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Skin Prick Test in Patients with Chronic Allergic Skin Disorders

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Abstract

Background:

Chronic allergic skin disorders are the inflammatory and proliferative conditions in which both genetic and environmental factors play important roles. Chronic idiopathic urticaria (CIU) and atopic dermatitis (AD) are among the most common chronic allergic skin disorders. These can be provoked by various food and aeroallergens. Skin prick tests (SPTs) represent the cheapest and most effective method to diagnose type I hypersensitivity. Positive skin tests with a history suggestive of clinical sensitivity strongly incriminate the allergen as a contributor to the disease process.

Aims and Objectives:

To determine the incidence of positive SPT in patients with chronic allergic skin disorders and to identify the various allergens implicated in positive SPT.

Methods:

Fifty patients of chronic allergic disorders were recruited in this study. They were evaluated by SPT with both food and aeroallergens.

Results:

In our study, SPT positivity in patients of CIU was 63.41% and in AD was 77.78%. Out of the 41 patients of CIU, the most common allergen groups showing SPT positivity were dust and pollen, each comprising 26.83% patients. SPT reaction was positive with food items (21.6%), insects (17.07%), fungus (12.20%), and *Dermatophagoides farinae*, that is, house dust mite (HDM) (7.32%). The allergen which showed maximum positivity was grain dust wheat (19.51%). Among nine patients of AD, maximum SPT positivity was seen with *Dermatophagoides farinae*, pollen *Amaranthus spinosus*, grain dust wheat, and cotton mill dust; each comprising 22.22% of patients.

Conclusion:

Our study showed that a significant number of patients of CIU and AD showed sensitivity to dust, pollen, insects, *Dermatophagoides farinae*, and fungi on SPT. Thus, it is an important tool in the diagnosis of CIU and AD.

Keywords: Atopic dermatitis, chronic idiopathic urticaria, skin prick test

What was known?

1. Chronic allergen skin disorders are provoked by a number of food and aeroallergens.
2. Finding out the allergen implicated in chronic allergic skin disorders has always been a challenge for clinicians.

Introduction

Allergic skin diseases are relatively common and, at times, devastating clinical problems that have great socioeconomic impact.[1] The skin is one of the largest immunologic organs and is often a target for allergic responses and it responds to allergic agents in a highly varied manner.[2] Type I reactions are those that are most commonly encountered in clinical allergy.

The two main chronic allergic skin disorders are chronic idiopathic urticaria (CIU) and atopic dermatitis (AD). A diagnosis of CIU is made when an etiological factor accounting for majority of lesions could not be elucidated on history, physical evaluation, and laboratory evaluation and the auto immune parameters are negative. Chronic urticaria is often a multifactorial disease and its day-to-day activity is determined by exogenous aggravating factors acting in conjunction with an endogenous cause.[3] AD is a paradigmatic skin disease that is the product of a complex interaction between various susceptibility genes, defects in skin barrier function, a specific immunologic response, and a clear interaction with infectious agents and host environment.[4] There is immune sensitization to food-derived allergens as well as aeroallergens. In westernized countries, the prevalence of food allergy is estimated to be 6-8% in children and 2-3% in adults.[5] With regards to inhalant allergens, seasonal exacerbation of AD in selected patients may correlate with reactions to inhalant allergens.[6] Skin prick testing (SPT) is a sensitive tool for investigation of these allergic disorders. As the antigen combines with immunoglobulin E (IgE) antibodies fixed to mast cells, chemical mediators are released from mast cells within 5 min resulting in formation of a wheal.

In our study, we tried to determine the incidence of positive SPT and various allergens implicated in positive SPT in patients with chronic allergic disorders including CIU and AD.

Materials and Methods

Fifty consenting patients of chronic allergic skin disorders including CIU or AD attending Skin and Dermatology and Venereology outpatient department of our institution were selected for the study. These patients were selected at random. Out of these 50 patients, 41 patients were diagnosed with CIU and nine patients with AD according to the diagnostic criteria selected. A written informed consent was taken from all patients. These patients were then evaluated by conducting a complete history of possible causes with special emphasis on dietary- and aeroallergens-induced urticaria and AD. Patients underwent investigations including complete hemogram with absolute eosinophil count, urine routine, stool routine, and thyroid profile to rule out underlying etiological causes. The patients were screened for acute stage of allergic disorders like active atopic dermatitis, acute symptoms of allergy like conjunctivitis, sinusitis, asthma, rhinitis, and acute phase of allergic contact dermatitis at the time of SPT; such patients were excluded from study. Patients with any history of anaphylaxis in past were also excluded. The patients were not tested till the dermographism was negative. The patients were asked to stop the intake of systemic drugs like antihistamine medication for 3 days and oral corticosteroids for 14 days prior to test. In case patient was taking tricyclic antidepressants and mast cell stabilizers, it was stopped 1 week prior to test. The application of high potency topical corticosteroids and immunomodulatory creams to the tested area was stopped 1 week prior to test. The SPT was performed at area free of any skin lesions.

In all patients, the SPT was done on the volar aspect of forearms and back. The test started with application of negative control and finished with positive control. Buffered saline in glycerol base and histamine phosphate 10 mg/ml was used as negative and positive control, respectively [Figure 1a]. The patients were subjected to a battery of 130 allergens (66 aeroallergens and 64 food allergens) obtained from Alcit India Pvt. Ltd. [Figure 1b] Resuscitative equipment for anaphylaxis was always kept ready. A droplet of each

purified allergen extract was placed on the cleansed volar aspect of the forearms and back at 2-3 cm intervals and the lancet pressed through the droplet perpendicular to the skin for 1 s to puncture the skin at 90° so that no blood was drawn out [Figure 1c]. The results were interpreted at 15 min interval. The wheal was measured with a standard ruler. If the wheal was not concentric, the mean of longitudinal and vertical wheal diameter is used. The positive control histamine should give a positive result and negative control should be negative to consider the test results true positive. Reactions of allergen extracts with a wheal diameter 3 mm or more than the negative control were considered positive [Figures 2 and 3]. All the observations were recorded in a proforma which was subjected to statistical analysis at the end.

Results

In our study, 50 patients were enrolled, of whom 41 had CIU and nine patients had AD. The mean age of patients of CIU was 33.15 years with a range of 7-62 years. Among patients with AD, the mean age was 31.44 years with a range of 11-45 years. The duration of illness in CIU varied from 6 months to 24 years with a mean duration of 3.98 years. The duration of illness in AD ranged from 9 months to 14 years with a mean duration of 6.31 years.

Table 1 shows demographic data of the patients studied, 19.51% of patients of CIU gave a history of food aggravation. History of aeroallergen aggravation in CIU was given by 12.20% of patients, but there was no significant pattern of seasonal exacerbation in these patients. Personal and family history of atopy was reported in 14.63 and 9.76%, respectively. The commonly associated atopic conditions were mainly allergic rhinitis and asthma. In patients of AD, personal and family history of atopy was high at 55.56% each. History of aeroallergen and food aggravation was given by 11.11% patients each.

Table 2 shows the details of SPT results. In 50 patients tested with SPT, the total SPT positivity was 66%. Of the 41 patients of CIU tested, 63.41% showed SPT positivity. In AD, the skin prick test positivity was 77.78%. Out of total patients of CIU, patients who had SPT positivity to only aeroallergens were maximum comprising 41.45% patients. The patients with SPT positivity to only food was the minimum at 7.32%. There were 14.63% patients who had positivity to both aeroallergens and food. The total SPT positivity in the AD group was 77.78%. In the patients of AD, the SPT positivity to only aeroallergens was seen in 66.67% of patients. Only one patient had SPT positivity to both aeroallergens and food. No patient had SPT positivity to food only.

Regarding the patients of CIU, the most common aeroallergen groups showing SPT positivity were dust and pollen, each comprising 26.83% patients of CIU. The next group was food which was positive in 21.9% patients followed by insects which showed a positivity in 17.07% of patients. Fungus and *Dermatophagoides farinae* were positive in 12.20 and 7.32% of patients, respectively. The fabric was positive in one patient only. No positivity was seen with danders and parthenium leaves which belonged to miscellaneous group. In patients with AD, the most common aeroallergen group to which positivity was seen was dust. It was positive in 44.44% of patients, 22.22% patients showed positivity to pollen, fungus, insects, and *Dermatophagoides farinae* each. Food was positive in 11.11% patient. No positivity was seen with danders and fabric [Table 3].

There were 19.52% patients of CIU who had SPT positivity to only one allergen. In 14.6% patients of CIU, two allergens were positive. The maximum number of aeroallergens that were positive in a single patient of CIU in the study was six. In the patients of AD, 33.33% of patients were SPT positive to one and two allergens each. The maximum number of allergens that were positive in a single patient of AD was three.

Table 4 depicts the allergens showing maximum positivity in our study group. In patients of CIU, grain dust wheat was positive in 19.51% of patients. The next most common allergen was grain dust rice and pollen *Gynandropsis gynandra* which were both positive in 9.76% of patients. The house dust mite (HDM), that is, *Dermatophagoides farinae* was positive in 7.32% of patients. The pollen *Amaranthus spinosus* and fungus *Fusarium solanii* were also positive in 7.32% of patients. Among AD patients, maximum SPT positivity was seen with *Dermatophagoides farinae*, pollen *Amaranthus spinosus*, grain dust wheat, and cotton mill dust, comprising two patients (22.22%) each. No patient of AD showed SPT positivity to *parthenium hysterophorus*.

Out all 50 patients tested with food allergens, the most common allergen found to be positive was mushroom. It was positive in two patients of CIU and one patient of AD. The food allergens, coffee, and chicken were positive in two patients each of CIU.

Out of all 50 patients tested, not even a single patient had any complication.

[Table 5](#) shows various studies concerning the incidence of positive SPT results in patients with CU, ranging 26-64%.

Discussion

SPT is the most convenient and least expensive method of allergy testing and results can be made available in minutes.[\[7\]](#) The present study was done with the aim of determining the incidence of SPT positivity in patients with two most common chronic allergic skin disorders, that is, CIU and AD. The various allergens implicated in positive SPT were identified in the study.

In our study, the total SPT positivity in patients of CIU was 63.41%. SPT positivity only to aeroallergens was the maximum, comprising 41.45% patients; SPT positivity only to food was the minimum at 7.32%; and 14.63% patients had positivity to both aeroallergens and food. In a study by Kulthanan *et al.*,[\[8\]](#) the prevalence of positive SPT among patients with chronic urticaria was 47.7% (41% SPT positive to aeroallergens, 30% gave positive results to food allergens, and 22.7% gave positive results to both food and aeroallergens). Caliskaner *et al.*,[\[9\]](#) observed a SPT positivity of 27.4% in 259 patients of CIU with only aeroallergens. Quaranta *et al.*,[\[10\]](#) reported that 13 out of 22 (59%) patients with chronic urticaria had positive SPT results.

The aeroallergen which was positive in maximum number of patients (19.51%) of CIU was grain dust wheat. As we know, grain growing, handling, and processing is the major occupation in Punjab and among all grains, wheat paramounts the entire crop plantation. Thus, the maximum positivity to grain dust wheat followed by grain dust rice in 9.76% patients, which can be attributed to the geographical location and more proportion of rural patients (73.1%) in our study group.

The pollens showing maximum positivity in our study were *Gynandropsis gynandra* (9.76%), *Amaranthus spinosus* (7.32%), *Parthenium hysterophorus* (4.88%), *Cannabis sativa* (4.88%), and *Eucalyptus tereticornis* (4.88%). In a study by Krupa Shankar *et al.*,[\[7\]](#) in Bangalore, the most common pollens showing positivity on SPT were parthenium, amaranthus, and cassia. Although parthenium is a very common aeroallergen causing type IV hypersensitivity, its role in type 1 hypersensitivity and CIU needs to be further evaluated.

In our study, insects were the fourth most common allergen group showing SPT positivity in patients of CIU. In this group, the most common allergens were cockroach, grasshopper, and rice weevil (4.88% each). Caliskaner *et al.*,[\[9\]](#) found cockroach sensitivity only in 0.8% patients. Cockroaches are an important indoor allergen found in abundance in beds, furniture, kitchens, etc.; but role in CIU is still under speculation.

The fungi are ubiquitous in nature and are reported to be prevalent in all parts of world, in outdoor environment. Various studies in the past have implicated the role of fungal allergens in the etiology of chronic urticaria. The evaluation of sensitivity to moulds is difficult because of their diversity, their uncertain regional distribution, and often prolonged period of exposure.[\[11\]](#) In our study, fungus was positive in 12.20% patients and included *Fusarium solanii* (7.32%) and *Rhizopus nigricans* (4.88%).

In our study, the HDM (*Dermatophagoides farinae*) was positive in 7.32% of CIU patients. Although there is no clear published data indicating that mite sensitivity leads to urticaria, the results by Caliskaner *et al.*,[\[9\]](#) proposed that mite allergens may cause urticaria in some mite sensitive patients. In their study on CIU patients, the most common allergens were HDMs (*Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*) in 24.7% patients. In comparison to other studies, the decreased incidence of HDM positivity in our study can be explained by the fact that our HDM preparation had only *Dermatophygoidea farinae*.

Animal danders were negative in all the patients of CIU. Similiarly, Caliskaner *et al.*,[\[9\]](#) in their study,

found negative SPT positivity to animal dander.

The SPT was positive to food allergens in 21.9% of patients of CIU. The most common allergen testing positive on SPT were mushroom, chicken, and coffee in 4.88% of patients each. In a study by Krupa Shankar *et al.*,^[7] among the food allergens tested, SPT was positive to brinjal, rice, chilli, milk, banana, and ginger in descending order. The comparison of various studies done on chronic urticaria over a long period, have pointed out towards a definite role of food items in causation of CIU. The fact that more than 30/100 of patients with chronic urticaria incriminate foods, argue in favor of a systematic search for food involvement in chronic urticaria.^[12]

In patients of AD, 44.44% patients had positive reaction to dust and 22.22% patients had SPT positivity to fungi, *Dermatophagoides farinae* (HDM), pollen, and insects each. In a study by Kulthanan *et al.*,^[13] on 29 patients, the most frequent allergen was *Dermatophagoides pteronyssinus* mites (64%). The others were dog epithelium (44%), mosquitos (44%), house dust (40%), etc., Dhar and Saxena^[14] also noticed maximum SPT positivity to HDM, pollen, aspergillus fumigates, and insects in his study.

Our study on AD gives maximum SPT positivity to dust in 44.44% patients. This comprised of two main aeroallergens in Punjab, that is, grain dust wheat and cotton mill dust. As already discussed, wheat is the main crop in Punjab which explains the increased incidence of SPT positivity to grain dust wheat noticed in the study group. Cotton mill dust is the dust produced during handling and processing of cotton through weaving or knitting of fabrics and dust present in other operations or manufacturing processes using raw or waste cotton fibers and cotton fiber byproducts from textile mills.

Our results in patients of AD indicates less role of food allergens in patients as only one patient showed positivity to it. Classical food allergy has small clinical importance in adults with AD, in contrast to children.^[15]

It is worth noting that in our study, six out of seven patients (85%) showing positive SPT had either personal or family history of atopy. Hence, it was observed that a positive family history of atopy is a significant risk factor for AD. A study of the epidemiology of 1,019 AD patients, aged between 4 weeks to 57 years, in southeast Nigeria showed a statistically significant association between AD patients and family history of atopic diseases.^[12]

Conclusion

Our study showed that a significant number of patients of CIU and AD showed sensitivity to dust, pollen, insects, *Dermatophagoides farinae*, and fungi on SPT. Thus, it is an important diagnostic tool in the diagnosis of CIU and AD.

What is new?

Skin prick test is a cheap, safe, and sensitive means of finding out allergens implicated in chronic allergic skin diseases.

Footnotes

Source of support: Nil

Conflict of Interest: Nil.

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Figures and Tables

Figure 1

(a) Positive and negative controls used. (b) Battery of 130 allergens (66 aeroallergens and 64 food allergens) from Alcit India Pvt. Ltd. (c) Allergens applied on volar aspect of both forearms of a patient

Figure 2

Skin prick test positive to one allergen

Figure 3

Skin prick test positive to multiple allergens

Table 1

Age (years)	CIU		AD	
	No.	% age	No.	% age
Up to 15	3	7.32	1	11.11
16-25	10	24.39	2	22.22
26-35	11	26.83	3	33.33
36-45	8	19.51	3	33.33
46-55	6	14.63	0	0.00
>55	3	7.32	0	0.00
Mean age	33.15		31.44	
SD	13.21		10.54	

CIU: Chronic idiopathic urticaria, AD: Atopic dermatitis, SD: Standard deviation

Demographic data of the patients

Table 2

Allergens	CIU		AD	
	No.	Percentage	No.	Percentage
Only food	3	7.32	0	0.00
Only aeroallergens	17	41.45	6	66.67
Both	6	14.63	1	11.11
Total	26	63.41	7	77.78

CIU: Chronic idiopathic urticaria, AD: Atopic dermatitis

Results of skin prick test

Table 3

Aeroallergens	CIU		AD	
	No.	Percentage	No.	Percentage
<i>Dermatophagoides farinae</i>	3	7.32	2	22.22
Pollen	11	26.83	2	22.22
Fungus	5	12.20	2	22.22
Insects	7	17.07	2	22.22
Dust	11	26.83	4	44.44
Danders	0	0.00	0	0.00
Fabrics	1	2.44	0	0.00
Food	9	21.9	1	11.11

Results of the skin prick tests in specific categories

Table 4

Aeroallergen showing maximum positivity	CIU		AD	
	No. of patients SPT	Percentage of patients SPT +ve	No. of patients SPT	Percentage of patients SPT
	+ve		+ve	+ve
Grain dust wheat	8	19.51	2	22.22
Grain dust rice	4	9.76	0	0
Cotton mill dust	0	0	2	22.22
<i>Gynandropsis gynandra</i>	4	9.76	0	0
<i>Dermatophagoides farinae</i>	3	7.32	2	22.22
<i>Amaranthus spinosus</i>	3	7.32	2	22.22
<i>Fusarium solanii</i>	3	7.32	1	11.11
<i>Parthenium hysteriphorus</i>	2	4.88	0	0

CIU: Chronic idiopathic urticaria, AD: Atopic dermatitis, SPT: Skin prick test

Allergen showing maximum positivity

Table 5

Author	Results (%)							
	SPT positivity	Dust	Pollen	Food	Insects	HDM	Fungi	Animal dander
Nath <i>et al</i>	44	Less	24	22	24	12	10	14
Caliskaner <i>et al.</i>	27.4		7.7		0.8	24.7	0.4	0
Krupa Shankar <i>et al.</i>		9	8	25				
Kulthanan <i>et al.</i>	47.7			30				
Our study		26.83	26.83	21.9	17.07	7.32	12.20	0

SPT: Skin prick test, HDM: House dust mite

Various studies concerning the incidence of positive SPT results in patients with chronic urticaria

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