

Significance of Patch Testing in Patients with Hand Eczema

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ABSTRACT

Introduction- Hand eczema has multifactorial etiology and can be aggravated by exogenous agents. Therefore identification and avoidance of the external contactants is of paramount importance in appropriate management.

Aim- To identify the allergen and to assess the significance of patch testing as a diagnostic tool in hand eczema

Materials and methods- Patch testing was performed in 100 patients of hand eczema with Indian standard series and as it is (ASIS) was done only for selected cases. Patches were applied on the back and reading was done on 2nd, 4th and 7th day according to International Contact Dermatitis Research group (ICDRG) guidelines.

Results- In our study maximum numbers of patients were in the age group of 21-30 years with slight male preponderance. Housewives (35%) were the most commonly affected group followed by cement workers (9%) and students (9%). Hyperkeratotic eczema (44%) and housewife eczema (20%) were most common morphological types. Patch test was positive in 49% cases. Fragrance mix (26.5%) emerged as most common allergen followed by thiuram mix (18.4%); potassium bichromate (16.32%); nickel sulphate and Paraphenyldiamine each 14.2%. Thiuram (30%) was most common allergen in men while fragrance mix (31.5%) was in females. ASIS was done in 10 patients, was negative in 9 and 1 showed irritant reaction.

Conclusion- Significant correlation was seen between hyperkeratotic eczema and paraphenyldiamine, fingertip eczema and fragrance mix, wear and tear eczema and neomycin, patchy vesiculosquamous eczema with neomycin sulphate, peru balsam, mercaptobenzothiazole and formaldehyde, ring eczema and paraphenyldiamine.

Keywords- hand eczema, patch testing

INTRODUCTION

Hand eczema, also known as hand dermatitis is a common and distressing dermatological disorder. [1] It is often a chronic, multifactorial disease and commonly related to occupational or routine household activities. A current and acceptable definition of eczema is that it is “an inflammatory skin reaction characterized histologically by spongiosis with varying degrees of acanthosis, and a superficial perivascular lymphohistiocytic

infiltrate.” [2] Eczema is broadly classified into endogenous and exogenous varieties. [3] Endogenous variety includes atopic dermatitis, discoid dermatitis and pompholyx and exogenous varieties are allergic contact dermatitis and irritant contact dermatitis. [1]

Allergic contact dermatitis, a type IV delayed-type hypersensitivity response, is an allergen specific reaction that requires prior sensitization of the individual to the chemical or allergen. [4] Irritant contact

dermatitis is a localized, non-immunologically initiated, cutaneous inflammatory reaction as a result of local toxic effect of irritant chemicals such as soaps, solvents, acids or alkalis. [5] Acute eczema is characterized by vesicles with superimposed weeping and crusting along with intense itching which lasts for less 3months. In contrast, chronic eczema lasts for more than 3 months characterized by lichenification, fissuring, and thickening of the skin. The most common causes are the use of latex gloves, chemical exposure, detergents and frequent hand washing. It often has a relapsing and remitting course and the dermatitis may become chronic if the diagnosis is delayed or the causative allergen is not detected. Patch testing is the “gold standard” for diagnosing allergic contact dermatitis and identifying causative agents. [4] It is a scientific method of investigation, with internationally defined rules and well-established foundations used in the identification of the etiologic agents of allergic contact dermatitis. [6]

Aim- To identify the allergen and assess the importance of patch testing as diagnostic tool in diagnosis of hand eczema.

MATERIALS AND METHODS

A prospective study was conducted in the outpatient (OPD) department of Dermatology of a Tertiary Care Centre situated in city of Navi Mumbai. A total 100 patients with clinical diagnosis of hand eczema, not on any treatment, were enrolled in the study. Patch testing was performed as a diagnostic tool in such patients. Patients on immunosuppressant drugs, pregnant or lactating women and patients under 18years of age were excluded from study. The test was not performed in active dermatitis and was done once it was subsided.

Method of patch test -The allergens were applied in the readymade Finn chambers on scanpor tape obtained directly from the manufacturer Systopic laboratory Ltd. and were placed on the back. If the back was hairy, shaving was done prior.

This was then re-strengthened by applying scanpor tape on all four sided of the patches.

AS IS Patch testing was performed where patient’s own suspected products used if they were present. To avoid any irritant effect they were mixed or dissolved in a vehicle to achieve suitable test concentration. The patients were instructed not to shower, get the back wet, or engage in sports while the patches were in place.

Patch was removed after 48hrs that is on 2nd day and test readings were marked with highlighter pen after 1hr of removal. Patients were followed up on 4th day and 7th day to look for delayed reaction. Patch tests reading were done according to scoring system that is International Contact Dermatitis Research group (ICDRG) guidelines.

Table 1: ICDRG grading

| | |
|-----|---|
| - | Negative |
| +/- | Equivocal |
| + | Weak (nonvascular), erythema, infiltration, papules |
| ++ | Strong (vesicular), erythema, infiltration, papules and vesicles. |
| +++ | Extreme Positive, bullous. |
| IR | Irritant/glazed/scalded appearance. |
| NT | Not Tested |

Statistical Analysis-

Data was entered into MS-Excel sheet and was analysed using statistical package IBM SPSS 21.0. The Data is presented using frequency, percentage and descriptive statistic such as mean, SD and SEM. Further statistical analysis was carried out using statistical tests such as Spearman rank correlation. Microsoft word and Excel were used to generate graphs and tables. The level of significance was set at 5%. P values less than 0.05 were considered to be statistically significant.

HYPOTHESIS

Null Hypothesis:

There is no significant correlation between the morphological type of hand eczema and the allergens in the standard series of patch test.

RESULTS

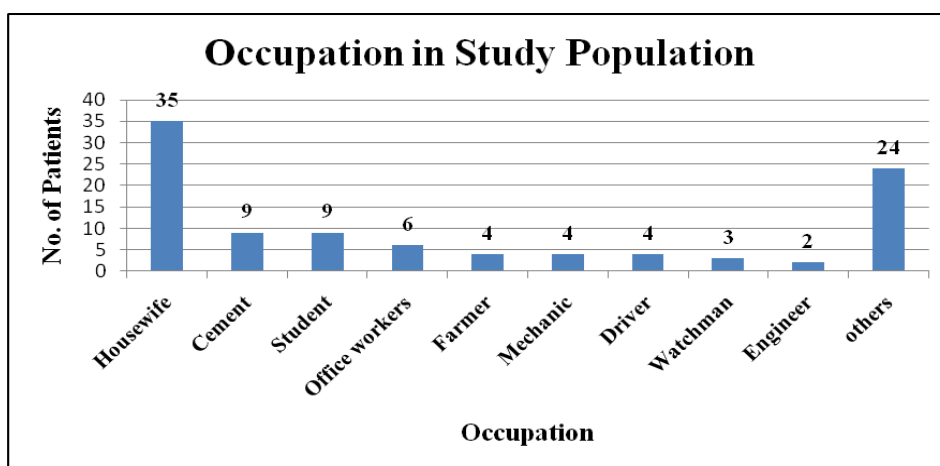
A total of 100 patients of hand eczema were subjected to “Patch test” with

Indian standard series and AS IS was done in selected cases. All clinical features with Patch test findings were recorded and photographed. Analysis was done using Spearman rank correlation. The level of significance was set at 5%. All p-values less than 0.05 were treated as significant

Maximum numbers of patients in the study population were between 21-30 years followed by 31-40 age groups. The least common age groups were <20 years and 61-70 years. Among the 100 patients, 47 (47%) were female and 53 (53%) were males. The Male to female ratio is 1.1:1 showing slight male preponderance. The frequency of both males and females was highest in the age group of 21-30 years and least in <20years

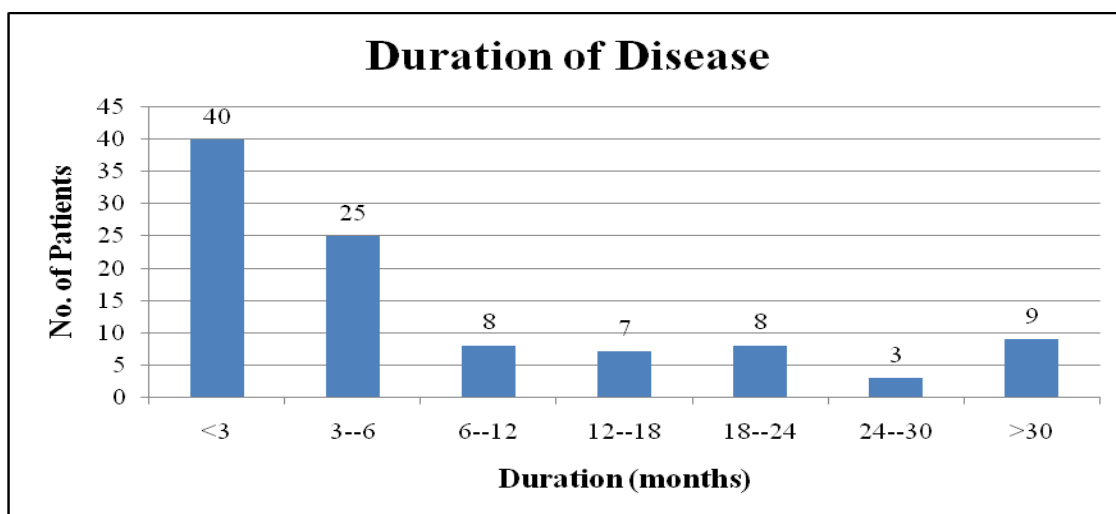
Table 2: Age wise distribution in the study population

| Age | No. of patients | Percentage (%) |
|-------|-----------------|----------------|
| <20 | 3 | 3 |
| 21-30 | 34 | 34 |
| 31-40 | 28 | 28 |
| 41-50 | 20 | 20 |
| 51-60 | 11 | 11 |
| 61-70 | 4 | 4 |



Graph 1: Distribution of occupation in study population.

Hand eczema commonly affected the house wives (35%) followed by cement workers (9%) and students (9%); office workers (6%); farmers, mechanics and drivers each 4%; watchman (3%); engineers (2%). The other occupations included food handler, teacher, tailor, housekeeping, table player and gynaecology resident.



Graph 2: Duration of disease in study population.

The duration of disease was less than 3 months in maximum patients. However 40% patients had acute eczema (<3 months) while 60% patients had chronic eczema (>3months) in the study population.

The detergents (23%) were the most common contact allergens followed by cement (9%), oils (7%), soaps (3%), ring (2%), plants (2%), other 12% included fruit juices, gloves, garlic, chalk, metal box, plastic knife and food while 42% did not have any contactants.

Hyperkeratotic eczema was the most common morphological type of eczema in patients (44%) followed by Wear and tear eczema (20%), recurrent focal Palmar peeling eczema (13%), pompholyx (10%), patchy vesiculosquamous eczema (6%),

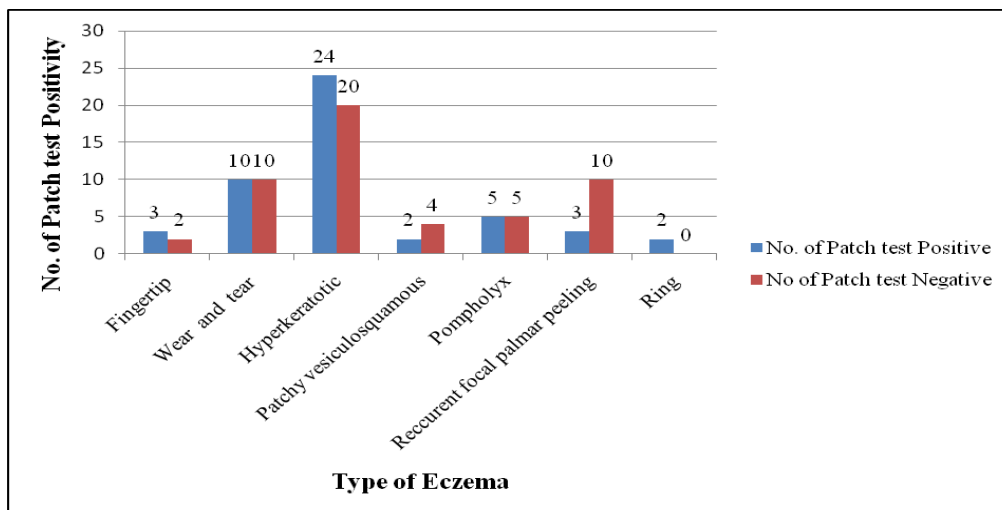
fingertip eczema (5%) and ring eczema (2%).

Patch testing was positive in 49% of patients and negative in 51% of patients

Table 3: Relation between Age and Patch test results

| Age (Years) | Positive patch test |
|-------------|---------------------|
| <20 | 0 |
| 21-30 | 20 |
| 31-40 | 13 |
| 41-50 | 8 |
| 51-60 | 6 |
| 61-70 | 2 |

The maximum patch test positivity was observed in age group between 21- 30 years and positivity declined with increase in age and below 20 years. Patch test was positive in 59.18% males and 40.81% Females.



Graph 3: Relation between type of eczema and patch test positivity

Table 4: Frequency of allergens positive in patch test

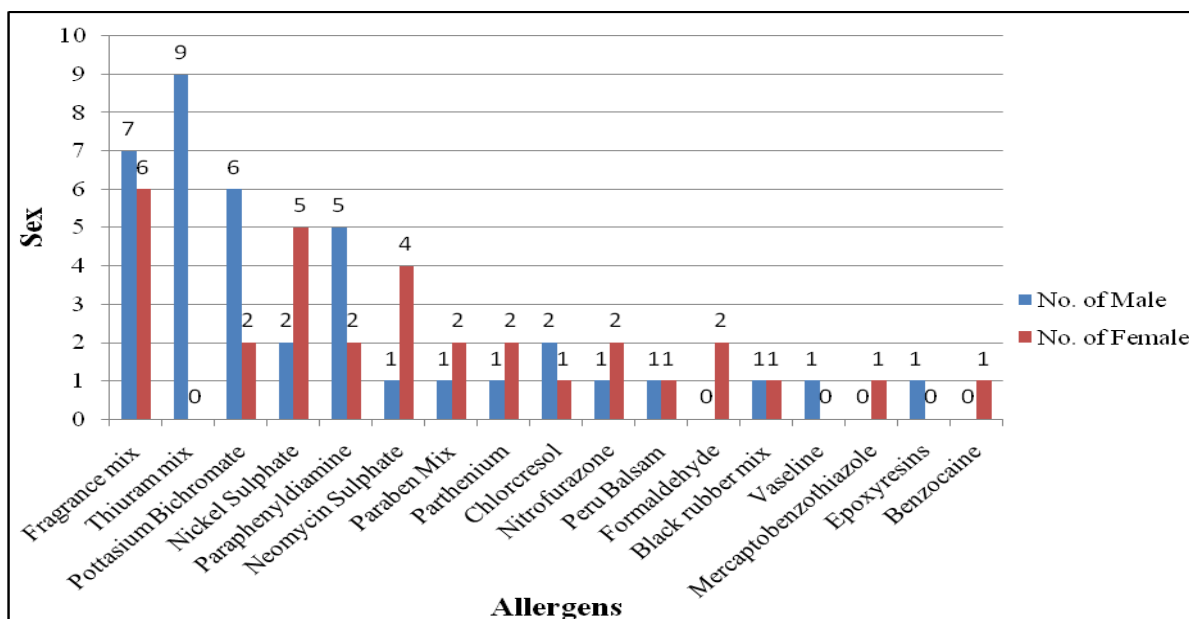
| Allergen | No. of patients | Percentage (%) |
|-----------------------|-----------------|----------------|
| Fragrance mix | 13 | 26.53 |
| Thiuram mix | 9 | 18.3 |
| Potassium Bichromate | 8 | 16.3 |
| Nickel Sulphate | 7 | 14.2 |
| Paraphenyldiamine | 7 | 14.2 |
| Neomycin Sulphate | 5 | 10.2 |
| Paraben Mix | 3 | 6.1 |
| Parthenium | 3 | 6.1 |
| Chlorocresol | 3 | 6.1 |
| Nitrofurazone | 3 | 6.1 |
| Peru Balsam | 2 | 4 |
| Formaldehyde | 2 | 4 |
| Black rubber mix | 2 | 4 |
| Vaseline | 1 | 2 |
| Mercaptobenzothiazole | 1 | 2 |
| Epoxyresins | 1 | 2 |
| Benzocaine | 1 | 2 |

Patch test was positive in maximum cases with Hyperkeratotic eczema (54.54%), followed by Wear and tear eczema (20.40%), pompholyx eczema (10.20%), fingertip eczema (6.12%), recurrent focal palmar peeling eczema (6.12%), patchy vesiculosquamous eczema (4.08%) and ring eczema (4.08%).

Fragrance mix (26.53%) was the most common allergen causing hand eczema followed by Thiuram mix (18.3%); Potassium bichromate (16.3%); Nickel sulphate (14.2%) and paraphenyldiamine (14.2%); neomycin sulphate (10.2%); Paraben mix, parthenium, chlorocresol and nitrofurazone 6.1% each; Peru balsam,

Formaldehyde and Black rubber mix 4% each; Vaseline, Mercaptobenzothiazole, Epoxy resin and benzocaine 2% each. ASIS

was done in 10 patients and was found to be negative in 9 and irritant reaction in 1.



Graph 3: Relation between Allergen and Sex

Thiuram mix (30%) was the most common allergen in males followed by fragrance mix (23.33%) and potassium bichromate (20%). The most common allergen in females was Fragrance mix (31.57%) followed by nickel sulphate (26.31%) and neomycin (21.05%). Thiuram, Vaseline and Epoxy resin are positive only in males whereas Formaldehyde, Mercaptobenzothiazole and Benzocaine are positive only in females

Table 5: Relation between Allergen and Type of Eczema

| Allergen | Hyper-keratotic n (P-value) | Finger Tip n (p-value) | Wear and tear n (P-value) | Patchy Vesiculo-squamous n (p-value) | Pompholyx n (p-value) | Recurrent Focal Palmar Peeling n (p-value) | Ring n (p-value) |
|-----------------------|-----------------------------------|---------------------------------|------------------------------------|---|-----------------------------|---|------------------------|
| Fragrance mix | 3(0.433) | 2(0.049) | 4(0.222) | 0 | 1(0.839) | 2(0.613) | 1(0.602) |
| Thiuram mix | 6(0.504) | 0 | 1(0.932) | 0 | 1(0.299) | 1(0.862) | 0 |
| Potassium Bichromate | 4(0.465) | 1(0.117) | 1(0.476) | 0 | 1(0.450) | 1(0.380) | 0 |
| Nickel Sulphate | 1(0.440) | 1(0.062) | 1(0.419) | 1(0.610) | 2(0.312) | 0 | 1(0.773) |
| Paraphenyldiamine | 6(0.021) | 0 | 0 | 0 | 0 | 0 | 1(0.016) |
| Neomycin Sulphate | 3(0.865) | 0 | 1(0.041) | 1(0.008) | 0 | 0 | 0 |
| Paraben Mix | 1(0.709) | 0 | 1(0.585) | 0 | 1(0.175) | 0 | 0 |
| Parthenium | 2(0.427) | 0 | 1(0.690) | 0 | 0 | 0 | 0 |
| Chlorocresol | 1(0.709) | 0 | 1(0.253) | 0 | 1(0.175) | 0 | 0 |
| Nitrofurazone | 1(0.865) | 0 | 1(0.602) | 0 | 0 | 1(0.585) | 0 |
| Peru Balsam | 1(0.865) | 0 | 0 | 1(0.008) | 0 | 0 | 0 |
| Formaldehyde | 0 | 0 | 1(0.289) | 1(0.008) | 0 | 0 | 0 |
| Black rubber mix | 1(0.209) | 0 | 0 | 0 | 1(0.058) | 0 | 0 |
| Vaseline | 1(0.261) | 0 | 0 | 0 | 0 | 0 | 0 |
| Mercaptobenzothiazole | 0 | 0 | 0 | 1(0.00004) | 0 | 0 | 0 |
| Epoxy resins | 1(0.261) | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzocaine | 1(0.261) | 0 | 0 | 0 | 0 | 0 | 0 |

The Table 5 shows significant correlation between hyperkeratotic eczema and paraphenyldiamine (p = 0.021); fingertip eczema and fragrance mix (p = 0.049); wear and tear eczema and neomycin (p = 0.041); patchy vesiculosquamous eczema with neomycin

sulphate ($p = 0.008$), peru balsam ($p = 0.008$), mercaptobenzothiazole ($p = 0.00004$) and formaldehyde ($p = 0.008$); ring eczema and paraphenyldiamine ($p = 0.016$).

Table 6: Relation between occupation, patch test positivity and allergens

| No. | Occupation | Total no. | Positive Patch test | Allergens positive (n) |
|-----|----------------|-----------|---------------------|--|
| 1 | Housewives | 35 | 14 | Fragrance mix (4) Formaldehyde (2) Paraben mix (2) Nickel sulphate (2) Neomycin sulphate (2) Parthenium (1) Potassium bichromate (1) |
| 2 | Cement workers | 9 | 7 | Thiuram mix (4) Potassium bichromate (1) Neomycin sulphate (1) Balsam of peru (1) |
| 3 | Students | 9 | 2 | Fragrance mix (1) Benzocaine (1) |
| 4 | Office workers | 6 | 4 | Nickel sulphate (2) Thiuram mix (1) Paraphenyldiamine (1) |
| 5 | Farmers | 4 | 1 | Potassium bichromate and Thiuram mix (1) |
| 6 | Drivers | 4 | 2 | Thiuram mix (1) Paraphenyldiamine (1) |
| 7 | Engineers | 2 | 2 | Thiuram mix (1) Paraben mix and paraphenyldiamine (1) |

Fragrance mix was most common allergen among housewives; Thiuram mix was most common among Cement workers, fragrance mix and benzocaine in students, nickel sulphate in students.



Fig 1: Patient with hyperkeratotic eczema. (a,b) Multiple hyperkeratotic hyperpigmented scaly plaques on bilateral palms and dorsum of hands of male welding worker, (c,d) Patch test shows 1+ positivity to Neomycin on day 2.



Fig 2: Patient with fingertip eczema –(a)Scaling at the finger tips in a clerk, (b,c) Patch test shows 1+ positivity to Fragrance mix on day 2.

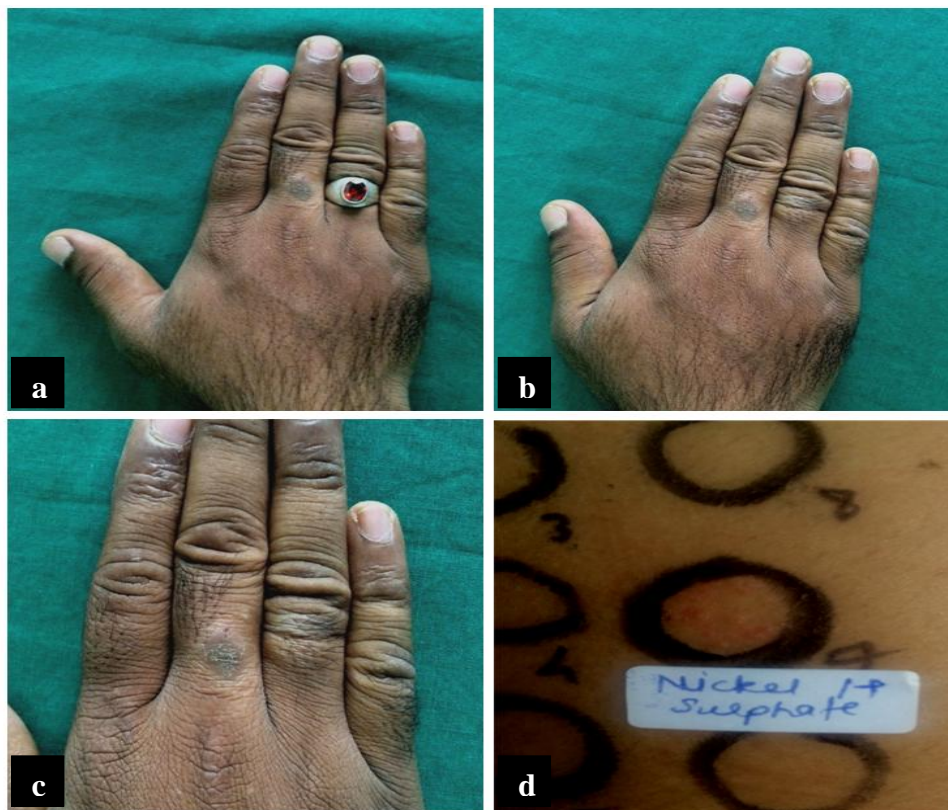


Fig 3: Patient with ring eczema , (a,b) Scaly hyperpigmented plaques seen at areas in contact with ring in a male clerk, (c,d) patch test shows 1+ positivity to Nickel sulphate on day 4.

DISCUSSION

A current and acceptable definition of eczema is that it is “an inflammatory skin reaction characterized histologically by spongiosis with varying degrees of acanthosis, and a superficial perivascular lymphohistiocytic infiltrate.” [2] The term Hand eczema implies the dermatitis which is largely confined to the hands, with none or only minor involvement of other areas. [1,2]

Most of the patients (34%) in our study were in the age group of 21-30 years which correlates with being the most active period in any individual's life. Only 3% were of age below 20 years and 4% above 60 years of age. A similar study conducted by Handa et al. [7] also showed 21-40 age group as the most commonly affected age group and 7% and 6% of patients below 20 years and above 60 years of age respectively.

Hand eczema was presumed to be more common in females. However males (53%) were more commonly affected than females (47%) in our study. In recent years there is increase in the incidence of hand eczema in men, and a similar trend was seen in study conducted by Handa et al. [7] and Laxmisha et al. [8]

Occupation has significant effect on hand eczema because of exposure to various contactants at workplace. [9,10] In our study hand eczema most commonly affected house wives (35%) followed by cement workers and students each 9%; office workers (6%); farmers, mechanics and drivers each 4%; watchman (3%); engineers (2%). The other occupations included food handler, teacher, tailor, housekeeping, table player and gynaecology resident. The findings are in accordance with a similar study by Suman et al. [10] of 100 patients, in which household work (37%), followed by masonry (14%) and students (11%) were the most common occupations.

The most common contactants were detergents (23%), cement (9%), oil (7%), soaps (3%), ring (2%), plants (2%) and other 12 % included fruit juices, gloves, garlic, chalk, metal box, plastic knife and

food while 42% did not have any contactants.

Patch test plays an important role in finding causative agent in suspected cases of contact dermatitis in hand eczema. The percentage of positive patch test reactions in our study was 49%. However the percentage of patch test positivity varied widely in various studies like in study by Li LF and Wang [11] (46.7%), Laxmisha et al. [8] (59.8%), Suman et al. [10] (67%) and Kishor et al. [3] (82%).

Patch test positivity was most common in the age group between 21- 30 years while declining with increase in age and below 20 years. This may be because of lack of exposure in patients less than 20 years or diminished inflammatory responses in elderly patients.

The most common contact allergens in our study were fragrance mix (26.5%) causing hand eczema followed by thiuram mix (18.4%); potassium bichromate (16.32%); nickel sulphate and paraphenyldiamine each 14.2%.

In study by Handa et al. [12] fragrance mix (16%) was the second most common allergen with a percentage similar to our study; potassium bichromate was the most common allergen (25%) followed by nickel sulphate (14%) and PPD (13%)

In study by Kishor et al. [3] potassium bichromate was the commonest sensitizer testing positive in 26% of the patients while nickel was the next common testing positive in 18% of the patients. Fragrance was the most common allergen in our study which can be because of increased use of perfumes, cosmetics, detergents, soaps and other personal care items which can sensitize an individual to fragrance.

Thiuram (30%) was the most common allergen in males followed by fragrance mix (23.3%) and potassium bichromate (20%). Thiuram is used as additives in manufacturing rubber products, such as gloves, tubes, tyres, elastic bands, rubber boots and slippers, adhesives while potassium bichromate is commonly present in cement, paints.

Fragrance mix (31.5%) was the most common allergen in females followed by nickel (10.5%) and neomycin (5.2%). In study by Vigneshkartik N et al.^[12] patch test positivity to nickel was exclusively seen among women. In the study by Handa et al.^[12] 11 out of 14 positive patch test results to nickel occurred in females. Similarly Majid^[13] found that 35 out of 45 positive patch test results to nickel occurred in females. In our study nickel was the second common allergen positive in females but the percentage being lower compared to other studies.

Out of 23 patients with history of exposure to detergents, patch testing was positive in 9 of them. 2 of these 9 patients showed patch test positivity to Fragrance, 2 of them to nickel, 2 to formaldehyde while remaining 3 showed positivity to paraphenyldiamine, potassium bichromate and neomycin respectively. The widely used surfactant sodium lauryl sulphate may be preserved with formaldehyde which is used in detergents, shampoos and shower gels. Nickel is present in soaps and detergents while Chromate sensitivity in some European women was found to be related to chromate in household bleach and various fragrances are used in detergents for pleasant odour. In study by Vigneshkartik N et al.^[12] among 31 patients with history of detergent exposure, patch testing was positive in 11, 3 of these showed patch test positivity to only nickel, 3 participants to both nickel and cobalt and 3 participants to PPD.

Among 9 cement workers, patch test positivity was present in 7 of them. 4 of the showed patch test positivity to thiuram mix, 1 to potassium bichromate while other 2 to neomycin and balsum of peru. The findings of our study were in contrast to other studies like Handa et al.^[7] and Vigneshkartik N et al.^[12] where potassium bichromate was commonly associated with masons. Thiuram is used as an additive in manufacturing rubber products, such as gloves used by the cement workers which can explain the patch test positivity in them.

No major side effects of patch test were seen in our study except for mild itching at the site of patch test which was seen in 45% and mild irritant reaction in 2% of the cases.

Final diagnosis based of history, symptoms, clinical features and patch test results were allergic contact dermatitis in 49% and in remaining 51%, 15.6% were clinically irritant contact dermatitis. However patch testing with additional allergens is required for the final diagnosis. The probable reason could be a higher contribution of irritant contact dermatitis and endogenous eczema, most commonly atopic eczema for the causation of hand eczema.

CONCLUSION

There was significant correlation between certain types of morphological or clinical types of hand eczema and certain allergens in our study. This significant correlation was observed between hyperkeratotic type of eczema and paraphenyldiamine, Fingertip eczema and fragrance mix, Wear and tear eczema and neomycin, patchy vesiculosquamous eczema with neomycin sulphate, peru balsam, mercaptobenzothiazole and formaldehyde and lastly with Ring eczema and paraphenyldiamine. As allergic and irritant contact dermatitis causing hand eczema have similar appearances in the chronic forms and are not always discernible clinically, therefore a detailed history of contact with allergen has to be elicited and if found relevant has to be confirmed by doing patch test which will help to identify an allergen or exclude an allergy to a suspected allergen. Thus patch test is a non-invasive and remarkably safe diagnostic procedure without any major side effects and helps in preventing the chronicity of the disease course. Thus patch testing had a significant role in hand eczema.

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