

## Evaluation of occupational allergic contact dermatitis and its related factors in Iran

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### Abstract

**Background:** Occupational contact dermatitis, especially in hand, is one of the most common occupational disorders. The present study aimed at evaluating patients with occupational allergic contact dermatitis (ACD) caused by common allergens based on occupation type and disease history.

**Methods:** This cross-sectional study aimed at evaluating the data of the patients with probable diagnosis of ACD in Center for Research and Training in Skin Diseases and Leprosy (CRTSDL) in Iran. In the present study, 946 patients were assessed from different regions of Iran. One hundred fifty-one cases with positive patch test and relevant exposure were entered into the study; data related to their occupation and disease activity history were evaluated and recorded. Then, factors related to disease activity history were assessed considering the occupational groups and common exposures.

**Results:** Nickel sulphate was the most common allergen in the 151 patients. Disease activity was constant in 29.8% of the patients; it increased in 27.8%, and decreased just before doing the patch test in 42.4%. Of the patients, 52.3% were getting worse during the working days. Occupational groups were significantly different in age and gender. Disease duration was also different in the occupational groups ( $p=0.001$ ). The least disease duration was observed in healthcare workers, and the most in service workers. Lesions in the foot were related to period of employment. In administrative work group, (teachers, technicians and housewives) disease activity was decreased in the most cases, while it was increased in most patients of service workers ( $p=0.086$ ).

**Conclusion:** The present study, similar to previous reports, revealed that nickel sulphate is the most common allergen in ACD cases. Moreover, it was found that the symptoms of disease activity remained constant or increased in a significant proportion of the cases during the working days. Therefore, these workers should seriously follow up on this matter and change their occupation, or limit the exposure to allergens.

**Keywords:** Allergic Contact Dermatitis (ACD), Disease History, Occupational Allergic Contact Dermatitis, Patch Test.

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### Introduction

Occupational contact dermatitis, especially in hand, is one of the most common occupational disorders (1-3). Many studies have been conducted in this field, but comprehensive studies on occupational risk factors and modalities to prevent disease or limit its progression are rare. General practitioners or dermatologists visit most patients with contact dermatitis, but usually there is little concern about occupational exposures. Thus, many patients with under-

lying occupational exposure may be misdiagnosed (4). Contact dermatitis could be allergic or irritant, and patch test is the gold standard for differentiating allergic contact dermatitis (ACD) from irritant contact dermatitis (ICD) (5). Based on previous reports, 10-15% of the general population is allergic to at least one allergen in the patch test (6,7). Moreover, contact dermatitis may remain for a long time, cause disability, and may decrease the quality of life of the affected patients (8-12). Although

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some patients with occupational contact dermatitis do not change their job, more than half of them have changed their occupation, and a great proportion experience at least one month of withdrawal from work (11,13). A study showed that 79% of these patients need treatment for ten years after diagnosis (14).

Minimizing allergen exposure is one of the important topics in managing allergic occupational dermatitis. Therefore, because of the necessity of exposure limitation, it is of great importance to acknowledge that allergic contact dermatitis is occupation related. In most cases, we can decrease the incidence and severity of ACD significantly in patient's occupational activity by intervention. Thus, diagnosis of occupational ACD is of prime importance in the opinion of occupational medicine professionals. This study aimed at evaluating patients with occupational ACD and factors related to disease activity history.

### Methods

In this cross-sectional study, the participants were from different regions of Iran who referred to CRTSDL of Tehran University of Medical Sciences (TUMS) with probable diagnosis of ACD. This population may not be an ideal representative of Iranian population; however, since patients were selected without any special demographic indices from most regions of Iran, they could be a good representative of all ACD cases around the country. A checklist was designed to collect demographic data including age, sex, job type, and history.

In this study, occupation was defined as a work that the participants performed during a considerable portion of their day, with or without salary. According to this definition, housekeeping is considered an occupation. The participants were at least 18 years old and were divided into 8 groups based on occupational exposures as follow: Administrative work, teachers, healthcare workers, technicians, hairdressers, cleaners, homemakers, etc. The study protocol was approved in the research ethical committee of

Tehran University of Medical Sciences, and informed consent was obtained from all the participants.

Patch test was as a gold standard for ACD diagnosis and differentiation from other dermatitis types including irritant contact dermatitis, atopic dermatitis, etc. In the patch test, German Contact Dermatitis Research Group (GCDRG) kits with 28 allergens, were used and the results were read by the CRTSDL's dermatologists at one, two, and three days after the test. The results were recorded as negative (-), suspicious (+?), (+), (++) and (+++), depending on the severity of the responses.

### Statistical Analysis

Data were analyzed by SPSS 17 (SPSS Inc. Chicago, IL, USA). Qualitative and quantitative variables were presented with mean/standard deviation and frequency/percentage, respectively. Chi square test was used to analyze qualitative variables, and one way ANOVA and t-test were used to analyze quantitative variables. P-value less than 0.05 was considered as statistically significant.

### Results

Among the 151 patients, 31 (20.5%) were male and 120 (79.5%) were female. Mean±SD age among the participants was 31.19±9.72 years (age range: 19-60). The most common patch testes in cases were as follow: Nickel sulphate in 67 (44.4%) of the participants, cobalt chloride in 15 (9.9%), paratertiarybutyl phenol formaldehyde resin (PTBP) in 15 (9.9%), potassium dichromate in 14 (9.3%), and parphenylenediamine in 13(8.6%) of the participants. Evaluation of positive allergen counts revealed 1 allergen in 107 participants, 2 allergens in 32, 3 allergens in 7, 4 allergens in 3, and five allergens in 2 participants (Table 1).

Food allergy was confirmed in 17 (11.3%) patients, and 32 (21.2%) were suspicious. Drugs allergy and ornaments were present in 14 (9.3%) and 3 (2%) of the patients, respectively. Evaluation of the site of

Table 1. The Frequency of Allergen in Occupational ACD

Allergens	Office workers	HCW	House wives	Teachers	Cleaners	Hair-dressers	Technicians	Other
Nickel sulfate	26	5	22	2	2	4	1	5
Wool wax Alcohol	1	2	1	1	0	1	1	1
Neomycin Sulfate	0	1	1	0	2	0	0	1
Potassium Dichromate	0	0	7	0	1	0	5	1
Caine mix	1	0	0	0	0	0	0	0
Fragrance mix	1	1	2	0	0	0	0	0
Colophony	3	1	2	2	0	1	1	0
Epoxy resin	0	0	4	0	0	0	2	1
Quinoline	0	0	1	0	0	0	0	0
Balsam of Peru	0	0	1	0	0	0	0	0
EDD	2	0	0	0	0	0	0	0
Cobalt Chloride	6	0	3	0	0	1	4	1
P-Tert	7	0	4	0	0	0	4	0
Paraben mix	04	0	2	0	0	0	0	1
Carba mix	02	0	3	0	0	0	0	1
Black rubber	0	0	1	0	0	0	0	0
Kathon CG	03	0	4	0	0	0	0	0
Mercaptobenzothiazole	0	1	0	0	0	0	0	0
P-phenyldiamine	02	0	5	0	1	1	1	3
Formaldehyde	3	1	3	0	1	0	0	2
Mercapto mix	2	0	1	0	0	0	0	1
Thiomersal	0	0	3	0	0	0	2	0
Thiuram mix	1	1	2	0	1	1	1	1
Tixocortol 21-Pivolate	0	0	1	0	0	0	0	0

involvement revealed facial lesions in 85 (56.3%) of the participants, hand lesions in 91 (60.3%), foot lesions in 49 (2.5%), and lesions in other parts of the body in 68 (45%) of the patients. As displayed in Table 2, significant differences were observed in the mean of age and gender distributions among the participants. No significant difference was observed between face and hand lesions in the occupational group

( $p=0.229$ , and  $p=0.236$ , respectively). However, foot lesions differed between the groups ( $p=0.034$ ). Twenty-six (17.2%) of the patients had a second occupation, which was housekeeping in 12 cases and administrative work in 14.

The mean duration of employment was  $9.28 \pm 8.90$  (CI95%=8.01-10.55) years; the mean interval between employment and lesion appearance was  $16.09 \pm 7.79$  (CI95%:

Table 2. Comparison of the Demographic Data in the Different Occupational Groups

Occupation Groups	Site of the Lesion (%)			Total Number of the Cases (%)	Gender F (%)	Age MD $\pm$ SD
	Foot	Face	Hand			
Administrative workers	13 (26.5%)	27 (55.1%)	27 (55.1%)	49 (32.5%)	M: 5 (10.2%) F: 44 (89.8%)	(SD=5.65) 26.33
Healthcare workers	2 (18.2%)	5 (45.5%)	6 (54.5%)	11 (7.3%)	M: 3 (27.3%) F: 8 (72.7%)	(SD=10.51) 30.73
Housekeepers	13 (29.5%)	25 (56.8%)	23 (52.3%)	44 (29.1%)	M: - F: 44 (100%)	(SD=9.68) 32.77
Teachers	-	1 (20%)	5 (100%)	5 (3.3%)	M: 1 (20%) F: 4 (80%)	(SD=9.12) 39.80
Service workers	2 (28.6%)	7 (100%)	4 (57.1%)	7 (4.6%)	M: 1 (14.3%) F: 6 (85.7%)	(SD=9.48) 41.86
Hairdressers	5 (83.3%)	4 (66.7%)	4 (66.7%)	6 (4%)	M: - F: 6 (100%)	(SD=6.12) 31.67
Technicians	8 (53.3%)	9 (60%)	10 (66.7%)	15 (9.9%)	M: 13 (86.7%) F: 2 (13.3%)	(SD=8.91) 30.80
Other	6 (42.9%)	7 (50%)	12 (85.7%)	14 (9.3%)	M: 8 (57.1%) F: 6 (42.9%)	(SD=10.17) 35.43
p	0.034	0.236	0.229		<0.001	<0.001

Table 3. Comparison of Employment Duration, Disease Duration, and the Interval between Employment and Disease Occurrence

Disease Time		Occupation	Work Experience	Interval from Employment to Occurrence of ACD
Administrative worker	Mean	65.10	6.88	17.43
	Std. Deviation	50.086	4.376	8.067
Healthcare workers	Mean	57.36	6.18	16.82
	Std. Deviation	72.834	6.096	8.035
Housekeepers	Mean	107.89	10.25	15.11
	Std. Deviation	109.114	9.336	8.096
Teachers	Mean	151.60	13.40	9.20
	Std. Deviation	98.259	8.620	5.762
Service workers	Mean	198.57	17.43	10.57
	Std. Deviation	91.212	7.368	6.294
Hairdressers	Mean	66.50	7.17	19.50
	Std. Deviation	61.311	5.231	1.761
Technicians	Mean	74.47	7.53	15.93
	Std. Deviation	99.632	8.114	8.242
Other	Mean	153.64	14.29	17.79
	Std. Deviation	113.424	9.738	6.117
p		0.001	0.001	0.106

14.83-17.34) months, and the mean duration of disease was  $95.25 \pm 93.67$  (CI95%=80.19-110.31) months. Duration of employment differed significantly among the groups ( $p=0.001$ ). Healthcare workers, administrative workers, and hairdressers had the least work duration, and service workers and teachers had the longest duration of occupation. No significant difference was found between the duration from employment and lesion occurrence between the occupational groups ( $p=0.106$ ). However, duration of disease differed between the occupational groups ( $p=0.001$ ). The least disease duration was in healthcare workers and the most in service workers (Table 3).

### Discussion

Based on cellular immunity, allergic contact dermatitis is a delayed (type IV) hypersensitivity reaction (15,16). Many factors may cause this kind of reaction, but the most important factor is the host, current hypersensitivity lesion, or recent skin injury (scratch or ulcer) in the site of the exposure with potential allergen (17-19). This explains how a worker with negative history of reaction to any allergen suddenly gets ACD (20,21). Studies on ACD patients had rarely been conducted on occupational types around the world. However, in Singapore, a study conducted on 125 patients with occupational contact

dermatitis found that patch test revealed ACD in 37.6% of the patients. Most cases of ACD were seen in constructional workers, and the most common allergen was chromate combinations (22). The mean age of the participants in this study was 30 years, which was lower than that of the ACD population in Iran. In the study of Kashani MN, et al., the mean age of the patients was 32 years. In the present study, 80% of the patients were female, while in Kashani MN's study of ACD cases in Iran 76% of the cases were female (23). The most common occupation groups were administrative work and housekeeping (60% of the cases), followed by technicians (10% of the cases). Hand (60%) and face (56%) were the most common sites of involvement in our cases. In the study by Warshaw et al., hand dermatitis was the most common site of involvement, and this result was expected since hand is in contact with allergens more than other parts of the body (24). The mean age in the occupational groups differed significantly; administrative workers were younger, and cleaners and teachers had the higher mean age. However, a portion of the cases in the administrative work group was university students, and this explains the lower mean age in this group. Gender distribution also differed between the occupation groups. Technicians, and miscellaneous job group

cases were mostly male, while the cases were mostly female in the other groups. In patients with occupational ACD, the most common allergens were nickel sulphate (47% of the cases), cobalt chloride (10%), PTBP (10%), potassium di chromate (9%), and parapehnyl di amine (8% of the cases), which were similar the findings of Dr. Nasiri. However, in different jobs, less common allergens were different (23).

Comparing the lesion site in the occupational groups, we found that only foot involvement differed significantly between the occupational groups. Hairdressers and technicians had more foot lesions, while teachers had no foot lesions. However, foot lesions occurred in less than 30% of the cases in other groups. Face involvement in service workers was 100%, emphasizing the necessity of effective mask usage in this group because of presence of vaporized allergens, especially from cleansing agents. Teachers also had 100% hand involvement, emphasizing a need to use gloves in this group.

The mean employment duration was 9 years, the mean interval between employment and lesion appearance was 16 months, and the mean disease duration was 8 years in this study. Employment duration was significantly shorter in healthcare workers, administrative workers, and hairdressers compared to other groups, while service workers and teachers had longer employment duration. On the other hand, the interval between employment and lesion appearance in teachers and service workers was shorter, which can be due to the direct and long-term exposure of the allergens in these two groups. However, this interval was longer in the administrative work group than other groups because of less allergen exposure in this group, especially university students. Disease duration was significantly shorter in the healthcare workers because of shorter employment duration and their own knowledge about work safety, while service workers had longer disease duration due to older age and less attention to work safety.

In the allergic patients to nickel sulphate, (67 cases, 44%), employment duration and the interval between employment and lesion appearance were significantly lower than others, but disease duration was significantly shorter in these cases, indicating that on average lesions appear 3 months earlier in patients with allergy to nickel sulphate. Some people react more easily to common haptans because of their genetic background. However, environmental factors seem more important because the total number of sensitized cases depends on the degree of exposure and environmental factors that impact the exposure rate (25). Since a great proportion of employees suffer from skin diseases, especially occupational ACD, prevention modalities seem to be of prime importance. Potential allergens should be recognized, and exposure should be avoided or minimized. Using suitable gloves and limiting exposure to allergen have a great impact on reducing the disease activity and symptoms. Dangerous allergen should be avoided and replaced with safer materials, if possible. The next important step is to consider sanitation at the work environment; for instance, clearing up the surfaces from allergens, working materials, and tools, having appropriate ventilation system in closed environments, and using machinery to avoid exposure of workers with dangerous and allergen materials play a key role in prevention of contact dermatitis. Workers should regularly wash the exposed areas and their cloths, and educating the workers can help reaching this goals (26). In a study, education was effective in reducing patients' symptoms, and disease control; symptoms were not continues in the educated cases, while 13% of the non-educated cases experienced the symptoms continuously (27). In the present study, workers experienced more symptoms during the working days. Changing occupation is a serious problem for the workers since sometimes due to lack of occupation opportunities with less exposure, they may remain unemployed for a considerable amount of time, and thus, they may choose



to continue work despite the presence of symptoms and suffering; and this causes problems for the workers, families, and reduces working efficiency. Exposure should be minimized, work safety be considered, and treatment be continued for those cases who cannot change their occupation. In addition, it is highly recommended to conduct further studies on patients who changed their occupation, or retired, and their disease history. Furthermore, more comprehensive studies should be conducted in Iran to provide accurate statistics about the prevalence of ACD, patch test results, and allergens. On the other hand, it may be possible to conduct especial patch tests based on occupation and use them routinely, and this could result in earlier recognition of suspicious and susceptible cases of occupational ACD, and early intervention such as changing the occupation or limiting the exposure. The present study had some limitations. Firstly, there were defects in the patients' medical records because the information in the dermatology and leprosy research center was incomplete and required follow up of the patients to complete their occupation information. However, it was impossible to contact some patients due to absence of contact number or unavailability. Secondly, in the follow up for the patch test and occupational diseases, some patients were unavailable, which led to reduced number of patients with complete follow up for disease activity history.

### Conclusion

Results of this study revealed that nickel sulphate is the most common allergen in occupational and non-occupational ACD, similar to other studies. According to the disease activity history, symptoms remained constant or increased in a considerable proportion of the cases, which makes it necessary to follow them closely, change the occupation if possible, or limit the exposure to allergen.

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