DOI: 10.7860/JCDR/2017/26391.10349

Original Article

Dermatology Section

Patch Test Results from an Occupational and Contact Dermatitis Clinic in a Tertiary Care Hospital of Southern India: A Retrospective Study

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ABSTRACT

Introduction: Occupational contact dermatitis, accounting for 95% of cases of occupational dermatoses, is the most common occupational skin disease.

Aim: To find out the various allergens in different occupational and environmental settings causing contact allergy, from our patients presented with contact dermatitis.

Materials and Methods: It was a retrospective study from the data in hospital outpatient register over one year period, which includes patients with age ranging from 11 years to 73 years. Patch test was done with total of 24 allergens from Indian standard battery and Indian standard series and with materials suspected to cause contact allergy. Result was expressed in terms of percentage.

Results: Contact dermatitis constitutes about 0.75% of total dermatological cases in our Dermatology Outpatient Department. A total of 358 contact dermatitis were included in this study with M:F ratio 2.25:1 and majority of the cases in the age group of 26-55 years. Out of 358 cases, 157 cases were positive to at least one allergen. Building construction workers constitute about 35.75% (128 cases) of total contact dermatitis cases, among which potassium dichromate (39 out of 57) is the most common allergen, followed by nickel (31) and cobalt (28). In other occupations, contact allergy to parthenium, hair dye, foot wear, paint, *kum-kum*, turmeric, detergents and cosmetics were also present in significant number and none was positive for vegetables, dettol, kerosene and native medication.

Conclusion: This study gives an idea about the common occupation and population who are prone to develop contact dermatitis in our environmental setting and also about the most common sensitizers involved in various occupation and environment.

Keywords: Allergic contact dermatitis, Contact allergy, Patch test

INTRODUCTION

Occupational contact dermatitis constitutes about 95% of cases of occupational dermatoses, is the most common occupational skin disease [1]. The incidence rate is believed to be around 5 to 19 cases per 10,000 full time workers per year [2]. Absenteeism due to occupational dermatoses are estimated to be around 10 million working days per year, causing great economic impact [3]. Detailed history, thorough dermatological examination is required for correct diagnosis and patch test is necessary for confirmation of contact allergy. With respect to the difference in occupation and environment, substances that cause contact dermatitis vary. Irritant contact dermatitis occupies the major portion of occupational dermatoses in industrialized countries, resulting in considerable social and economic implications [4]. As there was a need for sufficient studies and data to identify the most common contact substances and occupations which cause contact allergy in Indian population, this study was carried out to find out the various allergens in different occupational and environmental settings causing contact allergy, from our patients presented with contact dermatitis.

MATERIALS AND METHODS

It was a retrospective study in which data was collected from the outpatient register of Department of Occupational and Contact Dermatitis, Rajiv Gandhi Government General Hospital, Chennai, Tamil Nadu, India. The study period was from april 2015 to march 2016. Institutional Ethical Clearance was obtained before conducting the study.

A total of 358 patients with contact dermatitis, age ranging from 11 years to 73 years from different occupation and environment were included in this study. Consent was obtained to undergo patch test. Patients already treated with topical or systemic steroids and immunosuppressive agents, pregnant and lactating women and patients with other significant dermatoses were excluded from this study.

Indian standard battery of patch test allergens with the trade name 'Credisol' containing 20 allergens such as vasaline 100%, wool alcohol 30%, balsum of peru 10%, formaldehyde 2%, mercaptobenzothiazol 1%, potassium dichromate 0.1%, nickel sulphate 5%, cobalt sulphate 5%, colophony 10%, epoxy resins 1%, paraben mix 9%, paraphenylene diamine 1%, parthenium 15%, neomycin sulphate 20%, benzocaine 5%, chlorocresol 1%, fragrance mix 8%, thiurum mix 1%, nitrofurazon 1% and black rubber mix 0.6% were used for all patients [5]. In addition, mercaptomix 2%, polypropylene glycol 1%, para tertiary butyl phenol formaldehyde resin 1% and kathon CG 0.67% from Indian standard series were also used in some suspected cases.

The substances which were suspected to be the cause for contact dermatitis were also used for patch testing in optimal concentration such as turmeric, *kum-kum*, detergents, vegetables (garlic, onion, *Aloe vera* and lemon), kerosene, dettol and native medication, were all obtained from patients.

Substances in powder form such as *kum-kum*, turmeric, and native medication were all used as such in quantities occupying about 50% of Finn chamber. Juices were made from the *Aloe vera* and vegetables (garlic, onion, aloevera and lemon) used for patch testing. Dettol and detergents were used after dilution with water and kerosene brought by the patient was used for patch testing in the quantity of about 0.05 ml.

Age Group (Years)	Male	Female
11-25	14	17
26-40	68	42
41-55	119	38
56-70	43	12
Above 70	4	1
TOTAL	248	110

[Table/Fig-1]: Age distribution of contact dermatitis patients.

S.No.	Occupational/ Environmental Exposure	Suspected Contact Materials	No. of Patients (Out of 358)
1.	Construction Workers	Cement, Paint, Rubber, Wood, *Parthenium Hysterophorus*	128(35.75%)
2.	Home Makers/ Office Workers	Detergents, Turmeric, *Bindi*, *Kumkum*, Perfume, Vegetable	57(15.92%)
3.	Agriculture	*Parthenium Hysterophorus*	39(10.89%)
4.	Wall Painting	Paints, Varnishes	16(4.47%)
5.	Beautician	Cosmetic creams	2(0.55%)
6.	Carpentry	Wood dust, Adhesives	1(0.28%)
7.	Miscellaneous A) Hair Dye Users	Hair dye	68(19.00%)
	B) Ornament Wearers	Nickel, Cobalt	21(5.87%)
	C) Foot Wear Usage	Rubber, Leather, Adhesives	15(4.19%)
	D) Medications	Dettol, *Aloe vera*, Native medicines	6(1.68%)
	E) Industry Workers (Chemicals/Tanning)	Formaldehyde, Leather, Rubber gloves, Adhesives, Kerosene	5(1.40%)

[Table/Fig-2]: Suspected contact materials in various occupational and environmental settings.

S.No	Allergens Positive for Cement Contact Dermatitis	No. of Patients
1.	Dichromate, Nickel and Cobalt	21
2.	Dichromate and Nickel	7
3.	Dichromate and Cobalt	4
4.	Dichromate	7
5.	Nickel	3
6.	Cobalt	3

[Table/Fig-3]: Allergens positive for cement contact dermatitis.

The allergens were kept in Finn chamber and applied directly over back of the patient. Standard instructions were given to the patients and the reading was done according to International Contact Dermatitis Research Group (ICDRG) scoring system, after one hour of removal of the patch test on the third day (after 48 hours) [6].

STATISTICAL ANALYSIS

The softwares used for analysis of data were Microsoft Office Excel 2007 and SPSS version 16.0 and results were expressed in terms of percentage.

RESULTS

Out of 47,173 new out patients who attended dermatology clinic, after careful history taking and thorough dermatological examination, 358 patients were diagnosed to have contact dermatitis, which constitute about 0.75% of total dermatological cases. Among 358 patients, 248 were males and 110 were females. Male to female ratio was 2.25:1. Distribution of contact dermatitis among various age groups is shown [Table/Fig-1].

The prevalence is more common from 41 to 55 years of age. The number of contact dermatitis cases was more from April-2015 to October-15 with average of 36 cases per month (highest in April - 46 cases and lowest in June – 28 cases) compared to November-15 to March-16 with average of 21 cases per month (highest in December – 27 cases and lowest in January – 14 cases).

A total of 157 patients were found to have positive result for at least one allergen in the patch test. The suspected material in relation to occupational or environmental exposure of contact dermatitis patients is given in [Table/Fig-2].

A total of 35.75% of contact dermatitis patients were building construction workers and all of them had contact with cement. They have more chances of contact with various substances such as cement, paint, rubber, woods and plants in their occupational setting. Among 128 (119 males and 09 females) building construction workers with contact dermatitis, 57 were patch test positive (54 male and 3 female). Among 57 patients, 3 patients had patch test positive for 5 allergens, 1 patient had 4 allergens positivity, 28 patients were positive for 3 allergens, 9 patients were positive for 2 allergens and 16 patients were positive for 1 allergen positive. A total of 45 out of 57 patients were related to cement contact allergy with or without sensitivity to other allergens and they were tested with Indian standard battery of allergens containing potassium dichromate, nickel, cobalt but not with all the ingredients of cement individually. (Any one among potassium dichromate, nickel and cobalt were positive as they are the most potent sensitizers in cement) [7]. [Table/Fig-3] contains the details of the number of patients having positive reaction for various sensitizers in cement.

Among the patch test positive building construction workers, potassium dichromate was the most common sensitizer, positive in 39 patients, followed by nickel (31), cobalt (28), parthenium (14), epoxy resin (10), colophony (4), black rubber mix (2), formaldehyde (2), paraben (2), balsum of peru (1), fragrance mix (1), polyethylene glycol (1), para-phenylenediamine (1) and thiurum mix (1). The total number of patients, positive for patch test and the contact substances are given in [Table/Fig-4].

DISCUSSION

In this study, 267 (74.58%) patients were in the age ranges from 26 to 55 years which corresponds to the working age group. More number of cases were seen in summer and rainy season and low in winter season. Among 157 patch test positive patients, potassium dichromate was positive in 51 patients (32.48%) in this study. Majority of them were construction workers (39). Nickel is the second most common allergen in this study. A total of 45 patients were patch test positive (28.66%); 31 of them were construction workers.

Among 128 building construction workers with contact dermatitis, 57 had positive patch test (44.53%). Study by Goh CL et al., shows that nickel and cobalt are also constituents of Asian cements with concentrations ranging from 14.9 to 28.5 µg and 8.1 to 14.2 µg respectively [8]. In this study, next to potassium dichromate, nickel (31) and chromate (28) were most common sensitizers in cement contact allergy.

In studies by Iraji F et al., and Sharma V et al., potassium dichromate was the most common sensitizer which corresponds to 22% (33 out of 150 cement workers) and 92% (46 out of 50 cement workers) respectively [9,10].

In this study, among 21 patients suspected for contact allergy to ornaments, 8 patients (28.57%) had positive patch test. Among which, 6 patients were positive for nickel and 2 for nickel and cobalt. In the study by Singh KK and Singh G [11], nickel is the most common metal causing contact allergy due to jewellery followed by copper, chromium, cobalt and silver.

Parthenium terminates the crop productivity and natural flora as it invades and destroys agricultural land and natural ecosystem. It poses a severe health hazard in India. Parthenium dermatitis is a severe dermatitis causing significant morbidity in the productive age

S.No:	Contact Substance	Total Patients		Patch Test Positive		Name of the Allergen
		M	F	M	F	
1	Cement (Building Construction Workers)	119	09	54	03	Potassium Dicromate, Nickel, Cobalt, Epoxy Resin, and Parthenium (2), Potassium Dichromate, Nickel, Cobalt, Epoxy Resin and Thiurum Mix (1), Potassium Dicromate, Nickel, Cobalt and Formaldehyde (1), Potassium Dichromate, Nickel, and Cobalt (17), Potassiumdicromate, Nickel and Parthenium (5), Potassium Dicromate,Cobalt, and Epoxyresin (4), Formaldehyde,Paraben and PoLyethylene Glycol (1), Colophony, Fragrance Mix and Balsum of Peru (1), Nickel and Parthenium(3), Potassium Dichromate and Nickel (2), Colophony and Epoxyresin (2), Paraben, and Epoxyresin (1), Para-Phenylene Diamine and Colophony (1), Potassium Dichromate (7), Parthenium (4), Cobalt (3), Black Rubber Mix (2)
2	Hair Dye	54	14	24	7	Para-Phenylene Diamine (27), Para-Phenylene Diamine and Potassium Dichromate (2), Para-Phenylene Diamine, Nickel and Cobalt (1), Para-Phenylene Diamine, Black Rubber Mix and Epoxy Resin (1)
3	Parthenium (In Agriculture and Gardening)	29	10	15	6	Parthenium (17), Parthenium, Potassium Di Chromate and Nickel (3), Parthenium and Thiurum Mix (1), Parthenium and Colophony (1)
4	*Kumkum*	5	5	5	5	*Kumkum* (8), *Kumkum* and Turmeric (1), *Kumkum* and Balsum of Peru (1)
5	Paint	16	0	7	0	Potassium Dicromate (4), Epoxy Resin and Formaldehyde (2), Potassium Dichromate, Nickel and Epoxy Resin (1).
6	Detergent	2	24	0	6	Detergent Samples (4), Detergent and Nickel (1)
7	Turmeric	1	11	0	6	Turmeric (5), Turmerlc, Fragrance Mix and Paraben (1)
8	Metal (Ornaments)	4	17	2	6	Nickel (6), Nickel and Cobalt (2)
9	Foot wear	10	5	3	1	Potassium Di Chromate and Black Rubber Mix (2), Para Tertiary Butyl Phenol Formaldehyde Resin (Ptbf), Epoxy Resin, Foemaldehyde (1), Para-Phenylene Diamine and Epoxy Resin (1)
10	*Bindi*	0	2	0	2	Ptbf(1), Ptbf and Colophony (1)
11	Cosmetic cream	0	2	0	1	Paraben (1)
12	Perfume	0	1	0	1	Balsum of Peru and Fragrance Mix (1)
13	Rubber gloves	0	2	0	1	Thiurum Mix and Mercaptobenzothiazole (1)
14	Leather tanner	1	0	1	0	Formaldehyde (1)
15	Carpentry	1	0	1	0	Colophony (1)
16	Vegetable	0	6	0	0	-
17	Dettol	3	0	0	0	-
18	Native Medication and *Aloe vera*	1	2	0	0	-
19	Kerosene and Industrial Chemicals	2	0	0	0	-
20	Total	248	110	112	45	-

[Table/Fig-4]: Contact substance and the allergens positive.

group [12]. It contains Sesquiterpene Lactone (SQL), which acts as the sensitizer. A total of 35 out of 157 patch test positive patients (14 from construction work and 21 from agriculture and gardening) had parthenium contact allergy, which constitutes 22.29% of contact allergy cases in this study.

Hair dyes can be classified into temporary and permanent/oxidative hair dyes [13]. The oxidative hair dyes involve mixing of precursor along with coupler and oxidizing agent which leads to the generation of the resultant hair dye on the hair. The precursors include Para-Phenylenediamine (PPD), O-aminophenol and P-amino phenol [14]. They act as sensitizers in the hair dyes. In this study, among 68 patients suspected for hair dye contact dermatitis, 31 patients (45.59%) were positive for PPD. There is an increasing trend in sensitivity to PPD allergy as per study by Handa S et al., which compared patch test results in hair dye users in 10 years interval [15].

All 10 patients suspected to have *kum-kum* dermatitis had positive patch test. *Kum-kum* has a traditional and cultural value in Indian society and now the commercially available *kum-kum* has sensitizers such as brilliant lake red, sudan I, aminoazobenzene and canaga oil. In study by Kumar JV et al., all 20 patients had variable positive patch test result for all 4 allergens given above [16].

In this study, among 16 painters with contact dermatitis, 7 patients (43.75%) had positive patch test. Potassium dichromate is the most common sensitizer in this group, followed by epoxy resin and formaldehyde. In the study by Thilak S et al., potassium dichromate is the most common sensitizer in paint [17].

Out of 15 patients suspected for footwear contact dermatitis cases,

4 patients (26.66%) were positive for patch test. Study by Chowdari S et al., shows that footwear dermatitis can be due to various sensitizers used in the making of footwear such as potassium dichromate, cobalt, epoxy resin, black rubber mix, nickel sulphate, mercaptobenzothiazole, colophony, PPD, thiurum mix, PTBF resin and formaldehyde [18]. Potassium dichromate is the most common sensitizer among them.

Turmeric contains the active dye curcumin which can cause allergic contact dermatitis [19]. Out of 12 patients with contact allergy to turmeric, 6 had positive patch test (50%). One person had patch test positive to both *kum-kum* and turmeric.

Study by Huda MM and Paul UK showed that 19 out of 80 cases (23.75%) were house wives which revealed contact dermatitis to vegetables, soaps and detergents [20]. In our study, 6 housewives (23.08%) had positive patch test for detergents out of 26 suspected patients. Patients tested with dettol, kerosene and vegetables had negative patch test.

LIMITATION

Patients have chances of exposure to multiple allergens other than the allergens used for patch test in this study because of the work nature or environment and all components of various substances such as cement, *kum-kum*, turmeric were not tested individually.

CONCLUSION

This study gives an idea about the common occupation and population who are prone to develop contact dermatitis in our environmental setting and also about the most common sensitizers involved in various occupation and environment. In this study, patients who had exposure to cement, hair dyes and plants constitute the major proportion of patients with positive patch test. This study also emphasizes the need to add allergic constituents of various substances such as *kum-kum*, detergents and plants in addition to parthenium to the routinely used patch test kits.

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FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Dec 29, 2016**
Date of Peer Review: **Feb 25, 2017**
Date of Acceptance: **May 13, 2017**
Date of Publishing: **Aug 01, 2017**