Original Research Article

Decoding the Allergen profile of population attending dermatology OPD in a tertiary care center in north Kerala with Patch test – Our 7 years experience

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Abstract

Background: Patch testing is an integral part of the investigation to search for hidden and unknown allergens, proving the suspected allergen in allergic contact dermatitis (ACD). The Indian Standard Series (ISS), consisting of 20 allergens approved by the contact and occupational Dermatoses forum of India (CODFI), is available in India for this purpose. **Aim**: This study was undertaken to detect the common allergens responsible for causing ACD in our population. **Study design:** Retrospective and descriptive analysis. **Methods**: Data from 270 patients with allergic contact dermatitis who had undergone patch test with ISS during the study period, was collected from patchtest register maintained in the department. **Statistical analysis used:** SPSS software. **Results:** In this study of 270 patients, male to female ratio was 1.76:1. Patch test positivity was not significantly related to atopy. Most of the participants were aged between 21 to 60 years and 53.3% showed patch test positivity to one or more allergens. Construction workers constituted the majority (24.8%) and potassium dichromate (PPD) was the major sensitizer (16.7%). PPD was positive in 12.2 %, fragrance mix in 10% and nickel sulphate in 7.4%. Males showed higher and statistically significant patch test positivity than females. Fragrance mix was the predominant allergen in housewives. PPD was the most common offender in suspected contact dermatitis to hair dye and cosmetics. Nickel sulphate was the predominant sensitizer amongst painters and polishers. **Conclusion**: Patch test is a reliable tool in identifying the suspected allergen.

Key words: Patch test, Allergic contact dermatitis, CODFI.

Introduction

Allergic contact dermatitis (ACD) is the classic presentation of delayed-type hypersensitivity responses to exogenous agents. Over 3700 allergens have been reported to cause ACD in humans. ACD may clinically present acutely after allergen exposure and initial sensitization or after elicitation in a previously sensitized individual[1]. The prevalence of ACD ranges from 1.5 to 5.5% in general population. In India it accounts for 10-15% of dermatological out patients[1]. Common sensitizers also vary with place, patient profile and over the passage of time. Since optimal management of patients with ACD depends upon accurate advice on prevention, regular patch testing followed by estimation of relevance is imperative in all suspected cases[2]. This study was undertaken to study the clinico-epidemiological profile of allergic contact dermatitis and to identify the predominant sensitizers and the nature of contact sensitivity of the study population.

Study design

Retrospective study

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Study subjects

Clinically diagnosed cases of contact dermatitis who underwent patch testing

Inclusion criteria

Clinically diagnosed cases of contact dermatitis who underwent patch testing

Exclusion criteria

Patients with active skin lesions of ACD or other skin diseases at the sites of ACD
Contact Dermatitis involving the test site.
Patients who have been taking systemic steroid or immunosuppressive in the last 2 weeks, and those who have been taking antihistamines in the last 1 week.
Pregnant women.

Methods

Hospital records of 270 patients presented with clinical diagnosis of contact dermatitis during a period of 7 years from October 2009 to August 2016 were analyzed retrospectively. Patient details including the demographic variables, clinical history, pattern of dermatitis, clinical diagnosis and patch test results were obtained from the hospital records. The records contained details of patch testing

performed using the Indian Standard Series approved by Contact and Occupational Dermatoses Forum of India (CODFI) (Table 1).

Table1: List of antigens in Indian standard series

SL NO	ALLERGEN
1	Vaseline
2	Wool alcohol
3	Peru balsam
4	Formaldehyde
5	Mercaptobenzothiazole
6	Potassium dichromate
7	Nickel sulphate
8	Cobalt sulphate
9	Colophony
10	Epoxy resins
11	Paraben mix
12	Paraphenylenediamene
13	Parthenium
14	Neomycin sulphate
15	Benzocaine
16	Chlorocresol
17	Fragrance mix
18	Thiuram mix
19	Nitrofurazone
20	Black rubber mix

Finn chamber method was used. The allergen test patches were applied to upper back as per standard procedure and labeled. They were kept in place with special hypo allergic adhesive tapes undisturbed for 48 hours during which the patients were instructed to follow the necessary posttest precautions. Readings were recorded after 48 hours, which was taken half an hour after removal of patches. The reactions were graded according to International Contact Dermatitis Research Group recommendations (Table 2).

Table 2: The international contact dermatitis research group (ICDRG) system for clinical scoring of allergic patch test reactions

(-)	Negative
(+/-) or (?)	Doubtful reaction; faint macular erythema only
(+)	Weak positive reaction (erythema, infiltration and discrete papules)
(++)	Strong positive reaction (erythema, infiltration, papules and vesicles)
(+++)	Extreme positive reaction (intense erythema, infiltration and coalescing vesicles)
(IR)	Irritant
(NT)	Not tested

Results

Of the 270 patients analyzed, 63.7% were males and 36.3% were females, with a male to female ratio of 1.76:1. Most of the participants were between age 21 to 60 years. Construction workers constituted 24.8%, followed by housewives 21.8%, manual laborer 16.2%, and students13.3%. Various other occupations of the study group were agricultural workers, drivers, painters and welders, carpenters, cooks, clerks, and professionals.

In 29.6% patients, no specific allergen could be identified by history and clinical examination. 20.4% of individuals were suspected to have ACD to cements, 20% were cases of hand eczema, 12.2% were suspected cases of ACD to various cosmetics and hair dye. A combination of hand and foot eczema was seen in 8.9%. A minority of cases were ACD to nickels/metals, plastics/toilet seat and rubber.

Amongst the 270 patients studied 144 patients (53.3%) showed patch test positivity to one or more allergens, with majority of cases showing positivity to a single allergen (61.1%), 25.7% had reacted to 2 different allergens and 13.2% had multiple allergen positivity (3 or more). Among this, 59.9% of males were positive for one or more allergen, whereas only 41.8% of female had a positive result. Males showed significant higher positivity (*P* value 0.004).

Potassium dichromate was the most common allergen positive in 16.7%, followed by paraphenylenediamine (PPD) in 12.2%, fragrance mix in 10% and nickel sulphate in 7.4%

(Fig 1). Out of the total 5400 patches studied majority of allergens showed weak positive (+) reaction, extreme positive (+++) reactions were present in 11 patches with paraphenylenediamine being the major culprit (n=5) followed by fragrance mix (n=2) and thiuram mix (n=2). (Fig 2).

Fragrance mix was the predominant allergen in housewives (13.6%). Potassium dichromate was the predominant allergen tested positive in 52.5% of construction workers and welders. Potassium dichromate and PPD were the predominant sensitizers among manual laborers (13.6% each). Nickel sulphate was the predominant sensitizer amongst painters and polishers and fragrance mix was the predominant allergen in students (5.9%)

The predominant sensitizer in cases of hand eczema and suspected cases of ACD to cement was potassium dichromate (12.2% and 52.7% respectively). PPD was the most common allergen in cases with suspected contact dermatitis to hair dye and cosmetics (40%). Patients in whom no specific cause of ACD could not be identified by history, showed positivity to Nickel sulphate in 8.8%, and PPD in 7.5%. Of the total population 72 patients (26.7%) were atopics, and amongst them 56.9% of patients were tested positive for one or more allergens, but there was no statistically significant association between atopy and patch test positivity.

Amongst the total 74 patients exposed to cement 52.7% were tested positive for potassium dichromate, and there was statistically significant association between the same with *P* value of 0.000. Similarly, there was statistically significant association between exposure to various perfumes and patch test positivity to fragrance mix and peru balsam (*P* value of 0.003 and 0.000 respectively). Statistically significant association was also present between exposure

to various rubber products and patch test positivity to thiuram mix and black rubber mix. (*P* value 0.010 and 0.040 respectively).

Discussion

Allergic contact dermatitis (ACD) is a pruritic eczematous eruption of skin to a specific allergen which is usually well demarcated and localized to the site of contact, although it can have a diffuse or patchy distribution. Patch testing is a valuable tool for the diagnosis of ACD. Patch testing relies on the observation that primed antigen specific T lymphocytes will be present throughout the body, and hence allergen in the patch test can be applied to normal skin, usually on the upper back where the tests are least likely to be disturbed.

The exact prevalence, gender predisposition, age preponderance of contact dermatitis in a population is difficult to assess, there is also high variability in the exposure of individuals to different allergens based on their geographical, socio-cultural and occupational characteristics.In this retrospective study, there was male predominance, which was in accordance with the study of Sharma and Kaur et al,[3] Barauh and Singh et al [4]. Majority of participants were between age 21 to 60 years. Bajaj et al in their study observed that most of the cases (60%) were between 21 to 50 years[2]. Majority of the individuals studied were construction workers, followed by housewives. A high incidence of housewives having hand dermatitis was also reported by Bajaj (48%)[5] and Sharma and Kaur (34.3%). Inability to identify and avoid the causative agent as well as persistence of the antigen in the work environment may be responsible for chronicity of the lesions in ACD.

In majority of patients no specific allergen could be identified by history and clinical examination. The most common clinical diagnosis among the rest were ACD to cement in 20.4% followed by hand eczema in 20%. Other cases included ACD to cosmetics, hair dye, nickel and plastics. In the study by Bajaj AK et al, the commonest clinical pattern was that of footwear dermatitis followed by medicament and airborne contact dermatitis. In contrast, most of the large studies from abroad reported hand dermatitis as the commonest pattern[6,7]. This difference may have occurred due to variations in local culture, customs, occupational factors and climate.

Amongst the 270 patients studied, 144 patients (53.3%) showed patch test positivity to one or more allergens, with majority of cases showing positivity to a single allergen. Prior studies from other parts of India have reported patch-test positivity rates comparable to our study with majority of cases showing positivity to a single allergen[8]. There was statistically significant difference between the genders with males showing statistically significant higher positivity. Prior studies have reported concordant as well as discordant results with some showing higher sensitivity in femalesand some in males[9,10].

Our study identifiedpotassium dichromate as the most common allergen which was positive amongst 16.7% individuals and statistically significant association was present between history of cement exposure and potassium dichromate positivity. Akasya-Hillenbrand et al studied patch test results in 542 patients with suspected contact dermatitis in Turkey and found Nickel sulfate to be the most frequent sensitizer (19.1%), followed by potassium dichromate (11.8%)[11]. Akyol A, Boyvat A et al also reported nickel as the most common allergen followed by cobalt chloride and potassium dichromate[12].Chromates are distributed widely and abundantly in the environment. Exposure to this metal can occur through items of daily use such as bleaching agents, matches, detergents, paints, polish and cement. It is also used in electroplating, tanning, dyeing, photography and printing industries. In concordance to our study, high rates of chromate positivity have also been reported by Sharma et al from Chandigarh. 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-sensitizing trivalent form. The removal of chromium from a popular brand of household bleach resulted in a dramatic decline in chromate sensitivity in women.Potassium dichromate as a common sensitizer in hand dermatitis has been reported by other workers. The high rates of chromate positivity reported in this study could have been due to the large number of construction workers in our study population and due to the lack of stringent work precautions and quality control measures in our settings**.**

Of the total 5400 patches studied majority showed weak or positive reactions. Irritant reactions were reported only in 0.2%, amongst which PPD was the major culprit. Previous studies have also shown PPD to cause irritant reactions under a covered patch test[13]. In a study by Dogra A et al PPD positivity was reported in 35% of their study population. The major source of PPD exposure in our study population was hair dye and henna. Other sources of PPD exposure include photocopy machines, photographic developers, lithography, oils, greases and gasoline.Our study population showed fragrance mix sensitivity of 10%. The main causes of primary sensitization to fragrance chemicals are cosmetic products, particularly deodorants and perfumes, however multiple sources of exposure have been defined. In a Danish study the reported fragrance mix sensitivity was 2.7% whereas two similar German studies reported fragrance mix sensitivity of 11.4% and 15.9%, respectively[14].In our study, Nickel sulphate was the predominant sensitizer amongst painters and polishers which unmasks this usually hidden source of nickel exposure in our population. Previous studies have shown consistent nickel sensitivity following exposure to jewelry and various metallic items[15]. Nickel is ubiquitously present and exposure to it can occur while handling a variety of objects such as door knobs, bags, umbrellas, artificial jewelry, paper pins, and watches. The industrial exposure to nickel occurs in electroplating, as a mordant in dyeing and printing fabrics, electrical wiring, ceramics and paints for glass. Sharma and Kaur reported an incidence of nickel sensitivity in 45.8% of women and 37.85% of men.

The relationship of atopy, particularly atopic dermatitis, as a predisposition to allergic contact dermatitis has been a matter of much debate. Clinical studies have shown variable results, recent studies have shown an equal or even higher occurrence of contact allergy in atopic when compared with non-atopic subjects. Our study failed to reveal such an association.

The major limitation of the study was that it was a retrospective analysis from pre-recorded hospital data and follow-up data of patients after allergen avoidance in their day-to-day living couldn't be assessed. Our study also failed to conduct other tests for allergic contact dermatitis such as repeated open application tests, usage tests, open tests, spot tests and photo patch tests.

All suspected cases of ACD should not be labeled negative for allergens with just a routine patch test, the assumed allergen must be retested by another method, or in different concentration/ vehicle. One should also keep in mind the presence of innumerable allergens in the environment, all of which cannot be tested by this method, hence, it is also imperative to ask the patients to maintain a diary to record some correlation between the exposure to a substance and occurrence of contact dermatitis[16].

Patch tests are considered as category B by evidence-based medicine. In spite of this, they are considered to be a powerful tool in identifying the etiology in allergic contact dermatitis[17].

Conclusion

The higher incidence of ACD among males and the statistically significant higher sensitivity to allergens among males observed in the present study could be due to the regional characteristics where males were more likely to be exposed to various allergens in their work atmosphere. Fragrance mix was the predominant allergen in housewives, explained by exposure to various fragrance and cosmetic products among this group. Potassium dichromate and paraphenylenediamine were the predominant sensitizers amongst manual laborers. PPD was the most common allergen in cases with suspected contact dermatitis to hair dye and cosmetics, this was because majority of the individuals were exposed to hair dye and because use of cosmetics was very minimal in the study population.

A comprehensive history and clinical examination are of prime importance in suspecting a particular contact allergen. Patch testing is

an easily available non-invasive, cost effective and safe tool which helps in confirming a contact dermatitis and removal of the same from the patient's immediate environment, is imperative for the resolution of their complaints. Hence, we recommend that, patch test should be routinely undertaken and more similar studies may be performed in order to study the allergen profile of a particular geographic region. Clinicians should place patch testing is their regular armamentarium and non-hesitantly use this test to unmask the role of a contact allergen in the particular dermatoses.

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