

**DIAGNOSTIC VALUE OF PATCH TEST IN HAND AND FOOT ECZEMAS**

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**ABSTRACT****BACKGROUND**

The present study is undertaken to evaluate the results of patch test in 50 patients having hand and foot eczema attending skin OPD from October 2010 to September 2012 at KIMS, Narketpally.

**RESULTS**

Maximum number of cases in this study belong to 16-30 yrs. (46%).

- In majority of cases, eczema was seen in both hands and feet (40%). Hand and foot eczema was commonly seen in construction workers (42.3%).
- Mean duration of illness is 19.48 months.
- 42% of patients presented with acute eczema followed by subacute eczema (38%) and then chronic eczema (20%).
- Personal and family history of atopy was seen in only 4% and 6%, respectively.
- Hand and foot eczema (42.3%) was the commonest eczema followed by hand (30.74%) and then foot eczema (11.53%) and others (15.37%).
- 57.69% of patients are positive to more than one allergen and 42.3% were positive to single allergen.
- Multiple allergens positivity is seen in construction workers (30.76%).
- Potassium di chromate (28.5%) is the common allergen found in patch test followed by Parthenium (16.6%) followed by Paraphenylenediamine (14%) and then Cobalt sulphate and Thiuram mix (9.5%) and lastly Parabens mix, Nickel sulphate, Black rubber mix and Neomycin (4.7%).
- Positive patch test is more commonly observed in patients having hands and or foot eczemas (42.30%).

**CONCLUSION**

Hand and foot eczema (42%) was the commonest eczema followed by hand (30%) and then foot eczema (11.5%) and others (15.3%). Potassium dichromate is the commonest sensitizer (28.8%). We encountered a high degree of patch test positivity in our study group and the Indian standard series proved to be very useful.

**KEYWORDS**

Contact Dermatitis, Patch Test, Hand and Foot Eczema.

**HOW TO CITE THIS ARTICLE:** Stravani Sandhya B, Tina Priscilla K, Ramachandra S, et al. Diagnostic value of patch test in hand and foot eczemas. J. Evid. Based Med. Healthc. 2016; 3(90), 4906-4910. DOI: 10.18410/jebmh/2016/1034

**BACKGROUND**

Man is exposed to large variety of agents in the environment. It is interesting to note each of these agents is a potential antigen, though some agents are more potent than others in causing allergic reaction. Contact dermatitis is an inflammatory response of skin to an exogenous substance, which maybe irritant (or) allergen. Most allergens in contact dermatitis are of low molecular weight (<500 daltons) and are traditionally called "haptens."<sup>1</sup> Contact dermatitis is divided into two major types, Contact Irritant Dermatitis (CID) and Contact Allergic Dermatitis

(CAD), both of which include contact urticaria and photo contact dermatitis. Hand eczema is usually multifactorial. About 10% in women and 5% in men of all cases of contact dermatitis include hand dermatitis as this is the important site for both irritant and allergic contact dermatitis. Foot eczemas result from shoe materials, topical medicaments, antiseptics, antiperspirants and occupation.

A prevalence of 4.1% is noted among patients with all types of eczema.

**MATERIALS AND METHODS**

All patients above 5 years of age having eczemas of hands and/or feet attending Dermatology OPD at KIMS, Narketpally, are included in this study. Based on history, occupational exposure and hobbies and examination findings will be subjected to patch test to detect causative allergen.

The patch test will be performed using readymade purified antigens (Indian standard series and footwear series) Systopic Lab. Pvt. Ltd., Delhi, approved by Contact

*Financial or Other, Competing Interest: None.*

*Submission 19-09-2016, Peer Review 30-09-2016,*

*Acceptance 17-10-2016, Published 08-11-2016.*

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*DOI: 10.18410/jebmh/2016/1034*



and Occupational Dermatoses Forum of India (CODFI). The patch test material consists of allergens incorporated usually in petrolatum/aqueous solution in proper concentrations. The material is applied on the upper back with a tape for 48 hrs. and reading is taken after one hour after removal of patches. Upper back is prepared by shaving before 24 hrs. of doing patch test. The patient is advised to avoid exercise, sweating, wetting or scratching or exposure to sunlight.

If the patch test is negative after 48 hours, the patient is asked to come on 4<sup>th</sup> day to 7<sup>th</sup> day.

### Readings of Patch Test Results<sup>2</sup>

± Doubtful reaction	Faint erythema
+weak (NV) positive reaction	Erythema infiltration and discrete papules
++ strong (V) positive reaction	Erythema, infiltration, papules and vesicles
+++ extreme (B) intense erythema, positive reaction	Intense erythema, infiltration, coalescing vesicles

### NV (Non-Vesicular), V (Vesicular), B (Bullous)

#### Photo patch test

Some substances are photosensitisers in that these will result in dermatitis only if the skin after contact with these substances is exposed to sunlight or some other equivalent source of light. Such substances are to be tested by the patch test. Antigens are applied in duplicate parallel to each other and covered with an opaque material. Patches are removed on day 2, one set is irradiated with UVA 5J/cm<sup>2</sup>. When an allergic reaction occurs only on irradiated site and not on control side, it is recorded as positive photoallergic test.

#### Inclusion Criteria<sup>2</sup>

- Patients with eczemas of hands and feet.
- Patients above 5 years of age.

#### Exclusion Criteria<sup>2</sup>

- Patients with active eczemas.
- Patients on immune suppressive drugs, steroids and antihistamines.
- Patients with a history of keloids/hypertrophic scars.
- Patient in immune compromised state like neoplasm and HIV.
- Patients suspected to be having clinically psoriasis/lichen planus/dermatophyte infection of hands and feet.

### OBSERVATION AND RESULTS

Maximum number of cases in this study belong to 16-30 yrs. (46%), then followed by 31-45 yrs. (22%). The youngest age noticed is 14 yrs. and the eldest is 75 yrs. Mean age group involved in both sexes is 37.4 yrs.

Majority of cases are construction workers (38%) followed by farmers (36%) and then housewives (14%).

In majority of cases eczema was seen in both hands and feet (40%). Acute eczema (42%) is more commonly observed followed by subacute eczema (38%).

A personal (4%) and family history (6%) was seen in five patients.

Potassium dichromate (28.5%) is the common allergen found in patch test followed by Parthenium (16.6%).

Positive patch test positivity is seen more commonly in those cases having acute eczema (46.15%). Mean duration of illness is 19.48 months.

Positive patch test is more commonly observed in patients having hands and/or foot eczemas (42.30%).

Multiple allergens (57.69%) positivity is more commonly seen than single allergen positivity (42.30%).

### DISCUSSION

As the largest organ in the human body, the skin is a complex and dynamic organ that serves among many other purposes, the function of maintaining a physical and immunologic barrier to the environment. Therefore, the skin is the first line of defence after exposure to a variety of chemicals. Allergic Contact Dermatitis (ACD) accounts for at least 20% or more of the new incident cases in the subgroup of contact dermatitides (irritant contact dermatitis accounts for the remaining 80%). ACD, as the name implies, is an adverse cutaneous inflammatory CD, as the name implies, is an adverse cutaneous inflammatory reaction caused by contact with a specific exogenous allergen to which a person has developed allergic sensitisation. More than 3,700 chemicals have been implicated as causal agents of ACD in humans.<sup>2</sup> Following contact with an allergen, the skin reacts immunologically giving the clinical expression of eczematous inflammation. In ACD, the severity of the eczematous dermatitis can range from a mild short-lived condition to a severe persistent chronic disease. Appropriate allergen identification through proper epicutaneous patch testing has been demonstrated to improve quality of life as measured by standard tools as it allows for appropriate avoidance of the inciting allergen and possibly sustained remission of this potentially debilitating condition. Recognition of the presenting signs and symptoms and appropriate patch testing are crucial in the evaluation of a patient with suspected ACD. Cell-mediated (type IV), delayed type, hypersensitivity reaction caused by skin contact with an environmental allergen. Prior sensitisation to a chemical is required for allergy to develop.

The clinical manifestation of ACD is an eczematous dermatitis. The acute phase is characterised by pruritus, erythema, oedema and vesicles usually confined to the area of direct exposure. Recurrent contact to the allergen in a sensitised individual will result in chronic disease characterised by lichenified erythematous plaques with variable hyperkeratosis and fissuring that may spread beyond the areas of direct exposure. Itch and swelling are key components of the history and can be a clue to allergy.

The hands, feet and face (including the eyelids) are some of the common sites for ACD.

Patch testing is fundamental for the identification of causal allergens and is indicated for patients with persistent or recurrent dermatitis in whom ACD is suspected.

Avoidance is the mainstay of treatment for ACD. Educating patients about avoidance of the allergen and its

potentially-related substances and providing suitable alternatives are crucial to a good outcome.

## PATCH TESTING

### History

The history of allergic contact dermatitis dates back to 1896 when Jadassohn reported application of iodoform to normal skin of sensitised subjects produced a dermatitis.<sup>3</sup>

Bloch described in detail the technique of patch testing and phenomenon of cross sensitisation in 1911.<sup>4</sup> Cook introduced the term patch test.<sup>5</sup>

It was further developed and refined by Bonnevie in Europe and by Sulzberger and Wise in the USA. Standardisation was further delineated by the International Contact Dermatitis Group (ICDRG).<sup>6</sup>

Patch testing is at present the only practical and scientific method of demonstrating contact hypersensitivity. An ideal patch test produces no false positive reactions. The allergen should be pure and in the right concentration. The risk of active sensitisation should be low. There should be minimum irritant reactions and it should be easy to apply, stable, easy to read and suitable to the patient.

### Indications for Patch Testing

1. To confirm a clinical diagnosis of allergic contact dermatitis.
2. To determine the actual allergen among many clinically suspected allergens.
3. To detect relevant, but clinically unsuspected contact sensitisers.
4. All dermatitis of hands, lower legs and feet, which do not clear up in a short time.
5. As a predictive test to determine what materials, the patient can safely tolerate.

### Principle of Patch Test

Patch testing elicits an immune response by challenging an already sensitised person to defined amounts of allergen and assessing the degree of the response.

The test relies on the allergen being absorbed in sufficient quantity to induce a reproducible inflammation of the skin at the site of application in sensitised person.<sup>6</sup>

Patch testing should be performed when the dermatitis has subsided. The procedure should at least be delayed until the test site has been clear for at least a fortnight.

### Patch Test Units

Various types of chambers or discs are used to ensure occluded contact. The fixing tape should be nonocclusive, nonallergenic and nonirritant. The first patch tests used were pieces of cotton fabric soaked with allergen solutions. Later, filter paper discs were used in a similar way and taped to the skin under a water impermeable cover. It is an effective and usually nonirritant test unit. It consists of aluminium foil covered with polythene with a 10-mm central disc of filter paper adhered by heat.

Disadvantages of this include reactions to the polythene covering on the aluminium foil, spread of strong positive reactions to surrounding areas, use of occlusive tape with resultant reactions and large areas required for patches.

The Finn chamber is presently the most commonly used patch test unit. It consists of stiff aluminium and has a diameter of 8 mm and a depth of 0.5 mm. Advantages include tight apposition to the skin, thus localising, reaction to the test site, use of a porous tape and a small area required for patch testing.

### Allergens

Selection of chemicals for patch testing is always difficult and demanding. A small number of substances account for the majority of contact allergies. National and international groups of patch test specialists recommend that allergen series including mixes of allergens be used for routine testing. Such series comprise 20-25 test substance mixes containing 50-60 different allergens. Testing with these detects about 70% of allergic contact sensitivity.

To find a nonirritant concentration, most chemicals can be tested with three concentrations, that is, 10%, 1% and 0.1% in aqueous solution or in petrolatum. But, a positive reaction should not be accepted as allergic unless at least 20 controls are negative. Shelf life is prolonged if test substances not in daily use are stored in the dark in a refrigerator at 4°C.

### Concentration of Allergens

Ideal concentration of an allergen should be high enough to detect weakest degree of sensitivity and low enough to avoid irritant reaction.

### Dose of Test Substance

It is essential to use a standard amount of material for each patch test. An excess dose contaminates the surrounding unit and may spread beyond. If petrolatum is used as a vehicle, a length of 1 mm will suffice for solids and one drop for liquids.

### Test Site

Both allergic and irritant reactions are most easily provoked on the upper back. Reactions on the lateral aspect of the arm are stronger than the medial aspect. Sites other than the upper back and lateral aspect of the arm are generally less suitable as test areas.

### Technique of Application

Patches are applied on the interscapular and scapular regions from below upwards allowing the air to escape when the patient stands erect. After that, each disc should be pressed firmly. Each test side is numbered on plaster and skin.

### Reading and Evaluation of Patch Test Reaction<sup>7,8</sup>

Patches are normally applied for 48 hours on the upper back. The patient is instructed to avoid exercise and sweating, wetting the area and rubbing and scratching. The patient should not expose the area to sunlight or sun lamps. The test area should be marked with coloured or fluorescent ink.

Routinely, the patches are kept for 48 hrs. because this is the optimum time to elicit positive reactions. Though, there are reports of positive reactions after less than 1 hr.

of application of nickel salts, neomycin and p-phenylenediamine show maximum reactions on day 4 to 7 after application. Thus, it is imperative to take a second reading on day 4 to day 7 because over 50% error is likely if only one reading is taken on day 2. By the time of the second reading, immediate irritant reactions subside and the reactions of the most show allergens fully develop.

The present study shows males relatively outnumbering females similar to Chandra et al in 1978 and Narendra et al<sup>9</sup> in 2002 studies. Since, majority of patient's occupation belonged to farming and construction work, which is commonly done by males. Majority of our cases are construction workers (38%) (masons and labourers) followed by farmers (36%), housewives (14%) and others (10%) and a small proportion of cases belonged to students (2%). As construction workers and farmers do not use any mechanical barriers to prevent contact with various allergens, contact eczema is more common in these occupations.

However, in the study by Gurmohan Singh and Singh K<sup>6</sup> in 1986, housewives formed the largest group (57%) followed by construction workers (36.5%). Hand and foot dermatitis is commonest in our study showing 42.30% and it is greater compared to Singal et al<sup>10</sup> (12.24%) in 2001 and Yavuz et al (12.6%) in 2011 and this variation could be because the vast majority in our study construction workers and farmers who come in contact with allergens more frequently and also they do not use any barrier methods to prevent contact with allergens.

In present study, potassium dichromate is the commonest allergen showing 28.5%, which is almost similar to Sharma VK et al<sup>11</sup> in 1998 (20.5%). Potassium dichromate is a common contact sensitizer in hand and foot dermatitis, this is especially true in developing countries where legislation regarding in addition of ferrous sulphate to cement may simply do not exist. Chromate sensitivity has been traditionally associated with manual labour and masonry as seen in our study. Western

countries have reported a sharp decline in chromate positivity since the addition of ferrous sulfate to cement, which converts the easily absorbable hexavalent chromium to the less-sensitising trivalent form. In France, the removal of chromium from a popular brand of household bleach resulted in a dramatic decline in chromate sensitivity in women. The second most common is Parthenium with 16.8%, which is similar to Sharma VK et al<sup>11</sup> in 1998 (14%). As there is rampant overgrowth of this plant in the rural areas, which could possibly explain the increased contact sensitivity in farmers, the next common allergen is PPD (14.5%), which is used in hair dyes, leather processing, printing and the findings are similar to Sharma VK et al in 1998 (11.5%).<sup>11</sup> Other allergens seen in our study are Thiuram mix and Cobalt 9.5%, Black rubber mix, Neomycin and Parabens mix and Nickel sulphate 4.7%. Present study shows 57.69% of cases showing positivity to multiple allergens and similar findings were seen in Bajaj AK et al<sup>12</sup> in 2007 (59.7%) and Akasya et al<sup>13</sup> in 2002 (51.7%).

#### Distribution of Eczemas (N=50)

Clinical Pattern	Males	Females	Total Number of Cases and Percentage
Hands	9 (18%)	3 (6%)	12 (24%)
Feet	5 (10%)	4 (8%)	9 (18%)
Hands and feet	14 (28%)	6 (12%)	20 (40%)
Hand and/or foot eczema and other sites	7 (14%)	2 (8%)	11 (22%)

In majority of cases, eczema was seen in both hands and feet (40%).

#### Result of Indian Standard Series and Foot Wear Series (N=42)

Sl. No.	Allergens	Males	Females	Total Number of Cases and Percentage
1	Vaseline	-	-	-
2	Wool alcohol	-	-	-
3	Peru balsam	-	-	-
4	Formaldehyde	1	-	1 (2.3%)
5	Mercaptobenzothiazole	-	0	0
6	Potassium di chromate	10	2	12 (28.5%)
7	Nickel sulphate	-	2	2 (4.7%)
8	Cobalt sulphate	4	-	4 (9.5%)
9	Colophony	-	-	-
10	Parabens mix	2	-	2 (4.7%)
11	Paraphenylenediamine	3	3	6 (14.28%)
12	Parthenium	5	2	7 (16.6%)
13	Benzocaine	-	-	-
14	Chlorocresol	-	-	-
15	Fragrance mix	-	-	-
16	Thiuram mix	4	-	4 (9.5%)
17	Nitrofurazone	-	-	-
18	Black rubber mix	2	-	2 (4.7%)
19	Neomycin sulphate	1	1	2 (4.7%)

20	Epoxy resins	-	-	-
21	Hydroquinone	-	-	-
22	Kathon CG	-	-	-
23	Glutaraldehyde	-	-	-
24	Diocetyl phthalate	-	-	-
25	Disperse orange	-	-	-

Potassium di chromate (28.5%) is the common allergen found in patch test followed by Parthenium (16.6%).

## CONCLUSION

- The highest incidence of hand and/or foot eczema is seen in the age group of 2<sup>nd</sup> and 3<sup>rd</sup> decade of life, which is the most active part of life.
- Construction workers showed highest rate of positivity as they are exposed to more number of allergens.
- The highest rate of positivity is seen in hand and foot eczema because they are uncovered parts of the body and they infrequently use glove or other barrier method.
- Potassium dichromate is the common sensitizer followed by Parthenium as seen in previous studies.
- We encountered a high degree of patch test positivity in our study group and the Indian standard series proved to be very useful.

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