

Contact sensitization to cosmetic series of allergens in a general population in Beijing

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Summary

Cosmetic allergic contact dermatitis (CACD) due to common cosmetic allergens in standard series has been extensively studied; however, the prevalence of contact allergy to other cosmetic allergens other than those in standard series is largely unknown. In this study, the frequency of contact sensitization to a European cosmetic series of allergens (Chemotechnique Diagnostics, Vellinge, Sweden) in healthy university student volunteers were detected in Beijing. Of 201 students studied, fifty-eight exhibited positive results, and 9 of them reported had cosmetics related dermatitis previously. The total positivity rate was not correlated to gender. The leading allergens were thimerosal (19.4%), shellac (3.0%), cocamidopropyl betaine (2.0%), hexamethylenetetramine (1.5%), dodecyl gallate (1.5%), hexahydro-1,3,5-tris-(2-hydroxyethyl) triazine (1.0%) and methyldibromo glutaronitrile (1.0%). The positivity rate of thimerosal patch test in men (9.8%) was lower than that of women (23.6%, $P < 0.05$, Chi square test), but no difference could be found between the prevalence of other cosmetic allergens in men and women ($P > 0.05$, Chi square test). These results suggested that some cosmetic-related contact allergies may be missed by just testing patients with the European standard series or T.R.U.E. test system only, we recommend shellac, cocamidopropyl betaine, hexamethylenetetramine and dodecyl gallate as the additionally candidates for patch testing in patients with suspected CACD.

Keywords: cosmetics, contact allergy, patch test, epidemiology, prevalence

Introduction

Cosmetic allergic contact dermatitis (CACD) due to common cosmetic allergens in standard series has been extensively studied. The prevalence of contact allergy to other cosmetic allergens other than those in standard series is largely unknown. Recent studies from Western countries had shown that some cosmetic allergens other than those of standard allergens should be also tested in patients with suspected CACD.^{1,2} Cosmetics

consumption in China increased rapidly in recent years. The prevalence of contact sensitization to cosmetic series of allergens in China has not been reported. It has been found that the prevalence of contact allergy in volunteers is parallel to that in patients with eczema and we may extrapolate frequency from a general population to an eczema group.^{3,4} In this study, we determined the frequency of contact sensitization to cosmetic series of allergens in volunteers in Beijing.

Subjects and methods

Healthy university students were recruited by sending message through education department stating that volunteers are needed to test for the frequency of

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Table 1 Comparison of the prevalence of contact sensitization to cosmetic series of allergens in volunteers in Beijing and those reported^{1,2}

Allergens, Concentration(% w/w)	Volunteers (n = 201)			Results from Turkey	Results from America
	M (n = 61)	F (n = 140)	Total		
Thimerosal (Merthiolate), 0.1 pet	9.8**	23.6	19.4	3.2*	13.6
Shellac, 20.0 alc	3.3	2.9	3.0	NT	NT
Cocamidopropyl betaine, 1.0 aq	1.6	2.1	2.0	1.1	3.4
Hexamethylenetetramine, 2.0 pet	1.6	1.4	1.5	1.1	2.1
Dodecyl gallate, 0.25 pet	3.3	0.7	1.5	1.1	9.2*
Hexahydro-1,3,5-tris-(2-hydroxyethyl)triazine, 1.0 aq	1.6	0.7	1.0	1.1	4.6*
Methyldibromo glutaronitrile, 0.5 pet	1.6	0.7	1.0	3.2	5.7* †
Polyoxyethylene sorbitan monooleate, 5.0 pet	0	0.7	0.5	0	0.5
Imidazolidinyl urea, 2.0 pet	0	0.7	0.5	1.1	2.3
Paraben mix, 16.0 pet	0	0.7	0.5	NT	1.0
Hydroabietyl alcohol, 10.0 pet	0	0.7	0.5	NT	2.2
Phenyl salicylate, 1.0 pet	1.6	0	0.5	0	1.0
Sorbitan sesquioleate, 20.0 pet	0	0.7	0.5	0	0.9
Benzyl salicylate, 10.0 pet	1.6	0	0.5	0	0.7
Sodium-2-pyridinethiol-1-oxide (Sodium omadine), 0.1 aq	0	0	0.5	1.1	0.9
Methylisothiazolinone methylchlorisothiazolinone, 0.02 aq	1.6	0	0.5	NT	4.3* †
tert-Butylhydroquinone, 1.0 pet	0	0.7	0.5	0	2.3
1-(3-Chloroallyl)-3,5,7-triaza-1-azoniaadamantane chloride (Quaternium 15), 1.0 pet	1.6	0	0.5	NT	5.7* †
2,5-Diazolidinyl urea, 2.0 pet	1.6	0	0.5	1.1	NT
Iodopropynyl butylcarbamate, 0.2 pet	0	0.7	0.5	0	0.7
3-(Dimethylamino) propylamine, 1.0 aq	0	0.7	0.5	1.1	7.4*
Lauryl polyglucose, 3.0 pet	1.6	0	0.5	NT	NT
Methylisothiazolinone, 0.2 aq	1.6	0	0.5	NT	NT
Isopropyl myristate, 20.0 pet	0	0	0	2.2	0.4
Amerchol L 101, 50.0 pet	0	0	0	0	2.8*
Triethanolamine, 2.0 pet	0	0	0	0	0.6
Sorbitan monooleate, 5.1 pet	0	0	0	1.1	0.7†
2-tert-Butyl-4-methoxyphenol (BHA), 2.0 pet	0	0	0	0	0.6
2,6-Di-tert-butyl-4-cresol, 2.0 pet	0	0	0	0	0.4
Octyl gallate, 0.25 pet	0	0	0	0	16.0 †
Triclosan, 2.0 pet	0	0	0	1.1	0.6
Sorbic acid, 2.0 pet	0	0	0	0	0.9
4-Chloro-3-cresol, 1.0 pet	0	0	0	0	1.0
4-Chloro-3,5-xyleneol, 0.5 pet	0	0	0	0	0.7 †
Chlorhexidine digluconate, 0.5 aq	0	0	0	0	1.0
Phenyl mercuric acetate, 0.01 aq	0	0	0	0	NT
2-Chloroacetamide, 0.2 pet	0	0	0	0	0.2
Clioquinol, 5.0 pet	0	0	0	0	0.6
Ethylenediamine dihydrochloride, 1.0 pet	0	0	0	0	3.7*
Benzophenone-3, 10.0 pet	0	0	0	NT	NT
Propylene glycol, 5.0 pet	0	0	0	0	1.0†
Stearyl alcohol, 30.0 pet	0	0	0	0	0.6
Cetyl alcohol, 5.0 pet	0	0	0	0	0.1
2-Bromo-2-nitropropane-1,3-diol, 0.25 pet	0	0	0	0	2.8†
Benzyl alcohol, 1.0 pet	0	0	0	1.1	0.3
Drometrizole, 1.0 pet	0	0	0	NT	NT
Propyl gallate, 1.0 pet	0	0	0	0	0.7
2-Phenoxyethanol, 1.0 pet	0	0	0	0	5.7*
tocopherol, 100	0	0	0	NT	1.3
DMDM hydantoin, 2.0 aq	0	0	0	0	1.5
Tea tree oil, 5.0 pet	0	0	0	0	2.1
Peppermint Oil, 2.0 pet	0	0	0	NT	1.0
Tocopheryl acetate, 10.0 pet	0	0	0	NT	NT

(continued)

Table 1 (continued)

Allergens, Concentration(% w/w)	Volunteers(<i>n</i> = 201)			Results from Turkey	Results from America
	M (<i>n</i> = 61)	F (<i>n</i> = 140)	Total		
Turpentine oil oxidized, 0.4 pet	0	0	0	NT	NT
Musk mix, 3.0 pet	0	0	0	NT	0.3
Oleamidopropyl dimethylamine, 0.1 aq	0	0	0	NT	7.9*

M, male; F, female; Aq, water; pet, petrolatum; alc, alcohol; NT, not done.

* $P < 0.05$, compared with our total prevalence, chi-square test; ** $P < 0.05$, compared with the positivity rate of thimerosal patch test in female, chi-square test; $P > 0.05$ for all others.

†The test concentration they used is higher than ours.

allergic reactions to common environmental allergens from November 30, 2011 to December 30, 2011. Exclusion criteria included severe skin conditions, immunosuppressant treatment, or the use of corticosteroids within 4 weeks. A knowledge or suspicion of an existing allergy was neither an inclusion nor an exclusion criterion. All participants were Chinese Han ethnics. Local ethic committee approved this study and oral consent was obtained. Volunteers were patch tested with cosmetic series of allergens and IQ Chamber (Chemotechnique Diagnostics, Vellinge, Sweden, Table 1). The cosmetic series of allergens include 46 allergens. Of those, paraben mix, Cl+Me-isothiazolinone (kathon CG, methylisothiazolinone, methylchloroisothiazolinone), quaternium-15, thimerosal, diazolidinyl urea, and imidazolidinyl urea are also included in T.R.U.E. test system, and, quaternium-15 and Cl+Me-isothiazolinone (kathon CG, methylisothiazolinone, methylchloroisothiazolinone) can be also found in the European standard series. But, neither the European standard series nor T.R.U.E. test system contains the other remaining cosmetic allergens in this series, such as shellac, cocamidopropyl betaine, hexamethylenetetramine, and dodecyl gallate. Allergens were applied to the upper back, and the results were recorded at Day 2 and Day 4 according to International Contact Dermatitis Research Group (ICDRG) grading.⁵

Results

Fifty-eight of 201 volunteers studied [61 men, 140 women; mean (SD) age, 23.5 (2.0) years; range, 19–30 years] were test positive. The positivity rate of total cosmetic patch test in men (14/61, 23.0%) is similar to that of women (44/140, 31.4%, $P > 0.05$, chi-square test). The leading allergens were thimerosal (19.4%), shellac (3.0%), cocamidopropyl betaine (2.0%), hexamethylenetetramine (1.5%), dodecyl gallate (1.5%), hexahydro-1,3,5-tris-(2-hydroxyethyl)triazine (1.0%), and methyl dibromo glutaronitrile (1.0%) (Table 1).

The positivity rate of thimerosal patch test in men (6/61, 9.8%) is lower than that of women (33/140, 23.6%, $P < 0.05$, chi-square test, Table 1), but no difference could be found between the prevalence of other cosmetic allergens in men and women ($P > 0.05$, chi-square test, Table 1). A comparison of our test prevalence results with those reported worldwide is given in Table 1. Of the 58 volunteers with positive reactions, nine reported had cosmetic-related dermatitis previously and was considered past relevant.

Discussion

This study showed that the positive rate of several additional cosmetic allergens in volunteers was over 1% (Table 1) and some of them had past relevance, so these allergens should be tested in patients with suspected CACD. Our results also showed that the common cosmetic allergens are different in different regions^{1,2} (Table 1). The positivity rates of some allergens in our hands were lower than those in America. It is reasonable because their data were from patients with suspected CACD, and they used a higher test concentration for some allergens (Table 1). The prevalence of contact sensitization to thimerosal in our group was much higher than that of Turkey, but was similar to that of America^{1,2} (Table 1). The reason for this difference is unclear, but more Chinese like to use skin-whitening products and traditional Chinese medicine, both products may contain thimerosal, which may contribute partly to that and should be studied further. In general, women use more cosmetic products than men, so may have a higher cosmetic patch test prevalence. But in our result, except thimerosal, no difference could be found between the prevalence of cosmetic allergens in men and women ($P > 0.05$, chi-square test, Table 1). The reason for this should be studied further.

Because many cosmetic allergens in our cosmetic series are not included in the European standard series

and T.R.U.E. test system, such as shellac, cocamidopropyl betaine, hexamethylenetetramine, and dodecyl gallate. Some important cosmetic-related contact allergies may be missed by just testing patients with the European standard series or T.R.U.E. test system only. Our study showed that the positivity rate of several additional cosmetic allergens in volunteers was over 1% (Table 1) and some of them had past relevance, so these allergens should be tested in patients with suspected CACD. Therefore, we recommend shellac, cocamidopropyl betaine, hexamethylenetetramine, and dodecyl gallate as the additional candidates for patch test the patients with suspected CACD.

Because the population in this study is self-selected, some volunteers with known contact allergy may more likely to participate and cause some bias on the positivity rate. However, because the main purpose of this study was to determine the leading additional cosmetic allergens in China for further study, this bias has little influence. The age range in our study is quite limited (19–30 years), and our results are not suitable to all age population.

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References

- 1 Ada S, Seckin D. Patch testing in allergic contact dermatitis: is it useful to perform the cosmetic series in addition to the European standard series? *J Eur Acad Dermatol Venereol* 2010; **24**: 1192–6.
- 2 Wetter DA, Yiannias JA, Prakash AV, *et al.* Results of patch testing to personal care product allergens in a standard series and a supplemental cosmetic series: an analysis of 945 patients from the Mayo Clinic Contact Dermatitis Group, 2000–2007. *J Am Acad Dermatol* 2010; **63**: 789–8.
- 3 Mirshahpanah P, Maibach HI. Relationship of patch test positivity in a general versus an eczema population. *Contact Dermatitis* 2007; **56**: 125–30.
- 4 Li L-F. Contact sensitization to European baseline series of allergens in university students in Beijing. *Contact Dermatitis* 2010; **62**: 371–2.
- 5 Wahlberg JE, Lindberg M. Patch testing. In: Frosch PJ, Menné T, Lepoitevin J-P eds. *Textbook of contact dermatitis*, 4th edn. Berlin: Springer, 2006: pp. 365–90.