

Contact sensitization and allergic contact dermatitis in patients with eczematous lesions

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Abstract

Context: Patch testing is an effective investigative tool in the determination of specific allergens responsible for allergic contact dermatitis (ACD). Sensitization to various allergens has been shown to vary by geographic regions.

AIMS: The aim of this study was to use patch test to assess the frequency/pattern of contact allergy in patients with eczematous lesions and to identify possible relationships between sex, age, and type of eczema.

Subjects and Methods: From a total of 1331 patients seen at the dermatology clinic of the University of Abuja Teaching Hospital, Gwagwalada, in March 2015 to April 2016, 79 patients with eczema were consecutively patch tested.

Statistical Analysis Used: Chi-square test was used to analyze the categorical variables. The level of significance for all analyses was 0.05.

Results: One or more positive reactions were observed in 53 patients (67.1%). The highest yield was observed with potassium dichromate (10.4%), nickel sulfate (9.7%), cobalt chloride (7.6%), and fragrance mix 1 (6.9%). Of the 51 patients (64.6%) diagnosed to have ACD, clinical relevance was observed in 37 cases (69.8%). Contact sensitivity to potassium dichromate was more frequent in male patients ($P = 0.036$), whereas fragrance mix 1 sensitivity was more in female patients ($P = 0.032$). There was no significant relationship between the frequency of contact allergy and age, patient's occupation, and type of eczema.

Conclusions: Most ACD patients showed contact sensitization to leather products, metal, and perfume use. This knowledge is important when considering preventive measures. However, further studies are needed to provide more insight into contact allergy in Nigeria.

Keywords: Allergic contact dermatitis, patch test, sensitization

Introduction



Allergic contact dermatitis (ACD) is a form of dermatitis that develops as a result of an allergic response caused by the contact with specific allergens. It is one of the commonly mentioned examples of cutaneous Type 4 (delayed) hypersensitivity reaction, whereby the allergen (hapten) initiates a sensitization phase and subsequently an elicitation phase of inflammatory events on reexposure.^[1] It is usually considered in the differential diagnosis of chronic eczematous or noneczematous dermatitis.^[2] ACD diagnosis is based on detailed clinical history, complete physical examination, and true positive patch test.^[1]

Patch testing is a useful and effective investigative tool in the diagnosis of specific allergens responsible for ACD.^[2] It is usually carried out in most countries with the use of standardized baseline series consisting of allergens known to cause ACD in the given population, as well as individualized allergens relevant to a patient. Nigeria is yet to develop a baseline series; this is because studies on patching testing in ACD patients are quite few.

The aim of this study was to determine the frequency of sensitization to various contact allergens in patients with eczematous lesions using the European baseline series patch test, ascertain the clinical relevance, and identify a possible relationship between sex, age, and type of eczema.

Subjects and Methods



A cross-sectional study of 79 patients with eczematous dermatitis was undertaken at the dermatology clinic of the University of Abuja Teaching Hospital, Gwagwalada, from March 2015 to April 2016. Patients were recruited consecutively. Detailed history and physical examinations were conducted, and the patients were patch tested with 29 standard allergens of the European baseline series. The procedure was explained to the patient and consent obtained. The tests were applied on the backs of patients and left on for 48 h. The first reading was taken 48 h and the second 96 h after application. The test procedures and readings were conducted according to the International Contact Dermatitis Research Group recommendations.

Patients who were on systemic steroids and who had lesions involving >60% of body surface including the back were excluded from the study. The data were collected and analyzed using Statistical Package for Social Sciences (SPSS) software (version 16, SPSS, Inc., Chicago, IL, USA). Chi-square test was used to analyze the categorical variables. The level of significance for all analyses was 0.05.

Results



Patients' characteristics

Patch test results were evaluated in 79 patients, 35 males (44.3%) and 44 females (55.7%), aged 11–

77 years and a mean of 33.7 (± 14.9) years. Among the patients evaluated, 33 (41.8%) were students, 15 (19%) were civil servants, and 8 (10.2%) were traders. Patients with occupations known to have a high risk of developing ACD such as nursing, hairdressing, farming, homemakers, and cooks were quite few with modal frequency of one patient recorded. Eczematous lesions were grouped into hand and foot eczema, head and neck eczema, atopic dermatitis, and dermatitis involving other body parts. [\[Table 1\]](#) shows the patients' characteristics/types and distribution of eczema. There was no statistical difference concerning these grouped eczematous dermatitis and the age groups studied.

	Male	Female	Total, n (%)
Gender	35	44	79
Mean age (years)	37.3 $\pm$ 16.2	30.7 $\pm$ 13.3	33.7 $\pm$ 14.9
Atopic dermatitis	3	3	6 (5)
Hand and foot eczema	10	15	25 (31.6)
Head and neck eczema	3	3	6 (5)
Dermatitis other body parts	18	16	34 (43)
Positive results	26	27	53 (67.1)

Table 1: Distribution of eczematous dermatitis patients studied (n=79)

Results of patch test performed

One or more positive reactions were observed in 53 patients, with a contact sensitization rate of 67.1% (53/79). Among the 53 patients who had “at least one positive reaction,” 37 (69.8%) presented the current clinical relevance to their positive tests and received a diagnosis of ACD. Thus, this study observed a 46.8% prevalence rate of ACD. Irritant dermatitis was diagnosed in 22 (27.8%) patients, while other dermatoses were diagnosed in 20 (25.3%) patients.

There were a total of 114 sensitization reactions observed from the 29 allergens tested. Only 12 (22.6%) patients had monosensitization (reaction to one substance). Ten substances which topped the list of sensitization reactions elicited among the patients were potassium dichromate (10.4% of 114 reactions), nickel sulfate (9.7%), cobalt chloride (7.6%), fragrance mix 1 (6.9%), Balsam of Peru (6.3%), benzocaine mix (5.6%), thiuram mix (4.9%), lanolin alcohol (4.9%), neomycin sulfate (4.2%) and lyral (4.2%). [\[Table 2\]](#) shows the distribution of sensitization to the allergens.

Allergen	Male	Female	Total	P
Potassium dichromate	10	5	15	0.036
Nickel sulfate	8	6	13	
Cobalt chloride	6	5	11	
Fragrance mix 1	3	7	10	0.037
Balsam of Peru	4	5	9	
Benzocaine	4	4	8	
Thiuram mix	6	1	7	0.04
Lanolin	3	4	7	
Neomycin sulfate	3	3	6	
Lyrar	4	2	6	
Tixocortol	2	3	6	
Paraphenylenediamine	3	3	6	
Paraben mix	1	4	5	0.38
Fragrance mix 2	2	2	4	
Clioquinol	2	2	4	
Mercaptobenzothiazole mix	2	2	4	
Quaternium-15	1	2	3	
Methylchloroisothiazolinone and methylisothiazolinone	2	1	3	
Colophonium	1	2	3	
Epoxy resin	1	1	2	
N-isopropyl-N-phenyl-4-phenylenediamine	2	0	2	
Mercaptobenzothiazole	0	2	2	
Budesonide	0	2	2	
Mercaptobenzothiazole mix	0	1	1	
4-tert-Butylphenolformaldehyde resin (PTBP resin)	0	1	1	
Sesquiterpene lactone mix	1	0	1	
Methyldibromo glutaronitrile	1	0	1	
Methylisothiazolinone	0	1	1	
Formaldehyde	0	0	0	

PTBP=Para-tertiary butylphenol

Table 2: Gender distribution of sensitization to allergens in the European series

Frequencies of contact allergy to mercaptobenzothiazole mix, sesquiterpene lactone mix, methyldibromo glutaronitrile, and methylisothiazolinone were relatively low (frequency mode of 1) while formaldehyde did not produce any positive reactions. ACD patients were significantly sensitized to nickel sulfate ($P = 0.022$) and potassium dichromate ($P = 0.045$). There was a statistically significant higher frequency of contact sensitivity to potassium dichromate and thiuram mix in male patients ($P = 0.036$ and 0.04 , respectively), while the reverse was the case with sensitivity to fragrance mix 1 where female patients had a higher frequency ($P = 0.032$). There was no significant relationship between the frequency of ACD and age, patient's occupation, and type of eczema.

Discussion

The observed relative frequency of contact sensitization (67.1%) for at least one positive reaction is consistent with the findings from studies of patch testing in patients with dermatitis, which ranges from 44.3% to 69.2%.^{[2],[3],[4],[5]} The percentage clinical relevance of 69.8%, (rate of patients diagnosed as ACD) also falls within the range documented in the literature.^{[2],[4]} This demonstrates the importance of patch test in the diagnosis and management of ACD, especially as it helps differentiate ACD from other eczematous dermatitis. A relatively high percentage in clinical relevance may be affected by the type of patients selected for the study and the number of

substances tested. This study observed a 46.8% relative frequency of ACD, similar to the 49.5% observed in a recent report by the North American contact dermatitis group patch test results.^[4]

The average age of the patients in this study was quite young (33.7 years) and almost half of them were students. A higher frequency of younger patients being managed for ACD has similarly been observed in a Karlovac, Czech, and Ethiopian study.^{[3],[5],[6]} The reason for this trend is not clear although ACD is believed to increase with age. This could be related to an increase in the use of fashion/cosmetic products by the young or could be due to the study population. Our study site Gwagwalada is a university town. Furthermore, a very low frequency of patients with high-risk dermatitis occupation observed in this study could be due to a lower prevalence of occupational dermatitis in our environment and/or the reduced susceptibility to irritation in black skin compared to white skin as observed by Robinson.^[7] In addition, individuals in high-risk dermatitis occupation may have received training on work safety. It is also worthy to note that the high prevalence of hand and foot dermatitis observed in this study was shown to be unrelated to occupation.

On the frequency of sensitization to allergens, the most common allergens observed were potassium dichromate, nickel sulfate, cobalt chloride, and fragrance mix 1. This pattern of common allergens was also observed in a similar study in Lagos, Nigeria,^[8] and in another study by Bilcha *et al.* in Ethiopia.^[3] The gender differences in the frequency of contact sensitization seen in this study have also been observed and documented in other studies.^{[4],[5],[6],[7],[8],[9],[10]} In a preliminary study carried out in Cotonou, the Benin Republic, the female gender was significantly sensitized against fragrance mix and the males to potassium dichromate.^[9] This is in contrast to the Ethiopian study where nickel and 4-tert-butylphenol formaldehyde resin (para-tertiary butylphenol) was more common in females.^[3]

The source of potassium dichromate (Cr) allergen in this study was the use of leather products. This allergen was not detected on construction workers (though we had only one patient who presented). Review of some studies especially in Europe shows a lower incidence of potassium dichromate-sensitized patients because of successful restriction on use of Cr in cement and leather. According to the current European Union regulations, Cr content in leather should not exceed 3 mg/kg leather.^[11] Unfortunately, such legislation does not exist in Nigeria, where leather is produced and used on a daily basis without regard to the chromate content. A similar scenario exists for nickel sulfate allergy which is also controlled in the European Union by regulation. According to the European Union legislation, release of nickel in products that have direct and prolonged contact with skin should not exceed 0.5 µg/cm²/week.^[5] Cobalt chloride allergy has long been associated in the literature with other metals, especially nickel and chromate.^[12] It is not surprising that it is among the most common allergens associated with ACD in this study.

Conclusions



The most common allergens in the University of Abuja Teaching Hospital patients were potassium dichromate, nickel, cobalt, fragrance mix, and Balsam of Peru. Clinical relevance shows contact sensitization to leather products, metals, and perfume use. This knowledge is important when considering preventive measures. In addition to avoidance, another important preventive measure is to institute legislation to monitor the quantity of commonly used offending allergens in products. However, further studies involving many hospitals are needed to provide more insight into contact allergy pattern in Nigeria.

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Conflicts of interest

There are no conflicts of interest.

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