. Given high incidence of pollen sensitization in patients with SD, it can be assumed that in some cases, eating foods that have common antigenic determinants with pollen allergens can result in expanding the spectrum of sensitization and aggravating pathology as a result of cross-reactivity.

In turn, impaired skin barrier function in patients with SD can contribute to the penetration of various aeroallergens into the body. High incidence of sensitization to house dust and *Dermatophagoides pteronyssinus* in patients with SD deserves special attention. Recently, the literature dedicated to skin microbiota in SD patients has presented data on colonization of lesions by *Staphylococcus epidermidis* and *Staphylococcus aureus* [6, 13]. House dust mites can serve as carriers of bacteria of the Staphylococcaceae family, responsible for the induction of IgE-mediated sensitization to microbial antigens [14]. Therefore, high incidence of sensitization to *Dermatophagoides pteronyssinus* in patients with SD, which we identified, can be not only one of the important etiological factors of the pathology, but also induce an infectious allergy.

Sensitization to *Candida albicans* in patients with SD is of great interest. Yeast-like fungi of the genus *Candida*, being skin commensals, play a certain role in the pathogenesis of allergic diseases, such as atopic dermatitis [15]. The presence of sensitization to fungal allergens in the patients can be associated with cross-reactivity between *Candida albicans* and fungi of the genus *Malassezia*, whose role in the pathogenesis of SD is actively discussed [2, 3]. It is believed that SD arises following an immune response to fungal antigens of the genus *Malassezia* and products of their metabolism [2]. The pathological immune response contributes to increased penetration of *Malassezia* and *Candida albicans* through the epidermis, which leads to sensitization of the body and a continuous cycle of inflammation.

Despite the interesting data we obtained on the presence of a wide spectrum of sensitization to allergens of various origin in patients with SD, further in-depth specific allergological studies are required, including other diagnostic (elimination and provocation tests) and therapeutic (elimination diets, allergen-specific immunotherapy) measures in order to confirm the role of allergy as a trigger of the pathology. In addition, it can be assumed that SD may be one of the atypical clinical manifestations of allergy.

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