International Journal of Research in Dermatology
Lakshmi SJ et al. Int J Res Dermatol. 2019 Feb;5(1):1-7
http://www.ijord.com

DOI: http://dx.doi.org/10.18203/issn.2455-4529.IntJResDermatol20185081

Original Research Article

Clinical evaluation and role of patch testing in identifying the exogenous causes in patients presenting with hand eczema

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Received: 16 November 2018
Revised: 30 November 2018
Accepted: 03 December 2018

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ABSTRACT

Background: Hand eczema is a common dermatological problem resulting from both allergic and irritant contactants. Patch testing helps in both diagnosing and identifying allergens.
Methods: A cross sectional study wherein 110 patients with hand eczema attending Dermatology OPD were included and patch testing was done. Data was collected from April 2015 to July 2016 and was analysed for clinical and epidemiological characteristics.
Results: The mean age of the patients studied was 40.27 years with male preponderance. Housewives were the major occupational group comprising 25.5% followed by masons 21.8% and farmers 10.9%. The commonest morphological type was hyperkeratotic type constituting 51.85%, followed by fingertip eczema 19.1%, discoid eczema 11.8%, wear and tear dermatitis 8.2%, recurrent focal palmar peeling 4.5% and pompholyx 4.5%. In the study group 60% of patients showed positive patch test result. A total 66 patients showed patch test positivity to a total of 69 allergens. Nickel was the most common allergen 27.3% identified followed by potassium dichromate 10.9%. Among female patients with positive patch test 70% reacted to nickel and similarly 83.5% of male patients reacted to potassium dichromate. Parthenium allergy was seen in 41.5% of farmers studied.
Conclusions: Patch testing has a definitive role in diagnosing hand eczema caused by allergens. Identifying the allergen involved helps the clinician in advising the patient regarding further avoidance of contactants.

Keywords: Hand eczema, Morphological type, Patch test, Allergens

INTRODUCTION

The term hand eczema means the dermatitis is largely confined to the hands with only minor involvement of other areas.[1] The etiology maybe exogenous or endogenous. Most cases have multi factorial aetiology including allergic contact dermatitis. Clinical differentiation between chronic allergic and irritant hand eczema is difficult wherein patch test becomes an important diagnostic tool in identification of the allergens responsible for the eczema, resulting in emotional and physical morbidity.[2] Therefore, identification and avoidance of the external allergens is important in the management and treatment of the hand eczema. Patch testing is a tool to reproduce in a clinical setting, a mini model of allergic contact dermatitis using allergens suspended in a vehicle at non-irritant concentration. Patch test is the only scientific investigation to prove the diagnosis of allergic contact dermatitis.[3] We did this study to identify the common exogenous agents causing hand eczema with the help of patch test. It will help to educate the patients about the causative factors of hand eczema.

METHODS

Study design

A cross sectional study involving 110 patients having hand eczema.

Study place and period

Hand eczema patients attending dermatology department of SRMIST, Kattankulathur between April 2015 to July 2016.

Study group

We excluded patients with eczema in other areas of the body, other skin conditions and those on systemic steroids and anti-metabolites and pregnant and lactating women.

Procedure

After informed consent, detailed history including occupational details, duration of complaints, pruritus, history of occupational/ personal exposure to chemicals, history of atopy, recurrences, exacerbating factors, treatment history and personal history of all patients were noted down in the proforma. Detailed examination findings with area of involvement and morphology, final diagnosis and treatment were also noted. Every patient was counselled in detail about patch testing followed by application of the patch test.

Patch testing was done on these patients using the Indian standard series kit with 20 allergens in preloaded syringes approved by CODFI (Contact and Occupational Dermatoses Forum of India). The kit was supplied by Systopic laboratories, New Delhi. The kit was stored in the refrigerator at 4-8^{0}c. The patch test unit was applied to the right and left side of interscapular region avoiding the midline. Each chamber was pressed gently to secure better occlusion. The patches were marked and numbered with a marker pen. The patient was instructed not to wet the patches and avoid any physical activity, which may dislodge the patches. The patches were removed by the investigator after 48 hours. The reading was taken 15-30 minutes after removal of the occlusive strips, to allow the erythema due to compressive effect to subside. Another reading was taken after 72 hours, the reading were interpreted according to International Contact Dermatitis Research Group criteria and noted down.

Grading

- - negative reaction.
- **?**: Doubtful reaction, faintly macular erythema only.
- +: weak (non-vesicular) positive reaction, erythema, infiltration, possibly papules.
- ++: strong (vesicular) positive reaction, erythema, infiltration, papules, and vesicles.
- +++: extreme positive reaction, bullous reaction.
- IR: irritant reaction.

Statistical analysis was done using SPSS version 22.0 was used to analyze the data. To compare the proportions Chi-square test was applied. If any expected cell frequency is less than five, Fisher's exact test was used to calculate the p-value. Significance level is fixed as 5% (alpha =0.05).

Ethical approval

Obtained from Institution Ethical Committee, SRMIST.

RESULTS

Out of 110 patients, major occupation among them were housewives 28 (25.5%), followed by mason 24 (21.8%), farmers 12 (10.9%), mechanics 7 (6.4%), students 6 (5.5%), software engineer 6 (5.5%) (Table 1).

Table 1: Occupation of the study group.

Occupation	N	%
House wife	28	25.5
Mason	24	21.8
Farmer	12	10.9
Mechanic	7	6.4
Student	6	5.5
Teacher	4	3.6
Hotel worker	3	2.7
Housekeeping staff	2	1.8
Software engineer	6	5.5
Plumber/electrician/welder	5	4.5
Staff nurse	3	2.7
Printing work	3	2.7
Others	3	2.7
Total	110	100.0

Table 2: Morphological patterns of hand eczema.

Morphological diagnosis	N	%
Hyperkeratotic hand eczema	57	51.8
Finger tip eczema	21	19.1
Discoid eczema	13	11.8
Wear and tear dermatitis	9	8.2
Recurrent focal palmar peeling	5	4.5
Pompholyx	5	4.5
Total	110	100.0

Hyperkeratotic palmar eczema was the most common morphology observed in 57 of patients (51.8%) followed by 21 fingertip eczema (19.1%), 13 discoid eczema (11.8%), 9 wear and tear dermatitis (8.2%), 5 pompholyx (4.5%), 5 recurrent focal palmer peeling (4.5%) (Table 2).

Nickel was the most common allergen in our study 30 (27.3%) followed by potassium dichromate 12 (10.9%), parthenium 7 (6.4%), cobalt and nickel 3(2.7%), fragrance mix, formaldehyde and black rubber mix showed positive reaction in two patients each (totalling to 5.4%). Epoxy resin, balsm of Peru, cobalt, neomycin and mercaptobenzothiazole showed positive reaction in one patient each (totalling to 3.6%) (Table 3).

Table 3: Patch test results in the study group.

Patch test result	N	%
Negative	44	40.0
Nickel	30	27.3
Potassium dichromate	12	10.9
Parthenium	7	6.4
Cobalt, Nickel	3	2.7
Fragrance mix	2	1.8
Formaldehyde	2	1.8
PPD	3	2.7
Black rubber mix	2	1.8
Epoxy resin	1	0.9
Cobalt	1	0.9
Balsam of Peru	1	0.9
Neomycin	1	0.9
Mercaptobenzothiazole	1	0.9
Total	110	100.0

Out of 24 (21.8%) masons 13 (54.2%) were showed Discoid hand eczema, and the remaining were showed hyperkeratotic hand eczema. Out of 28 (25.5) housewives 11 (39.3%) patients showed finger tip eczema, 7 patients showed hyperkeratotic eczema, wear and tear dermatitis in each (50%), 2 (7.1%) patients showed recurrent focal palmar peeling eczema. Out of 12 farmers 9 (75.5%) showed hyperkeratotic hand eczema, 2 (16.7%) showed finger tip eczema and 0ne (8.3%) showed recurrent focal palmar peeling eczema. This was statistically significant ($p<0.001$).

Figure 1: Hyperkeratotic eczema.

Figure 2: Finger tip eczema.

Figure 3: Discoid eczema.

Figure 4: Recurrent focal palmar peeling eczema.

Table 4: Chi square test to compare occupation with patch test result.

Occupation	Patch test resust																													
	Negative		Nickel		Potassium dichromate		Parthenium		Cobalt, Nickel		Fragrance mix		Formaldehyde		PPD		Black rubber mix		Epoxy resin		Cobalt		Balsam of Peru		Neomycin		Mercaptobenzothiazole		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Mason	12	50.0	0	0.0	12	50.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	24	100.0
House wife	10	35.7	17	60.7	0	0.0	0	0.0	1	3.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	28	100.0
Farmer	7	58.3	0	0.0	0	0.0	5	41.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	12	100.0
Mechanic	4	57.1	2	28.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	14.3	7	100.0
Student	4	66.7	0	0.0	0	0.0	0	0.0	0	0.0	2	33.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	6	100.0
Teacher	1	25.0	0	0.0	0	0.0	1	25.0	0	0.0	0	0.0	0	0.0	1	25.0	0	0.0	0	0.0	0	0.0	1	25.0	0	0.0	0	0.0	4	100.0
Hotel worker	1	33.3	1	33.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	33.3	0	0.0	0	0.0	0	0.0	3	100.0
House keeping staff	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	50.0	0	0.0	1	50.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	100.0
Painter	2	50.0	0	0.0	0	0.0	0	0.0	1	25.0	0	0.0	0	0.0	0	0.0	0	0.0	1	25.0	0	0.0	0	0.0	0	0.0	0	0.0	4	100.0
Software engineer	2	33.3	4	66.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	6	100.0
Plumber/Electrician/Welder	0	0.0	4	80.0	0	0.0	0	0.0	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5	100.0
Staff nurse	1	33.3	1	33.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	33.3	0	0.0	3	100.0
Printing work	0	0.0	1	33.3	0	0.0	0	0.0	0	0.0	0	0.0	1	33.3	0	0.0	1	33.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	100.0
Others	0	0.0	0	0.0	0	0.0	1	33.3	0	0.0	0	0.0	0	0.0	2	66.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	100.0
Total	44	40.0	30	27.3	12	10.9	7	6.4	3	2.7	2	1.8	2	1.8	3	2.7	2	1.8	1	0.9	1	0.9	1	0.9	1	0.9	1	0.9	110	100.0

Chi-square- P-Value <0.001 Significant

Table 5: Chi square test to compare occupation with morphological pattern of hand eczema.

Occupation	Morphological diagnosis													
	Discoid eczema		Fingertip eczema		Hyper kerototic hand eczema		Pompholyx eczema		Recurrent focal palmar peeling		Wear and tear dermatitis		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Mason	13	54.2	0	0.0	11	45.8	0	0.0	0	0.0	0	0.0	24	100.0
House wife	0	0.0	11	39.3	7	25.0	1	3.6	2	7.1	7	25.0	28	100.0
Farmer	0	0.0	2	16.7	9	75.0	0	0.0	1	8.3	0	0.0	12	100.0
Mechanic	0	0.0	0	0.0	6	85.7	0	0.0	1	14.3	0	0.0	7	100.0
Student	0	0.0	3	50.0	0	0.0	2	33.3	0	0.0	1	16.7	6	100.0
Teacher	0	0.0	2	50.0	2	50.0	0	0.0	0	0.0	0	0.0	4	100.0
Hotel worker	0	0.0	0	0.0	3	100.0	0	0.0	0	0.0	0	0.0	3	100.0
Housekeeping staff	0	0.0	0	0.0	2	100.0	0	0.0	0	0.0	0	0.0	2	100.0
Painter	0	0.0	0	0.0	4	100.0	0	0.0	0	0.0	0	0.0	4	100.0
Software engineer	0	0.0	1	16.7	2	33.3	2	33.3	0	0.0	1	16.7	6	100.0
Plumber/ Electrician/Welder	0	0.0	0	0.0	5	100.0	0	0.0	0	0.0	0	0.0	5	100.0
Staff nurse	0	0.0	2	66.7	0	0.0	0	0.0	1	33.3	0	0.0	3	100.0
Printing work	0	0.0	0	0.0	3	100.0	0	0.0	0	0.0	0	0.0	3	100.0
Others	0	0.0	0	0.0	3	100.0	0	0.0	0	0.0	0	0.0	3	100.0
Total	13	11.8	21	19.1	57	51.8	5	4.5	5	4.5	9	8.2	110	100.0

Chi square test – p<0.001 Significant.

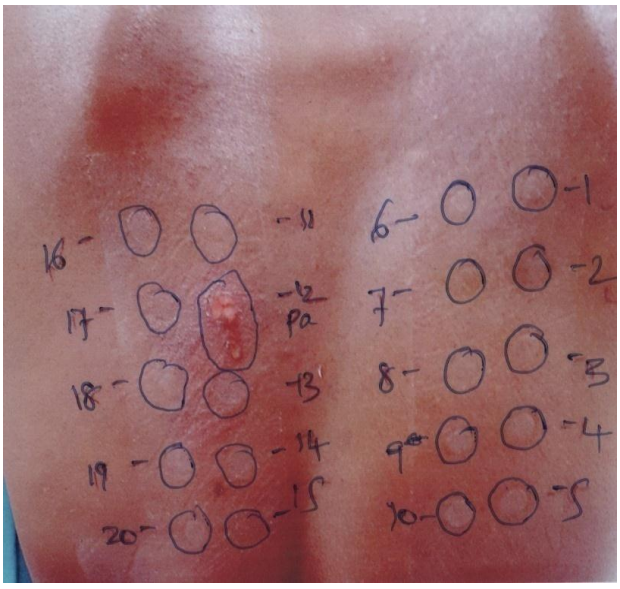

Figure 5: Patch test 3+ positive for parthenium.

DISCUSSION

Among the 110 patients, 51.8% were males and 48.2% were females, showing a slight male predominance. Similar to most of the previous Indian studies, our study also shows a male predominance.[5,8,9] In contrast, studies done by Minocha et al, and Templet et al, reported higher incidence in females.[7,10]

The majority of our patients withhand eczema in our study belonged to 21-60 years age group similar to several previous studies.[5,8,9] In both sexes hand eczema has rarely been observed earlier than before the 3rd decade and later the 6th decade.[7] In our study out of 110 patients, only 3 were of age less than 21 years and 4 were more than 60 years of age. The reason for this could be that older individuals may have immune defects in both induction and elicitation of allergic contact dermatitis, and in younger age group occupational exposure is less likely.[5]

In our study the most common occupational group was housewives 25.5% followed by masons 21.8% farmers 10.9% and others. This is in concordance with other Indian studies.[5,9]

In the Indian study by Kishore et al reported the commonest occupational group among the females was the housewives, as in our study.[8] This may be because of increased risk of contact with variety of agents during household chores like cooking, cleansing, washing, which may act as irritant or allergens in addition to the trauma of rubbing and scrubbing.

Masons constituted second major occupational group amounting to 21.8% of our study population. In other studies done by Suman et al and Laxmisha et al a higher percentage of masons similar to our study was reported this might be due to the growth of construction industry in our region.[4,9]

Among the various types of hand eczema, hyperkeratotic hand eczema 51.8% was the most frequent type in our study followed by fingertip eczema 19.15%, discoid eczema 11.8%, wear and tear dermatitis 8.2%, pompholyx 4.5% and recurrent focal palmar peeling

4.5%. Different Indian studies report different morphological patterns in their study.[5,9]

In our study, we found significant correlation between pompholyx and history of atopy (p=0.001). As also reported by Handa et al.[5]

Wear and tear dermatitis was present in 7 out of 9 housewives in our study and this is statistically significant (p<0.001). This condition mainly affects housewives and cleaners who frequently immerse their hands in water and detergents. Indian housewives tend to develop hand eczema at a younger age as compared to those in developing countries. This is mainly because of repeated exposure to different household allergens and infrequent use of protective wears like gloves and aprons.

Fingertip eczema could be because of both irritant and allergic reactions. It is commonly seen among housewives who frequently handle vegetables (onion, garlic), and other kitchen products, farmers involved in tulip harvesting and newspaper deliverers. In our study, fingertip eczema was present in 11 out of 21 housewives and this was statistically significant (p<0.001).

A positive patch test was seen in 60% of patients in our study group. However, positive patch test reactions ranging from 30% to 82% have been reported in various studies Kishore et al, Suman et al, Handa et al, Li et al, Agarwal et al, and Laxmisha et al, which reported the incidence of positive patch test results in their study population to be 82%, 67%, 65%, 46.7%, 30%, 52.78% respectively.[4,5,8,9,13,14]

The most common allergen yielding positive result is nickel 27.3%. Suman et al, Agarwal et al and Duarte et al also reported nickel to be the most common allergen similar to our study.[4,13,15] We found allergy to nickel is significantly (p=0.041) more common among women amounting to 70% of total nickel positivity. Similar to our study, Handa et al reported that 11 out of 14 patients who showed positivity to nickel were females.[5]

Majority of the patients with nickel allergy were housewives 60.7% in our study. Exposure to wet work, sensitization during ear piercing, artificial jewellery and utensils could be the reason for these findings. Uter et al reported in their study that female sex and wet work are the important risk factors for the development of nickel allergy.[16] In our study, out of 17 patients with history of using artificial jewellery 14 tested positive for nickel.

In our study, we did not find any statistically significant correlation between nickel sensitivity and atopy. In contrast to our study, Handa et al found that nickel sensitivity is significantly more common in atopics.[5]

In this study we found nickel to be the most common allergen among pompholyx patients, out of 5 pompholyx patients 3 patients showed positive result to nickel. Similar to our study, Handa et al and Boonstraet al reported that there is significant relation between nickel sensitivity and pompholyx.[5,17] Foods with high nickel content can worsen the vesicular hand eczema in nickel sensitive patients.[12]

Potassium dichromate was the next common allergen 10.9% in our study. This could be because of the fact that masons constituted 21.8% of total population in our study. Chromate are present in cements, leather, matches, bleaches, yellow paints, and varnishes, certain chromates containing glues, soap, and detergents.[2] All patients showing chromate sensitivity were masons in our study this was statistically significant [p<0.001]. Handa et al reported that out of 25 chromate sensitive patients, 22 were masons similar to our study.[5] Laxmisha et al, Kishore et al, Soket et al also reported that potassium dichromate was the most common allergen among masons.[6,8,9] These results indicate that potassium dichromate is the most important allergen in the persons employed in construction industry.

The high incidence of cement allergy could be explained by rapid urbanization, lack of protective measures, non-availability of hypoallergenic cement and poor labelling laws. In developed countries, where the laws regarding the addition of ferrous sulphate to cement are strictly enforced have reported a sharp decline in chromate positivity since the addition of ferrous sulphate to cement, converts the easily absorbable hexavalent chromium to the less-sensitizing trivalent form.[16]

In our patients the main source of the chromium was from cement. In our study 28 patients were gave history of exposure to cement, among them 14 patients showed negative patch test result, 12 patients showed positive patch test result to potassium dichromate, one patient showed both cobalt and nickel positivity and one patient showed cobalt positivity. As we mentioned before, in addition to soluble hexavalent chromate, cement also contains other metals leading to multiple allergies.

Among 12 farmers we tested with patch test, 5 showed a positive test result to parthenium. While comparing with other occupation, parthenium sensitivity is common among farmers this was statistically significant (p<0.001).

PPD allergy was present in 3 patients, all of them were using hair dye. Similar to our study Handa et al reported that large number patients with PPD positivity gave history of using hair dye.[5] The wide spread use of hair dyes and lack of awareness about PPD allergy is responsible for this problem.

Other allergens showed positive results in our study were black rubber mix in 2 cases, cobalt, balsm of Peru, neomycin sulphate, mercapto benzothiozole in one case each. However, in these cases we could not find any

relationship with the occupation or the type of hand eczema.

Among 66 positive patients, 46 (69.7%) patients have shown 1+ reaction, 18 (27.3%) patients have shown 2+ reaction, 2 (3%) patients have shown 3+ reaction. The most common allergen showed strongly positive result 2+ was nickel, followed by potassium dichromate 5 patients, parthenium 3 patients and one fragrance mix. One patient each showed 3+ strongly positive result to parthenium and epoxy resin.

Three patients showed more than one positive reaction, 3 of them showed positive reactions to nickel and cobalt. Metals like cobalt, copper and palladium are commonly alloyed with nickel, hence nickel allergy is often coexists with these metals.

Study limitation

One of the study limitations is the possible first stage selection bias, which cannot be ruled out.

CONCLUSION

Majority of our patients with hand eczema in our study belonged to 21 to 60 years of age. Housewives, masons, farmers and mechanics are predisposed to developed hand eczema. Hyperkeratotic palmar eczema was the most common morphological type followed by fingertip eczema. Patch test positivity was most frequently observed with nickel, especially in housewives. Cement containing potassium dichromate is most common allergen among mason. History of atopy is common among patient with pompholyx.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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Cite this article as: Lakshmi SJ, Gopalakrishnan K. Clinical evaluation and role of patch testing in identifying the exogenous causes in patients presenting with hand eczema. Int J Res Dermatol 2019;5:1-7.