

To Study on Common Allergens Causing Contact Dermatitis**B. M. Monisha^{1*}, S Vinoth kumar² Faheem Mubeen³**¹*Assistant Professor, Skin and STD Department, Vinayaka Mission's Kirupananda Variyar Medical College & Hospital, Salem, Tamil Nadu, India*²*Associate Professor, Department of Radiology, Vinayaka Mission's Kirupananda Variyar Medical College & Hospital, Salem, Tamil Nadu, India*³*Associate Professor, Ayaan Institute of Medical Sciences, Hyderabad, India.***Received: 14-03-2021 / Revised: 28-04-2021 / Accepted: 02-06-2021****Abstract****Introduction:**Contact dermatitis (CD) is a skin disorder characterized by redness, itching and vesiculation. In chronic cases, scaly desquamation and lichenification may also be present. CD results from contact with environmental substances that elicits an allergic and/or irritant response.**Material and Methods:**A total of 100 patients of contact dermatitis of either sex who attended the Out-Patient Department of Dermatology, Venereology and Leprosy at Tertiary care teaching hospital over a period constituted the subject material for the present study. Inclusion Criteria: Patients clinically suspected to have contact dermatitis. Patients with active dermatitis were first treated and then subjected to patch testing so as to avoid false positivity and excited skin syndrome (Angry back syndrome). **Results:** Maximum number of cases (21%) showed worsening of disease in summer. Most common clinical pattern was hand dermatitis (30%) followed by foot dermatitis (25%), Air borne contact dermatitis (ABCD) (16%), kumkum dermatitis (11%), Hand and foot dermatitis (7%). In males potassium bichromate (10%), parthenium (9%) and thiuram mix (6%) were the most common allergens whereas in females nickel (9%), kumkum (9%) and fragrance mix (6%) were the most common allergens. In males positive reaction to potassium bichromate (P<0.05), parthenium (P<0.05), thiuram mix (P<0.01), were significantly more common in males. Females showed significantly more positive reactions to nickel (P<0.05), fragrance mix (P<0.05) and kumkum (P<0.01). **Conclusion:**In our study, the commonest allergens in our patients from hospital adjoining places were potassium bichromate, thiuram mix and parthenium in males, whereas nickel, fragrance mix and kumkum in females. In view of the differences in clinical patterns, positivity rates etc. reported from different parts of India, we owe it to our patients to clarify the epidemiology of this important problem.**Keywords:** Allergens, Dermatitis, Irritant contact dermatitis, allergic contact dermatitis.

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Introduction

Contact dermatitis (CD) is a skin disorder characterized by redness, itching and vesiculation. In chronic cases, scaly desquamation and lichenification may also be present. CD results from contact with environmental substances that elicits an allergic and/or irritant response. [1] A high clinical suspicion of an allergic contact dermatitis (ACD) is the first step in making the diagnosis. Patch testing is indicated in any patient with an acute or chronic dermatitis if an underlying or secondary ACD is suspected. [2] CD is a common skin disorder with an estimated 5.7 million physician visits per year. All age groups are affected, with a slight female preponderance. Although the true prevalence and incidence is not known, CD accounts for approximately 85 – 95% of all occupational skin disease in industrialized countries. [3] Hand dermatitis is the most common clinical manifestation, affecting 2–6% of this population. A fundamental characteristic of CD is its relationship to environmental exposures which can be determined by the site and shape of the skin lesions as well as a thorough history. [4] Irritant contact dermatitis (ICD), the most common type of contact dermatitis, most frequently affects the hands. In children, diaper dermatitis and dry skin dermatitis are the most common forms of ICD. [5] These skin lesions develop with prolonged and repeated

exposure to substances that chemically abrade, physically irritate, or damage the skin (i.e. caustic agents, detergents). In children, lesions often result from repetitive exposure to water (lip licking or thumb sucking). [6] Lesions are often well-circumscribed with a glazed, parched, or scalded appearance. Patch testing is usually negative and lesions resolve promptly with withdrawal of the offending agent.

Although inflammatory cells play a role in the development of the dermatitis, allergen-specific immune lymphocytes are not involved in the pathogenesis thus prior sensitization is not necessary. The susceptibility to irritants varies among individuals but, given sufficient exposure, almost anybody can develop an ICD. [7]

Material and Methods

A total of 100 patients of contact dermatitis of either sex who attended the Out-Patient Department of Dermatology, Venereology and Leprosy at Tertiary care teaching hospital over a period constituted the subject material for the present study.

Inclusion Criteria:

- Patients clinically suspected to have contact dermatitis.
- Patients who are willing for patch testing
- Patients with active dermatitis were first treated and then subjected to patch testing so as to avoid false positivity and excited skin syndrome (Angry back syndrome).

Exclusion Criteria:

- Patients having pre-existing skin disorders.
- Patients who refuse patch testing.
- Patients on immune suppressive therapy
- Pregnancy

Results**Correspondence***Dr .B. M. Monisha**

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Table 1: Age distribution

Age Distribution	No. of Patients N=100	Percentage
11-20 yrs	8	8
21-30 yrs	16	16
31-40 yrs	31	31
41-50 yrs	30	30
51-60 yrs	12	12
>60 yrs	3	3

In this study the majority of cases were between the age group of 21-40 years.

Table 2: Place distribution

Place Distribution	No. of Patients N=100	Percentage
Rural	28	28
Urban	72	72

Contact dermatitis was more among the urban population compared to rural population.

Table 3: Occupation

Occupation	No. of Patients N=100	Percentage
Farmer	12	12.0
Housewife	27	27.0
Labour	7	7.0
Mason	15	15.0
Mechanic	6	6.0
Nurse	4	4.0
Student	10	10.0
Teacher	8	8.0
Beautician	3	3.0
Barbar	2	2.0
Electrician	2	2.0
Factory worker	2	2.0
Medical worker	1	1.0
Priest	1	1.0

Majority of the patients included in the study were engaged in house hold work (27%), followed by construction work (including mason and labour) (22%) and fanning (12%).

Table 4: Seasonal variation

Season wise distribution	No. of Patients N=100	Percentage
Summer	21	21.00
Winter	15	15.00
No seasonal variation	64	64.00

Seasonal variation was reported by 36% of the patients. In the remaining 64%, no seasonal variation was seen. Maximum number of cases (21%) showed worsening of disease in summer.

Table 5: Clinical pattern

Clinical Patterns	No. of Patients N=100	Percentage
Hand dermatitis	30	30.00
Foot dermatitis	25	25.00
Hand & Foot dermatitis	7	7.00
ABCD	16	16.00
KumKum dermatitis	11	11.00
Other types of dermatitis	11	11.00

Most common clinical pattern was hand dermatitis (30%) followed by foot dermatitis (25%), Air borne contact dermatitis (ABCD) (16%), kumkum dermatitis (11%), Hand and foot dermatitis (7%).

Table 6: Etiological profile of various allergens established with positive patch test

Allergens	Male		Female		Total	
	No.	%	No	%	No	%
1. Perubalsam	1	1.0	2	2.0	3	3.0
2. Formaldehyde	0	-	2	2.0	2	2.0
3. Mercaptobenzothiazole	6	6.0	5	5.0	11	11.0
4. Potassium bichromate	10	10.0	2	2.0	12	12.0
5. Nickel sulphate	3	3.0	9	9.0	12	12.0
6. Cobalt sulphate	3	3.0	1	1.0	4	4.0
7. Colophony	0	-	3	3.0	3	3.0
8. Epoxy resins	2	2.0	0	-	2	2.0
9. Parabens mix	0	-	3	3.0	3	3.0
10. Paraphenylenediamine	3	3.0	3	3.0	6	6.0
11. Parthenium	9	9.0	3	3.0	12	12.0
12. Neomycin sulphate	1	1.0	2	2.0	3	3.0

13. Benzocaine	0	-	1	1.0	1	1.0
14. Fragrance mix	1	1.0	6	6.0	7	7.0
15. Thiuram mix	6	6.0	0	-	6	6.0
16. Nitrofurazone	0	-	2	2.0	2	2.0
17. Black rubber mix	1	1.0	0	-	1	1.0
18. KumKum	1	1.0	9	9.0	10	10.0
Total	47	47.0	53	53.0	100	100.0

In males potassium bichromate (10%), parthenium (9%) and thiuram mix (6%) were the most common allergens whereas in females nickel (9%), kumkum (9%) and fragrance mix (6%) were the most common allergens.

Table 7: Comparison of single and multiple antigen sensitizations in males and females

Sensitization	Positive cases		Statistical analysis test
	Male N=33	Female N=36	
Single antigen	19	21	0.09, NS
Multiple antigen	14	15	

NS - Not significant, P<0.05 - statistically significant

There was no significant difference statistically.

Table 8: Comparison of positive allergens in males and females

Allergens	Male N=33	Female N = 36	Statistical analysis test. df=1
Perubalsam	1	2	0.26, NS
Formaldehyde	0	2	1.89, NS
Mercaptobenzothiazole	6	5	0.15, NS
Potassium bichromate	10	2	5.86, P<0.05
Nickel	3	9	4.13, P<0.05
Cobalt sulphate	3	1	1.26, NS
Colophony	0	3	2.88, NS
Epoxy resins	2	0	1.89, NS
Parabens mix	0	3	2.88, NS
paraphenylenediamine	3	3	0
parthenium	9	3	4.13, P<0.05
Neomycin sulphate	1	2	0.26, NS
Benzocaine	0	1	0.26, NS
Fragrance Mix	1	6	3.85, P<0.05
Thiuram Mix	6	0	7.17, P<0.01
Nitrofurazone	0	2	1.89, NS
Black rubber mix	1	0	0.26, NS
KumKum	1	9	6.71, P<0.01
Total	47	53	

NS-Not Significant, P<0.05-statistically significant

In males positive reaction to potassium bichromate (P<0.05), parthenium (P<0.05), thiuram mix (P<0.01), were significantly more common in males. Females showed significantly more positive

reactions to nickel (P<0.05), fragrance mix (P<0.05) and kumkum (P<0.01).

Table 9: Comparison of metal allergens in males and female

Metal allergens	Male N=33	Female N=36	Statistical analysis X ² test.
Potassium bichromate	10	2	
Nickel	3	9	
Cobalt sulphate	3	1	
Total	16	12	4.07, P<0.05

NS - Not significant, P<0.05 - statistically significant

Metal allergens (P <0.05) significantly more common in males.

Table 10: Comparison of allergens commonly present in rubber products in males and females

Rubber allergens	Male N=33	Female N=36	Statistical analysis X ² test.
Mercaptobenzothiazole	6	5	
Thiuram Mix	6	0	
Black rubber mix	1	0	
Total	13	5	4.68, P<0.05

NS - Not significant, P<0.05 - statistically significant

Table 11: Comparison of allergens commonly present in plastic materials in males and females

Plastic allergens	Male N=33	Female N=36	Statistical analysis X ² test.
Epoxy resin	2	0	2.25, NS

NS - Not significant, P<0.05 - statistically significant There was no significant difference statistically.

Discussion

Allergic contact dermatitis (ACD) is an inflammatory skin disease that affects about 20% of the adult general population and is also an important occupational skin disease. [8] A recent study showed that 27% of the general population from five European countries had contact allergy (that is, sensitization to at least one contact allergen of the European baseline series). [9] A large proportion of these individuals are at risk of developing ACD following exposure to everyday products. Among the occupational diseases, 40% are skin-related. [10] Contact dermatitis (both irritant and allergic) accounts for about 90% of these. Collectively, these epidemiological data demonstrate the importance of ACD as a challenge to human health. Therefore, basic and clinical research is needed to understand the pathomechanisms of ACD and to develop better strategies for diagnosis and treatment. ACD is mediated by T cells recognizing low-molecular weight organic chemicals or metal ions in the context of major histocompatibility complex (MHC) molecules. [11] These usually electrophilic chemicals penetrate the skin and react with extracellular and cellular proteins. Their protein reactivity is mandatory and underlies their unusual ability to trigger innate immune as well as T-cell responses. [12]

Activation of the innate immune system is a prerequisite for the activation and skin migration of contact allergen-specific T cells. The first skin contact with allergens initiates the activation of skin cells, most importantly the epidermal Langerhans cells and dermal dendritic cells (DCs), which subsequently migrate to the local lymph nodes and present the contact allergen(s) to naïve T cells. Contact allergen-specific T cells then proliferate and differentiate to effector T cells that enter the blood circulation. [14] Repeated skin contact with the same contact allergen then results in the recruitment of these T cells into the skin and the elicitation of the clinical reaction of ACD. [15] The response is limited and downregulated by regulatory T and B cells, natural killer T (NKT) cells, and further cell types. Here, we review recent progress in basic research aimed at understanding the cellular and molecular mechanisms underlying the innate immune responses as well as the pathogenic T-cell response and its regulation. Moreover, we will give an overview of the current status of the management of ACD. [16]

Conclusion

In our study, the commonest allergens in our patients from hospital adjoining places were potassium bichromate, thiuram mix and parthenium in males, whereas nickel, fragrance mix and kumkum in females. In view of the differences in clinical patterns, positivity rates etc. reported from different parts of India, we owe it to our patients to clarify the epidemiology of this important problem.

References

1. Ring J: Occupational skin disease - a major health problem in Europe. *J Eur Acad Dermatol Venereol.* 2017; 31(6):919–20.
2. Thyssen JP, Linneberg A, Menné T et al. The epidemiology of contact allergy in the general population—prevalence and main findings. *Contact Dermatitis.* 2007; 57(5):287–99.
3. Diepgen TL, Ofenloch RF, Bruze M et al. Prevalence of contact allergy in the general population in different European regions. *Br J Dermatol.* 2016; 174(2):319–29.
4. Alfonso JH, Bauer A, Bensefa-Colas L et al. Minimum standards on prevention, diagnosis and treatment of occupational and work-related skin diseases in Europe - position paper of the COST Action Stan Derm (TD 1206). *J Eur Acad Dermatol Venereol.* 2017; 31(Suppl4):31–43.
5. Weber FC, Németh T, Csepregi JZ et al.: Neutrophils are required for both the sensitization and elicitation phase of contact hypersensitivity. *J Exp Med.* 2015; 212(1):15–22.
6. Gimenez-Rivera VA, Siebenhaar F, Zimmermann C et al. Mast Cells Limit the Exacerbation of Chronic Allergic Contact Dermatitis in Response to Repeated Allergen Exposure. *J Immunol.* 2016; 197(11):4240–6.
7. Jiang X, Park CO, Geddes Sweeney J et al. Dermal $\gamma\delta$ T Cells Do Not Freely Re-Circulate Out of Skin and Produce IL-17 to Promote Neutrophil Infiltration during Primary Contact Hypersensitivity. *PLoS One.* 2017; 12(1):e0169397.
8. Schmidt JD, Ahlström MG, Johansen JD et al. Rapid allergen-induced interleukin-17 and interferon- γ secretion by skin-resident memory CD8+ T cells. *Contact Dermatitis.* 2017; 76(4):218–27.
9. Nielsen MM, Lovato P, MacLeod AS, et al. IL-1 β -dependent activation of dendritic epidermal T cells in contact hypersensitivity. *J Immunol.* 2014; 192(7):2975–83.
10. Nielsen MM, Dyring-Andersen B, Schmidt JD et al. NKG2D-dependent activation of dendritic epidermal T cells in contact hypersensitivity. *J Invest Dermatol.* 2015; 135(5):1311–9.
11. Adam C, Wohlfarth J, Haußmann M et al. Allergy-Inducing Chromium Compounds Trigger Potent Innate Immune Stimulation Via ROS-Dependent Inflammasome Activation. *J Invest Dermatol.* 2017; 137(2):367–76.
12. Nakamura N, Tamagawa-Mineoka R, Ueta M et al. Toll-like receptor 3 increases allergic and irritant contact dermatitis. *J Invest Dermatol.* 2015; 135(2):411–7.
13. Bonefeld CM, Geisler C, Giménez-Arnau E et al. Immunological, chemical and clinical aspects of exposure to mixtures of contact allergens. *Contact Dermatitis.* 2017; 77(3):133–42.
14. Nedorost S.A diagnostic checklist for generalized dermatitis. *Clin Cosmet Investig Dermatol.* 2018;11:545-549.
15. Ezendam J, Braakhuis HM, Vandebriel RJ. State of the art in non-animal approaches for skin sensitization testing: from individual test methods towards testing strategies. *Arch Toxicol.* 2016; 90(12):2861–83.
16. Simonsson C, Andersson SI, Stenfeldt A et al. Caged fluorescent haptens reveal the generation of cryptic epitopes in allergic contact dermatitis. *J Invest Dermatol.* 2011; 131(7): 1486–93.

Conflict of Interest: Nil

Source of support: Nil