

Atopy patch test

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Introduction

Atopic dermatitis is a chronic, relapsing, intensely pruritic, inflammatory skin condition with a significant socioeconomic importance and a negative impact on quality of life.¹ Usually, there is an early onset but it can start at any age.² The worldwide prevalence of childhood atopic eczema varies between 3% and 20.5% while in India it is between 2.4% and 6%.³

Although the diagnosis of atopic dermatitis is mainly clinical as per the criteria of Hanifin and Rajka,⁴ it is best understood as a chronic inflammatory condition with both IgE and non-IgE-mediated immune dysregulation.⁵ The skin shows a poor barrier function, likely due to a filaggrin mutation, allowing the entry of allergens; hypersensitivity to these allergens worsens atopic dermatitis.⁶ Conversely, avoidance of these allergens leads to an improvement. Both food and aeroallergens are considered to have a role, and they can be evaluated based on the history of exposure along with laboratory tests.

Two types of hypersensitivity reactions are involved in atopic dermatitis:

- Immediate type I IgE-mediated – diagnosed with skin prick tests and measurement of serum-specific IgE
- Delayed type IV T cell-mediated – The patch test is a standard method to assess delayed hypersensitivity to contact allergens, a modification of which – the atopy patch test – is used in atopic dermatitis.

Differences between atopy patch test and patch test are shown in Table 1.

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Definition

Atopy patch test is an epicutaneously applied patch test procedure with allergens known to evoke IgE-mediated reactions with the test sites evaluated for a delayed hypersensitivity type eczematous reaction after 48–72 hours.⁷

History

The pioneers of the atopy patch test were Rostenberg and Sulzberger who in 1937 used aeroallergens in patch testing.⁸ However, it was not until 1982 that the patch test was performed specifically in atopic dermatitis patients by Mitchell.⁹ Ring coined the term “atopy patch test” in 1989.¹⁰ At present, the most widely followed protocol is that of the European Task Force on Atopic Dermatitis.¹¹

Indications

- Patients in whom an aeroallergen or food allergen is suspected but there is no positive specific IgE or a positive skin prick test
- Severe and/or persistent atopic dermatitis where trigger factors are unknown
- Multiple IgE sensitizations without proven clinical relevance in patients with eczema.

Contraindications

- Acute flares of eczema, especially on the area to be tested
- Pregnancy and lactation
- Immunodeficiencies
- Ongoing immunosuppressive therapies
- Autoimmune diseases.

Materials

Internationally, a few commercial kits are available – ALK-Abello, Diallerstest and Stallergenes. Different allergens used include prick test solutions on filter paper, purified allergens in hydrogel or in petrolatum and native food.

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Table 1: Differences between atopy patch test and patch testing

APT	Patch test
To detect aeroallergens or food allergens	To detect cutaneous allergens
Used in atopic patients	Any patient with a suspected contact allergy
Skin prick test allergens are separately loaded onto patch test chambers and then used for testing	Patch test kits with standardised series available for direct testing

APT: Atopy patch test

In India, patch test solutions are aqueous allergens (supplied by Creative Drug Industries, Navi Mumbai) which are loaded in aluminum patch test chambers with filter paper using the dropper provided by the manufacturer (Systopic Laboratories, New Delhi).¹² Some of the antigens used in India are listed in Table 2. Others include corn, potato, peanut, soy, chicken, beef, pork, fish, cockroach antigens and tree pollen.¹³ Isotonic saline solution or petrolatum can be used as the negative control. Best results are obtained with purified allergens with a known protein content. Allergen strengths are expressed in protein nitrogen units for aeroallergens and 1% weight by volume for food allergens. Protein nitrogen unit between 5 and 7 is ideal. Allergen concentration needs to be higher for atopy patch test than skin prick test.⁷

Technique

Certain precautions need to be taken before performing atopy patch test:¹⁴

- Area should be nonlesional
- Avoid topical steroids for 5 days
- No ultraviolet radiation for 4 weeks
- Avoid oral antihistamines for at least a week
- Oral steroids and immunosuppressants are stopped depending on the dose and duration (generally 4 weeks)
- No pretreatment of the area, e.g. tape stripping or acetone painting.

Using a dropper, the allergen extracts are placed on a filter paper loaded individually into 12-mm aluminum test cups. These are then placed on the skin of the back using an adhesive tape. Patient is asked to avoid activities such as vigorous exercise and sweating that may lead to the dislodgement of cups. The test chambers are removed after 48 hours when the first reading is done. Final reading is at 72 hours.^{15,16}

Reading

Readings are based on the European Task Force on Atopic Dermatitis key shown in Table 3. This is roughly similar to the International Contact Dermatitis Research Group reading key used for conventional patch testing.¹¹

Discussion

Important aeroallergens that cause atopic flares are house dust mites, tree and grass pollen and animal dander. House

Table 2: List of some allergens available for use in atopy patch test in India

Mites	Dermatophagoides farina and pteronyssinus (house dust mite)
	<i>Blomia</i> spp.
Fungi	<i>Aspergillus</i> spp.
	<i>Fusarium solani</i>
	<i>Rhizopus nigricans</i>
	<i>Candida albicans</i>
	<i>Penicillium</i> spp.
Pollen	<i>Cynodon dactylon</i> (durva grass)
	<i>Parthenium hysterophorus</i> (congress grass)
	<i>Xanthium strumarium</i> (chota dhatura)
	<i>Mangifera indica</i> (mango tree)
	<i>Ricinus communis</i> (castor-oil plant)
	<i>Cocos nucifera</i> (coconut tree)
Dusts	Wheat dust
	Cotton dust
	Saw dust
	Rice dust
	Spider web dust
Epithelia	Dog epithelia
	Sheep wool
	Pigeon feather
	Cat dander
Food	Rice
	Moong dal
	Toor dal
	Wheat
	Tomato
	Milk
	Egg (white) and egg (yolk)
	Garlic
	Salmon
	Peanut
	Potato
	Brinjal

dust mites were found to be the most common cause for atopy patch test positivity followed by grass pollen, birch pollen and cat dander in various studies from Germany,¹⁷ the Czech Republic,¹² Croatia¹⁸ and Thailand.¹⁹ Interestingly, in India, parthenium accounted for nearly half of the atopy patch test positivity (42%), followed by house dust mites and *Cynodon*.¹³ In one study, more urban patients than rural patients showed positive atopy patch test, and, of them, the most frequent allergen in the urban group was house dust mites and grass pollen for the rural group, possibly indicating the role of extent of exposure to the allergens.¹² A significant association was found between positive atopy patch test

Table 3: European Task Force on Atopic Dermatitis key for atopy patch test reading

Result	Visual inspection
Negative	No change in skin
Questionable (?)	Only erythema
1+	Erythema and infiltration
2+	Erythema and a few papules
3+	Erythema with many or spreading papules
4+	Erythema with vesicles

results for aeroallergens and an air-exposed eczema pattern in a Chinese study.¹⁴ Strong atopy patch test positivity to house dust mites is associated with extensive atopic dermatitis suggesting that sensitization to house dust mite allergens plays a significant role in determining the severity of atopic dermatitis.

Important food allergens, known to cause not only atopic flares but also gastrointestinal disturbances, include cow's milk, egg, wheat proteins, soy, peanuts, seafood and rice. Food allergy depends upon the child's age and the eating traditions of the family and the nation. Milk, soy and egg were the most common allergens causing positive atopy patch test.^{19,20}

The importance here lies in the fact that patients showing positive atopy patch test to food allergens have relief from atopic flares and gastrointestinal complaints on eliminating the offending food from the diet.^{21,22} Food allergens were found to be less significant compared to the aeroallergens in an Indian study.¹³ Atopy patch test has also been performed with food additives, implicating carmine in the evolution of atopic dermatitis in some patients.²³

Significance of Atopy Patch Test

Atopy patch test helps to determine the patients in whom atopic flares are related to extrinsic allergen exposure, and these patients can be counselled to avoid these triggers as far as possible. Although it is not possible to completely eliminate house dust mites, a few changes can help minimize the exposure such as:

- Removal of wall-to-wall carpets from the house
- Avoid keeping pets in the house
- Use of dust mite-proof mattress protectors and pillowcases
- Frequently washing bed sheets in hot water
- Installing high-efficiency media filter in airconditioning unit.

Narrowing down the allergens to a select few, especially in the case of food allergens, can avoid unnecessary elimination of large food groups from the diet.

While double-blind placebo-controlled food challenge is still the gold standard for diagnosing food allergy, the procedure

involves repeated food administration over a period of few hours and carries the risk of dangerous anaphylaxis in a few patients.²⁴ Atopy patch tests can be used as a substitute here. In one study, atopy patch test predicted the results of oral food challenge in 28 out of 33 cases. There was 100% negative predictive value for atopy patch test.²⁵ Another study showed that positive predictive value was best for skin prick test (0.91) followed by radioallergosorbent test (RAST) (0.82) followed by atopy patch test (0.63).²⁶ Atopy patch test can be a useful tool to study the pathomechanisms of atopic dermatitis.

The test can be performed at a younger age. Atopy patch test has been found to be positive earlier than skin prick test in small children with food allergies, especially in case of cereals.²⁷ Specificity of atopy patch test ranges from 69–92% and sensitivity 42–75%.⁷ Specificity and sensitivity of atopy patch test vary for different allergens ranging from a specificity of 43.5% for milk to 90% for barley and sensitivity of 90.2% for milk to 98.7% for barley.²⁸

However, atopy patch test is not suitable for diagnosing immediate food allergies. It is expensive, time-consuming and cumbersome. It may be difficult to interpret in cases of “angry back syndrome” where a strong positive patch test could cause hyperreactivity to other patch tests. Being prone to skin irritations, atopic patients may show higher degree of false positive reactions. Different results may be obtained with variations in allergen (whole mite vs mite extract), allergen concentration, vehicle, site of testing, skin condition at the time of testing and reading time. There can be local flares of eczema, irritation to the adhesive used and urticarial reactions to allergens such as egg and soy.

Conclusion

Atopy patch test is generally not considered in isolation. It can be thought of as another arrow in the quiver available for the diagnosis of atopic dermatitis. It should be used in addition to a good history, clinical examination and skin prick test and serum-specific IgE. A combination of all these tools helps in a better understanding of atopic dermatitis.

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Conflicts of interest

There are no conflicts of interest.

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