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Analysis of Hand, Face, and Body Contact Dermatitis in Children with Chemical Patch Tests

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Abstract:

Objective: *Allergic contact dermatitis is a late-type (type IV) hypersensitivity reaction that occurs after repeated exposure to previously sensitized substances. There are 3700 chemicals reported that can cause this condition. There are publications in the literature indicating that the hands and face are the most frequently involved body parts in contact dermatitis in adults. However, since there is insufficient data on which region is more frequently involved in children and allergen examination according to the involved areas, this study was aimed to be conducted.*

Materials and Methods: *In our study, 102 patients who applied to our outpatient clinic between January 2019 and June 2021 with a diagnosis of contact dermatitis and underwent a chemical patch test were included and retrospectively analyzed.*

Findings: *Of the 102 patients included in the study, 43 were female (42.2%), and 59 were male (57.8%). The ages of the patients ranged from 4-18 years, with a mean age of 9.45±3.92 years. When the body parts with contact dermatitis were scrutinized, 33 (32.4%) had hand involvement, 7 (6.9%) had hand and arm involvement together, and 2 (2%) had hand and face involvement together. Facial involvement was present in 19 patients (18.6%), and 5 patients (4.9%) had involvement of the body and face together. Body involvement was identified in 36 patients (35.3%).*

Result: *When Myroxylon Pereiare Resin and Formaldehyde sensitizers were evaluated according to lesion localization, the difference between them was statistically significant ($p<0.05$). Myroxylon Pereiare Resin was identified positive in 8 of the patients with body contact dermatitis. Formaldehyde sensitization was observed in 5 of 19 patients with facial involvement. There was no significant difference between lesion localization and positivity rates in other chemical parameters.*

Key Words: *Allergic contact dermatitis, Patch test, Myroxylon Pereiare Resin, Formaldehyde*

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Introduction

Contact dermatitis is an inflammatory condition caused by direct contact with a specific chemical [1]. Irritant contact dermatitis is a non-specific inflammatory cutaneous reaction to an irritant substance. Allergic contact dermatitis (ACD), on the other hand, is a late-type (type IV) hypersensitivity reaction that occurs after re-exposure to previously encountered substances to which sensitization has developed [2]. While it may cause symptoms such as erythema, edema, vesicle, and intense pruritus in acute stages, hyperkeratosis, desquamation and lichenification may develop when it becomes chronic [3]. Metals, cosmetics, fragrances, preservatives, textiles, rubber, resins, plants, topical treatments, and many other allergens can cause contact dermatitis. The most common causative substances vary according to the frequency of use of allergens and geographical regions [4]. 3700 chemical substances that may cause ACD have been reported [5].

The diagnostic criteria for Allergic Contact Dermatitis are patient history (presence of substance contact), physical examination (allergic lesions) and skin patch test. Patch testing is the most important method used to confirm the diagnosis in patients. The positivity of the test may vary according to age, gender, presence of atopy, the series used and the characteristics of countries and regions [6]. In 2018, a study published in Europe reported that allergic contact dermatitis affects 27% of the general population [7].

The increase in the number of published studies on patch test results in children and adolescents has contributed to the vast body of knowledge on the subject, demonstrating that contact sensitization and allergic contact dermatitis are not uncommon in childhood or adolescence [8].

Aim: There are publications in the literature indicating that the hands and face are the most frequently involved body parts in contact dermatitis in adults. However, since there is insufficient data on which region is more frequently involved in children and allergen examination according to the involved areas, this study was aimed to be conducted.

Materials and Methods

Between January 2019 and June 2021, 102 patients admitted to our outpatient clinic with a diagnosis of contact dermatitis who underwent chemical patch testing were retrospectively analyzed. Age, gender, lesion localizations, results of chemical patch tests, eosinophil count, percentage, and total IgE levels were recorded in patients whose laboratory tests were obtained on admission.

All patients underwent patch testing with chemotechnique MB© standard series. It was taken into consideration that the patients did not have active lesions at the time of patch test application

and had not used topical corticosteroids and immunosuppressive drugs in the last week before the test. Allergens were attached to the upper back of the patients using IQ Chambers© (Chemotechnique Diagnostics, Sweden). The tests were evaluated after opening after 48 hours and waiting for 30 minutes. Tests were evaluated for the second time at 96 hours and for the third time on day 7. The evaluation was performed according to the criteria determined by the International Contact Dermatitis Research Group [9].

Statistical Analysis

Data analysis was performed with IBM SPSS 21 package program. Summary values for qualitative variables were given as frequency and percentage, and for quantitative variables as mean ± standard deviation and median (Q1-Q3). The relationship between patch test results and other qualitative variables was evaluated by chi-square analysis (Pearson, Yates, Fisher Exact). The conformity of quantitative variables to normal distribution was evaluated by the Shapiro Wilk test. Comparison of non-normally distributed blood parameters according to lesion localization regions was performed by the Kruskal Wallis test. Cases with a $p<0.05$ analysis result were considered significant.

Result

Of the 102 patients included in the study, 43 were female (42.2%) and 59 were male (57.8%). The ages of the patients ranged from 4-18 years, with a mean age of 9.45±3.92 years. Some patients had contact dermatitis on more than one body part.

When the body parts with contact dermatitis were scrutinized, 33 (32.4%) had hand involvement, 7 (6.9%) had hand and arm involvement together, and 2 (2%) had hand and face involvement together. Facial involvement was present in 19 patients (18.6%), and 5 patients (4.9%) had involvement of the body and face together. Body involvement was detected in 36 patients (35.3%) (Table 1).

Table 1. Distribution of patients according to lesion localizations

Lesion localizations	Number of patients (%)
Hand	33 (%32,4)
Face	19 (%18,6)
Body	36 (%35,3)
Hand+ Face	2 (%1,96)
Hand+ Arm	7 (%6,9)
Body+ Face	5 (%4,9)
Total	102 (%100)

When the patients who showed positive reactions in the patch test results were separated according to gender, the number of sensitization in male and female patients was twenty to ten for Potassium Dichromate, ten to two for Myroxylon Pereiare Resin, and eighteen to seven for Fragrance Mix. However, since the number of patients was not sufficient, there was no statistically significant difference between genders in terms of allergens with positive reactions (P>0.05) (Table 2).

Table 2: Distribution of patients with positive skin patch test results by gender

Allergen	Male (%)	Female (%)	P
Potassıum Dichromate	17 (%28,8)	13 (%30,2)	1,00
Phenylenediamine Base	5 (%8,5)	2 (%4,7)	0,69
Neomycin Sulfate	14 (%23,7)	13 (%30,2)	0,61
Cobalt(2) Chlorıde Nexahydrate	22 (%37,3)	22 (%51,2)	0,23
Benzocaine	3 (%5,1)	2 (%4,7)	1,00
Nickelsulfate Hexahydrate	14 (%23,7)	13 (%30,2)	0,61
Cliguinol	0	2 (%4,7)	0,17
Colophony	6 (%10,2)	2 (%4,7)	0,46
Paraben Mix	20 (%33,9)	10 (%23,3)	0,34
N-Isopropyl-N-Phenyl-4-Phenylenediamine	7 (%11,9)	5 (%11,6)	1,00
Lanolin Alcohol	15 (%25,4)	7 (%16,3)	0,38
Epoxy Resin	6 (%10,2)	3 (%7,0)	0,73
Myroxylon Pereiare Resin	10 (%16,9)	2 (%4,7)	0,11
4-Tert Butylphenolformaldehyde Resin	2 (%3,4)	1 (%2,3)	1,00
Mercaptobenzothiazote	3 (%5,1)	5 (%11,6)	0,27
Formaldehyde	5 (%8,5)	5 (%11,6)	0,73
Fragrance Mix	18 (%30,5)	7 (%16,3)	0,15
Sesquiterpenelactone Mix.	2 (%3,4)	3 (%7,0)	0,64
Quaternium-15	3 (%5,1)	0	0,26
2-Mexhoxy-6-N-Pentyl-4-Benzoquinone(Primin)	4 (%6,8)	4 (%9,3)	0,71
Methylisothiazolinone+ Methychloroisothiazolinone	8 (%13,6)	8 (%18,6)	0,67
Budesonide	0	3 (%7,0)	0,07
Tixocortol-21-Pivalate (Mdbgn)	3 (%5,1)	2 (%4,7)	1,00
Methyldibromo Glutaronitrile	3 (%5,1)	3 (%7,0)	1,00
Fragfance Mixll	6 (%10,2)	3 (%7,0)	0,73
Methylisothiazolinone	9 (%15,3)	5 (%11,6)	0,81
Textile Dye MixLyral	6 (%10,2)	5 (%11,6)	1,00

In our study, 84 (82.3%) of 102 patients who underwent patch testing were positive for one or more of the allergens tested. Eight patients had a positive reaction to one allergen, while in 76 patients (74.5%) positivity to more than one allergen was detected. Most common allergens to which reactions were detected: Cobalt(2) Chloride Nexahydrate (43.1%), Potassium Dichromate (29.4%), Paraben Mix (29.4%), Neomycin Sulfate (26.5%), Nickel Sulfate (26.5%), Fragrance Mix (24.5%),

Lanolin (21.6%), Methylisothiazolinone+ Methychloroisothiazolinone (15.7%), Methylisothiazolinone (13.7%), Myroxylon Pereiare Resin (11.8%), Textile Dye MixLyral (10.8%). These parameters were also evaluated in patients whose IgE and hemogram tests were taken at the time of admission. The minimum, maximum and median values of eosinophil counts, eosinophil percentages, and IgE values were compared according to lesion localizations, and the difference between them was not statistically significant (P>0.05) (Table 3).

Table 3: Distribution of blood values according to lesion localizations

Blood Parameters	Hand	Face	Body	P
Ig E Mean(Min-Max)	140,94±187,39 69,5(26-227)	492,25±738,75 130,5(23-854,5)	97,36±110,8 63,5(21-116)	0,67
Eosinophil count Mean(Min-Max)	298,15±218,1 270(140-440)	252,5±208,42 155(90-460)	297,89±214,78 220(140-400)	0,73
Eosinophil Mean(Min-Max)	3,77±2,54 3(1,7-4,7)	3,55±2,39 2,7(1,6-6)	4,17±3,17 2,8(1,9-6,3)	0,93

Patients with hand, face, and body contact dermatitis were grouped and analyzed according to the allergens found positive (Table 4). While grouping, patients with body and face involvement together and patients with hand and face involvement together were excluded. Those with hand and arm involvement were analyzed in hand contact dermatitis. Allergens causing contact dermatitis on the hands, face, and body were compared according to the localizations of involvement and the p value was calculated. Myroxylon Pereiare Resin was positive in 8 patients with body contact dermatitis, 2 patients with hand contact dermatitis, and 1 patient with facial contact dermatitis, and the difference between these values was statistically significant (p=0.036936). A total of 10 patients with hand, face, and body contact dermatitis developed sensitization with Formaldehyde; 5 of these patients had facial contact dermatitis, and only one patient had body localized contact dermatitis, and the difference between the results was statistically significant (p=0.021625). There was no significant difference between lesion localization and positivity rates in other chemical parameters.

Table 4: Distribution of patch test results according to lesion localization

Allergen	Hand	Face	Body	P
Potassıum Dichromate	11	4	11	0,75
Phenylenediamine Base	2	1	2	1,00
Neomycin Sulfate	10	3	12	0,36
Cobalt(2) Chlorıde Nexahydrate	19	6	16	0,50
Benzocaine	2	0	2	0,68
Nickelsulfate Hexahydrate	10	3	10	0,60
Cliguinol	1	1	0	0,67
Colophony	5	0	3	0,28
Paraben Mix	11	9	8	0,14
N-Isopropyl-N-Phenyl-4-Phenylenediamine	3	1	7	0,16
Lanolin Alcohol	8	3	8	0,85
Epoxy Resin	3	3	3	0,59
Myroxylon Pereiare Resin	2	1	8	***0,03***
4-Tert Butylphenolformaldehyde Resin	0	0	2	0,17
Mercaptobenzothiazote	2	2	4	0,62
Formaldehyde	4	5	1	***0,02***
Fragrance Mix	10	5	8	0,93
Sesquiterpenelactone Mix.	1	1	3	0,72
Quaternium-15	0	1	1	0,50
2-Mexhoxy-6-N-Pentyl-4-Benzoquinone(Primin)	4	2	2	0,79
Methylisothiazolinone+ Methychloroisothiazolinone	6	2	7	0,67
Budesonide	1	1	0	0,68
Tixocortol-21-Pivalate (Mdbgn)	1	1	3	0,72
Methyldibromo Glutaronitrile	4	0	2	0,36
Fragfance Mixll	2	2	4	0,62
Methylisothiazolinone	6	2	5	0,93
Textile Dye MixLyral	6	3	1	0,13
Gold sodıum thiosulfate	2	0	0	0,35
Wool alcohols	1	0	0	1,00

Discussion

Although a detailed history is the first step in diagnosing allergic contact dermatitis, patch testing is the most valuable method that allows us to confirm the diagnosis and identify the allergen. Although this test is more than 100 years old, it is still a diagnostic approach that provides a high degree of standardization and was developed by Jadassohn in 1895 [10,11].

Studies evaluating the prevalence of ACD in children have reported patch test positivity rates between 14.5-70.7% [12,13]. In studies conducted in our country, the frequency of positive reactions in patch tests was reported to vary between 31.3% and 73.75% (14). In our study, 84 (82.3%) of 102 patients who underwent patch testing were positive for one or more of the allergens tested.

In a study conducted by Seidenari S et al. in children between the ages of 7 months and 12 years, it was reported that the highest sensitivity was found under the age of three[14]. Wöhrl S. et al. reported that the overall sensitivity rate decreased continuously, being highest in children younger than 10 years (62%) and lowest in patients older than 70 years (34.9%) [15]. There is no consensus among different studies on the effect of age on the incidence of ACD in children, but in the study by (Alt+1) Hammonds LM et al. [16], it was shown that in younger children (<10 years), males were more likely to have a positive patch test. We think that sensitization may develop earlier in children with the increasing use of chemicals and the increasing diversity in care products and that this is reflected in the positivity rates of our study.

In a study conducted in 2009, it was reported that there was no significant difference between different age groups (3-10, 11-15, 16-18 years), although there was a tendency to respond less positively with increasing age in males [17]. In our study, no statistically significant difference was found when the age distribution of patients with positive patch test was evaluated.

Of the 102 patients in our study, 43 were female (42.2%) and 59 were male (57.8%). There was no statistically significant difference between sexes regarding sensitization rate in patch tests. However, in an analysis published in 2015, which examined patients between 2002 and 2010 across Europe, it was reported that no difference was found between boys and girls in terms of susceptibility [18].

There are many publications in the literature on contact dermatitis and patch tests. The aim of our study was to determine whether the allergens reacted to differ according to body parts and which substances cause more sensitization. In a study conducted for this purpose and published in 2019, it was shown that contact dermatitis on the hands was more common, although the majority of patients were aged 40 and over and different results were obtained in different countries. In addition, when allergic contact dermatitis of the hands and feet were compared in this study, methylisothiazolinone was found to be a common contact allergen in patients with ACD of the hands and thiuram mixture was a common contact allergen in patients with ACD of the hands, while mercapto mixture and 2-mercaptobenzothiazole were common in patients with ACD of the feet. While Myroxylon pereirae, colophonium, lanolin alcohol, and paraben mixture were contact allergens frequently found in patients with leg ACD, positive patch test reactions to N- isopropyl- N' -phenyl- p-phenylenediamine were common in patients with head and upper extremity ACD, but not in patients with body and lower extremity ACD [19].

In our study, Myroxylon Pereiare Resin was found to have a statistically higher positive rate in patients with body ACD compared to hand and face contact dermatitis. Myroxylon Pereiare Resin is included in cosmetics, personal care products, and some topical formulations.

In addition, in our study, Formaldehyde was found to be statistically significantly higher in patients with facial ACD compared to other regions. Formaldehyde is generally found in cosmetic products, creams, shampoos and soaps [20].

In a study published by Tunca M. et al. in 2019, patch test results were examined and it was reported that the most common positive allergen was Nickel Sulfate with 18.3% [21]. However, the most frequently detected allergens in our study were Cobalt (2) Chloride Nexahydrate (43.1%), Potassium Dichromate (29.4%), Paraben Mix (29.4%).

Since our study was single centered and included only pediatric ACD cases, the number of patients and the number of sensitized allergens were limited. Therefore, although differences were found with some allergens according to the sites of involvement, statistically significant differences could not be obtained. Physicians and families in our society should be informed about ACD and patients should be referred to physicians and clinics specialized in contact dermatitis where patch tests can be performed. In addition, the allergens sensitized in ACD may vary according to geographical conditions, lifestyle and the variety of products used in daily life. Therefore, there is a need for multi-centered studies across Turkey. In our country, there is also insufficient data on allergens sensitized according to the areas of contact dermatitis involvement in children. For this purpose, studies with more patient participation should be carried out by grouping according to the regions where dermatitis is seen.

Conclusions

When the lesion location was investigated, the difference between the sensitized ones with Myroxylon Pereiare Resin and Formaldehyde was shown to be statistically significant (p0.05). Myroxylon Pereiare Resin was found to be positive in 8 of 36 people with body-only contact dermatitis. Sensitization developed in five of the 19 individuals who had formaldehyde in their faces. In addition, because allergies vary based on regional conditions and the drugs used, multicenter study across Turkey should be undertaken.

Acknowledgments

Potential for conflict of interest.

There are no conflicts of interest declared by the authors.

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