New-onset or Exacerbated Occupational Hand Eczema among Healthcare Workers During the COVID-19 Pandemic: A Growing Health Problem

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ABSTRACTHand hygiene is one of the cornerstones in ensuring effective infection control during the Coronavirus disease 2019 (COVID-19) outbreak. We aimed to investigate the prevalence of new-onset occupational HE during the COVID-19 outbreak in healthcare workers (HCWs) and the clinical course, clinical features, and risk factors of occupational hand eczema (HE). A total of 159 volunteer HCWs (female: n=112; male: n=47, mean age=35.55±7.03 years) working in a pandemic hospital were included. Participants were questioned in terms of daily hand hygiene, use of gloves, and signs and symptoms associated with HE before and during the COVID-19 pandemic. HCWs were divided into two groups classified as non-COVID and COVID, according to the unit they worked in. In our study, 55 participants reported new-onset signs and/or symptoms associated with HE during the COVID-19 pandemic. 59 participants described an increase in signs and/or symptoms associated with HE. The presence of newly-formed or increased signs and/or symptoms associated with HE was found to be 71.7%. A significant increase in dryness, itching, pain/burning, erythema, and scaling was observed ($P<0.05$). No difference was found between the COVID and non-COVID groups in terms of newly formed and/or increased signs and symptoms ($P>0.05$). The study included a limited number of participants, and the participants self-reported the signs and symptoms associated with HE. During the COVID-19 period, there has been a significant increase in the signs and symptoms of occupational HE as a result of increased hand hygiene practices in HCWs.

KEY WORDS: contact dermatitis, COVID-19, hand dermatitis, hand eczema, healthcare workers, occupational, SARS-CoV-2

INTRODUCTION

The coronavirus disease 2019 (COVID-19), which has affected the whole world, can spread through contact with contaminated surfaces or objects (1). Therefore, hand hygiene has had an important place in infection control during the COVID-19 outbreak. The World Health Organization (WHO) recommends regularly and thoroughly cleaning hands with alcohol-based products or washing them with soap and water (2). In line with these recommendations, frequent handwashing and the use of alcohol-based products have become very common around the world. While these measures are indispensable for preventing the transmission of COVID-19, they also have negative effects. Recently, attention has been

drawn to hand eczema (HE) as a growing dermatological problem (3). Before the COVID-19 pandemic, occupational contact dermatitis was reported at high rates in healthcare workers (HCWs) and was among the primary health problems related to the profession (4-7). Hand dermatitis (hand eczema) was one of the most frequently indicated occupational contact dermatitises (4,8). HE, which has increased with intensive hand hygiene regulations in the COVID-19 pandemic, was first reported in frontline HCWs (9). Afterwards, an increase in HE was reported both in HCWs serving patients other than those with COVID-19 and in the community (10-12). Therefore, increasing the awareness of HCWs about this disease and preventive measures is important for both their own health and public health (13). During this pandemic period that will last for months, perhaps for years, many authors have compile measures to prevent HE and recommend the implementation of these measures (14-17).

The main purpose of this study is to investigate the prevalence of new-onset occupational HE during the COVID-19 pandemic in HCWs, to investigate the clinical course and clinical characteristics of occupational HE, and to determine the factors affecting the occurrence thereof. With this study, we aim to raise awareness about occupational HE and preventive measures that can be taken.

PATIENTS AND METHODS

Data collection

Ethical approval for the study was obtained from the local ethical committee (Decision number: 2020 / 7-37). This cross-sectional survey study was conducted between August 5 and August 12, 2020 in a tertiary healthcare institution that served as a pandemic hospital. A total of 159 volunteer HCWs were included in the study. HCWs were divided into two groups classified as non-COVID and COVID according to the unit they worked in.

Questionnaire design

Sociodemographic characteristics such as sex, age, profession (physician, nurse/midwife, or others) and clinical history of atopic diathesis (asthma, allergic rhinitis, atopic dermatitis) were included in the questionnaire. The frequency of daily handwashing, hand disinfection, and hand cream application and the duration of glove use among the participants were investigated. Participants self-reported the signs and symptoms associated with HE, such as erythema, itching, crusting, pain, dryness, and others before and during the pandemic (Appendix 1).

Statistical methods

The SPSS package program was used for statistical analysis. Mean, standard deviation, median, minimum, maximum, and percentage values were used while presenting descriptive analyses. The compatibility of the variables to normal distribution was examined by the Shapiro-Wilk tests and Kolmogorov-Smirnov test. Categorical data, such as COVID and non-COVID groups, data before and during the COVID-19 pandemic, were compared using Fisher's Exact Test or the Pearson chi-square test. The student's T-test was used for data following the normal distribution. Statistical significance was accepted as $P<0.05$.

RESULTS

Demographic data

A total of 159 HCWs (female: n=112; male: n=47) were included in the study. The mean age of the participants was 35.55±7.03 years. The COVID group consisted of 69 participants (female: n=42; male: n=27, mean age: 34.86±6.31). The non-COVID group consisted of 90 participants (female: n=70; male: n=20, mean age: 36.07±7.53). The COVID group included 39.1% men, while the rate of men in the non-COVID group was 22.2%. Demographic characteristics of COVID and non-COVID groups are presented in Table 1.

Atopy

Participants reported asthma, allergic rhinitis, and atopic dermatitis with a frequency of 11.9%, 17.6%, and 9.4%, respectively. No significant difference was found between the COVID and non-COVID groups in terms of clinical history of atopic diathesis ($p>0.05$) (Table 1).

Handwashing and disinfection

Participants washed their hands on average 28.00±16.78 times on working days and 16.62±11.39 times on non-working days ($P<0.001$). While the COVID group washed their hands on average 30.28±15.36 times on working days, the non-COVID group washed their hands 26.24±17.68 times ($P>0.05$). The most commonly used hand hygiene product was hand disinfectant (91.2%). The average daily use of hand hygiene products of the participants was 20.36±18.27 in the COVID group and 13.93±9.90 in the non-COVID group ($P=0.006$) (Table 2). While the participants washed their hands on average 28.00±16.78 times on working days, the average use of hygiene products was 16.75±14.45 ($P<0.001$). 13.9% of the participants answered never, 19.5% rarely, 42.1% occasionally, 20.1% frequently, and 4.4% answered always regarding using handwashing and hygiene products at the same time.

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Appendix 1: Questionnaire

1-How old are you? .....

2- What is your biological sex? Female Male

4-What is your job?
Physician Nurse/midwife Dietician Technician Secretary
Cleaning staff Other .....

5-How many years have you been working in your current job? .....

6-Do you serve directly to patients diagnosed with/suspected COVID-19 in your institution? Yes No

8-Have you ever had any allergic diseases? (You can choose multiple.)
No Asthma Allergic rhinitis Atopic dermatitis Latex allergy

10-On average, how many times a day do you wash your hands on the days you work? .....

11-How many times a day do you wash your hands at home on the days you don't work? .....

12-On the days you work, do you use any of the following products for hand hygiene other than hand washing?
No Hand sanitizer Alcohol/cologne Bleach Other.....

13-How many times a day do you use the above-mentioned hygiene product(s) on the days you work? .....

15- Do you use hand washing and hygiene products at the same time?
Always Often Occasionally Rarely Never

16-How many hours on average do you use gloves on the days you work?
I don't use gloves..... I use gloves for ..... hours

17- Which type of gloves do you use? (You can choose multiple.)
I don't use gloves I did not pay attention to glove feature/type
Powdered latex gloves Powder-free latex gloves
Latex-free gloves Transparent bag gloves Other .....

18-How many layers of gloves do you usually wear? .....

19- Did you have any of the following complaints on your hands before the pandemic?
(You can choose multiple.)
No Eczema diagnosis Dryness Itching Pain/burning
Erythema Scaling Vesicle/watery bubble Other .....

20-If any of the above were present, did you refer to the dermatology outpatient clinic for this reason? .....

21-If yes, have you received any treatment or used moisturizers? .....

22-Have any of your complaints just started or increased during the pandemic? (You can choose multiple.)
No Eczema diagnosis Dryness Itching Pain/burning
Erythema Scaling Vesicle/watery bubble Other .....

23- In which parts of your hands are there lesions? (You can choose multiple.)
No lesions Between the fingers Back of the hand Palm
Wrist Fingernail

24- In which part of your hands did the first lesion start? (You can choose multiple.)
No new lesions/no increase Between the fingers Back of the hand
Palm Wrist Fingernail

25-Do you use any moisturizer? No Yes

26-How many times a day do you use moisturizer? (If you don't use it, please write 0.)
.....

29- Have you had a patch test or an allergy test before? No Yes

Table 1. Demographic characteristics of the participants

	COVID n (%) or mean ± SD	Non-COVID n (%) or mean ± SD	Total n (%) or mean ± SD	*P* value
Total **Female** **Male**	n=69 (43.4) 42 (60.9) 27 (39.1)*	n=90 (56.6) 70 (77.8) 20 (22.2)	n=159 (100) 112 (70.4) 47 (29.6)	**<0.05**
Mean age	34.86±6.31	36.07±7.53	35.55±7.03	>0.05
Duration in occupation (years)	11.56±6.07	12.37±8.23	12.02±7.36	>0.05
Title **Physician** **Nurse/midwife** **Other**	 9 (5.7) 41 (25.8) 19 (11.9)	 11 (6.9) 47 (29.5) 32 (20.1)	 20 (12.6) 88 (55.3) 51 (32.0)	>0.05
Asthma	9 (5.7)	10 (6.2)	19 (11.9)	>0.05
Allergic rhinitis	9 (5.7)	19 (11.9)	28 (17.6)	>0.05
Atopic dermatitis	6 (3.7)	9 (5.7)	15 (9.4)	>0.05
Latex allergy	1 (0.6)	4 (2.5)	5 (3.1)	>0.05
Dermatology application for hand eczema before the COVID-19 pandemic	9 (5.7)	12 (7.5)	21 (13.2)	>0.05
Use of moisturizer or medication for hand eczema before the COVID-19 pandemic	27 (16.9)	41 (25.8)	68 (42.7)	>0.05
Participants who had a prick or patch test before the COVID-19 pandemic	17 (10.7)	23 (14.5)	40 (25.2)	>0.05

*The COVID group included significantly more male participants than the non-COVID group.

Use of gloves

The average daily glove wearing time of the participants was 6.20±5.43 hours. The average daily glove wearing time for the COVID group was 7.72±6.72 hours and 5.04±3.84 hours (*P*=0.002) for the non-COVID group (Table 2). They most often used powder-free latex gloves (69.2%). As for how many layers of gloves the participants used, 11.3% stated that they did not use any gloves at all, 46.5% used one layer, and 42.2% used two or more layers of gloves; the median was 1 (minimum = 0, maximum = 5).

Application of hand creams

78.6% of the participants (COVID = 32.7%, non-COVID = 45.9%) reported that they regularly applied moisturizing cream on their hands every day. The average daily use of moisturizing cream for all participants was calculated as 3.14±4.27 times. There was no significant difference between the COVID and non-COVID groups in terms of the use of moisturizing cream on the hands (*P*>0.05) (Table 2).

Signs and symptoms associated with hand eczema

In our study, the presence of new or increased signs and/or symptoms associated with HE during the COVID-19 pandemic period in HCWs was found to be 71.7% in total. 55 of the participants reported that they had new-onset complaints during the COVID-19 pandemic, while there had been no previous signs and/or symptoms associated with HE; on the other hand, 59 reported an increase in signs and/or symptoms associated with HE that was present before the COVID-19 pandemic. 60% of the physicians (n=20), 83.0% of nurses/midwives (n=88), and 56.9% of other HCWs (secretary, technician, cleaning staff) (n=51) reported the presence of new or increased signs and/or symptoms associated with HE. The rate of new-onset or increasing signs and/or symptoms associated with HE in the nurse/midwife group was significantly higher than the other groups (*P*<0.05). The most frequently reported new-onset or increased signs and symptoms were dryness (66.0%), itching (44.7%), erythema (27.7%), pain and burning (17.0%), and scaling (11.9%). Dryness, itching, redness, pain/burning and scaling, both newly occurring or increasing during the COVID-19 pandemic, were found to be significantly higher when compared to the rate before the pandemic (*P*<0.05) (Table 3). There was no significant difference in new or increasing signs and symptoms such as dryness, itching, pain/burning, erythema, scaling, and vesicles between the non-COVID and COVID groups (Table 4). While 42.8% of the participants did not report lesions on the hands during the survey, 30.8% reported that they had lesions

Table 2. Hand hygiene and hand care behaviors according to the unit where the participants worked

	COVID-19 n (%) or mean ± SD	Non-COVID-19 n (%) or mean ± SD	Total n (%) or mean ± SD	*P* value
Hand washing while not working (times per day)	17.04±12.15	16.30±10.82	16.62±11.39	>0.05
Hand washing while working (times per day)	30.28±15.36	26.24±17.68	28.00±16.78	>0.05
Preferred hand hygiene product				
Hand sanitizer	64 (50.9)	81 (40.3)	145 (91.2)	>0.05
Alcohol/cologne	27 (17.0)	33 (20.7)	60 (37.7)	>0.05
Bleach	8 (5.0)	6 (3.8)	14 (8.8)	>0.05
Use of hygiene products (times per day)	20.36±18.27	13.93±9.90	16.75±14.45	**0.006**
Duration of glove wearing (hours per day)	7.72±6.72	5.04±3.84	6.20±5.43	**0.002**
Moisturizer use	52 (32.7)	73 (45.9)	125 (78.6)	>0.05
Moisturizer use (times per day)	3.30±4.46	3.02±4.14	3.14±4.27	>0.05

in multiple parts of the hand. Lesions were most commonly reported on the dorsum of the hand (52.2%), followed by the fingers (15.7%), palm (15.1%), wrist (15.1%), and fingernails (0.6%). Participants reported that the lesion most often started in the dorsum of the hand (46.5%).

Discussion

This study reveals that new-onset signs and symptoms associated with HE were high in HCWs during the COVID-19 pandemic, as were the complaints of HCWs in whom previously present signs and symptoms associated with existing HE increased significantly. Approximately half of the symptoms and/or signs associated with HE during the COVID-19 pandemic were exacerbation of previous occupational HE, while the other half were new signs and/or symptoms. After the onset of the COVID-19 pandemic, the symptoms and signs associated with occupational HE were found to be high in all HCWs, regardless of where they worked. In previous studies, Erdem *et al.* examined 107 HCWs working in COVID-19 patient care units and found HE in 50.4% of the participants (18). In a study by Lin *et al.*, 376 of 1000 questionnaires were answered by HCWs (consisting of physicians and nurses), and 237 (63.0%) participants reported adverse skin reactions on the hands (19). These two studies evaluated the current situation and did not include the change in HE status before and during COVID-19. Guertler *et al.* evaluated 114 HCWs (consisting of physicians and nurses) working in COVID-19 and non-COVID-19 patient care units with a self-reported questionnaire and reported symptoms associated with acute HE as 90.4% in all HCWs (12). In this study, the frequency of symptoms associated with HE and self-reported onset of HE were evaluated. Although most participants suffered from symptoms associated with HE, only 14.9% (n=17/114) of HCWs recognized symptoms as the onset of the disease. In another study, Lan *et al.* evaluated 526 front-line COVID-19 HCWs (consisting of physicians and nurses) with skin damage with a self-reported questionnaire examining the new skin damage in the participants during the COVID-19 pandemic, and found skin damage in the hands of 74.5% of the participants at a rate similar to our study (9). However, risk factors for

Table 3. Self-reported signs and symptoms associated with hand eczema before and during COVID-19 pandemic

	Before the pandemic (n and %)	Newly formed or increased during the pandemic (n and %)	*P* value
Dryness	57 (35.8)	105 (66.0)	**<0,001**
Itching	29 (18.2)	71 (44.7)	**<0,001**
Pain/burning	10 (6.3)	27 (17.0)	**0.003**
Erythema	19 (11.9)	44 (27.7)	**<0,001**
Scaling	8 (5.0)	19 (11.9)	**<0.05**
Vesicle	2 (1.3)	4 (2.5)	**>0.05**
≥1 signs and/or symptoms associated with hand eczema	70 (44.0)	114 (%71.7)	**0.002**

Table 4. New onset or increased signs and symptoms associated with hand eczema during the COVID-19 pandemic, according to the unit participants worked in

	COVID n (%)	Non-COVID n (%)	Total n (%)	*P* value
Dryness	47 (29.5)	58 (36.5)	105 (66.0)	>0.05
Itching	35 (22.6)	36 (22.0)	71 (44.7)	>0.05
Pain/burning	9 (11.3)	18 (5.7)	27 (17.0)	>0.05
Erythema	17 (10.7)	27 (17.0)	44 (27.7)	>0.05
Scaling	10 (6.3)	9 (5.7)	19 (11.9)	>0.05
Vesicle	1 (0.6)	3 (1.9)	4 (2.5)	>0.05
≥1 signs and/or symptoms associated with hand eczema during the COVID-19 pandemic	50 (31.4)	64 (40.3)	114 (71.7)	>0.05

occupational HE were not examined in detail in this study. In our study, we clearly demonstrated the effect of the COVID-19 pandemic on the increased frequency of occupational HE and its clinical course by evaluating how the signs and symptoms associated with HE changed during the COVID-19 pandemic. In addition, we examined the possible risk factors in detail with questions such as those on the frequency of handwashing, the frequency of use of hygiene products, the frequency of moisturizer use, and the duration of gloves use.

Frequent hand hygiene (more than 20 handwashing per day) is among the identified risk factors for the development of occupational HE (20,21). In our study, it was shown that the participants washed their hands significantly more frequently on working days than on non-working days. This data indicates that their profession may have an impact on the onset of HE in the participants. The fact that there was no significant difference between the COVID and non-COVID groups in terms of daily handwashing frequency indicates that the recommended hygiene regulations are applied in all disciplines. The frequency of using hand hygiene products was significantly higher in the COVID group (P=0.006). In the study by Guertler *et al.*, although there was no statistically significant difference, the use of hand disinfection products was found to be higher in the COVID-19 group, and this was associated with the use of hand disinfection at every step while frequently changing personal protective equipment such as protective face shields, masks, gloves, and gowns (12). For the same reason, we think that the frequency of hand hygiene product use was significantly higher in the COVID group.

In our study, it was found that there were significant mistakes in the hand hygiene behavior of the participants. 86.1% of the participants used hand washing and hygiene products more or less at the same time. 24.5% of the participants often used hand washing and hygiene products together. This should be avoided because moist hands increase the permeability of disinfectants/detergents, which leads to an increase in the occurrence of HE (22). Combined use of hand washing and hygiene products disrupts the epidermal barrier functions more than when they are used separately. Therefore, combined use is not recommended (23). In this study, the participants preferred hand washing more than using hygiene products during the working days. Although hand washing with warm water and soap continues to be the gold standard for hand hygiene during the COVID-19 pandemic, the use of alcohol-based products is the most effective method for hand hygiene (14,24,25). Moreover, alcoholic hand sanitizers protect the epidermal barrier better than soap handwashing (25). In our study, the use of disinfectants was found to be significantly higher than in other studies (12). However, hand washing with soap and water is still the preferred method of hand cleaning. It is recommended to use alcohol-based products to clean and disinfect when the hands are not visibly dirty (16). HCWs should be supported in the use of disinfectants. In addition, alkaline soaps and washing hands with hot water increase the risk of occupational HE (17). HCWs should also be informed about this issue.

Long-term glove use is another independent risk factor identified for the development of occupational HE (21,26). Hamnerius *et al.* reported that use of gloves for longer than 3 hours daily increases the risk of occupational HE in HCWs (26). In our study, the average daily duration glove wearing was found to be close to 8 hours in the COVID group, 5 hours in the non-COVID group, and more than 6 hours on average. It is recommended to avoid wearing gloves for long periods of time and to use softeners containing repair components such as hyaluronic acid, ceramide, and vitamin E if gloves are to be used for a long time (14). Regular replacement of gloves and the use of a cotton inner liner for long-term use of gloves are also recommended (12,16,27,28). Using cotton gloves

inside latex gloves should be encouraged. Powder-free gloves should be used. Hands should be clean, disinfected, and dry before putting on gloves. After removing gloves, hands should be washed and dried thoroughly (27).

Although there are publications that recommend wearing double layers of gloves, a layer of high-quality latex gloves was deemed sufficient for the protection of the skin in the consensus article of Chinese experts (14,29). Three quarters of the participants in our study reported that they used latex gloves. The type of glove used was determined to be compliant with the recommendations. More than one third of the participants reported using two or more layers of gloves. In the consensus decision, the use of additional layers is recommended for HCWs in cases where there is skin damage or risk of glove rupture (14).

In our study, dryness was the most common symptom before and during the COVID-19 pandemic. Dryness has been reported at very high rates (>65%) in previous publications (9,12,19). Although dryness was the most common symptom, about a quarter of the participants reported not using any moisturizer. The average daily use of moisturizer (3.14±4.27) of the participants was found to be quite low. Lin *et al.* reported that despite the increase in the frequency of hand washing and disinfectant use, regular use of moisturizer was quite low (19). Guertler et al, on the other hand, stated that the use of moisturizers increased significantly during the COVID-19 pandemic but reported that the frequency of daily moisturizer use was 2.47±1.34, which is lower than in our study (12). Moisturizers have an important role in skin care. Adequate moisturization helps preserve the moisture content of the *stratum corneum*, preserves the "brick wall" structure of the epidermis, and facilitates cell self-repair (30). Moistening is important to repair the skin barrier. To prevent HE, it is recommended to apply moisturizers as often as possible after each hand wash, if possible (3,14-16,19,28,31,32.

In this study, all HCWs reported high rates of new-onset or increased signs and symptoms associated with HE, regardless of the unit they worked in. There was no difference in the frequency of new or increasing signs and symptoms between the COVID and non-COVID groups. Similarly, Guertler *et al.* reported that there was no significant difference in self-reported symptoms between the non-COVID and COVID groups. Also matching the results reported by Guertler *et al.*, acute HE findings such as dryness, itching, and erythema were found more frequently in our study than chronic HE findings such as scaling and pain (12). The fear is that skin damage among HCWs caused by advanced infection prevention measures could create an entryway for COVID-19. The cell receptor for the entry of SARS-CoV-2 is found in large amounts in the blood vessels/capillaries of the skin, the basal layer of the epidermis, and hair follicles (33).

In our study, it was determined that the back of the hand was the most affected area in occupational HE. In a study by Erdem *et al.*, the most frequently affected area in occupational HE was reported as the back of the hand (85.2%). This was followed by the palm (20.4%) and the area between the fingers (18.5%) (18). In our study, the reason that finger and palm involvement was found to be equal may be the frequent use of alcohol-based products by the participants. Finger and palm involvement is highly pathognomonic for dermatitis caused by disinfectants (11).

Considering the above-mentioned conditions, it is essential to provide HCWs with training in hand hygiene and care. Educational intervention for HE risk factors has been shown to improve hand-skin health among HCWs (13). Dermatologists are tasked with training people to maintain "healthy hands".

The most important limitation of this study was that it included a limited number of participants and the participants self-reported the signs and symptoms associated with HE. Participants were not evaluated by a dermatologist. In addition, retrospective questions in the questionnaire about the signs and symptoms associated with HE in the pre-COVID-19 pandemic period may have caused recall bias. Another limitation may be response bias, as HCWs with skin damage on their hands will be more likely to answer the questionnaire.

CONCLUSION

Increased infection prevention measures among HCWs disrupt the barrier functions of the epidermis, causing a significant increase in signs and/or symptoms associated with HE. This may affect the work motivation of HCWs during the pandemic period that will still last for months, perhaps even years. HCWs should be informed about proper hand hygiene and hand care.

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