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ARTICLE *in* ANAIS BRASILEIROS DE DERMATOLOGIA · APRIL 2012

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Study of the frequency of allergens in cosmetics components in patients with suspected allergic contact dermatitis*

Estudo da frequência dos alérgenos da bateria de cosméticos em pacientes com suspeita de dermatite alérgica de contato

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Abstract: BACKGROUND: Contact dermatitis to cosmetics is a common dermatosis, especially in adults and professionals who handle them.

OBJECTIVE: The objective of this study was to evaluate the frequency of sensitization to cosmetics' components in patients with suspected allergic contact dermatitis and to identify the main sensitizers related to occupational contact dermatitis.

METHODS: During the period of January 2008 to June 2010, all the patients with a presumptive diagnosis of allergic contact dermatitis to cosmetics were selected. The patients were submitted to the patch tests of cosmetics series, composed by ten substances.

RESULTS: Among the 147 patients studied sensitization to cosmetics components occurred in 31,29% of the cases, 14 of those (19,18%) equally corresponding to BHT and triethanolamine substances, 13 (17,81%) to ammonium thioglycolate, 09 to sorbic acid (12,33%), 08 to tosilamida (10,95%), 06 to germall (8,22%). The other elements tested showed indices of 5% or less. A higher frequency of contact dermatitis to cosmetics was observed in women and the age most affected was concordant with the age range of greatest professional activity of the population.

CONCLUSIONS: Allergic contact dermatitis was more frequently associated with Triethanolamine, BHT and ammonium thioglycolate, and the relation with occupational contact dermatitis was discreet.

Keywords: Dermatitis, allergic contact; Dermatitis, occupational; Hypersensitivity

Resumo: FUNDAMENTOS: A dermatite de contato por cosméticos é uma dermatose relativamente comum, sobretudo em adultos e em profissionais que os manipulam.

OBJETIVO: O objetivo do estudo foi avaliar a frequência de positividade aos componentes de cosméticos, em pacientes com suspeita de dermatite alérgica; e identificar os principais sensibilizantes relacionados à dermatite de contato ocupacional.

MÉTODOS: Durante o período de janeiro de 2008 a junho de 2010 foram selecionados todos os pacientes com hipótese de dermatite alérgica de contato a cosméticos. Os pacientes foram submetidos aos testes epicutâneos com bateria de cosméticos, composta por dez substâncias.

RESULTADOS: Dos 147 pacientes estudados, a sensibilização aos componentes do cosmético ocorreu em 31,29% dos casos, sendo 14 (19,18%) corresponderam igualmente às substâncias BHT e trietanolamina, 13 (17,81%) ao tioglicolato de amônia, 09 ao ácido sórbico (12,33%), 08 tonsilamida (10,95%), 06 germal (8,22%). Os demais elementos testados proporcionaram índices iguais ou inferiores a 5%. Observou-se maior frequência de dermatite de contato aos componentes da bateria de cosméticos em mulheres e a idade mais acometida foi concordante com a faixa etária de maior atividade profissional da população.

CONCLUSÕES: Houve maior frequência de dermatite alérgica de contato pelas substâncias trietanolamina, BHT e tioglicolato de amônia, demonstrando pouca associação à dermatite de contato ocupacional.

Palavras-chave: Dermatite alérgica de contato; Dermatite ocupacional; Hipersensibilidade

Received on 02.03.2011.

Approved by the Advisory Board and accepted for publication on 25.04.2011.

* Work performed at the Allergic Test Sector of the Immunology Lab of the Instituto Lauro de Souza Lima de Bauru (ILSL) – Bauru (SP), Brazil.

Conflict of interest: None

Financial funding: None

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INTRODUCTION

Allergic contact dermatitis (ACD) corresponds to a cutaneous inflammatory reaction mediated by T lymphocytes, resulting from repeated contact of the skin with non-protein chemical substances, denominated haptens. It is a frequent dermatosis in industrialized countries, with great socioeconomic impact, and it is one of the most common occupational diseases, affecting predominantly the more productive age group of the population, and as such it is important to conduct detailed studies in regards to its etiology and prevalence.^{1,2}

As the skin is the first barrier to get in contact with chemical and physical factors from the environment, the understanding of the allergenic exposure at different places is important in order to assess the profile of clinically relevant allergens and the measures to be taken to reduce this exposure, especially with the occupational contact dermatitis, which is a public health problem in the building industry workers.^{3,4,5}

The occurrence of contact dermatitis to cosmetics is relatively common, above all in adults and in professionals who manipulate them, like hairdressers. Many are the products that can be allergenic, and the fragrances, *paraphenylenediamine*, ammonium thioglycolate and preservatives are the main sensitizers.⁶

The diagnosis of contact dermatitis is done by the clinical history, clinical presentation and contact tests. The contact tests help with the differentiation between primary irritant contact dermatitis and allergic contact dermatitis, and also with the identification of possible etiologic agents of the ACD.

As such, the objective of this study is to present the frequency of positivity to cosmetics' components in individuals seen at the dermatology outpatient clinic of the Instituto Lauro de Souza Lima (ILSL) in Bauru, highlighting their association with occupational contact dermatitis.

MATERIAL AND METHODS

This is an observational, cross-sectional study, where all the patients with a hypothesis of allergic contact dermatitis to a cosmetic (n = 147), seen at the ILSL in Bauru during the period of January 2008 to June 2010 were selected. The patients were submitted to epicutaneous tests with a battery of cosmetics, manufactured by the FDA-Allergenic (RJ-Brazil), composed of 10 substances which are discriminated on chart 1.

In all the cases retainers of the FINN *Chambers* (Oy, Finland) type were used, and the readings were done in 48 to 96 hours, according to the *International Contact Dermatitis Research Group* (ICDRG) criteria from 1981, in which: (-) negative reaction; dubious reaction; (+) mild reaction, with mild erythema and some papules; (++) moderate

CHART 1: Brazilian Standard Battery of cosmetics for epicutaneous tests suggested by the Brazilian Group of Studies in Contact Dermatitis (Grupo Brasileiro de Estudos em Dermatite de Contato), 2002

Substances	Concentration	Vehicle
C1 Germall	2%	Solid vaseline
C2 BHT (butylated hydroxytoluene)	2%	Solid vaseline
C3 Tosilamide/Formaldehyde Resin	10%	Solid vaseline
C4 Triethanolamine	2,5%	Solid vaseline
C5 Bronopol	0,5%	Solid vaseline
C6 Chloroacetamide	0,2%	Solid vaseline
C7 Sorbic acid	2%	Solid vaseline
C8 Ammonium thioglycolate	2,5%	Solid vaseline
C9 Amerchol L - 101	100%	
C10 Chlorhexidine	0,5%	Water

reaction, with erythema, papules and some vesicles; (+++) intense reaction, with erythema, papules and confluent vesicles.

The data was collected based on a protocol used by the dermatology service, where information like age, sex, professional activity, time course of the dermatosis, location of the lesions and results from contact tests are recorded. If necessary, the medical charts were also studied.

For the analysis, the data was entered into an Excel[®] spreadsheet. For the comparison of the proportions of positive and negative cases amongst the substances, the Cochran test was used, executed on the SPSS v.13 program, and the level of significance was set at 5% (p<0,05).

RESULTS

From the 147 patients (48 males and 99 females) submitted to the epicutaneous tests, 15 (10,2%) were students and did not perform any professional activity; and the remaining 132 patients (89,79%) worked in various sectors, as demonstrated on table 1.

Forty-six patients had positive reactions to substances from the cosmetics' battery, 18 males (average age 49,05) and 28 females (average age 43,0), and the time course of the dermatosis varied from two to 312 months, with an average of 12 months.

In regards to location of the dermatosis, some patients had more than one location, and hands and the cephalic segment (head and neck) were the most commonly involved, followed by upper limbs, lower limbs, feet and trunk, abdomen, armpits and other

TABLE 1: Distribution of the positive results to the epicutaneous tests to cosmetics, according to profession, of the 147 patients of the Dermatology Outpatient Clinic of the Instituto Lauro de Souza Lima de Bauru (2008-2010)

Professional Occupational Area	Patients Number	Number of Patients with positive reaction	Substances
Cleaning	16	08	C5 C3 C1 C1 C2 C2 C7 C8 C4 C2 C1
Home duties	20	07	C7 C6 C3 C1 C2 C4 C3 C2 C4 C8
Building	13	08	C5 C7 C4 C5 C4 C8 C8 C8 C8 C7 C8 C4
Clerical	13	04	C2 C6 C3 C2 C4 C8 C5
Health	12	02	C3 C4
Mechanic/Metallurgic	05	02	C8 C2 C4 C7 C8
Clerk/Retail	07	03	C2 C7 C2 C4 C7
Hairdresser/Manicure	05	01	C3
Taylor/Dressmaker	05	02	C3 C2
Carpenter	06	01	C1 C4 C6 C8
Farmer/Cattle breeder	06	01	C2 C4 C6
Food sector	06	01	C4 C7 C8
Shoe industry	03	01	C1
Student	15	04	C8 C2 C4 C7 C2 C3
Other activities and not disclosed	15	01	C9
TOTAL	147	46	

locations, like genital/groin area, and generalized, covering 2,5% of the total (Table 2).

In terms of the sensitization index of the tested substances, the main sensitizers were BHT and triethanolamine (19,18% each), ammonium thioglycolate (17,81%), sorbic acid (12,33%), tonsilamida (10,95%), germall (8,22%). The remaining elements tested had index equal to or lower than 5% (Table 3).

When we compare the result amongst the 10 substances with the proportion of positive and negative cases of the test, we observe that a higher proportion of positive cases happened in C4 - triethanolamine (9,52%) and the lowest in C10 - chlorhexidine (0,00%) (Table 4). The comparisons that were statistically significant were the ones among C2, C4 and C8 substances compared to C10, which did not give a positive result in any of the patients tested ($p < 0,0001$).

DISCUSSION

The cosmetics are preparations composed of natural or synthetic substances that can be grouped in four categories: hygiene products, cosmetics, perfume and infant use products. These preparations are for external use on the various areas of the human body.⁷ In this study, a higher frequency of contact dermatitis to the components of the cosmetics' battery was observed in women and the age most affected was concordant with the age group of the highest professional activity of the population. The hand was the most affected place (Table 2), comparable with studies that show higher frequency in hands of women who work in most environments.^{8,9}

Working in a moist environment facilitated the presence of occupational contact dermatitis (OCD) in 27,9% of our studied patients (home activities, hairdresser and cleaning), which is in accordance with

TABLE 2: Distribution of the 46 individuals with contact dermatitis who had some professional activity, according to the location of the dermatosis

LOCATION	Number	%
Head and neck	16	20
Upper limbs	13	16,25
Hands	20	25
Lower limbs	5	6,25
Feet	11	13,75
Trunk	2	2,5
Abdome	8	10,0
Armpit	3	3,75
Genital/groin	1	1,25
Generalized	1	1,25
Total	80	

Some patients presented with more than one location

other publications.^{10,11} Besides, numerous studies report the irritant contact dermatitis (ICD) on the hands as the most frequent form of OCD, with high prevalence in the cleaning sector workers, due to the exposure to irritating agents.^{12,13,14}

CAD resulting from cosmetics many times presents a diagnostic challenge, due to the use of different topical agents by the same patient. The incidence of this dermatosis varies according to the population, as it depends on the behavior as well as on the variation of the products over the years. In our study the main sensitizers were: triethanolamine, BHT and ammonium thioglycolate, followed by sorbic acid and tonsilamida resin (Tables 3 and 4).

The patients who had a reaction to the BT and triethanolamine did not show any important difference in terms of sex; however, men were on average older (58,6 and 49,4) when compared to female groups (Table 3). This is probably due to the fact that the sample assessed had a great number of patients with long standing dermatosis.

Triethanolamine, which proportion of positive tests was 9,52 % of the cases, is an organic base of the tralomine group, used in the cosmetic industry in the formulation of oil-in-water emulsions, as well as in medicines, especially in ear drops to remove the cerumen. As it is alkaline it causes irritation on the skin and mucosa, and it can also trigger CAD.

BHT (butylated hydroxytoluene) was responsible for 8,84 % of the positive responses to the test.

TABLE 3: Distribution of the substances with positive tests on the 46 patients, according to sex and average age

Positive substance	%	Sex		Average age	
		M	F	M	F
Germall	6%	2	4	50,5	59
BHT	14%	5	9	58,6	38,5
Tosilamide Resin	8%	-	8	-	40,12
Triethanolamine	14%	7	7	49,4	37,85
Bronopol	4%	2	2	45,5	36
Chloroacetamide	4%	1	3	35	34,33
Sorbic acid	9%	7	2	58,57	37,5
Ammonium thioglycolate	13%	11	2	43,6	39,5
Amerchol	1%	-	1	-	65
Chlorhexidine	0%	-	-	-	-
TOTAL	35	38			

M masculine; F feminine; some of the patients presented with positivity to more than one substance.

Table 4: Proportion of positive and negative cases to each substance

Substance	Negative (%)	Positive (%)
C1	95,92	4,08
C2	91,16	8,84
C3	94,56	5,44
C4	90,48	9,52
C5	97,28	2,72
C6	97,28	2,72
C7	93,88	6,12
C8	91,16	8,84
C9	99,32	0,68
C10	100,00	0,00

This preservative with anti-oxidative characteristics of oils and fats is widely used in cosmetics, food and medicines.

Despite having limited information in regards to the relevance of the sensitization of the patients to these two substances, important information is the history of frequent use of topical products on the skin, for a long time.

On the group of patients with positivity to ammonium thioglycolate, (8,84%), a higher frequency of contact dermatitis was observed in men (11 of the 13 cases). The highest frequency of this positivity in males is considered controversial, particularly when we consider their occupation: (05) building industry, (02) mechanic/metallurgic and (01) carpenter (Table 1). In various published works this positivity is associated with the hairdressing occupation, a result we did not find. This can be explained by the fact that the allergen used to detect ACD to perms in hairdressers is the glyceryl thioglycolate.^{15,16}

The ammonium thioglycolate is a hair straightener which acts by breaking the disulphide links that unite the cistine units, and for this reason it is used in

the anti-shrinking treatment of wool and fabrics. It is possible that it is present in automotive materials, since they undergo washings to remove chemical products.

There are no reports of other applications for the ammonium thioglycolate besides that in hair perm products. References about the use of the product on the building industry and automotive mechanics were not found either, but due to the diversity of products used in automotive maintenance, it is possible that it is used in some of them. It is worth highlighting that this chemical is not a good marker for allergic dermatitis and the contact reaction observed on the present study could have been irritating.

In relation to the remaining sensitizers, we observed that both women and men had contact with substances that can be present in cosmetics, but two substances did not sensitize the male group studied: tosilamide and amerchol.

Amerchol is a marker for contact dermatitis by lanoline and its derivatives, and it is widely used in the cosmetic industry and in some medicaments. On the other hand, the *toluenesulfonamide formaldehyde resin used as a plastifying agent of the nitrocellulose* is the main substance responsible for allergic contact dermatitis by nail polishers. In our study this sensitization reflects more the habit of women to have their nails painted, more than to professional use.

CONCLUSION

We evidenced that, from the cosmetics evaluated, the triethanolamine and the BHT had the highest frequencies of positivity, followed by the ammonium thioglycolate, which demonstrates small association with occupational contact dermatitis. Furthermore, we can infer that the epicutaneous test from the cosmetics battery can be an important tool to facilitate the diagnosis of hypersensitivity to these products. However, we suggest that more studies are conducted in order to observe the variations responsible for allergic contact dermatitis to cosmetics. □

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How to cite this article: Silva EA, Bosco MRM, Mozer E. Study of the frequency of allergens in cosmetics' components in patients with suspected allergic contact dermatitis. *An Bras Dermatol.* 2012;87(2):263-8.