

Original Research Article

A study on incidence of various allergens involved in allergic contact dermatitis by patch testing among 150 patients in a tertiary care hospital in South India

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ABSTRACT

Background: Allergic contact dermatitis is common dermatoses seen among patients attending dermatology clinics. Allergic contact dermatitis is due to delayed type of hypersensitivity reaction. The diagnosis of allergic contact dermatitis is made by patch testing. A positive reaction to a patch test commonly proves the cause of dermatitis.

Methods: A retrospective study was conducted to estimate the incidence of various allergens among 150 patch test positive patients with allergic contact dermatitis who had attended the dermatology OPD in Rajiv Gandhi Government General Hospital, Chennai, between October 2014 and September 2016. All the details regarding history, examination findings, investigations and patch test results were collected from case records, the data were tabulated and analysed.

Results: Allergic contact dermatitis to cement was the commonest (44.7%), followed by nickel (10%) and plant antigens (9.3%). The commonest allergen to be tested positive was Potassium dichromate (82 cases), followed nickel (15 cases) and formaldehyde (8 cases). Most of the patients were in the age category between 41 and 50 years (47 cases– 31.33%). Male to female ratio was 2.41:1. 14 were atopic individuals (9.33%) by Hanifin and Rajka's criteria. Allergic contact dermatitis in 103 cases of our study were of occupational in origin (67%).

Conclusions: Avoidance of allergen and proper preventive measures in workplace and day to day activities will lead to significant decrease in the morbidity of the disease and improvement in quality of life in patients with allergic contact dermatitis.

Keywords: Allergic contact dermatitis, Patch test, Occupational, Potassium dichromate, Avoidance of allergen

INTRODUCTION

Allergic contact dermatitis (ACD) is common dermatoses seen among patients attending dermatology clinics. Allergic contact dermatitis occurs when the skin comes in contact with an allergen, with the skin being sensitive or allergic to that agent. Clemens Peter Freiherr von Pirquet, an Austrian scientist first coined the term "allergie".¹ It is

derived from Greek terminologies 'allos' and 'ergon' meaning 'other or different work'. Bloch and Steiner-Woerlich were the first to prove allergic sensitization of human skin experimentally.² A simple chemical must combine with proteins in order to sensitise and cause contact dermatitis was described by Landsteiner and Jacobs.³ Josef Jadassohn, a German physician is considered to be the founder of the Patch Testing.⁴ The

concepts of standard series of allergens, cross sensitization and systemic allergic contact dermatitis were introduced by Bruno Bloch, a Swiss dermatologist.^{5,6} The prototype of our present day patch test series was derived by expanding the Bruno Bloch's standard series by Paul Bonnevie, Professor of Occupational medicine from Copenhagen.

Allergic contact dermatitis is due to delayed type of hypersensitivity reaction. Sensitisation (induction or afferent limb) and elicitation (efferent limb) are the two main steps in the induction of allergy.⁷ Erythema, swelling, papules and papulovesicles are seen with itching being the most predominant symptom in contact dermatitis. In acute cases, vesicles and blisters can be seen. Skin becomes dry, scaly and thicker with lichenification and fissuring if the disease persists chronically. The distribution of dermatitis is of diagnostic importance but its morphology is usually of no help. Photoallergic reactions are based on immunological mechanisms similar to that of allergic contact dermatitis. Certain substances are transformed into photosensitizers after irradiation with UV or short-wave visible radiation (280-600 nm).⁸ The dermatitis is localised to the exposed areas of the skin with sparing of chin and a small triangular area behind the earlobes (Wilkinson's triangle).⁹ "Persistent light reaction" is a phenomenon where the light sensitivity persists even after the elimination of the sensitizer.¹⁰

The diagnosis of allergic contact dermatitis is made by patch testing. Patch testing relies on the concept that primed antigen-specific T lymphocytes will be present throughout the body. A positive reaction to a patch test commonly proves the cause of dermatitis. In a patient with dermatitis, a positive patch test must never be disregarded. If found in a healthy person, it may indicate a future risk of allergic dermatitis from that particular allergen.

Aim of the study

To estimate the incidence of various allergens in 150 patch test positive patients with allergic contact dermatitis. To estimate the age and sex incidence among patients of contact dermatitis to various allergens. To determine the association of allergic contact dermatitis with atopy, Diabetes mellitus and Absolute eosinophil count.

METHODS

A Retrospective study was conducted among 150 cases with Allergic contact dermatitis who had attended the dermatology OPD in Rajiv Gandhi Government General Hospital, Chennai, between October 2014 and September 2016, who were patch test positive. Details regarding the duration and type of occupation, morphology of the lesions, sites of involvement, history, symptoms and signs suggestive of atopy, past history of the patient for

similar complaints, history of any drug intake prior and after onset of lesions, investigations like routine hemogram, blood sugar and patch test results were collected from the case records of the patients.

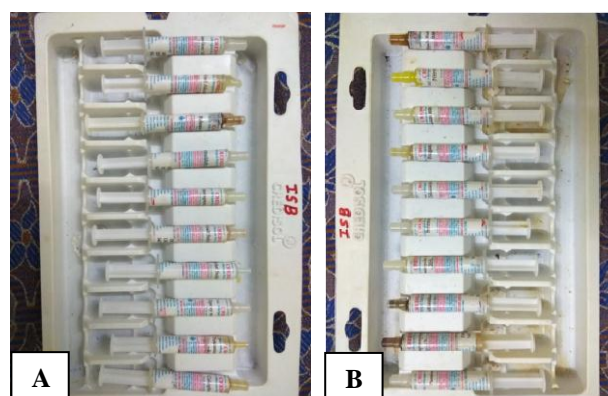


Figure 1 (A and B): Patch test kit (Indian standard series).

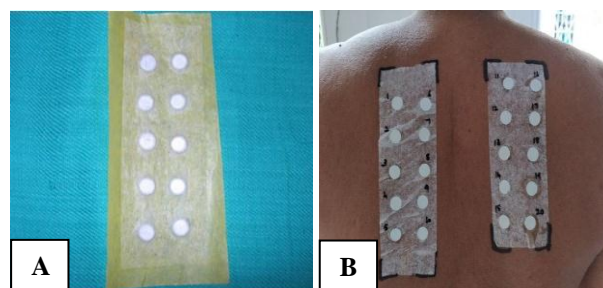


Figure 2 (A and B): Aluminium chamber and patch testing.

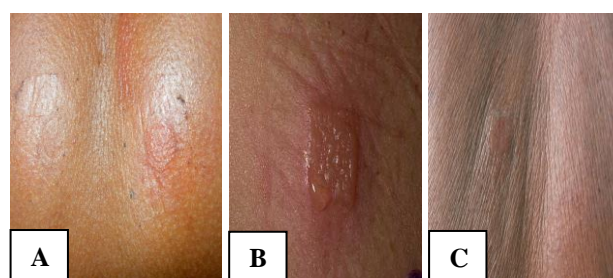


Figure 3 (A-C): Patch test results. A=1+, B=2+, C=3+.

Based on the type and nature of exposure to a specific occupation or antigen, the patients were patch tested with the appropriate allergens. The patch test allergens used were approved by the Contact and Occupational Dermatoses Forum of India (CODFI) (Figure 1). Allergens were placed over the upper back on either side of midline with the help of strips with aluminium chambers provided with the kit (Figure 2). Patches were removed after 48 hrs (2 days). Reading was taken after 45-60 mm and a second reading was taken on day 4 after application to confirm the presence of allergic reaction (Figures 3).

Readings were then interpreted according to the guidelines devised by International Contact Dermatitis Research Group (ICDRG) (Table 1).

Table 1: Inference of patch testing results.

Result	Inference
-	Negative
? -	Doubtful reaction. Faint erythema only
+	Weakly positive reaction. Palpable erythema, infiltration, possibly papules
++	Strong positive reaction. Erythema, infiltration, papules and vesicles
+++	Extreme positive reaction. Intense erythema & infiltration, coalescing vesicles
IR	Irritant reaction
NT	Not tested

RESULTS

150 patients with history of exposure to a specific substance and also patch test positive for the respective allergens were included in the study. Out of the total 150 cases, Allergic contact dermatitis to cement tops the list with 67 cases (44.7%). Contact dermatitis to nickel is the second common with 15 of a possible 150 cases (10%) followed by plant antigens i.e. phytophotodermatitis with a total of 14 cases (9.3%). Other substances are paint – 10 cases (6.7%), kumkum– 8 cases (5.3%), rubber– 8 cases (5.3%), leather– 7 cases (4.7%), oil and grease– 7 cases (4.7%), turmeric– 5 cases (3.3%) and other miscellaneous substances– 9 cases (6%) (Table 2).

Table 2: Incidence of various substances causing allergic contact dermatitis.

Allergic substances	No of cases (%)
Cement	67 (44.7)
Nickel	15 (10)
Phytophotodermatitis	14 (9.3)
Paint	10 (6.7)
Kumkum	8 (5.3)
Rubber	8 (5.3)
Leather	7 (4.7)
Oils, grease	7 (4.7)
Turmeric	5 (3.3)
Others	9 (6)

The commonest allergen to be tested positive was potassium dichromate (82 cases), the second common being nickel (15 cases). Formaldehyde was the third common allergen (8 cases) followed by cobalt chloride, epoxy resin, parabens, 4-chloro 3-cresol, black rubber mix. Among the miscellaneous cases 6 were allergic contact dermatitis to hair dyes. Others was allergic contact dermatitis to chrysanthemum, neomycin, polish, lipstick, tooth powder, printing ink, photographic film developing fluid and eye ointment (Table 3).

Among the study group, 106 patients were male (70.7%) and 44 patients were female (29.3%). Male to female ratio was 2.41:1. Female predominance was seen in allergic contact dermatitis to nickel, kumkum and turmeric (Table 4). Most of the patients were in the age category between 41 and 50 years of age (47 cases– 31.33%). Second most common age category was 31 to 40 years of age (32 cases– 21.33%). Third most common age group was between 51 to 60 years (30 cases–20%). The youngest patient in the study was 13 years of age and the oldest was 65 years of age (Table 5).

Table 3: Incidence of various allergens by patch testing.

S. No.	Allergens	No. of cases
1.	Potassium dichromate	82
2.	Nickel	15
3.	Formaldehyde	8
4.	Cobalt chloride	7
5.	Epoxy resin	7
6.	Parabens	7
7.	4 chloro 3 cresol	5
8.	Black rubber mix	5
9.	Thiuram mix	3
10.	Mercapto mix	2
11.	Wood alcohol	2
12.	4-phenylene diamene	2
13.	Chinoform	2
14.	Colophony	1
15.	Fragrance mix	1
16.	Polyethene glycol	1

Table 4: Sex incidence in allergic contact dermatitis patients.

Substance	Males	Females
Cement	56	11
Nickel	3	12
Phytophoto	12	2
Paint	9	1
Kumkum	1	7
Rubber	7	1
Leather	5	2
Others	6	3
Turmeric	1	4
Oils, grease	6	1
	106	44

Table 5: Age Incidence in allergic contact dermatitis patients.

Age in years	No. of patients
10 - 20	5
21 - 30	23
31 - 40	32
41 - 50	47
51 - 60	30
>60	13

Table 6: Allergic contact dermatitis in atopics.

Patch test result	No. of patients
1+	3
2+	10
3+	1

Table 7: Eosinophilia in patients with allergic contact dermatitis

Allergen	No. of patients with eosinophilia
Nickel	17
Cement	7
Phytophoto	5
Others	3

Table 8: ACD patients with diabetes mellitus.

Patch test result	ACD patients with Diabetes
1+	11
2+	1

Of the 150 cases, 14 cases were Atopic individuals (9.33%) by Hanifin and Rajka's criteria. 11 out of the 14 cases had 2+ positivity (78.6%) (Table 6). 3 cases were 1+ positive and 1 case was 3+ positive. Nickel was the commonest allergen to be positive among atopics – 6 cases (42.9%). Cement (potassium dichromate) was the second common allergen with 5 cases (35.7%). 16 cases (10.67%) showed eosinophilia (eosinophils >5 in a differential count– Davidson's textbook of Internal medicine). Eosinophilia was most common amongst the patients who tested positive for nickel– 8 cases (53.33%) (Table 7). Out of the 150 cases, 12 had diabetes mellitus (8%). 11 of the 12 patients had 1+ positivity (91.67%) (Table 8).



Figure 4: Contact dermatitis to A=Cement, B=Printing ink, C=Paint.



Figure 5 (A and B): Nickel contact dermatitis.



Figure 6 (A and B): Contact dermatitis to kumkum.



Figure 7 (A and B): Parthenium and CD to parthenium.



Figure 8 (A and B): Contact dermatitis to hair dye and lipstick.

Out of the 150 cases, 69 cases presented with Hand eczema (46%) with cement being the commonest allergen followed by paint (Figures 4). Contact dermatitis to nickel was seen in 14 patients (Figures 5). Kumkum dermatitis was seen in 8 patients (Figures 6). Parthenium contact dermatitis was seen in 8 patients (Figures 7). CD to hair dye was seen in 2 cases and to lip balm in 1 case (Figures 8).

Allergic contact dermatitis in 103 cases of our study were of occupational in origin (67%) and 47 cases were non-occupational in origin (33%). The ratio between

occupational and non-occupational cases is 2.03:1 (Figure 9).

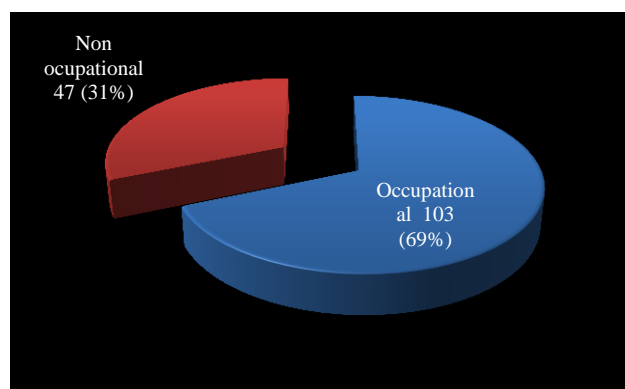


Figure 9: Occupational status.

DISCUSSION

Allergic contact dermatitis to cement was found to be the commonest in the study (43.33%). Hexavalent chromium is the most common allergen in the cement. The higher incidence of allergic contact dermatitis to cement is due to more people being employed in construction working in Chennai, Tamil Nadu. In a similar study conducted by Kishore Nanda et al in Mangalore and Sharma V et al in Himachal Pradesh, allergic contact dermatitis to cement tops the list.^{11,12} The most common sites to be involved were hands, forearms, feet and face, i.e. the exposed sites. Contact dermatitis to Nickel was the second commonest in the study (10.33%). Nickel in general is the most common metal causing sensitization. Nickel sensitivity was found to be more common in females compared to males. This is in accordance to the studies done by Nielson in a group of Danish population.¹³ Jewellery and metal components of clothing were the frequent sources of Nickel in the study due to prolonged contact with the skin. Most common substances causing nickel sensitization in the study were necklaces, other jewellery, watches and studs in clothing.

Phytophoto dermatitis to plant allergens was the third common. Photosensitivity commonly co-exists with Compositae family allergy. From India, parthenium hysterophorus has been reported to be the main cause of compositae contact dermatitis. All the patients patch tested were uniformly sensitive to parthenium hysterophorus both before and after phototesting. Most common pattern seen was that of airborne contact dermatitis. This pattern was also the most common in the studies conducted by Sharma and Kaur.¹⁴ Allergic contact dermatitis to kumkum was seen in 5.7% cases and allergic contact dermatitis to turmeric was seen in 3.7% cases. Kumkum was found to be the commonest cause of cosmetic dermatitis. Common allergens in kumkum are brilliant lake red R, Sudan I, Canaga oil and aminoazobenzene as separated by thin layer chromatography. Patch test was done with commercial kumkum as such. Due to traditional use of turmeric and kumkum by south

Indian women, there is an increasing incidence of contact dermatitis. Contact dermatitis to rubber constituted 5.7% cases. Rubber was found to be the commonest allergen in the footwear series. This is in contrast to the studies conducted by Choudhuri where leather was the commonest substance to cause allergy in footwear.¹⁵ Contact depigmentation in footwear series was due to rubber. This was also seen in studies conducted by Singh et al.¹⁶

Potassium dichromate was found to be the commonest allergen in the Indian standard series. Next in the order of the frequency are nickel, formaldehyde, cobalt chloride, epoxy resin, parabens, 4-chloro 3-cresol. The Indian standard series differs from the european standard series by the inclusion of propylene glycol, nitrofurazone, gentamycin, chlorocresol, PEG 400 and Ethylene diamine chloride whereas sesquiterpene lactone mix and primin allergens are excluded. The study conducted by Srinivas C.R in P.S.G Institute of Medical Sciences and Research showed nickel to be the most frequent sensitizer followed by potassium dichromate, Cobalt chloride and Colophony in that order.¹⁷ The reason for potassium dichromate to be the commonest allergen in the study is due to the increased number of patients with allergic contact dermatitis to cement in the study.

Male to female ratio in our study of 150 cases was 2.41:1. Reason for male predominance may be due to the fact that more cases were occupational in nature where men were employed in preference to women. In the study conducted by Srinivas. In P.S.G. Institute of Medical Sciences and Research showed a male to female ratio of 1.8:1, in the study conducted by Kishore Nanda et al in Mangalore the ratio was 1.27:1 and a similar in the study by Handa et al.^{11,17,18} Female predominance was specifically seen in cases of allergic contact dermatitis to nickel, kumkum and turmeric. It has also been seen in the study conducted by Nielson et al.¹³ It is also due to common usage of nickel and kumkum by women in South India. The most common age category of the patients was 41 to 50 years. In a similar study conducted in Iran, the mean age of the patients was found to be 43.6 years. Very young and extremes of ages were least affected. This is due to the fact that people accumulate allergies acquired over a life time and that inflammatory response is diminished in elderly patients.

Nearly 10% of the patients were atopic individuals as diagnosed by Hanifin and Rajka criteria. In the study conducted by Sharma in Assam, allergic contact dermatitis was found not uncommon amongst atopic individuals.¹⁹ Patch test positivity was 2+ in most cases and Nickel was the most common allergen among atopics which was in concordance to our study.

CONCLUSION

With allergic contact dermatitis being one of the commonest presentations in dermatology clinics, dermatologists should be aware of the various allergens

incriminated in substances with which patients come into contact with their day to day activity. By advising avoidance of allergens, proper preventive measures and by early diagnosis and management, the duration of contact with allergens can be substantially reduced, which will help to reduce the morbidity associated with the disease and improve the quality of life in these patients.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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