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Outcomes of the European baseline series patch test in the geriatric population

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Abstract
Background: Skin aging causes various immunological and structural changes and increases the risk of many skin diseases such as contact dermatitis.
Objective: Our aim was to share the allergen contact dermatitis sensitivities of the elderly population with the European baseline series (EBS) results.
Materials and methods: Patients aged 65 years and older who were patch tested with EBS in the immunology and allergy clinic between January 1, 2018, and March 1, 2025, were included in the study.
Results: The median age of the 62 patients included in the study was 69.5 years (25-75, 66.0-73.3 years); 54.8% of the patients were female; and 82.3% of the patients were under the age of 75. The rate of at least one positive patch test was 41.9%, and no positivity was observed in approximately half of the allergens included in the EBS. The rate of at least one positive test result was 37.3% in the 65-74 age group and 63.6% in the 75-84 age group (p = 0.177). The rate of at least one positive test result was 35.3% in women and 50% in men (p = 0.243). The most common allergen over the age of 65 was fragrance mix I (11.3%), followed by potassium dichromate (9.7%) and fragrance mix II (9.7%) in equal proportions.
Conclusion: It is also very necessary to create an "elderly baseline series" by avoiding unnecessary allergens that are not detected as positive in patch tests. In addition, increasing the number of studies in geriatric patients will help in understanding trends in contact allergy.

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Introduction

Contact dermatitis is an inflammation of the skin that occurs as a result of interaction between external agents and the skin. According to the underlying pathomechanisms, contact dermatitis may be allergic with immunological sensitization, irritant without a specific immunological mediator, or mixed type when both mechanisms are seen together. Patch testing is recommended for the diagnosis of contact allergy resulting from type IV hypersensitivity, including allergic contact dermatitis.[1] Given that the general population is aging and that people now tend to live longer than previous generations, individuals use cosmetic products for longer periods. In addition, skin aging causes various immunological and structural changes, increasing the risk of many skin diseases such as contact dermatitis.[2,3] There are studies in the literature showing that the contact sensitivity of elderly patients in different populations was evaluated using patch tests.[4-7] Our aim with this study was to share our patch test results in patients over the age of 65 who underwent European baseline series (EBS) in our population.

Materials and Methods

Study populations

All patients who underwent patch testing with EBS at the Immunology and Allergy Clinic between January 01, 2018, and March 01, 2025, were evaluated and those aged 65 years and older were included in the study. They all underwent patch testing with the EBS allergens, and the IQ Ultra™ Chambers (Chemotechnique Diagnostics, Vellinge, Sweden) were used for allergens. The allergens, vehicle, and concentration of vehicle included in the patch test are listed in Table 1. The gender, age, localization of lesions (hand, face, leg, trunk, or widespread), and atopy of the patients were recorded. Those over the age of 65 were divided into three groups: youngest-old between 65 and 74 years, middle-old between 75 and 84 years, and oldest-old from 85 years and above.[8] The number of patients included in the study is given in Figure 1.

Patch test

Chambers containing standard doses of allergen were placed on the patient's upper back and secured with non-allergenic tape. After 2 days of exposure to the allergen, the patch test chambers were removed. The initial evaluation of the test was performed on Day (D) 2, with subsequent evaluations on D3 or D4, and if the patient had a strong history, on D7. Morphologically positive reactions (+, ++, or +++) on D3 or at a later evaluation were considered allergic.[1]

Statistical analysis

Statistical evaluation of the data obtained was made with the Statistical Package for Social Sciences (SPSS) 27.0 and the Kolmogorow-Smirnov test was used for normality testing. For variables that did not show a normal distribution, the median (25–75%) was given, and for categorical variables, the number of people (n) and (%) are shown. Chi-square and Fisher's exact tests were used to compare categorical data; $p < 0.05$ was considered as statistically significant.

Ethics statement

The study protocol was approved by the Local Ethics Committee (Date: 06.03.2025, Decision Number: 418).

Results

The median age of the 62 patients included in the study was 69.5 years (25–75, 66.0–73.3 years). In all, 54.8% of the patients were female, and 82.3% were under the age of 75. Lesion localization information was available for 49 patients. Of these, 55.1% had dermatitis on the hands, 18.4% on the face, and 16.3% on the legs. The rate of at least one positivity in the patch test was 41.9%, while the rate of two or more positivity was 19.4%. The rate of at least one positive test result was 37.3% in the 65–74 age group and 63.6% in the 75–84 age group ($p = 0.177$). At least one positivity was 35.3% in female and 50% in male ($p = 0.243$). The most common allergen over the age of 65 was fragrance mix I (11.3%), followed by potassium dichromate (9.7%) and fragrance mix II (9.7%) in equal proportions. No positivity was observed in nearly half of the allergens included in the EBS. Allergen positivity and distribution of positivity in EBS are shown in Table 1. While the highest positivity was observed against fragrance mix I (9.8%) in the youngest-old, potassium dichromate (18.2%) and fragrance mix II (18.2%) accompanied fragrance mix I (18.2%) equally in the middle-old. In addition, positivity was not observed in the middle-old against more than half of the allergens in which positivity was observed in the youngest-old. No statistically significant difference was found between the youngest-old and middle-old groups in terms of positive allergens. A comparison of allergens positively detected in the youngest-old and middle-old patients is shown in Table 2.

The allergen with the highest positivity in men over the age of 65 was fragrance mix I (14.3%), while women showed the highest positivity in potassium dichromate (8.8%), formaldehyde (8.8%), and fragrance mix I (8.8%) and fragrance mix II (8.8%) equally. Statistical analysis revealed no significant difference between genders with regards to positive allergens. The comparison of positively detected allergens by gender is shown in Table 3.

Discussion

In this study, we reveal that the rate of at least one positivity in 62 elderly patients who underwent EBS patch testing was 41.9% and that we did not observe any sensitization to approximately half of the allergens included in the EBS. In a study conducted in the United States among patients aged 65 and over, 84.6% of patients had one or more

Table 1 Allergen positivity and distribution of positivity in EBS.

Allergen (% Concentration Vehicle)	Positivity n/n* (%)	+ n (%)	++ n (%)	+++ n (%)
Potassium dichromate (0.5% pet.)	6/62 (9.7)	1 (1.6)	1 (1.6)	4 (6.5)
p-Phenylenediamine (1.0% pet.)	1/62 (1.6)	0 (0.0)	0 (0.0)	1 (1.6)
Thiuram mix (1.0% pet.)	2/62 (3.2)	0 (0.0)	1 (1.6)	1 (1.6)
Neomycin sulfate (20.0% pet.)	0/62 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Cobalt chloride (1.0% pet.)	1/62 (1.6)	1 (1.6)	0 (0.0)	0 (0.0)
Benzocaine (10.0% pet.)	0/62 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Nickel sulfate (5.0% pet.)	2/62 (3.2)	1 (1.6)	1 (1.6)	0 (0.0)
Clioquinol (5.0% pet.)	0/50 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Colophonium (20.0% pet.)	0/62 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Paraben mix (16.0% pet.)	0/62 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
N-Isopropyl-N-phenyl-4-phenylenediamine (0.1% pet.)	0/62 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Lanolin alcohol (30.0% pet.)	1/62 (1.6)	0 (0.0)	0 (0.0)	1 (1.6)
Mercapto mix (2.0% pet.)	0/62 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Epoxy resin (1.0% pet.)	0/62 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Peru balsam (25.0% pet.)	4/62 (6.5)	2 (3.2)	2 (3.2)	0 (0.0)
p-tert-Butylphenol formaldehyde resin (1.0% pet.)	0/62 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
2-Mercaptobenzothiazole (MBT) (2.0% pet.)	0/62 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Formaldehyde (2.0% aq.)	3/62 (4.8)	1 (1.6)	2 (3.2)	0 (0.0)
Fragrance mix I (8.0% pet.)	7/62 (11.3)	1 (1.6)	4 (6.5)	2 (3.2)
Sesquiterpene lactone mix (0.1% pet.)	0/62 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Quaternium 15 (1.0% pet.)	1/50 (2.0)	0 (0.0)	1 (2.0)	0 (0.0)
Primin (2-Methoxy-6-N-Pentyl-4-Benzoquinone) (0.01% pet.)	1/50 (2.0)	1 (2.0)	0 (0.0)	0 (0.0)
Methylchloroisothiazolinone/methylisothiazolinone (MCI/MI) (0.02% aq.)	0/62 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Budesonide (0.01% pet.)	0/62 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Tixocortol-21-pivalate (0.1% pet.)	0/62 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Methyldibromo glutaronitrile (0.5% pet.)	4/62 (6.5)	3 (4.8)	0 (0.0)	1 (1.6)
Fragrance mix II (14.0% pet.)	6/62 (9.7)	0 (0.0)	3 (4.8)	3 (4.8)
Hydroxyisohexyl 3-cyclohexene carboxaldehyde (5.0% pet.)	0/51 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Methylisothiazolinone (0.1% aq.)	0/62 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Textile dye mix (6.6% pet.)	2/51 (3.9)	1 (2.0)	0 (0.0)	1 (2.0)
Caine mix III (10.0% pet.)	1/12 (8.3)	1 (8.3)	0 (0.0)	0 (0.0)
2-Hydroxyethyl methacrylate (2.0% pet.)	0/12 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Sodium Metabisulfite (1.0% pet.)	0/12 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Propolis (10.0% pet.)	0/12 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Benzisothiazolinone (0.1% pet.)	1/11 (9.1)	0 (0.0)	1 (9.1)	0 (0.0)
Decyl Glucoside (5.0% pet.)	0/11 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

Pet: petrolatum; aq: aqueous; *: number of patients administered allergen.

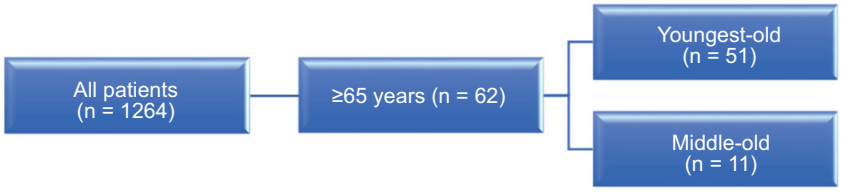

Figure 1 The number of the patients included in the study.

positive reactions in the patch test,[4] while studies conducted in Europe yielded results similar to our study (40.7-43%).[9-11] There is a striking difference between our findings and the United States, which can be explained by the differences in population and series. However, the similarity of populations and series in the studies may have caused our results to be similar to those in Europe. The overall incidence of allergic contact dermatitis varies according to reports and may decrease with age, but sensitization to certain allergens, such as topical medications and fragrances, is observed to increase with advancing age.[12] Repeated exposure to scented products found everywhere

Table 2 Comparison of allergens detected positively among youngest-old and middle-old.

Allergen (% Concentration Vehicle)	Youngest-Old n*/n** (%)	Middle-Old n*/n** (%)	P
Potassium dichromate (0.5% pet.)	4/51 (7.8)	2/11 (18.2)	0.287
p-Phenylenediamine (1.0% pet.)	0/51 (0.0)	1/11 (9.1)	0.177
Thiuram mix (1.0% pet.)	2/51 (3.9)	0/11 (0.0)	1.000
Cobalt chloride (1.0% pet.)	1/51 (2.0)	0/11 (0.0)	1.000
Nickel sulfate (5.0% pet.)	1/51 (2.0)	1/11 (9.1)	0.326
Lanolin alcohol (30.0% pet.)	1/51 (2.0)	0/11 (0.0)	1.000
Peru balsam (25.0% pet.)	3/51 (5.9)	1/11 (9.1)	0.552
Formaldehyde (2.0% aq.)	2/51 (3.9)	1/11 (9.1)	0.449
Fragrance mix I (8.0% pet.)	5/51 (9.8)	2/11 (18.2)	0.597
Quaternium 15 (1.0% pet.)	1/51 (2.0)	0/11 (0.0)	1.000
Primin (2-Methoxy-6-N-Pentyl-4-Benzoquinone) (0.01% pet.)	1/43 (2.3)	0/7 (0.0)	1.000
Methyldibromo glutaronitrile (0.5% pet.)	4/51 (7.8)	0/11 (0.0)	1.000
Fragrance mix II (14.0% pet.)	4/51 (7.8)	2/11 (18.2)	0.287
Textile dye mix (6.6% pet.)	2/43 (4.7)	0/8 (0.0)	1.000
Caine mix III (10.0% pet.)	1/8 (12.5)	0/4 (0.0)	1.000
Benzisothiazolinone (0.1% pet.)	1/8 (12.5)	0/3 (0.0)	1.000

Pet: petrolatum; aq: aqueous; *: number of positive reactions; **: number of patients administered allergen.

Table 3 Comparison of positively detected allergens by gender.

Allergen (% Concentration Vehicle)	Male n*/n** (%)	Female n*/n** (%)	P
Potassium dichromate (0.5% pet.)	3/28 (10.7)	3/34 (8.8)	1.000
p-Phenylenediamine (1.0% pet.)	1/28 (3.6)	0/34 (0.0)	0.452
Thiuram mix (1.0% pet.)	0/28 (0.0)	2/34 (5.9)	0.497
Cobalt chloride (1.0% pet.)	1/28 (3.6)	0/34 (0.0)	0.452
Nickel sulfate (5.0% pet.)	0/28 (0.0)	2/34 (5.9)	0.497
Lanolin alcohol (30.0% pet.)	1/28 (3.6)	0/34 (0.0)	0.452
Peru balsam (25.0% pet.)	2/28 (7.1)	2/34 (5.9)	1.000
Formaldehyde (2.0% aq.)	0/28 (0.0)	3/34 (8.8)	0.245
Fragrance mix I (8.0% pet.)	4/28 (14.3)	3/34 (8.8)	0.691
Quaternium 15 (1.0% pet.)	1/20 (5.0)	0/30 (0.0)	0.400
Primin (2-Methoxy-6-N-Pentyl-4-Benzoquinone) (0.01% pet.)	1/20 (5.0)	0/30 (0.0)	0.400
Methyldibromo glutaronitrile (0.5% pet.)	3/28 (10.7)	1/34 (2.9)	0.320
Fragrance mix II (14.0% pet.)	3/28 (10.7)	3/34 (8.8)	1.000
Textile dye mix (6.6% pet.)	1/21 (4.8)	1/30 (3.3)	1.000
Caine mix III (10.0% pet.)	1/8 (12.5)	0/4 (0.0)	1.000
Benzisothiazolinone (0.1% pet.)	1/7 (14.3)	0/4 (0.0)	1.000

Pet: petrolatum; aq: aqueous; *: number of positive reactions; **: number of patients administered allergen.

in daily life causes sensitization to chemical fragrance products. The frequency of fragrance allergy may increase with advancing age due to cumulative exposure.[13] There are studies showing that the most common contact allergen in elderly patients in real life is fragrance mix, with our study supporting the result.[4,5,7] Age is thought to have a strong effect on contact allergy to fragrance mix.[14,15] Our observation that the frequency of fragrance blends in elderly patients increases with age supports this view and suggests that the aging population may be more vulnerable to fragrance-related contact allergens. It is essential to implement regulatory measures to reduce the exposure of individuals to potentially allergenic fragrance ingredients in consumer products. These measures should include mandatory labeling of such ingredients and clear warnings about possible exposure risks. Age-specific safety guidelines are particularly important in this context; however, although nickel sulfate positivity decreases in elderly patients, it is still one of the most common allergens that can even be defined as the most common allergen in this age group.[9,10,16]

Nevertheless, in our study, although nickel sulfate could not be identified as a common allergen, nickel sulfate positivity was observed in the elderly population. Potassium dichromate, one of the most frequently sensitized allergens in the elderly group, has also been observed in studies covering different age groups in our country.[17-19] Preservatives are widely used in cosmetics, household products, and industrial products, increasing the prevalence of contact allergy to benzisothiazolinone.[20] Supporting this view, our study observed a higher sensitivity to benzisothiazolinone among preservatives. This trend highlights the need for comprehensive regulatory measures, such as stricter rules for benzisothiazolinone concentration in products, better labeling, and increased awareness of possible contact dermatitis. Hair dyes are used to hide grey hair, and women are more likely than men to have dyed their hair at some point in their lives. Sensitivity to p-Phenylenediamine (PPD) is most common in middle-aged individuals between the ages of 30 and 50, with men more affected than women.[21,22] In our study, PPD positivity was observed in one middle-old man.

There is a thought that there is this gradual increase in the prevalence of skin sensitization until the age of 65, a plateau in middle-aged adulthood, and then a decline in older adults.[6] Another view is that declining epidermal skin barrier function and repeated allergen exposure with increasing age may predispose older individuals to the development of contact allergies, although a weaker immune system may also reduce this tendency.[2] Positive reactions were more common in the oldest subjects,[11] and similar to this study, we observed more positivity in subjects over the age of 75 than in subjects under the age of 75. While this contradicts the view that cellular immunity is suppressed with aging, it supports the view that it is due to loss of epidermal skin barrier function and the result of cumulative exposure. Age-related decline in immune function may be accompanied by a slower ability of an individual to respond to a contact allergen; so, additional reading of contact tests between D5 and D7 should be considered in appropriate populations, including the elderly.[9,13] Although we did not routinely perform D7 measurement on every patient, if the patient's history was strong, the measurement was extended to D7, but no allergen positivity was observed.

Baseline series are recommended for contact allergy screening by experts from different working groups and countries.[23] In our study, in addition to the lack of sensitization to about half of the allergens included in the EBS, more than half of the allergens positive in the youngest-old were not positive in the middle-old. This raises the idea of creating a special baseline series for the elderly and even for subgroups of the elderly.

In people over the age of 65, as in other age groups, there is more positivity in women than in men.[9,11,24] However, we observed the opposite, with at least one positive test result being observed at a higher rate in men. Although there were differences between genders in allergen sensitivities, no significant difference was observed—This may be due to the small number of patients.

This study has some limitations: first, although the number of patients who underwent patch testing in a single center was high, the number of patients over the age of 65 was low; second was that it was a retrospective cross-sectional study; third was that we did not perform routine D7 readings in all patients; therefore, some positivity may not have been detected, especially in the geriatric population.

Conclusion

Due to the increasing proportion of elderly individuals, the elderly baseline series created by stratifying according to age is of great importance in the evaluation of allergen sensitivity. This approach helps prevent unnecessary exposure of elderly patients to allergens that do not show positive patch tests. We believe that such a baseline series will be cost-effective, reduce unnecessary testing, and prevent loss of workforce. Furthermore, increasing the number of studies, including patch test results from geriatric patient groups like ours, provides information about trends in contact allergies in the elderly population and contributes to the development of preventive measures.

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Authors Contribution

ME: Concept, design, supervision, data collection and/or processing, analysis and/or interpretation, literature search, writing manuscript, critical review. GÖ: Concept, design, supervision, data collection and/or processing, analysis and/or interpretation, literature search, writing manuscript, critical review. LÇ: Data collection and/or processing, literature search, critical review. RSC: Data collection and/or processing, literature search, critical review. HB: Data collection and/or processing, literature search, critical review. SD: Data collection and/or processing, literature search, critical review.

Conflicts of Interest

The authors declare that there is no conflicts of interest.

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