



Indian J Dermatol. 2014 May-Jun; 59(3): 252–256.
doi: [10.4103/0019-5154.131386](https://doi.org/10.4103/0019-5154.131386)

PMCID: PMC4037945

Aeroallergen Patch Testing in Patients of Suspected Contact Dermatitis

[Nelee Bisen](#), [Shrutakirthi D Shenoj](#),¹ and [C Balachandran](#)¹

From the Department of Dermatology, Father Muller Medical College, Kankanady, Mangalore, Karnataka, India

¹Department of Dermatology, Kasturba Hospital, Manipal, Karnataka, India

Address for correspondence: Dr. Nelee Bisen, Department of Dermatology, Father Muller Medical College, Kankanady, Mangalore - 575 002, Karnataka, India. E-mail: drnelee@gmail.com

Received November 2012; Accepted May 2013.

Copyright : © Indian Journal of Dermatology

This is an open-access article distributed under the terms of the Creative Commons Attribution-Noncommercial-Share Alike 3.0 Unported, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

Background:

Aeroallergens are airborne substances present in the environment with the potential to trigger an allergic reaction in the respiratory tract, mucosae, or skin of susceptible individuals. The relevance of aeroallergens in the pathogenesis of atopic dermatitis has been reported by many investigators. However, very few studies have been conducted to investigate their role in the production of allergic contact dermatitis (ACD).

Aims:

To determine the prevalence of aeroallergen patch test positivity in patients of suspected ACD and to study the clinical characteristics of patients testing positive with aeroallergens.

Materials and Methods:

Patients presenting to our department with suspected contact allergy and undergoing patch testing with Indian Standard Series (ISS) between January 2010 and June 2011 were studied. After a detailed history and clinical examination, patients were patch tested with ISS and aeroallergen series. Based on the history and clinical suspicion, patients were additionally patch tested with 15% *Parthenium*. Prior tape stripping was done in some patients.

Results:

Out of total 114 patients, 26 (22.8%) showed sensitivity to aeroallergen series. *Parthenium* was the commonest aeroallergen being positive in all 26 patients followed by *Xanthium* in two. None reacted to other allergens. Although positivity was more in patients with prior tape stripping, the difference was not statistically significant.

Conclusion:

Most common aeroallergen found to be positive in our study was *Parthenium hysterophorus*. In view of low positivity to other allergens, routine aeroallergen patch testing in patients with suspected contact dermatitis may not be necessary.

Keywords: Aeroallergens, allergic contact dermatitis, patch test

Introduction

What was known?

1. Aeroallergens are important in the etiopathogenesis of atopic dermatitis.
2. *Parthenium*, an aeroallergen, is one of the most common sensitizer in patients with allergic contact dermatitis, especially airborne contact dermatitis.

Aeroallergens can be either outdoor or indoor allergens and have been implicated in allergic asthma, rhinoconjunctivitis, and atopic dermatitis. Major outdoor allergens include those derived from the pollens of trees, grasses, and weeds. Major indoor allergens are derived from dust mites, molds, cockroaches, cat, dog, and other furry animal debris.

The relevance of aeroallergens in the pathogenesis of atopic dermatitis has been reported by many investigators.[1,2,3] Atopic dermatitis is believed to exhibit a biphasic immune pattern wherein a Th2 profile predominates at onset and during acute exacerbations, whereas a Th1 profile prevails during chronic stages of the disease. The complex interplay of antigen presenting cells, particularly skin resident Langerhans cells, various cytokines and skin homing T cells have lead few authors to suggest the hypothesis that atopic dermatitis is a form of immunoglobulin E (IgE)-mediated allergic contact dermatitis (ACD) to various aeroallergen. Earlier, aeroallergens were thought to induce only type 1 hypersensitivity (TH-2 response) as demonstrated by the skin prick test, but recently many studies have focused on type 4 (TH-1) response of aeroallergens in atopic dermatitis by means of atopy patch testing.

However, very few studies have been conducted to investigate the role of aeroallergens in the production of ACD. Lin and Wang[4] investigated the significance of contact allergens and aeroallergen sensitization in suspected ACD, unclassified endogenous eczema, and nonatopic chronic urticaria and found high rate of aeroallergen sensitization in above patients. An Indian study of 86 subacute and chronic dermatitis patients done by Kapur *et al.*, [5] showed that among the 50 patients who tested positive for house dust mite (HDM), 19 (38%) had atopic dermatitis, while a large proportion, that is, 25 (50%) had clinically suspected ACD.

Moreover, in clinical practice we often encounter patients with air borne contact dermatitis (ABCD) or disseminated dermatitis with negative or irrelevant positive patch test (PT) reactions when screening with a standard series. Hence, this study was conducted to determine the prevalence of aeroallergen PT positivity in patients of suspected contact dermatitis and to study the clinical characteristics of patients who tested positive with aeroallergens.

In our “aeroallergen series” we chose aeroallergens implicated in atopic dermatitis (HDM, cat and dog dander), common regional pollens (*Parthenium hysterophorus*, *Xanthium strumarium*, *Cocos nucifera*, *Mangifera indica*) and other common occupational airborne allergens (wood dust, grain dust).

Materials and Methods

Patients (18 years and above) presenting to our department with suspected contact allergy who were patch tested with Indian Standard Series (ISS) between January 2010 and June 2011 were included in the study [Figure 1a and b]. Patients with widespread dermatitis involving back, those on systemic steroids or immunosuppressants in past 4 weeks or topical steroids in past 2 week, unwilling patients and pregnant females were excluded. A written informed consent was obtained from all patients.

A detailed history taking and thorough clinical examination was done in each patient and the findings entered in a proforma. Diagnosis with regard to the type of dermatitis was made on clinical grounds.

All patients were patch tested with ISS and aeroallergen series. A total of 54 patients were additionally patch tested with 15% *Parthenium* based on the history and clinical suspicion. ISS containing 25 allergens and 15% *Parthenium* were supplied by Systopic Pharmaceutical Lab, New Delhi, India.

For aeroallergen testing, prick test allergens supplied by Creative Drug Industries, Navi Mumbai, India were used. These were in the form of aqueous solutions containing 50% glycerine as stabilizing factor and preserved with 0.4% phenol, their strengths expressed in protein nitrogen units (PNU). The antigens were loaded in aluminium PT chambers with filter paper, using the dropper provided by the manufacturer. A

drop from the dropper measured approximately 1/16 mL.

Following aeroallergens were used:

1. Mite (*D. farinae*) – 1500 PNU/mL
2. Mite (*D. pteronyssinus*) – 1000 PNU/mL
3. *Parthenium hysterophorus* – 5000 PNU/mL
4. *Xanthium strumarium* – 5000 PNU/mL
5. *Cocos nucifera* – 5000 PNU/mL
6. *Mangifera indica* – 5000 PNU/mL
7. Saw dust (wood dust) – 5000 PNU/mL
8. Grain dust (rice) – 5000 PNU/mL
9. Dog dander – 5000 PNU/mL
10. Cat dander – 5000 PNU/mL

Patches were applied on upper back of the patients and read at 48 and 72 h. Readings were interpreted according to International Contact Dermatitis Research Group (ICDRG) grades.

To enhance allergen penetration, tape stripping was done prior to applying patch in last 35 patients. A 5 cm wide cellophane tape was applied vertically onto the skin parallel to the spine and removed in one quick movement at an angle of 45° in the direction of adherence. A total of 10 such stripping were done for each patient.

The various parameters analyzed were age of patients, gender, duration of disease, clinical types of dermatitis, extent of involvement, seasonal variation, family/personal history of atopy, positivity of aeroallergens, and other allergens of ISS.

The result of patch testing was correlated with the history and clinical examination and probable relevance established.

The study was approved by the Institutional Ethics Committee of our university.

Results

A total of 114 patients were recruited in the study, 80 males and 39 females. Their age ranged from 18 years to 74 years. Majority of the patients were agriculturists (28.95%) followed by housewives (21.05%). The commonest clinical diagnosis was ACD (45.62%) followed by photodermatitis (15.72%) and ABCD (10.53%).

Clinical characteristics of patients with aeroallergen positivity

Out of 114 patients, 26 (22.8%) showed sensitivity to aeroallergen series [Figures 2 and 3]. Of these, 21 were males and 5 females. The youngest patient was a 38 years old female and the eldest was a male of 74 years. Majority of patients were 50-70 years old. *Parthenium* was the commonest aeroallergen being positive in all 26 patients followed by *Xanthium* in two.

The most common occupation of patients with aeroallergen positivity was agriculture (84.61%). Half of the patients had disease duration between 1 and 5 years. Most patients had aggravation of their dermatitis during summer season (34.62%). A total of 20 out of 26 positive patients (76.92%) reported aggravation on contact with *Parthenium* and 18 (69.23%) reported photosensitivity. Sweating was an aggravating factor in six patients and plants in general, detergents, and food items in two each. There was no personal or family history of atopy in most of these patients. Only 3 (11.54%) gave history of atopy. The clinical diagnosis was ABCD in 11 (42.30%), photodermatitis in 9 (34.62%), and ACD in 6 (23.08%). Possible relevance was established in 24 of the 26 patients by correlating with the history.

Results of ISS series

Of the total 114 patients, 57 (50%) showed sensitivity to one or more of the ISS allergens. The five most common allergens were potassium dichromate (13.16%), fragrance mix (12.28%), nickel sulphate (9.65%),

cobalt chloride (9.65%), and Balsam of Peru (7.89%).

Patch test results with 15% *Parthenium*

Out of 54 patients who were additionally patch tested with 15% *Parthenium*, 32 tested positive [Figure 4]. Twenty-six (81.25%) of these also showed positivity for *Parthenium* of aeroallergen series. Pearson's Chi-square test revealed no statistically significant difference between the results of 15% *Parthenium* and *Parthenium* of aeroallergen series ($P = 0.247$).

Patch test versus strip patch test

Stripping before patch testing of aeroallergens was performed in a total of 35 patients [Figure 5]. Among these, PT with 15% *Parthenium* was positive in 11 patients, while *Parthenium* of aeroallergen series was positive in 10 patients. Out of the 79 patients in whom prior stripping was not done, PT with 15% *Parthenium* was positive in 21 patients, while *Parthenium* of aeroallergen series was positive in 16 patients. Although the positivity for *Parthenium* of aeroallergen series had increased after stripping, this difference between the above two groups was not statistically significant ($P > 0.05$). Two cases of irritant reaction to multiple allergens occurred in strip patch test (SPT) group.

Discussion

In our study, out of 114 patients, 26 (22.8%) showed positive results to aeroallergen series. *Parthenium hysterophorus* was the most common aeroallergen being positive in all 26 patients followed by *Xanthium strumarium*, positive in two.

None of our patients reacted to HDM or cat and dog dander which are commonly found to be associated with atopic dermatitis. Similar results were obtained by Whitmore *et al.*, [6] who patch tested 113 patients of suspected ACD with six common aeroallergens in glycerine-dust, mold, cat epithelium, tree, grass, and weed. Out of 113 patients, allergic reactions were seen to one aeroallergen in five patients (three with atopic dermatitis and mucosal allergy, and two with no history of atopy). The authors suggested that aeroallergen patch testing was of little use in the evaluation of patients referred for routine patch testing for suspected "nonaeroallergen" ACD.

However, in the study by Kapur *et al.*, [5] one of the reasons for high positivity of dermatophagoides (DP) mix among atopic and nonatopic patients could be the high concentration of DP mix (20% in petrolatum, obtained from chemotechnique diagnostic, Sweden) used in their study. Jamora *et al.*, [7] demonstrated high number of false-positive reactions to the 20% concentration of DP mix (chemotechnique) with 15 (83%) out of 18 nonatopic, healthy control subjects yielding positive reactions. They found out that a 0.1% dilution of 20% *D. pteronyssinus*/farinae mix antigen was useful in identifying mite-allergic individuals with atopic dermatitis.

Thus, in case of HDM and cat/dog dander, the association of IgE-mediated sensitivity to the antigen along with delayed hypersensitivity response to it, as occurs in atopic dermatitis, remains to be studied in ACD patients.

Parthenium has been reported as the most common sensitizer in plant series and overall by many investigators.[8,9] Traditionally *Parthenium* dermatitis is reported to occur more frequently in males. In our study also, 22 (84.61%) of the above patients were agriculturists and 21 (80.76%) were males reflecting greater exposure of men to airborne allergens in fields.

ABCD was the most common clinical pattern seen in 11 (42.30%) patients of the above group followed by 9 (34.62%) photodermatitis and 6 (23.08%) ACD (without any specific pattern). Eighteen (69.23%) of these patients gave history of photoaggravation. Various patterns of *Parthenium* dermatitis have been described in the literature,[10,11,12] a typically ABCD involving the eyelids and nasolabial folds, photodermatitis, atopic dermatitis, seborrheic dermatitis, exfoliative dermatitis, and photosensitive lichenoid dermatitis. Sharma *et al.*, [13] recently postulated that the differing patterns of *Parthenium* dermatitis are a function of time; dermatitis always starts as the classical airborne pattern and gradually changes to an actinic or mixed pattern. Bajaj *et al.*, [8] suggested that the clinical pattern of *Parthenium*

dermatitis possibly depends on factors such as occupation, clothing pattern, underlying atopy, and route of (re) exposure. It has been argued by Mahajan *et al.*,^[14] that a generalized pattern of dermatitis in these patients may be the result of systemic, possibly inhalational exposure resulting in a systemic contact dermatitis.

Two of our patients showed sensitivity to *Xanthium* along with *Parthenium*. Cases where the patient showed positive PTs with plants other than *Parthenium hysterophorus* have been recorded by several workers.^[15,16,17,18,19,20] In most of these cases, the patients had shown positive PTs with other plant(s) in addition to *Parthenium hysterophorus*. Compositae plants are well-known for their ability for cross reactions within the family. Common allergenic determinants like sesquiterpene lactones can cause patterns of cross sensitivity between the four compositae plants *Parthenium hysterophorus*, *Xanthium strumarium*, *Helianthus annuus*, and *Chrysanthemum coronarium*, as reported in Indian literature.^[21] However, Pasricha *et al.*,^[22] reported two patients with classical ABCD who showed negative PTs with *Parthenium hysterophorus* but strongly positive reactions with *Xanthium strumarium*. This highlights the importance of patch testing patients of ABCD with clinically important plants other than *Parthenium* also.

Almost half of our 114 patients showed sensitivity to one or more of the ISS allergens. The five most common allergens were potassium dichromate (13.16%), fragrance mix (12.28%), nickel sulphate (9.65%), cobalt chloride (9.65%), and Balsam of Peru (7.89%). Males were most sensitive to potassium dichromate, while females to nickel sulphate. Our above data on various allergens is comparable to that recently reported by Bajaj *et al.*,^[8] Handa and Jindal^[9] and Narendra G.^[23] In a previous study from our department, done in 1994, the most common sensitizers were gentamycin (14.2%), potassium dichromate (11.3%), and nickel sulphate (10.8%). Sensitivity to fragrance mix was demonstrated in 6.1% patients. This moderate change in allergen sensitivity over the time may relate to the reduced use of over-the-counter available corticosteroid-gentamycin preparations and increased use of cosmetics containing various fragrances.

We did not find any statistically significant difference between the sensitivities of 15% and aeroallergen *Parthenium* implying that *Parthenium* antigen of the aeroallergen (or prick test series) can be used as a PT antigen. Owing to its lower concentration, irritant reactions sometimes associated with 15% *Parthenium* can be avoided.

A noteworthy point was the strikingly low sensitivity to parthenolide antigen of ISS. Among the 32 *Parthenium* sensitive patients, only one (3.12%) tested positive for parthenolide. Parthenolide is a sesquiterpene lactone found in several compositae plants like feverfew and chrysanthemum. Above figures suggest that it does not indicate the sensitivity to *Parthenium hysterophorus*, the *Parthenium* species commonly found in India, thus questioning the relevance of including it in the ISS.

The SPT, as suggested by Spier and Sixt in 1955,^[24] is a modification of the conventional PT. It is employed when substances with poor percutaneous penetration, for example, drugs, photopatch test substances, and aeroallergens, need to be tested, with the intention of enhancing their penetration through the stratum corneum. In a multicenter, prospective study involving 790 patients with suspected ACD, Dickel *et al.*,^[25] found that SPTs detected considerably more sensitization to nickel sulfate and potassium dichromate compared to PTs. We performed prior tape stripping of the PT sites in 35 patients and compared the positivity of 15% *Parthenium* and aeroallergen series *Parthenium* in the groups who underwent and who did not undergo prior tape stripping. Although the sensitivity to aeroallergen increased after tape stripping, the difference between the above two groups was not statistically significant ($P > 0.05$). These findings suggest that prior tape stripping may enhance antigen penetration in patch testing; however, further studies involving larger number of patients are needed to prove this.

In the light of low positivity to aeroallergens other than *Parthenium* in our study, we conclude that routine aeroallergen patch testing in patients with suspected contact dermatitis may not be necessary.

What is new?

1. Routine aeroallergen patch testing in patients with suspected contact dermatitis may not be

necessary.

2. *Parthenium* antigen of the prick test series can be used as a PT antigen.
3. Parthenolide antigen may not be a good indicator of sensitivity to *Parthenium hysterophorus*.

Acknowledgment

The authors extend thanks to Mrs. Meera and Mr. Dinesh P. for their help in carrying out PT in the patients.

Footnotes

Source of Support: This study was supported financially by Thesis research grant from Manipal University

Conflict of Interest: Nil.

References

1. Clark RA, Adinoff AD. Aeroallergen contact can exacerbate atopic dermatitis: Patch test as a diagnostic tool. *J Am Acad Dermatol*. 1989;21:863–9. [PubMed: 2600213]
2. Darsow U, Laifaoui J, Kerschenlohr K, Wollenberg A, Przybilla B, Wüthrich B, et al. The prevalence of positive reactions in the atopy patch test with aeroallergens and food allergens in subjects with atopic eczema: A European multicenter study. *Allergy*. 2004;59:1318–25. [PubMed: 15507101]
3. Krupa Shankar DS, Chakravarthi M. Atopic patch testing. *Indian J Dermatol Venereol Leprol*. 2008;74:467–70. [PubMed: 19052405]
4. Lin LF, Wang J. Patch testing and aeroallergen intradermal testing in suspected allergic contact dermatitis, unclassified endogenous eczema and non-atopic chronic urticaria. *Contact Dermatitis*. 2001;45:84–8. [PubMed: 11553117]
5. Kapur C, Sheno SD, Prabhu SS, Balachandran C. Patch testing with dermatophagoides and its correlation with chronic eczema and atopic dermatitis. *Indian J Dermatol*. 2009;54:243–6. [PMCID: PMC2810690] [PubMed: 20161855]
6. Whitmore SE, Sherertz EF, Belsito DV, Maibach HI, Nethercott JR. Aeroallergen patch testing for patients presenting to contact dermatitis clinics. *J Am Acad Dermatol*. 1996;35:700–4. [PubMed: 8912564]
7. Jamora MJ, Veralllo-Rowell VM, Samson-Veneracion MT. Patch testing with 20% Dermatophagoides pteronyssinus/farinae (Chemotechnique) antigen. *Am J Contact Dermat*. 2001;12:67–71. [PubMed: 11381340]
8. Bajaj AK, Saraswat A, Mukhija G, Rastogi S, Yadav S. Patch testing experience with 1000 patients. *Indian J Dermatol Venereol Leprol*. 2007;73:313–8. [PubMed: 17921610]
9. Handa S, Jindal R. Patch test results from a contact dermatitis clinic in North India. *Indian J Dermatol Venereol Leprol*. 2011;77:194–6. [PubMed: 21393954]
10. Lonkar A, Mitchell JC, Calnan CD. Contact dermatitis from *Parthenium hysterophorus*. *Trans St Johns Hosp Dermatol Soc*. 1974;60:43–53. [PubMed: 4466007]
11. Warshaw EM, Zug KA. Sesquiterpene lactone allergy. *Am J Contact Dermat*. 1996;7:1–23. [PubMed: 8796737]
12. Lakshmi C, Srinivas CR, Jayaraman A. Ciclosporin in parthenium dermatitis: A report of 2 cases. *Contact Dermatitis*. 2008;59:245–8. [PubMed: 18844701]
13. Sharma VK, Sethuraman G, Bhat R. Evolution of clinical pattern of parthenium dermatitis: A study of 74 cases. *Contact Dermatitis*. 2005;53:84–8. [PubMed: 16033401]
14. Mahajan VK, Sharma NL, Sharma RC. Parthenium dermatitis: Is it a systemic contact dermatitis or an airborne contact dermatitis? *Contact Dermatitis*. 2004;51:231–4. [PubMed: 15606646]
15. Bajaj AK, Govil CD, Bhargava NS. Contact Dermatitis due to plants. *Indian J Dermatol Venereol*

Leprol. 1982;48:268–70.

16. Sharma SC, Kaur S. Contact dermatitis from composite plants. Indian J Dermatol Venereol Leprol. 1990;56:27–30.

17. Pasricha JS. 2nd ed. New Delhi: Department of Science and Technology; 1988. Contact Dermatitis in India; pp. 21–42.

18. Siddiqui MA, Singh R, Sharma RC. Contact dermatitis due to *Parthenium hysterophorus*. Indian J Med Res. 1978;68:481–4. [PubMed: 744635]

19. Tiwari VD, Sohi AS, Chopra TR. Allergic contact dermatitis due to *Parthenium hysterophorus*. Ind J Dermatol Venereol Leprol. 1979;45:392–400.

20. Pasricha JS, Nandakishore TH. Air-borne contact dermatitis due to Chrysanthemum with true cross sensitivity to *Parthenium hysterophorus* and Xanthium strumarium. Ind J Dermatol Venereol Leprol. 1992;58:268–71.

21. Nandakishore T, Pasricha JS. Pattern of cross-sensitivity between 4 Compositae plants, *Parthenium hysterophorus*, Xanthium strumarium, Helianthus annuus and Chrysanthemum coronarium, in Indian patients. Contact Dermatitis. 1994;30:162–7. [PubMed: 8187516]

22. Pasricha JS, Verma KK, D'Souza P. Air-borne contact dermatitis caused exclusively by xanthium strumarium. Indian J Dermatol Venereol Leprol. 1995;61:354–5. [PubMed: 20953020]

23. Narendra G, Srinivas CR. Patch testing with Indian standard series. Indian J Dermatol Venereol Leprol. 2002;68:281–2. [PubMed: 17656969]

24. Spier HW, Sixt I. The dependency of the results of patch tests in eczema on the thickness of the corium; quantitative abrasion epicutaneous test. Hautarzt. 1955;6:152–9. [PubMed: 14391794]

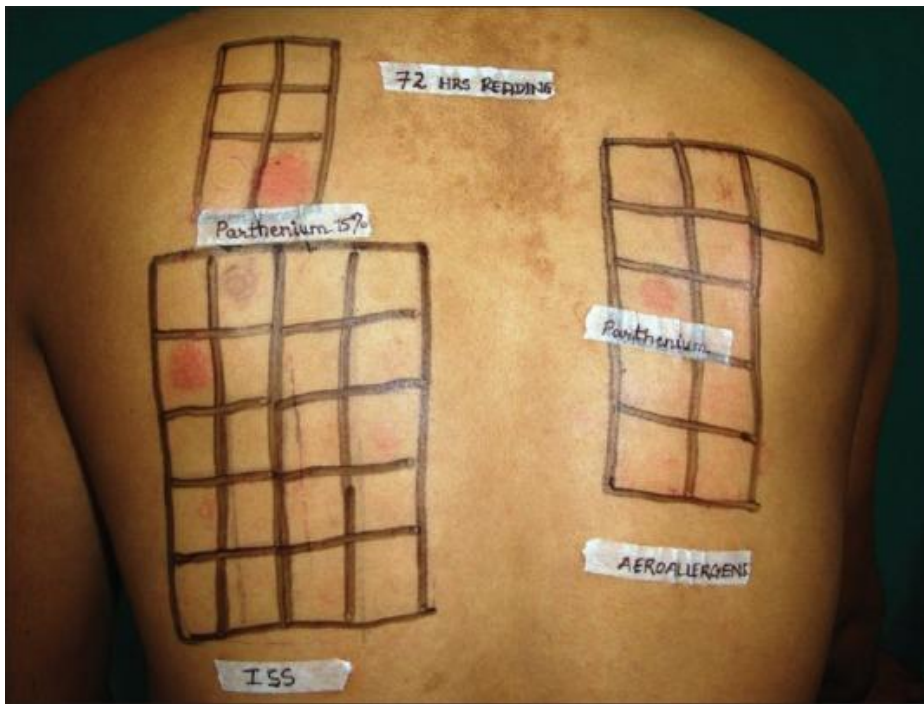
25. Dickel H, Kreft B, Kuss O, Worm M, Soost S, Brasch J, et al. Increased sensitivity of patch testing by standardized tape stripping beforehand: A multicentre diagnostic accuracy study. Contact Dermatitis. 2010;62:294–302. [PubMed: 20536477]

Figures and Tables

Figure 1



(a and b) Airborne contact dermatitis

Figure 2

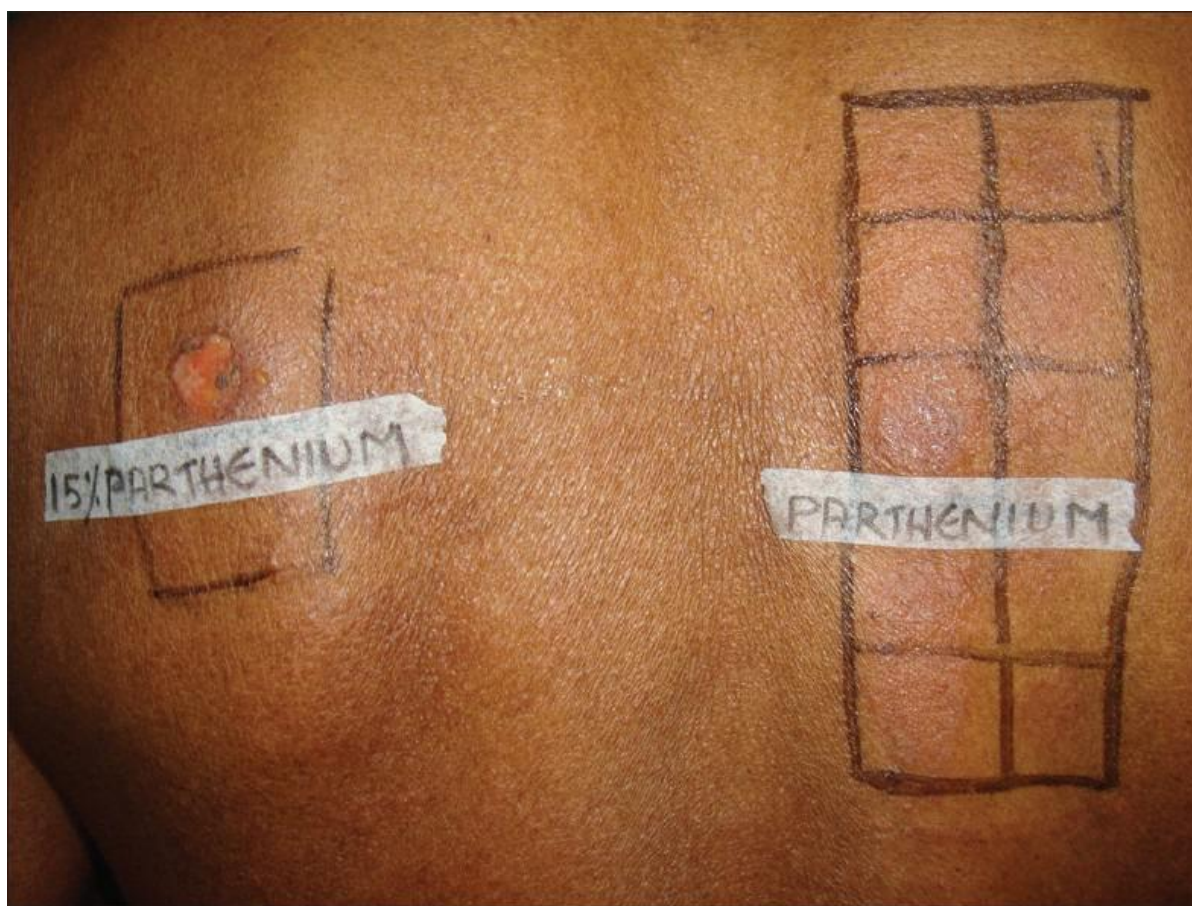
Positive patch test results

Figure 3



Close up view showing 2+ reaction

Figure 4



Positive reaction to 15% Parthenium and Parthenium of aeroallergen series

Figure 5



Tape stripping prior to patch test

Articles from Indian Journal of Dermatology are provided here courtesy of **Medknow Publications**