

Skin Manifestations Associated with Personal Protective Equipment (PPE) in Health Care Professionals during COVID 19 Pandemic

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Abstract

Objective: To determine the frequency and characteristics of skin manifestations among healthcare workers using PPE during COVID-19 pandemic.

Methods: This cross sectional study was carried out at department of Dermatology unit1, Jinnah hospital, Lahore. A total of 102 health care professionals including doctors and nurses working in Jinnah hospital Lahore and using PPE including masks, gloves, and full body protective suits for more than 4 hours per day were enrolled in the study. After informed consent data regarding age, sex, duration of wearing PPE, and history of previous skin disease was noted. Patients were asked about any skin problem related to use of PPE and those with a positive response were examined by a dermatologist and skin lesions noted. All information was recorded on a predesigned proforma.

Results: The mean age of the participants was 28.5+ 3.2 years. There were 33 (32.4%) males and 69 (67.6%) females. Among these 88 (86.2%) were doctors and 14 (13.8%) were nurses. Adverse skin reactions associated with use of PPE were reported in 99 (97%) participants. Those using masks and full body protective suits reported skin manifestations in 97% and 90 % respectively while only 34.3% of those wearing gloves had any skin problem. Common skin manifestations due to use of masks were acne (56.8%), ear soreness and fissuring (54.9%), pressure bruises (32.3%), frictional dermatitis (26.4%) and contact dermatitis(22.5%). Contact dermatitis to gloves was reported in 33.3%. Problems associated with full body protective suit were excessive sweating (82.3%), folliculitis (6.8%) miliaria (3.9%) and intertrigo (1.96 %).

Conclusion: The use of PPE is associated with high rates of adverse skin reactions. There is a need to devise guidelines to prevent or minimize these skin problems and to encourage awareness among health care workers of the role of dermatologists in their care.

Keywords: personal protective equipment, adverse skin reactions, health care workers, COVID-19

Introduction

The novel corona virus as it is commonly called appeared for the first time in December 2019 in Wuhan, China, and took the world by storm.¹ It is a highly contagious disease and routes of transmission include respiratory, contact and aerosol routes. During the current pandemic healthcare workers (HCWs) have been the frontline warriors, caring for

patients with COVID-19. As a result many of them contracted the illness and sadly a large number of HCWs across the world including Pakistan, lost their lives in this battle. Personal protective equipment (PPE) including masks, gloves, goggles, eye shields, gowns and full body protective suits is a crucial part of the armamentarium in this battle against an enemy that attacks from all sides.²

Keeping in mind the highly infectious nature of the disease and the uncertainty of the infection status of patients, all HCWs must wear PPE not only those looking after confirmed corona patients but also suspected, symptomatic as well as asymptomatic cases during the pandemic. PPE, such as N95 masks, latex gloves, and protective clothing, need often be worn for hours at a time. Unfortunately, the PPE needed to help protect us from this virus can also

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cause unwanted skin conditions. Existing research on prevalence and characteristics of these adverse skin reactions and their associated risk factors due to the use of PPE by HCWs is limited. A study done in Hubei Province during the COVID-19 outbreak by Lan J et al, collected the results of a survey of adverse skin reactions caused by the use of PPE by HCWs. Their results showed a 97% prevalence in HCW reporting adverse skin reactions in 526 out of 542 individuals.³ Another study by Kaihui Hu et al showed that among the 61 HCWs who regularly used PPE 58 (95.1%) reported skin problems.⁴

The present study was planned to identify the frequency and characteristics of skin manifestations associated with use of PPE in our set up as no local data was available. As health care workers, it is our primary responsibility to protect not only our patients but also ourselves, and the community in general. Wearing PPE for prolonged periods can adversely affect the skin of HCW. To maintain compliance and help diminish long-term skin problems it is of prime importance not only to recognize these occupationally induced cutaneous manifestations but to devise guidelines for their prevention.⁵

Methods

This cross sectional survey was done at dermatology unit 1, Jinnah hospital, Lahore after approval from the ethical review board. Patient information and identification were kept confidential. The target population chosen for this study was healthcare staff working in Jinnah hospital included doctors and nurses. A total of 102 HCWs using PPE including masks, gloves, and full body protective suits for more than 4 hours per day were enrolled in the study. After informed consent basic information regarding gender, age, occupation, and clinical history of previous skin disease was obtained. Patients were asked about any skin problem related to use of PPE. Those with a positive response were examined by a dermatologist and skin lesions noted. All information was recorded on a predesigned proforma. Statistical analysis was performed using SPSS 20. Comparisons of differences between the groups were done using chi square and 2 sample t tests. A p value of less than 0.05 was considered significant.

Results

This study included 102 HCWs of Jinnah hospital Lahore. The mean age of the participants was 28.5±3.2 years. There were 33 (32.4%) males and 69 (67.6%) females. Among these 88 (86.2%) were doctors and 14 (13.8%) were nurses. (Table 1) Adverse skin reactions associated with use of PPE were reported in 99 (97%) participants. Those using masks and full body protective suits reported skin reactions in 97% and 90 % respectively while only 34.3% of those wearing gloves had any skin problem.(Table 2). Majority of the HCWs were using the PPE for 6 hours or less (78%.) while only 22% reported its use for more than 6 hours.

Common skin manifestation due to use of masks were acne (56.8%), ear soreness and fissuring (54.9%), pressure bruises (32.3%), frictional dermatitis (26.4 %), contact dermatitis(22.5%) and tinea faciei (1.96 %) Contact dermatitis to gloves was reported in 33.3% and fungal infection (0.98%) Skin Problems associated with full body protective suit were excessive sweating (82.3%), folliculitis (6.8%) miliaria (3.9%) and intertrigo (1.96 %).(Table 3) When data was stratified according to age, gender and duration of use of PPE there was no statistical significance across the various subgroups (p value >0.05).

Disussion

COVID-19 has presented all of us with many challenges. Wearing of PPE is mandatory for HCW not only to ensure safety of their patients but also to protect themselves and their families. The use of PPE causes a spectrum of common dermatoses. The most common

Table 1: Characteristics of Study Sample

Characteristics	Patients n=102
Age (years)	
• Age range	22-34 yrs
• Mean Age	28.5± 3.2 yrs
Gender	
• Male	33
• Female	69
Occupation	
• Doctors	88
• Nurses	14
Duration of wearing PPE	
• 6 hours or <	79
• > than 6 hours	23

ones reported in our study were excessive sweating, acneiform eruption, ear soreness & fissuring, fric-

Table 2: Frequency of Adverse Skin Reactions with different Types of PPE

Type of PPE		
Mask	Gloves	Full body suit
99(97%)	35(34.3%)	92(90.1%)

Table 3: Patterns of Adverse Skin Reactions Associated with use of Masks Gloves and Full Body PPE Suits

Masks	n (%)	Gloves	n (%)	Full body PPE suits	n (%)
Acne	58(56.8)	Contact dermatitis	34(33.3)	Excessive sweating	84(82.3)
Ear soreness / fissuring	56(54.9)	Fungal infection	1 (0.98)	Folliculitis /frunculosis	7 (6.8)
Pressure bruises	33(32.3)			Miliaria	4(3.9)
Frictional dermatitis	27(26.4)			Intertrigo	2 (1.9)
Contact dermatitis	23(22.5)				
Tinea faciei	2 (1.9)				

tional dermatitis on face and irritant/contact dermatitis. Less common adverse skin reactions found were, folliculitis, miliaria and intertrigo. (Table 2)

In this cross-sectional study, a total of 102 HCWs participated. Adverse cutaneous reactions was seen in 99 (97%) cases. This was exactly similar to a study by Lan J et al, who showed a 97% prevalence of skin reactions in HCW using PPE. 3 Age of the participants ranged from 22 to 34 years with a mean age of 28.5+3.2 years. Females (67.6%) outnumbered males (32.4%) with a ratio of 2:1. The results of our study are comparable with that of a study in China in which 91.8% participants were females and 8.2% males with a high prevalence in 30-39years age group.² We saw cutaneous adverse reactions more in doctors (86%) than in nurses and paramedics (13.7%). However, Hu et al found adverse skin reactions more in paramedics (51.6%) than doctors (49.1%).² Another study in Singapore reported prevalence of adverse skin reactions to PPE during SARS outbreak more in nurses (73%) and other ancillary staff (12.7%) than doctors (14.3%).³ This difference may be due to higher level of protective measures taken by our doctors than paramedic staff. Another possible reason for difference in percentage may be due to randomized study sample collection and enrollment of overall less number of paramedical staff.

The most common adverse reaction reported to face mask application was acne (56.8%) in our study compared to 59.6% in Foo et al who also reported acne as the most common cutaneous reaction to face mask.³ The occlusion of pilosebaceous ducts due to local pressure on the skin from the close-fitting mask could be the possible reason of acne or flare up of acne.



Figure-1: Pressure Bruise due to Mask

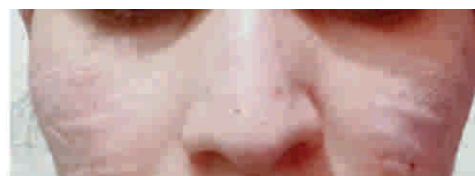


Figure-2: Mask Induced Acne



Figure-3: Ear Fissuring

Ear soreness and fissuring was reported 54.9% in our study compared to 11.5% in study conducted by Hu et al.² The common practice of usage of KN 95 and surgical face masks with ear loops rather than WHO recommended standard N95 face masks due to limited resources in our health care system could be the possible reason of this difference. Frictional dermatitis was reported in 26.4% in our study compared to 26.2% in a study conducted by Hu et al and 25.5% in a review article by Shehla et al.^{2,4} As HCWs tie the mask tightly and squeeze the metal clip hard to ensure sealing of mask to prevent entry of

infection this may be the possible reason of friction induced dermatitis. Other reported adverse cutaneous signs in our study include irritant contact dermatitis on face in 22.5% cases. This is consistent with 24.6% in Hu et al.² It may be attributed to irritant contact dermatitis from the material of mask as edge of the mask is in close contact of skin. Among the adverse skin reactions to gloves, the most common was contact dermatitis 33.3% in our study compared to 37.5% in Foo et al.³ Prolonged exposure of hands to air impermeable environment of gloves, type-1 Immunoglobulin E mediated hypersensitivity reaction to latex,^{5,6} latex allergy⁷ and repeated contact with irritants such as alcoholic disinfectants⁸ may be the possible causes of this adverse skin reaction. The most common adverse skin reaction reported by use of protective clothing was excessive sweating 82.3% in our study followed by folliculitis 6.8%, miliaria 3.9%, and intertrigo 1.9%. Literature supports data of our study. Jiang reported heavy sweat in 91% HCWs wearing protective gown for longer duty hours.⁹ Heavy and airtight PPE of non-woven fabric with added factor of hot climate of Pakistan may be the possible reasons of excessive sweating. Moreover, hot and humid environment is conducive to blockage of sweat ducts and growth of candida causing miliaria and intertrigo respectively. Our study provides evidence of a high frequency of adverse skin reactions, with prolonged use of protective suits, face masks and gloves in particular. To the best of our knowledge, this has not been described in the local dermatological literature and existing international data on adverse cutaneous skin reactions due to use of PPE is also limited. It is important to note, however, that in other similar studies the reported skin reactions could not be verified and documented by investigators, but were purely based on the subjective assessment of the healthcare staff themselves. However in our study all patients were examined by dermatologist to document the features accurately.

Our HCWs, fighting on frontline against COVID 19 must not ignore care of their skin. Few practical guidelines for prevention of these adverse skin reactions include:

1. To prevent acneiform eruptions, washing with noncomedogenic cleansers, using water based moisturizers and taking breaks from the mask for

15 minutes every 2-3 hours are recommended.

2. For contact or irritant dermatitis due to masks, using alcohol-free barrier film wipes or thin foam dressings behind the ears and wearing N95 mask straps on the crown of the head to minimize contact with ears may be helpful.
3. Low potency topical glucocorticoid and tacrolimus can be applied in case of eczema. In case of bacterial and fungal infection, an antifungal and antibiotic drug is advisable respectively.
4. To prevent and treat pressure-related facial skin injury, a thin hydrocolloid or foam dressing can be worn under surgical masks and an alcohol-free barrier wipe can be applied to areas of direct contact prior to wearing N95 masks.
5. Dryness caused by the long-term use of PPE can be relieved by adequate water intake and frequent application of bland emollient, urea or ceramide containing moisturizer that should be applied at least 30 minutes before wearing face mask. Medical staff is advised to avoid smoking if they have applied white soft paraffin as it is flammable.⁹
6. Regarding hand care, HCWs should use high quality non-powdered latex gloves after application of moisturizer on hands. Cotton gloves should be used inside latex gloves in case of latex allergy. The practice of wearing gloves for longer time period should be avoided. Mild soaps should be used for hand washing.
7. Excessive sweating should be avoided by HCWs as it damages the skin barrier function. It can be controlled by adequate air conditioning at the work place, use of better material in PPE, avoiding prolonged working hours with frequent rotations and taking a proper shower after leaving contaminated area. In case of persistence or gradual worsening of skin problems, HCWs are advised to consult a Dermatologist.¹⁰

PPE is going to stay as part of our daily routines in the hospital setting for the predictable future. Clinicians need to be aware of the potential problems that may result from prolonged use of these necessary protective measures. This study will help dermatologists to propose solutions for cutaneous side effects of PPE in future.

Conclusion

Extended use of personal protective equipment (PPE) has increased the frequency and severity of common dermatologic conditions in healthcare workers. Proper management of occupationally induced skin conditions during the COVID-19 pandemic is critical to minimize long-term consequences and promote compliance to safety measures.

Authors Contribution

LM, SI, WH, RM, AND SR: Concept, data collection, analysis, write up.

TR: Concept, analysis, write up.

Conflict of Interest: None

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