

# Comparison of patch testing results between job related and non job related allergic contact dermatitis in Iran

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**Background:** Job-related allergic contact dermatitis (ACD) may prolong the disease duration, increase disabilities, and decrease the patient's quality of life. The aim of this study was to determine common allergens causing ACD, investigating certain features of the disease and evaluating its relation to the patients' jobs.

**Method:** In this cross-sectional study, relevant data was obtained from patch test clinics at the Center for Research and Training in Skin Diseases and Leprosy, Tehran University of Medical Sciences, and two private dermatology clinics in Tehran, Iran. Nine hundred and forty six patients from different regions of Iran with a probable diagnosis of ACD were recruited into the study. Patch testing was used as the gold standard test to differentiate ACD from other differential diagnoses.

**Result:** Of 946 studied patients with a probable diagnosis of ACD, 649 (68.6%) cases were females. The mean age  $\pm$  standard deviation (SD) of the patients was  $31.9 \pm 12.3$  years. Five hundred and twenty eight (55.7%) cases had positive patch test results to at least one tested allergen. Comparing job-related and non job-related ACD patients revealed that while there was a significant difference in the mean age of the two group ( $30.6 \pm 11.3$  vs.  $32.7 \pm 12.9$  years in job-related and non-job-related groups, respectively) ( $P=0.016$ ), there were no significant differences in the gender distribution, number of positive patch tests, frequency of allergens, reaction time, and severity of reactions between the two groups. Nickel sulphate and cobalt chloride were the two most common allergens in both groups.

**Conclusion:** Job-related patients were younger and most of them were female compared to non job-related patients. However, other characteristics were not different between the two groups.

**Keywords:** allergic contact dermatitis, job-related allergic contact dermatitis, eczema, patch testing

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## INTRODUCTION

Contact allergy develops in predisposed individuals as a consequence of environmental exposure to allergens <sup>1</sup>. It seems that some people are more easily sensitized to common haptens which can be due to their genetic background; however,

environmental factors seem to be more important <sup>2</sup>.

It has been estimated that there are about 2800 chemicals with allergic properties in the world <sup>3,4</sup>. People who are exposed to these chemicals may develop allergic contact dermatitis (ACD) which accounts for approximately 9.7% of all dermatology visits <sup>5</sup>.

Contact dermatitis is divided into two main groups: ACD and irritant contact dermatitis (ICD). It is almost impossible to differentiate between these two types by the pattern of the lesion<sup>6-8</sup>; thus, patch testing is the gold standard method to differentiate them. According to the previous studies, 10-15% of healthy individuals have at least one positive reaction in patch testing<sup>9,10</sup>.

The manifestations of acute contact dermatitis include erythema, papules, and vesicles. The patients may complain about itching, as well. Chronic dermatitis has minimal inflammation and presents with lichenification, desquamation, and fissures in the tense areas of the skin. The pattern of the distribution of dermatitis is a clue to the exposure pattern; however, the borders are not usually sharp and well defined as expected. In hand exposure, lesions may appear initially in the dominant hand, or the hand with more initial exposure<sup>11-13</sup>.

Studies show that contact dermatitis leads to prolongation of the disease and increases the associated disabilities. The quality of life decreases especially in the job-related cases. According to a study, 79% of the patients require treatment ten years after the diagnosis<sup>6</sup>. Common allergens vary in different regions and each country needs to set a plan to reduce exposure to its common allergens and consequent contact dermatitis<sup>7</sup>. Since the number of publications on contact dermatitis, especially job-related ACD, is limited in Iran, this study was conducted to investigate certain features of ACD among patients with a probable diagnosis of the disease in three dermatology clinics using patch testing. In this study, the main focus was on comparing patch test results between job-related and non job-related patients with ACD.

## PATIENTS AND METHODS

This cross-sectional study was performed using data from patients with a probable diagnosis of ACD from different regions of Iran that were recorded in a patch test registry at the Center for Research and Training in Skin Diseases and Leprosy (CRTSDL), Tehran University of Medical Sciences (TUMS), and two private dermatology clinics in Tehran, Iran. For these patients, patch testing was used as the gold standard test to differentiate ACD from other differential diagnoses such as ICD and atopic dermatitis.

To perform the test, after taking the medical history and performing physical examination, the Thin-Layer Rapid Use Epicutaneous (T.R.U.E.) patch test panels (TROLAB<sup>®</sup>, Almirall Hermal GmbH, Reinbeck Germany), which included 29 allergens, were used. For proper application of the panels, the information provided with the T.R.U.E. test package was reviewed and applied. The results were interpreted and recorded by the dermatologists after 24, 48 and 72 hours. Test results were recorded as negative (-), suspicious (?), mild (+), moderate (++) and severe (+++). Positive results (mild to severe) were considered positive test result.

A questionnaire was designed to record age, sex, clinical diagnosis, duration of lesion(s), personal and family history of atopy, occupation and result of the patch test of each case. To make comparisons between the frequency of jobs in job-related and non-job related allergic contact dermatitis, jobs were categorized to seven different categories in accordance with similarities of job-related exposures to sensitizers in each job group. The categories were housewife; student and clerk with no particular exposure; health care provider; teacher, lecturer and professor; worker with exposure to known sensitizers; service provider with exposure to known sensitizers; and a miscellaneous group.

Data was analyzed using PASW Statistics (IBM Corp., Armonk, USA) version 18. To describe the data, frequency, proportion (%), and mean  $\pm$  SD were used. Frequency tables were provided to summarize data. Chi square and independent *t* tests were used for statistical analyses. This study was conducted in accordance with the Helsinki declaration and informed consent was obtained from all participants.

## RESULTS

In this study, 946 patients with a probable diagnosis of ACD were investigated. Among them, 649 (68.6%) cases were female and 297 (31.4%) were male. The mean age of the patients was  $31.9 \pm 12.3$  years. Among the population, 528 (55.8%) cases had at least one positive patch test result. A significant difference was found in mean age between the positive patch test group ( $30.8 \pm 11.5$  years) and the negative patch test group ( $32.9 \pm 13.2$  years) ( $P=0.021$ ). Of 528 cases with at least one positive

reaction to the patch tested allergens, 346 (65.5%) cases had reactions which were related to their jobs and were considered as having job-related ACD. In this study, ACD in housewives was also considered as job-related.

The three most common allergens were the same in both job-related and non-job-related groups. Nickel sulphate was the most common detected allergen in both job related (161 [46.5%]) and non-job-related patients (69 [37.9 %]), followed by cobalt chloride (63 [18.2 %]) in job-related and (41 [22.5 %]) non-job-related patients. Also, potassium dichromate was positive in 48 (13.9 %) job-related and 18 (9.9 %) non-job-related ACD patients. A total of 973 positive reactions to allergens were found in this study. The frequency of positive allergens in patients with at least one positive reaction as well as job-related and non-job-related ACD cases have been summarized in Table 1. The most common allergens in this study were nickel

sulphate (23.6%), cobalt chloride (10.7%), potassium dichromate (6.8%), fragrance mix (6.4%), and paraphenylenediamine free base (6.2%).

In 346 patients with positive patch test results, dermatitis was job-related. Among them, 140 (40.4%) had certain relevancy, 113 (32.5%) had possible and 94 (27.1%) had probable relevancy. The mean age of these patients was  $30.6 \pm 11.3$  years compared to a mean age of  $32.7 \pm 12.9$  years in non-job-related patients with positive patch test results ( $P=0.016$ ). Gender distribution was not statistically different between job-related (251 [72.5 %] were females) and non-job-related (127 [70.2 %] were females) groups ( $P=0.565$ ). The frequency of job categories was not associated with job-relevance ( $P=0.698$ ). The frequency of different job categories in job-related and non-job-related ACD groups is demonstrated in Table 2.

The number of positive allergens was not statistically different between job-related and non job-

**Table 1.** Frequencies and relative frequencies of positive reactions to patch tested allergens in job-related and non-job-related groups.

Allergen	Total (%)	Job related (%)	Non-job related (%)
Nickel sulphate	230 (23.6)	161 (25.0)	69 (21.0)
Cobalt chloride	104 (10.7)	63 (9.8)	41 (12.5)
Potassium dichromate	66 (6.8)	48 (7.4)	18 (5.5)
Fragrance mix	62 (6.4)	39 (6.1)	23 (7.0)
Paraphenylenediamine free base	60 (6.2)	38 (5.9)	22 (6.7)
Paratertiarybutyl phenol formaldehyde resin	54 (5.6)	31 (4.8)	23 (7.0)
Thiuram mix	50 (5.1)	39 (6.1)	11 (3.3)
Paraben mix	50 (5.1)	29 (4.5)	21 (6.5)
Balsam of Peru	49 (5.0)	33 (5.1)	16 (4.9)
Colophony	41 (4.2)	27 (4.2)	14 (4.3)
Cl ME isothiazolinone	32 (3.3)	21 (3.3)	11 (3.3)
Neomycin sulphate	28 (2.9)	20 (3.1)	8 (2.4)
Wool alcohols	25 (2.6)	19 (2.9)	6 (1.8)
Formaldehyde	25 (2.6)	16 (2.5)	9 (2.7)
Thiomersal	17 (1.8)	11 (1.7)	6 (1.8)
Epoxy resin	16 (1.7)	10 (1.5)	6 (1.8)
Quaternium-15	14 (1.4)	9 (1.4)	5 (1.5)
Mercapto mix	13 (1.3)	8 (1.2)	5 (1.5)
Mercaptobenzothiazole	10 (1.0)	6 (0.9)	4 (1.2)
Quinoline mix	9 (0.9)	6 (0.9)	3 (0.9)
Tixocortol-21-pivalate	5 (0.5)	3 (0.5)	2 (0.6)
Budesonide	4 (0.4)	2 (0.3)	2 (0.6)
Ethylene diamine dihydrochloride	3 (0.3)	2 (0.3)	1 (0.3)
Black rubber mix	2 (0.2)	1 (0.2)	1 (0.3)
Carba mix	2 (0.2)	1 (0.2)	1 (0.3)
Caine mix	1 (0.1)	1 (0.2)	0 (0.0)
Imidazolidinyl urea	1 (0.1)	0 (0.0)	1 (0.3)
Diazolidinyl urea	0 (0.0)	0 (0.0)	0 (0.0)
Hydrocortisone-17-butyrate	0 (0.0)	0 (0.0)	0 (0.0)
Total	973 (100.0)	644 (100.0)	329 (100.0)

**Table 2.** Frequencies and relative frequencies of different job categories in job-related and non-job-related ACD groups.

Job category	Job-related (%)	Non job-related (%)
Students/Office workers	77 (35.6)	26 (38.2)
Housewives	63 (29.2)	23 (33.8)
Workers with Exposures to known sensitizer	26 (12.0)	10 (14.7)
Service providers with Exposures to known sensitizers	21 (9.7)	5 (7.3)
Health Care Providers	12 (5.5)	1 (1.5)
Teachers, professor and lecturers	6 (2.8)	1 (1.5)
Miscellaneous	11 (5.2)	2 (3.0)
Total*	216 (100.0)	68 (100.0)

\*The difference between the total numbers of the patients in table 2 the total number of the patients with at least one positive reaction to the tested allergens has been caused by the poor recording of the jobs of the patients in both groups.

related patients; 234 (67.6%) job-related patients had one positive patch test, 74 (21.4%) had 2 positive patch tests and 38 (11%) had more than 2 positive patch tests while 124 (68.5%) non job-related patients had one positive patch test, 41 (22.7%) had 2 positive patch tests and 16 (8.8%) had more than 2 positive patch tests ( $P=0.516$ ). The duration of developing positive reactions to patch tested antigens (dichotomized to less and more than 48 hours) was not significantly different between the two groups. There were no statistically significant differences in the severity of patch tests between job-related and non job-related groups.

## DISCUSSION

Allergic contact dermatitis (ACD) is a delayed (type IV) hypersensitivity reaction based on cellular immunity<sup>8,14</sup>. Sensitization may be influenced by genetic factors, age, sex, and atopy<sup>15</sup>. In a study by Kashani et al, from Iran, 126 of 250 patients (50.4%) showed at least one positive reaction when they were patch tested, and 23 patients reacted to more than two allergens. The 5 most common allergens were nickel sulphate (28.0%), cobalt chloride (12.8%), paratertiarybutyl phenol formaldehyde resin (PTBP) (8.0%), potassium dichromate (5.2%) and colophony (5.2%). Allergy to nickel sulphate is the most common contact allergy in Iran, mostly seen in female subjects and patients younger than 40 years of age<sup>16,17</sup>.

In this study, job-related patients were younger than non job-related ones. More exposure of job-related patients to allergens at an earlier age and the lower mean age of the workers may explain this difference. The gender distribution between the groups was similar, so job-related ACD is not associated with gender. Comparison of the patch

testing results between job-related and non job-related patients revealed no significant difference between the groups. Nickel sulphate was the most common allergen which was detected by patch testing in both job-related and non job-related patients. Similar findings have been reported in other studies from Iran and other countries<sup>16-21</sup>. Allergy to fragrance mix and Balsam of Peru was not dramatically different between job-related and non-job-related patch tested patients (Tables 1,2) and both were slightly higher in comparison with a previously published article from Iran<sup>22</sup>.

The main limitation of the present study was incomplete medical recording, which in some cases could not be completed even through contacting them because of the lack of contact information. In addition, some patients were unavailable during the follow-up period, which reduced the number of patients with complete data on their disease activity history. Job-related patients were younger when compared to non job-related patients. The findings of the present study showed no significant difference in the causative allergens, the mean reaction time, and the mean number of allergens between job-related and non-job-related ACD.

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