

Contact hypersensitivity in hand eczema – A study with Indian standard series of allergens

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Abstract

Patch testing is a definitive tool for diagnosing contact allergic dermatitis that provides the trends of contact sensitization in the dermatology patient community. This study was an open prospective study reporting the results of patch test data from a dermatology clinic at a tertiary care hospital in Jaipur, Rajasthan (India) from October 2012 to April 2014. Hundred patients (59 males and 41 females) with contact allergic dermatitis of hands were tested with standard series of 24 allergens consisting of Indian standard series of patch testing, expanded with allergens prepared from extracts of onion, garlic, soap and detergents. Occupationally the patients included were unskilled workers (53%), housewives (19%), skilled workers (10%), students and people engaged in white-collar jobs - 9%. The frequent sensitizers were found to be potassium dichromate (28%), nickel sulphate (25%), vegetable (10%), medicaments (7%), parthenium (6%), soap and detergents (5%), fragrance mix (4%), and paraben mix (3%). In majority of the patients, occupational substances were the causative allergens leading to contact dermatitis.

Key Words: Allergens, Contact dermatitis, Occupation, Patch Test.

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INTRODUCTION

Dermatitis refers to the inflammation of the skin and may occur because of internal causes or due to external causes. Contact eczema occurs in response to substance which comes in direct contact with skin. It presents as short term or persistent redness, itching, blistering, scaling and oozing of the skin, often involving a particular anatomical area of the body e.g. Hand dermatitis (HD), foot eczema, or disseminated eczema. It can be of two types Irritant Contact Dermatitis (ICD) and Allergic Contact Dermatitis (ACD). An allergic reaction is specific to the individual and to a substance or a group of related substances called

allergen, and occurs due to hypersensitivity to it, involving the immune system. The rash of ACD often involves the area in contact with the allergen e.g. hand eczema, foot eczema etc. and at times other areas distant from the contact allergen. It presents with oedema, oozing, redness, dryness, scaling and fissuring which is associated with intense itching without pain. It may be ACUTE, SUB ACUTE or may become CHRONIC. ***ACD may appear many years after the initial exposure to the suspected allergen.*** The eczema may curiously persist for some time even after the allergen has been removed. Eczema cases form almost 20% of all cases attending dermatology OPD. Out of which a large percentage are that of hand eczema as hands are essential for execution of basic human needs and earning livelihood. The incidence of hand eczema is on increase. It leads to significant morbidity and loss of working hours. Common allergens of hand eczema includes detergents, dyes, cement, metals, cosmetics, preservatives, hair colors, industrial oils, fragrances, rubber, medicated creams and plants etc. ***Patch testing is the only way to prove that a substance is causing or aggravating ACD.*** Once an allergen is identified, avoiding it should help to cure or at least reduce the severity and duration of eczema. Patch

testing can also help to differentiate between ICD and ACD. Patch testing has become standard method of investigating patients with suspected allergic contact dermatitis. Testing with standard series is useful when an offending agent cannot be identified inspite of careful history and clinical examination. There is a wide variation in prevalence of contact sensitivity depending on the geographical area, type of industrialization, occupation, socio-economic status, pollution and other environmental factors. The purpose of the study was to find out the frequent sensitizers in cases of hand eczema in Jaipur and area around.

MATERIALS AND METHODS

This study was a prospective open label cross-sectional study including 100 patients suffering from hand dermatitis. The inclusion criteria were age group between 10 and 60 years, both sexes, patients suffering from HE and patients willing to undergo patch test. The patients that were excluded from the study were age group less

than 10 years and more than 60 years, pregnant mothers, patients in acute phase of dermatitis, patients in whom the dermatitis was the result of a known systemically administered agent, patients who were on corticosteroids equivalent to 20mg or more of prednisolone, PUVA and / or any other immunosuppressive drugs for the preceding 14 days and patients having photo allergic contact dermatitis. A detailed history regarding duration, occupation, site, season, aggravating factors, nature of work, hobbies, part time activity and atopy were recorded. A carefully designed clinical record form was used. All patients were tested with 24 antigens consisting of *The Indian Standard Series (ISS)* developed by CODFI (Contact & Occupational Dermatitis Forum of India) plus additional indigenous antigens prepared from extracts of onion, garlic, soap and detergents. Patch testing was done with Finn’s aluminium chambers. The results were read after 48 hours and 72 hours as per criteria laid down by ICDRG (International Contact Dermatitis Research Group)

Table of ICDRG

Symbol	Morphology	Interpretation
-	No reaction	Negative
±	Erythema only, no infiltration	Doubtful reaction
+	Erythema, infiltration, possibly discrete papules	Weak positive reaction
++	Erythema, infiltration, papules, vesicles	Strong positive reaction
+++	Erythema, infiltration, confluent vesicles	Extreme positive reaction
ir	Different types of reactions (soap effect, vesicles, blisters, necrosis)	Irritant reaction
Nt		Not tested

ICDRG: International Contact Dermatitis Research Group



Figure 1



Figure 2



Figure 3

Legend:

Figure 1: Patch test unit- aluminum chambers with allergens

Figure 2: Patch test units applied on the upper back

Figure 3: Strong positive reaction to potassium dichromate and weak reaction to nickel sulphate

STATISTICAL ANALYSIS

Chi-Square test

The Chi-Square test procedure tabulates a variable into categories and computes a chi-square statistic. This goodness-of-fit test compares the observed and expected frequencies in each categories to test either that all categories contain the same proportion of values or that

each category contains a user-specified proportion of values.

A ‘p’ value of 0.05 proportion or less was considered to be of statistical significance

OBSERVATIONS AND RESULTS

A total of 100 patients completed the study, of which 59 (59%) were males and 41 (41%) females. The male to female ratio was 1.44:1

Mean age was 34.96 years (Table 1 & 2).

Table 1: Distribution of HE cases according to age

Age Group (Years)	Number of patients	%
10 to 19	1	1%
20 to 29	23	23%
30 to 39	45	45%
40 to 49	28	28%
> 50	3	3%
Total	100	100%
Mean ± SD	34.96 ± 8.15	
Min - Max	15 - 60 yrs	

Table 2: Distribution of HE cases according to sex

Sex	Number of patients	%
Male	59	59%
Female	41	41%
Total	100	100%

They had dermatitis for an average period of 1-5 years (Table 3).

Table 3: Distribution of HE cases according to duration of disease

Duration	Total	Male	Female	P value
< 6 Months	15	9 (15.3%)	6 (14.6%)	0.898
<6 – 12 Months	20	14 (23.7%)	6 (14.6%)	0.060
> 1 – 2 Years	25	15 (25.4%)	10 (24.4%)	0.866
> 2 – 5 Years	30	17 (28.8%)	13 (31.7%)	0.672
> 5 Years	10	4 (6.8%)	6 (14.6%)	0.104
Total	100	59 (100%)	41 (100%)	

This group comprised of unskilled workers (53), skilled worker (10), housewives (19), students (9), and white collar jobs (9). (Table 4)

Table 4: Distribution of HE cases according to occupation (n = 100)

Occupation	Total	Male	Female	P value
Unskilled	53	45 (76%)	8 (13.55%)	<0.001*
Housewife	19	0 (0%)	19 (46.34%)	<0.001*
Skilled	10	7 (11.86%)	3 (7.31%)	0.190
Student	9	3 (5.08%)	6 (10.16%)	0.048*
White Collar	9	4 (6.77%)	5 (12.19%)	0.222
Total	100	59 (100%)	41 (100%)	

Patients falling into the unskilled worker group included manual labourers, daily wage workers, agriculturists, masons, factory workers. Skilled worker group include mechanics, drivers, painters, musician, lab technicians, medical, nursing, paramedical and others. White collar workers included teachers, business persons and others. Majority of the patients included in the study were engaged were unskilled workers followed by household work. Small number (9% each) of patients were students, medical, nursing, paramedical workers, and teachers.

Lesions were in the form of scaling, itching and fissuring, etc as shown in Table 5.

Table 5: Distribution of HE cases according to morphology of lesions

Morphology of lesions	Total	Male	Female	P value
Erythema	16	6 (10.2%)	10 (24.4%)	0.020*
Edema	2	1 (1.7%)	1 (2.4%)	0.713
Papules	15	2 (3.4%)	13 (31.7%)	<0.001*
Papulovesicles	38	23 (39%)	15 (36.6%)	0.741
Dry scaly skin	91	56 (94.9%)	35 (85.4%)	0.325
Fissuring	79	49 (83.1%)	30 (73.2%)	0.289
Lichenification	73	43 (72.9%)	30 (73.2%)	0.975
Hyperpigmentation	80	50 (84.7%)	30 (73.2%)	0.214
Oozing	14	11 (18.6%)	3 (7.3%)	0.011*
Nail changes	23	13 (22%)	10 (24.4%)	0.699

Site of involvement was palmar (40%), fingers only (29%), dorsal (16%) and whole hand (15%) (Table 6). Patient with potassium dichromate positivity had hyperkeratotic dorsal, palmar and whole hand involvement. Patients with nickel sulphate positivity presented with hyperkeratotic scaly lesions affecting palmar aspects. Vegetable dermatitis characteristically affected palmar aspects of distal phalanges of thumb, index finger, middle fingers of both hands. In some cases other fingers were also involved. Soap and detergent dermatitis mainly showed dorsal pattern of erythema, scaling and papulovesicular lesions as well. Topical medicaments also produced similar lesion affecting any part of the hand depending upon the site of contact

Table 6: Distribution of HE cases according to pattern of HE

Pattern of HE	Total	Male (n=59)	Female (n=41)	P value
Palmar	40	24 (40.7%)	16 (39%)	0.824
Dorsal	16	9 (15.3%)	7 (17.1%)	0.726
Fingers only	29	13 (22%)	16 (39%)	0.023*
Whole hand (including nails)	15	13 (22%)	2 (4.9%)	<0.001*

Out of 100 patients, 68 patients showed positive reactions to one or more allergens.

Potassium dichromate positivity was seen in 28% patients (20 males and 8 females). Nickel sulphate sensitivity was seen in 25% patients (11 males and 14 females). Vegetable sensitivity was seen in 10 females, medicament sensitivity was seen in 7% patients (3 males and 4 females). Parthenium sensitivity was seen in 6% males, cobalt in 3% patients (2 males and 1 female), fragrance mix in 4% patients (1 male and 3 females), Paraben mix in 3% patients (1 male and 2 females), balsam of peru in 2% patients (1 male and 1 female), soap and detergent in 5% females. (Table 7).

Table 7: Etiological profile of various allergens established with positive patch test

S. No.	Allergens	Total	Male (n=59)		Female (n=41)	
			No	%	No	%
1	Potassium Dichromate	28	20	33.9%	8	19.5%
2	Neomycin sulphate	3	1	1.7%	2	4.9%
3	Cobalt chloride	3	2	3.4%	1	2.4%
4	Formaldehyde	0	0	0.0%	0	0.0%
5	Benzocaine	0	0	0.0%	0	0.0%
6	4-Phenylenediamine base (PPD)	0	0	0.0%	0	0.0%
7	Parabens mix	3	1	1.7%	2	4.9%
8	Nickel sulphate	25	11	18.6%	14	34.1%
9	Colophony	1	0	0.0%	1	2.4%
10	Gentamicin	1	1	1.7%	0	0.0%
11	Epoxy resin	1	1	1.7%	0	0.0%
12	Fragrance mix	4	1	1.7%	3	7.3%
13	Mercaptobenzthiazole (MBT)	0	0	0.0%	0	0.0%
14	Nitrofurazone	3	1	1.7%	2	4.9%
15	Chlorocresol	0	0	0.0%	0	0.0%
16	Wool alcohols	0	0	0.0%	0	0.0%
17	Balsam of Peru	2	1	1.7%	1	2.4%
18	Thiuram mix	1	1	1.7%	0	0.0%
19	Black rubber mix	0	0	0.0%	0	0.0%
20	Parthenium hysterophorus	6	6	10.2%	0	0.0%
21	Onion (Allium cepa)	6	1	1.7%	5	12.2%
22	Garlic (Allium sativum)	4	0	0.0%	4	9.8%
23	Soap	3	0	0.0%	3	7.3%
24	Detergent	2	0	0.0%	2	4.9%

No positive patch test hyper sensitivity was seen with Formaldehyde , Benzocaine , 4-Phenylenediamine base (PPD) Mercaptobenzthiazole (MBT), Chlorocresol , wool alcohols , black rubber mix.

The correlation of positive patch test results with occupation is shown in Table 8

Table 8: Correlation of positive patch test results with occupation

Occupation	Patch Test Results		
	No of Patients	Patients showing positive reaction	
		No.	%
Housewife	19	12	63%
Unskilled Workers			
Mason	18	18	100%
Laborer	7	6	40%
Farmer	6	6	100%
Factory worker	21	11	52.33%
Vegetable seller	2	-	0 %
Barber	1	1	100%
Tailor	1	-	0%
Skilled Workers			
Paramedical staff	7	6	40%
Mechanic	1	-	00%
Electrician	2	-	0%
Carpenter	5	3	60%
Student	5	4	80%
White Collar			
Teacher	2	1	50%
Clerk	1	-	0%
Supervisor	1	-	0%
Business Persons	1	-	0%
Grand Total	100	68	

DISCUSSION

Contact dermatitis occurs in all age groups although more frequently in young adults with mean age 33-42 years a feature noted in many studies. It is reflection of vulnerability to exposure to multiple allergens in their environment.⁵ Our study had maximum number of patch test positivity in 30-39 age group. Out of 100 patients of suspected CD in the present series 68 showed positive patch test. This is in conformity with the reports of Al Sheikh *et al* although higher than that of Zang *et al*. Our study reveal that CD was noted to single antigen 70.58%, two antigen 13.23% and more than 2 antigens in 16.22%. Patients having CD are intrinsically hyperresponsive and thus prone to develop multiple allergies as seen in various studies.^{8,9,10} Etiology of CD is quite varied and differ from place to place. Chromate was found to be positive in 28 cases. Chromate is widely distributed in cement, leather, paints, bleaching agents etc.⁶ Nickel was found to be responsible for high rate of sensitization in 25 cases This may be attributed to increasing use of artificial jewelry^{8,9,10} Garlic and onion are used in almost every household. These were positive in 10 cases, all housewives. Similar incidents have been reported by Bajaj², Calnan⁴ and Sinha *et al*.¹¹ This response has been attributed to perennial use and sensitizing capabilities of these vegetables and also to the fact that these are held in the hands while peeling. Cobalt is another common sensitizer related to plastic, lubricating oil, cement, detergent etc. cross sensitivity is also seen. Nethercott *et al* and Al Sheikh *et al* found positive hypersensitivity with cobalt in 12% and 17.3% respectively. In contrast our study, only 3% patient reacted to it. This could be due to geographical, environmental, occupational and ethnic variations. Neomycin, Gentamycin, Nitrofurazone have become common sensitizers as seen in various studies.^{2,8,9} These observations are amply supported by our study which showed 7% positive patch test in our patients. Parthenium positivity was seen in 6% of cases. This has been found to be the most common plant allergen seen in a study by Sharma *et al*¹⁰ in Chandigarh. Hand Eczema is multifactorial disease caused by a complex interplay of both exogenous and endogenous factors. The higher incidence of hand dermatitis is seen in the productive age group in 2nd and 3rd decade indicates that it is a disorder commonly seen among economically productive groups. The higher rates of occurrence in males shows that outdoor and unskilled workers are more prone to develop CD of hands because of exposure to cement, construction material, paint, lubricants, rubber, etc. The higher incidence among house wives, construction workers, factory workers and farmers, is due to the persistent exposure to the allergens. Approximately one-third of the patients had history of atopy which probably suggests that

atopic diathesis is a predisposing factor for chronic hand dermatitis due to impaired cutaneous barrier function. Bulk of cases in our study group belonged to manual workers of lower socio-economic status, it indicates lower socio-economic status is a risk factor for hand dermatitis. Palmar involvement was more common (40%) as compare to involvement of fingers only (29%) and dorsal involvement (16%) and it depends on the type of occupation. Nail involvement, was seen in almost one fourth of the patients suggests that HE of the hands can be considered in the differential diagnosis of nail diseases. Potassium dichromate and nickel sulphate were common antigens as in previous studies.^{2,9} Male and female ratio showed potassium dichromate more common in males and nickel sulphate was more common in females. Our study showed hyperkeratotic eczema and patchy vesiculosquamous type of hand dermatitis was the common patterns, but clinical patterns and specific allergen association was inconclusive. A relatively high degree of positive patch test result in our study and the presence of some unexpected positive findings such as topical medicaments gave us a distinct edge in further management of our patients.

CONCLUSION

Patch testing is a very useful investigative procedure for CD. It helped in revealing the etiology of CD in 68% of cases thus proving the usefulness of Indian standard series in our set-up. However association between clinical patterns and the allergens was not predictable. In conclusion, Indian standard series with inclusion of some other indigenously prepared antigens is suitable for testing cases of hand eczema in our region. The present study revealed that chromate (28%), Nickel (25%), vegetables (12%), Medicaments (7%), Parthenium (6%), Soap and detergents (5%) were the most common sensitizers in Jaipur and nearby area and should be included while doing battery patch test in cases of Hand eczema.

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