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Original Research

European Standard Series Patch Test Results in Contact Dermatitis Patients in a Tertiary Care Hospital

Ersoy Acer, Hilal Kaya Erdogan, Tayfun Batan, Zeynep Nurhan Saracoglu

Department of Dermatology, Eskisehir Osmangazi University Faculty of Medicine, Eskisehir, Turkey

Abstract

Objectives: Sensitization of allergens varies among societies and also it is influenced by various factors, such as age and gender. It may even change over the years. In this study, we aimed to evaluate the patch test results in patients with contact dermatitis (CD) in our center.

Methods: European standard series patch test results of patients with CD between 2017 and 2018 were evaluated retrospectively.

Results: Of the 135 patients, 65 (48.1%) were males, 70 (51.9%) were females. The mean age of patients was 41.43±14.26 (11-78) years. In 78 (57.8%) patients, a positive reaction against at least one allergen was detected. The most common allergens were nickel sulfate (27.4%), potassium dichromate (14.8%), cobalt chloride (11.9%), textile dye mix (8.1%), fragrance mix i, ii (6.7%) and balsam of Peru (4.4%). The sensitization of nickel sulfate was higher in females and sensitization of cobalt chloride and potassium dichromate in males (p=0.03, 0.05, 0.03, respectively). In the multivariate logistic regression analysis, age was independently related to a positive reaction against at least one allergen.

Conclusion: Nickel sulfate, potassium dichromate, cobalt chloride and textile dye mix were the most common allergens. Legal regulations should be made to decrease exposure to allergens.

Keywords: Contact dermatitis; European standard series; nickel sulfate; patch test; potassium dichromate; textile dye mix.

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Contact dermatitis is an inflammatory skin disease induced by external agents.[1] Two major types are irritant contact dermatitis (ICD) and allergic contact dermatitis (ACD).[2] The most common contact dermatitis is ICD and approximately 20% of all contact dermatitis are ACD.[3] ACD arises from type 4 hypersensitivity reaction to allergens. ACD occurs in vulnerable people who have been sensitized in the past[2]. Patch testing determines the responsible allergens that are used for the diagnosis of ACD.[4]

Of the most common allergens, nickel sulfate and cobalt chloride are frequently found in metal objects, potassium dichromate in cement and leather products, textile dye mix in textile products and balsam of Peru and fragrance mix in cosmetics.[5]

Contact sensitization is influenced by atopy, age, gender, personal risk factors, environmental exposure, genetic, geographical, occupational and socio-economic factors. It varies among societies and even also in different regions of the same country. On the other hand, the most common responsible allergens of ACD may even change over

Address for correspondence: Ersoy Acer, MD. Eskisehir Osmangazi Universitesi Tip Fakultesi, Dermatoloji Anabilim Dali, Eskisehir, Turkey
Phone: +90 506 714 75 74 **E-mail:** ersoyacer@hotmail.com

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the years.[4, 5] There are studies related to patch test results in different regions of our country in literature, but, to our knowledge, there is no data from our region. In our study, we aimed to evaluate patch test results of the European standard series (ESS) in patients with CD.

Methods

Results of ESS patch tests in135 patients with suspicion of ACD between 2017 and 2018 were evaluated retrospectively. The positive test results, age, gender, occupation of the patients, localization and duration of the disease were recorded. The local ethics committee approved the study protocol (Approval number: 2019/14).

ESS that contains 30 allergens (Chemotechnique Diagnostics, Malmo, Sweden) and the IQ-Chamber test material (Chemotechnique IQ Chamber®; Chemotechnique Diagnostics) were used in all patients. Patch tests were not performed in patients under the treatment of systemic corticosteroids or other immunosuppressives. These drugs were discontinued at least one month before the procedure. Topical corticosteroids at the test area were discontinued at least seven days before the procedure. Patch tests were applied to patients' back. Reactions were evaluated at the 48th, 72nd and 96th hours according to criteria of International Contact Dermatitis Research Group (ICDRG) (Only faint erythema; doubtful reaction, erythema, infiltration, possibly papules; +, erythema, infiltration, papules, vesicles; ++, intense erythema, infiltrate, coalescing vesicles; +++, various morghologies, such as soap effect, bulla, necrosis; irritan reaction). At least 1+ reaction was accepted as positive patch test reaction.[6]

Statistical Analysis

IBM SPSS Statistics 21.0 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.) software was used for the data analyses. Continuous data were presented as mean±standard deviation and median. Categorical data were presented in percentage (%). Pearson Chi-Square, ANOVA and multivariate logistic regression analysis were used. Age, gender, localization of dermatitis and duration of disease were included in multivariate logistic regression analysis. P≤0.05 value was accepted to be statistically significant.

Results

Of the 135 patients, 65 (48.1%) were males, 70 (51.9%) were females. The mean age of patients was 41.43±14.26 (11-78) years. The mean duration of the disease was 35.33±54.23 (1-240) months. The most common localization of dermatitis was hands (43.7%), trunk (27.4%), face (19.3%), feet (11.1%) and extremities (5.1%), respectively. Construction workers (16.4%), students-officials (14%) and blue-collar worker (10.4%) were the largest group of the patients.

In 78 (57.8%) of the 135 patients, a positive reaction against at least one allergen in patch test was detected. Thirty-five (25.9%) patients had positive reaction against at more one allergen. There were two positive allergens in 14 patients, three positive allergen in 14 patients, four positive allergen in five patients, five positive allergens in two patients.

The most frequent allergens with a positive reaction were nickel sulfate (27.4%), potassium dichromate (14.8%), cobalt chloride (11.9%), textile dye mix (8.1%), fragrance mix i and ii (6.67%), balsam of Peru (4.4%), P-phenylenediamine (4.4%), thiuram mix (4.4%), methylisothiazolinone (4.4%), methyldibromoglutaronitrile (MDBGN) (4.4%), N isopropyl-N-phenyl-4-phenylenediamine (3.7%), 4-tert Butylphenoformaldehyde resin (2.2%), benzocaine (1.5%), Cl+Me-isothiazolinone (1.5%), neomisin sulfate (1.5%), colophony (1.5%), lanolin alcahol (0.7%), mercapto mix (0.7%), sesquiterpene lactone mix (0.7%), clioquinol (0.7%), epoxy resin (0.7%) and lyral (0.7%), respectively. On the other hand, paraben mix, mercaptobenzothiazole, formaldehyde, quaternium 15, primin, budesonide and tixocortol-21-pivalate were not positive in any patients.

There was no significant difference in a positive reaction against at least one allergen according to gender, localization of the lesions, occupation of patients and duration of the disease (p>0.05). In the multivariate logistic regression analysis, age was independently related to a positive reaction against at least one allergen (Table 1).

Potassium dichromate was the most common allergen in construction workers. Nickel sulfate was the most common allergen in all other occupations. In addition, the most common positive allergen was nickel sulfate in all localization of dermatitis.

The most common allergens were nickel sulfate, potassium dichromate, cobalt chloride, balsam of Peru and textile dye mix in females, whereas nickel sulfate, potassium dichromate, cobalt chloride, textile dye mix and methylisothiazolinone in males, respectively. There was significantly higher nickel sulfate sensitization in females and higher cobalt chloride and potassium dichromate sensitizations in males (p=0.03, 0.05, 0.03, respectively). Sensitization to potassium dichromate and cobalt chloride were more common in patients who were ≤39 years of age and sensitization to other allergens was more common in patients who were ≥40 years of age, but the difference was not statistically significant (p>0.05).

Table 1. Odds of a positive reaction against at least one allergen according to multivariable logistic regression analysis

	β	S.E.	Test Statistics	p	OR	95% C.I. for OR	
						Lower	Upper
First Step							
Age	0.047	0.019	5.998	0.014	1.048	1.009	1.088
Gender	0.608	0.495	1.506	0.220	1.836	0.696	4.844
Localization of dermatitis							
Feet			6.393	0.172			
Extremities	23.442	25874.603	0.000	0.999	15164110041.684	0.000	
Hands	2.646	1.313	4.060	0.044	14.104	1.075	185.086
Trunk	1.689	1.271	1.765	0.184	5.415	0.448	65.433
Face	1.312	1.284	1.044	0.307	3.715	0.300	46.025
Duration of disease	-0.005	0.004	1.468	0.226	0.995	0.987	1.003
Constant	-3.596	1.571	5.242	0.022	0.027		
Last Step							
Age	0.034	0.017	3.968	0.046	1.035	1.001	1.070
Constant	-1.053	0.713	2.179	0.140	0.349		

Discussion

ACD is a type iv hypersensitivity reaction to allergens.[1] The history and dermatological examination of ACD patients may help to determine the possible allergens. Patch testing is the standard method used to investigate the contact allergy. The ESS is initially recommended to identify common responsible allergens by most clinicians.[6] Some countries have constituted self standard series, but there is not a specific standard series of our country. ESS is usually used in Turkey.

In a study conducted in 11 European countries, a positive reaction to at least one allergen of ESS in ACD patients was reported as 44% (from 24.6% to 60.2%).[7] In the literature, different results ranging from 43.5% to 63.5% in different countries and from 30.4% to 55.0% in Turkey have also been reported (Table 2, 3).[8-17] In our study, 57.8% of the patients had a positive reaction to at least one allergen. It was more than other previous studies from Turkey;[12-16] however, it was similar to a study from Turkey in 2016.[17] According to these results, the sensitization of allergens seems to increase in our country.

In our study, the most common allergens were nickel sulfate (27.4%), potassium dichromate (14.8%), cobalt chloride (11.9%) and textile dye mix (8.1%). These results were consistent with literature in both Turkey and other countries (Table 2, 3).[8-17] On the other hand, there were not any positive reactions to paraben mix, mercaptobenzothiazole, formaldehyde, quaternium 15, primin, budesonide, and tixocortol-21-pivalate in our study. Similar results were reported before in our country.[13, 18, 19] Exposure to these allergens may be minimal in Turkey.

Lam et al.[9] reported higher positive patch test results in patients above aged 40 years than under aged 40 years. Age was independently related to a positive reaction against at least one allergen in our study. The odds of a positive reaction against at least one allergen increased with age. Akyol et al.[14] reported that sensitization of potassium dichromate, balsam of Peru, fragrance mix were significantly more in patients above aged 40 years and sensitization of

Table 2. The most common allergens (%) in our study and different countries

Allergens	Our study	Europea[7]	Chekia[8]	Hong Kong[9]	Israel[10]	Ethiopia[11]
At least one positive allergen	57.8	24.6-60.2	63.5	54.7	43.5	52.7
Nickel sulfate hexahydrate	27.4	20.14	13.8	24.4	13.9	17.7
Potassium dichromate	14.8	4.46	3.95	4.3	3.8	6.4
Cobalt (ii) chloride hexahydrate	11.9	6.74	5.22	8.7	3.4	8.0
Textile dye mix	8.1	-	-	-	-	-
Fragrance mix i and ii	6.7	7.62	5.8	13.7	7.1	14.8
Balsam of Peru	4.4	6.08	7.3	5.7	3.6	1.9
P-phenylenediamine (PPD)	4.4	4.08	2.0	6.0	1.8	6.4

Table 3. The most common allergens (%) in our study and different regions of Turkey

Allergens	Eskişehir*	İstanbul[12]	İzmir[13]	Ankara[14]	Ankara[15]	Sivas[16]	Ankara[17]
At least one positive allergen	57.8	51.7	31.3	32.3	34.7	48.7	55
Nickel sulfate hexahydrate	27.4	19.1	12.2	17.6	17.3	27.3	19
Potassium dichromate	14.8	11.8	5.6	4.6	3.0	17.5	14.5
Cobalt (ii) chloride hexahydrate	11.9	8.5	7.1	5.3	7.2	19.8	13.0
Textile dye mix	8.1	-	-	-	-	-	-
Fragrance mix i and ii	6.7	5.5	1.9	2.1	2.9	-	9.4
Balsam of Peru	4.4	2.0	2.8	2.1	1.8	-	6.36
P-phenylenediamine (PPD)	4.4	3.7	1.5	1.8	2.6	-	0.6

*Our study.

nickel sulfate in under aged 40 years. Sensitization of all allergens except nickel sulfate and cobalt chloride was higher in patients older than 40 years of age in our study, but there was no statistically significant difference.

Nickel sulfate was the most common allergen in many studies from Turkey and other countries.[7-17] It was more common in females in our study, consistent with the literature.[8, 9, 20, 21] Using cheap jewellery, increasing ear and body piercing fashions in females may increase the sensitization with nickel sulfate.[8] In a recent study among the general population from five European countries, the lowest prevalence of nickel sensitization was reported in Sweden (8.3%), whereas the highest in Portugal (18.5%). The authors proposed that lower nickel sensitization in Sweden due to less nickel exposure as a result of early nickel legislation.[20] Nickel sulfate sensitization was more frequent in our study and previous studies from Turkey than other countries' results.[8-17] It may be due to the lack of adequate legal regulations of nickel in Turkey.

Potassium dichromate is one of the most frequent allergens; cement and leather products are sources of exposure. It was the most common allergen of construction workers, unlike the other occupations in our study. The reason may be exposure to cement. More frequent potassium dichromate sensitization in males was reported in studies consistent with our results.[8, 9, 20, 21] However, leather shoes may be an important source of potassium dichromate in females due to wearing shoes with naked feet.[20] Potassium dichromate sensitization was more frequent in our study and previous studies from Turkey than other countries' results.[8-17] To decrease the exposure of potassium dichromate, legal regulations are required.

Cobalt chloride is one of the most common allergens around the world. Resources of cobalt exposure are jewellery, metal products, prosthesis and paints. Cobalt was the third most common positive allergen in patch test results in our study. Similar to the results of other studies from Turkey, it was more common in male patients. Sensitization of cobalt was more common in female patients in our study than the result of other countries.[8, 9, 12, 14, 20, 21] High prevalence in males in Turkey can be explained by high industrial exposure of cobalt chloride to males and high prevalence in females may be associated with cheap jewellery.

Textile dye mix consists of eight disperse dyes. They are used for colouring in the textile industry and are common sensitizers. In a multicenter study, frequency of textile dye mix sensitization varied from 2.1% to 6.9% (mean 3.7%).[22, 23] It was 8.1% in our study. This result showed that the exposure of disperse dyes was high in Turkey. Textile dye mix has been included in ESS in recent years. There was not another data related to textile dye mix from our country. Concomitant reactions to p-phenylenediamine and textile dye mix might occur. In a previous study, concomitant reactions to these allergens were in 11.9% of the patients, and it was reported that p-phenylenediamine is a poor marker of textile dye allergy.[24] In our study, five patients had a sensitivity of p-phenylenediamine, 11 patients had a sensitivity of the textile dye mix. Concomitant positive reactions to p-phenylenediamine and textile dye mix were in three patients.

Cosmetics, household products and topical preparations often include balsam of Peru and fragrance mix, which are markers of perfume or fragrance allergy.[8, 9] The sensitization of balsam of Peru and the fragrance mix was less common in our study than the results of other countries.[7-11] Sensitization of these allergens was more common than the results of previous studies from Turkey.[12-16] They were more common in a recent study from Turkey, similar to our results, too.[17] Exposure to balsam of Peru and fragrance mix increases in our country. This may be due to the increased use of products, such as cosmetics in Turkey, in recent years. It was reported that the sensitization of these allergens increased in both genders and was more common in females.[8, 17, 21] However, there was no statistically significant difference between genders in our study.

Study Limitations

Limitations of this study were retrospective single-center study design and relatively small sample size.

Conclusion

Nickel sulfate, potassium dichromate and cobalt chloride were the most frequent allergens in our study. Textile dye mix, which has been included in ESS recently and also has been one of the most common allergens. In addition, the sensitization of allergens, especially the fragrance mix and balsam of Peru, seems to increase in our country. Legal regulations should be made to decrease exposure to these allergens to prevent the risk of sensitization and the development of ACD.

Disclosures

Ethics Committee Approval: Eskişehir Osmangazi University Faculty of Medicine Ethics Committee, decision no: 2019/14.

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Conflict of Interest: None declared.

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