



Dermatological Complaints of Contact Dermatitis During the COVID-19 Pandemic (2019-2021) Among Healthcare Workers of an Isfahan University-Affiliated Hospital, Iran

Aram Eini^{1*}, Alireza Safaeian²

¹Student Research Committee, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran

²Isfahan University of Medical Sciences, Isfahan, Iran

Abstract

Background and aims: Using anti-septic and personal protective equipment (PPE) may cause contact dermatitis (CD) in hospital staff. During COVID-19, the team used PPE and hand washing more frequently. This study investigated the prevalence of CD and its related factors among hospital staff during the COVID-19 pandemic.

Methods: Overall, 360 participants were selected by proportion sampling from an Isfahan University-affiliated hospital (Alzahra hospital) between 2019 and 2021. A checklist about demographic and workplace variables, skin signs, and symptoms was distributed to samples. We assessed associations between the frequencies of the worksite and cleaning product exposures and a symptom-based definition of CD among current hospital workers.

Results: The prevalence of hand dermatitis in participants and their mean age were 84% and 35.7 ± 8.6 years, respectively. In addition, the most reported symptoms were itching (147, 40%) and redness of the hand (141, 39%). Using gloves, especially latex and vinyl gloves, had a significant association with the incidence of CD ($P < 0.03$). The frequency and time of hand washing had no significant relationship with dermatitis ($P > 0.05$).

Conclusion: Setting up preventive actions and managing this condition are better to be influential among the policies of hospital managers given the high prevalence of CD among hospital workers.

Keywords: Contact dermatitis, COVID-19, Hospitals workers, Medical staff

*Corresponding Author:

Aram Eini,
Email: arameini9776@gmail.com

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Introduction

Contact dermatitis (CD) is one of the most common inflammatory dermatological conditions.¹ It is caused by exposure to exogenous substances that elicit an immune response, resulting in skin inflammation and mucous membranes.² The CD has subtypes in which allergic and irritant are the most frequent types of CD, and allergic has a poor prognosis compared to the irritant; however, the irritant type is more common.^{1,2} Symptoms are similar in both groups; however, symptom initiation is different and is sorted into acute, sub-acute, and chronic types based on time.³ The allergic type usually occurs in a person with a prone genetic condition; however, the irritant type can occur in the average population. In addition, both genders are at the same risk for CD.³

The most frequent form of CD is irritant CD (ICD), accounting for 80% of cases. Typically, ICD is caused by the cumulative effect of weak irritants such as soap and water. Other prevalent irritants include degreasing agents, cosmetics, dust, foods, and solvents.²

Based on the previous study, the prevalence of CD has increased during the COVID-19 outbreak, which may

be caused by the increasing use of personal protective equipment (PPE) such as shields, gloves, and glasses, or maybe because of the growing use of antiseptics agents, along with repetitive washing hands with water or antiseptic solutions.⁴

Therefore, the evaluation of hand dermatitis and its cause and prevention has an essential role. Thus, this study assessed the prevalence of CD, especially the irritant type, in the health workers of our affiliated hospital during the COVID-19 outbreak and evaluated its association with demographic data and other possible impact factors.

Materials and Methods

Study Design

For this cross-sectional study, whose sampling method was multi-stage sampling (stratified-simple random sampling), our participants included healthcare workers of Alzahra hospital (our affiliated hospital) during the COVID-19 breakout. It is a super-specialty hospital with more than a thousand employees based on the hospital database in proportion to job titles and place of service, and our population was chosen by quota sampling.

The inclusion criteria were all health workers without any history of previous skin diseases and informed consent to participate in the study. On the other hand, the exclusion criteria included those suspected of fungal infection and those who did not answer the questionnaire more than 80%. In addition, all participants had more than one year's experience.

This study commenced after receiving its ethical approval from the institutional review board. Subjects were selected based on the list of all hospital workers by quota sampling. All participants were informed about the aim and scope of the study, and the checklist was filled out by asking them questions.

Data Collection and Instrument

A checklist designed based on previous studies and common reasons for CD was used for data collecting. The initial data collection method was face-to-face interviews conducted by researchers. The checklist included items about demographics (age, gender, number of children, marriage state, and education), health conditions (smoking, CD, other comorbidities), and job information (job title, working hours monthly, and shift work). The other items were chemical exposure, safe work practices, symptoms associated with chemical exposure, type of PPE, and agents used for protection such as gloves, masks, scrub, full dress, and shields. The involved parts of the body included the wrist, fingers, forearm, nose, cheeks, and trunk contained in our list. Further, symptoms such as itching, pain, dryness, stinging, and blistering during the pandemic are considered symptoms of CD, and the population was split into two groups with the occurrence of CD signs and without any symptoms.

Sample Size

The minimum required sample size based on a similar study,⁵ which reported the prevalence of dermatitis as about 80%, and considering $\alpha=0.05$, $d=0.05$, $z=1.96$, $p=0.8$, and $q=0.2$, was estimated for 256 individuals. Finally, to increase the power of the study, the size of the final sample was considered to be 360 participants.

Statistical Analysis

IBM SPSS software (version 24.0) was used for data analysis. The categorical variables are expressed as numbers and percentages, while the quantitative variables are expressed as means and standard deviations. Baseline measurements were performed by an independent *t* test for quantitative variables. Categorical variables were compared using the chi-square test. If the heterogeneity of variance was not met, *P* values < 0.05 (two-tailed) are considered statistically significant.

Results

Three hundred sixty hospital workers, including nurses, nurse aids, operation room technicians, anesthesiologists, clerks, and midwiferies, were selected according to the

inclusion/exclusion criteria and participated in this study. The demographic features of the population are presented in Table 1. The overall risk of CD sign incidence was about 84% in our population. The population's mean age was 35.7 ± 8.6 years, which was 35.6 ± 8.3 and 35.9 ± 9.3 in the CD group and group without the incidence of any CD signs, respectively. Age and CD had no significant relation ($P > 0.05$). The mean number of children was 1 ± 0.88 in both groups. Most of the participants were women and married, and the association of gender with the incidence of any sign of CD (Odds ratio [OR] was 0.51 (95% confidence interval [CI]: 0.29-0.93). The job variables are provided in Table 2. The average working hour in a

Table 1. Demographic Characteristics Among Hospital Workers During the COVID-19 Outbreak

Variable	Categories	Total N (%)	Incidence of Contact Dermatitis		P Value
			Yes N (%)	No N (%)	
Gender	Male	113 (31)	88 (29)	25 (43)	0.027
	Female	247 (69)	215 (71)	32 (57)	
Marital status	Single	110 (30)	90 (29)	20 (35)	0.41
	Married	250 (70)	213 (71)	37 (65)	
Academic status	Diploma	6 (1.5)	3 (1)	3 (5)	0.1
	Post-diploma	46 (12)	41 (13)	5 (8)	
	Bachelor's Degree	8 (2)	4 (1)	4 (7)	
	Master's Degree	273 (75)	233 (76)	40 (70)	
Smoking	Positive	38 (10)	29 (9)	9 (15)	0.26
	Negative	322 (90)	274 (91)	48 (85)	

Note. Nominal variables are the number of patients (percentage), and numerical variables are the mean (standard deviation). The independent t-test was employed for the statistical analysis of numerical variables, and these P-value analyses are significant at <0.05 level. The chi-square test was used for the statistical analysis of nominal variables, and these P value analyses are significant at <0.05 level.

Table 2. Job Variables Among Hospital Workers During the COVID-19 Outbreak

Variables	Categories	Total N	Incidence of Contact Dermatitis		P Value
			Yes N (%)	No N (%)	
Working hour		182.3 ± 24	180.5 ± 25	189.3 ± 24	0.03
	Morning	29	21 (73)	8 (27)	
Shift work	Evening	40	31 (77)	9 (23)	0.34
	Rotational	291	251 (86)	40 (14)	
Second job	Positive	287	244 (85)	43 (15)	0.29
	Negative	73	59 (80)	14 (20)	
Work experience		11.4 ± 7.6	11.2 ± 7.5	12.1 ± 8.6	0.37
	Nurse	241	202 (83)	39 (17)	
	Nurse aids	54	43 (79)	11 (21)	
	Operation room's technician	22	21 (95)	1 (5)	
	Anesthesiologist	20	17 (85)	3 (15)	
	Clerk	12	9 (75)	3 (15)	
Midwife	11	11 (100)	0	0.11	

month was 182.3 ± 24 , which was higher in the group without incidence of any sign of CD and had a significant association with OR of 98 (95% CI: 97-99). Almost all participants were vaccinated for COVID-19 (98%). In addition, there was no significant relationship between the occurrence of any sign of CD and COVID-19 vaccination. The number of doses was not an essential factor either. Moreover, no significant association was found between the type of vaccine and CD signs. The CD characteristics and PPE are summarized in Tables 3 and 4, respectively, and it should be noted that the association of using gloves on CD signs represented an OR of 3.2 (95% CI: 0.6-4.9). In this study, the CD incident with variants and signs of stinging and itching were the most prevalent signs of CD. The most involved parts of all participants were the wrist and finger. The most involved parts in gloves and mask users were wrist and face, with rates of 91% and 58%, respectively. However, there was no statistically significant association between them.

Discussion

In this study, the aim was to investigate CD prevalence and its associated factors among hospital personnel during the COVID-19 outbreak. The prevalence of hand dermatitis in the present study was 84%, which is lower than the frequency of dermatitis in the survey conducted by Lan et al,⁶ reporting a prevalence of 97% during the COVID-19 epidemic in China. This difference may be because the above-mentioned study was conducted at the onset of the disease outbreak, and the number of hospitalized patients was high. However, it should be noted that its rate in the present study was higher than that of previous studies performed before the COVID-19 outbreak; the rate of dermatitis in previous studies varied from 15% to 82%. Our findings show that age is not a significant factor for the incidence of any sign of CD in adults, which can be

Table 3. Characteristics of Contact Dermatitis

Variables	Categories	No. (%)
Sign of CD	Lichenification	212 (58)
	Itching	147 (40)
	Redness	141 (39)
	Stinging	101 (28)
	Dryness	98 (27)
	Stretch marks	91 (25)
	Pain	18 (5)
	Blisters	6 (1)
Area of involvement	Wrist	303 (84)
	Fingers	167 (46)
	Nose	42 (12)
	Forearm	40 (11)
	Cheeks	31 (8)
	Forehead	13 (3.5)
	Trunk	13 (3.5)

Note. CD: Contact dermatitis.

explained by the fact that most of the staff were young and middle-aged; thus, there was no significant difference in their skin sensitivity, which is similar to the result of the study by O'Neill et al⁷. It should be noted, in some studies with populations such as pediatrics, children had a higher chance for CD incidence, which can be described by their higher sensitivity state.⁸ Gender is an essential factor for the occurrence of CD, which is similar to previous studies by O'Neil et al and Guertler et al.^{5,7} This condition describes that the female's skin is more sensitive to chemicals and other CD reasons,⁹ which may be because of the estrogen role in the female's body.⁷ Married people had a higher rate in our population, and the mean number of their

Table 4. Protective Measures Against COVID-19 and Contact Dermatitis

Variables	Categories	Total N	Incidence of Contact Dermatitis		
			Yes N (%)	No N (%)	P Value
Using hydration agents before COVID-19	Yes	112	89 (79)	23 (21)	0.1
	No	248	214 (86)	34 (14)	
Using hydration agents during COVID-19	Yes	72	54 (75)	18 (25)	0.01
	No	288	249 (86)	39 (14)	
Protection					
Mask	Positive	357	301 (84)	56 (16)	0.23
	Negative	3	2 (66)	1 (34)	
Gloves	Positive	339	287 (84)	52 (16)	0.03
	Negative	21	16 (76)	5 (24)	
Scrub	Positive	191	153 (80)	38 (20)	0.36
	Negative	169	150 (88)	19 (12)	
Full dress	Positive	72	59 (81)	13 (19)	0.24
	Negative	288	244 (84)	44 (16)	
Shield	Positive	175	157 (89)	18 (11)	0.22
	Negative	185	146 (78)	39 (22)	
Sleeve	Positive	50	41 (82)	9 (18)	0.4
	Negative	310	262 (84)	48 (16)	
Foot cover	Positive	54	51 (94)	3 (6)	0.24
	Negative	306	252 (82)	54 (18)	
Scrub solution	Alcoholic	304	253 (83)	51 (17)	0.29
	Non-alcoholic	54	48 (88)	6 (12)	
Detergent solution	Liquid soap	220	186 (84)	34 (16)	0.16
	Personal soap	20	18 (90)	2 (10)	0.23
	Antiseptic	44	31 (70)	13 (30)	0.18
	None	76	68 (89)	8 (11)	0.2
Type of gloves	Latex	176	152 (86)	24 (14)	0.04
	Nitril	5	1 (20)	4 (80)	0.32
	Vinyl	22	21 (95)	1 (5)	0.03
	Nylon	30	19 (63)	11 (37)	0.12
Type of the mask	Normal	135	107 (79)	28 (21)	0.6
	N95	175	149 (85)	26 (15)	0.04
	Other	50	36 (72)	14 (28)	0.2

Note. Pos: Positive; Neg: Negative; Nominal variables are presented as the number of patients (percentage), and numerical variables are indicated as the mean (standard deviation).

children was 0.88. However, marital state and the number of children cannot be considered a significant factor in the incidence of CD, which is similar to the findings of other previous studies by Jacobsen et al and Soltanipoor et al.^{9,10} The academic state is also not a significant factor in CD and any signs. However, we think it could be essential that participants with a high academic state are more obsessive about their protection. Based on the previous study, the population with a higher academic state is at more risk of allergic and atopic conditions, which aligns with studies by Borok et al and Jacobsen et al.^{8,9} We found no significant association between smoking and CD; however, another study demonstrated that cigarettes might directly cause allergic CD by multiple etiologies.¹¹ It can be explained that most participants were females, and smoking was not prevalent in their population. In addition, it may be due to dishonesty in self-declaration. History of COVID-19 infection cannot be considered a significant factor for CD incidence, which conforms to the results of other studies by Guertler et al and Appelen et al. Although respiratory infections such as COVID-19 cannot be the reason for CD, they can increase the risk of CD incidence by providing conditions.^{5,12} The average working hour monthly is higher in the normal group than the other, which conflicts with the results of other studies, showing that more monthly working hours are associated with a higher rate of CD sign incidence,^{4,9} which can be explained by our limitations, including our sample size or type of the study (a single-center study). Another evaluated factor in our study was the job title. CD signs were higher in the operation room staff, which was 95%. However, there was no significant association between them, although it conflicts with some previous studies conducted by Johnston et al and Soltanipoor et al,^{10,13} in which they reported that nurse aids and workers more exposed to detergent have more chance for CD signs. In another study by Hannani et al, the prevalence of CD was higher in operating room staff, which is demonstrated by the frequent hand scrubbing.¹⁴ The history of previous CD is a significant factor in the incidence of CD during the COVID-19 outbreak, for which the study by O'Neill et al⁷ revealed that the history of CD and any other skin allergic conditions is an absolute risk for the recurrence of this condition.^{5,7} Using more hydration in the CD group than in the other group can be explained by employing the lotion and hydration cream, which can decrease CD symptoms such as dryness or itching; thus, using these agents increased the CD group. It must be noted that using this agent before the COVID-19 breakout has no significant association with CD.^{10,13,15} Regarding dermatitis, the most common hand symptoms were itching and redness. This finding is in line with the findings of a study by Guertler et al⁵ in which more than 80% of workers reported redness in their hands. The high percentage of dry hands in the study conducted by Guertler et al⁵ was because samples were selected from the intensive care unit for COVID-19 patients. In contrast, the staff of all wards participated in the present study. In a

study by Lan et al,⁶ the most common symptoms of hand dermatitis were dryness, roughness, and lichenification, which is consistent with the results of the current study. Protection methods, including gloves, masks, shields, and the like, are important risk factors for CD.¹⁶ In this study, a significant association was found between the use of gloves and the incidence of CD signs, which conforms to the results of other studies by Hannani et al and Jacobsen et al.^{9,14} It can be described that the material such as latex used in PPE is a potential sensitizer⁹ and can be the reason for any atopy and allergy for the skin; in addition, the type of gloves is another important factor in the incidence of CD signs, which Latex and Vinyl gloves have the more chance of the incidence of CD signs, which is in conformity with the results of other studies and can be explained by the issue that Latex and Vinyl are potential allergens to some of the populations due to their chemical nature.¹⁷ Using other PPE, including masks and shields, is not important for CD possibly because of the types of the used material. Additionally, our result corroborates with those of other studies by O'Neill et al and Guertler et al.^{5,7} However, masks as another protection have a significant association with the incidence of CD signs in a previous study by Singh et al and Jacobsen et al.^{9,18} However, in our study, there was no significant association between them, although a significant relationship was observed between the type of mask and the incidence of CD signs, which can be explained by the fact that the N95 mask has much more pressure on the face, and the continued time of using is another potential factor for this condition. Furthermore, the type of the applied material is different. It may be the reason for the condition that is similar to the study by Jacobsen et al.⁹ The type of scrub solution (alcoholic/non-alcoholic) does not have a significant association, which conflicts with some of the findings of previous studies, which may be because of incorrect information or differences in solution concentration.

Limitations

Some of our results may differ from those of some previous studies because all the participants are of the same race, and due to financial problems, there is no possibility for the evaluation of the use of PPE outside the workplace. We cannot use more sensitive and specific tests such as the Patch Test to assess CD. In addition, there is no possibility of counseling with a dermatologist, and there is no possibility of a definite clinical diagnosis for CD.

Conclusion

CD incidence and the signs of CD have risen during the COVID-19 outbreak because of increased hand washing and use of protection, especially gloves.

Authors' Contribution

Conceptualization: Alireza Safaeian.

Data curation: Aram Eini.

Formal analysis: Aram Eini.

Funding acquisition: Alireza Safaeian.

Investigation: Aram Eini.

Methodology: Alireza Safaeian.

Project administration: Alireza Safaeian.

Resources: Aram Eini.

Software: Aram Eini, Alireza Safaeian.

Supervision: Alireza Safaeian.

Validation: Alireza Safaeian.

Visualization: Alireza Safaeian.

Writing—original draft: Aram Eini, Alireza Safaeian.

Writing—review & editing: Aram Eini, Alireza Safaeian.

Competing Interests

All authors declare no potential conflict of interests.

Ethical Approval

All procedures performed in this study were based on the ethical standards of the institutional and national research committee and the 1964 Helsinki declaration and its later amendments. The protocol of this study was approved by the Institutional Review Board of Isfahan University of Medical Sciences and received approval number "IR.MUI.MED.REC.1400.125". Written informed consent was also obtained from all participants before the enrollment.

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