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Original Research Article

Dermatoses due to personal protective equipment and other protective/preventive measures in COVID-19 pandemic: a study on frontline health care workers

Avanita D. Solanki, Neela M. Patel, Sonali Saxena*, Kartavya Banker, Tithi Shah

Department of Dermatology, AMC MET medical college and hospital, Ahmedabad, Gujarat, India

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***Correspondence:**
Dr. Sonali Saxena,
E-mail: juhisaxena2005@gmail.com

ABSTRACT

Background: The use of personal protective equipment (PPE) around the world in view of COVID-19 pandemic has led to high incidence of occupational dermatoses amongst healthcare workers (HCWs). Amongst all staff members visiting dermatology services, irritant dermatitis (body, hand) and acne form eruption remained the most common concerns. Apart from improving staff morale and quality of life, prevention and management of these conditions will also minimize the risk of breaching stringent PPE protocol. Preventive strategies including frequent breaks from PPE and less than 6 hours of continuous PPE usage can make the working environment more conducive for HCWs.
Methods: A quantitative descriptive research-based study is utilized, in which participants who fulfilled the required criteria were selected and were asked to fill the questionnaire. Results were analysed.
Results: Redness and itching are the commonest complaints encountered followed by skin rash and acne. Facial occupational dermatoses due to PPE revealed that allergic and irritant contact dermatitis are most common, followed by acne form eruptions and contact urticaria.
Conclusions: With adequate hydration, workplace modifications, taking regular breaks from wearing PPE gear may help in alleviation of dermatoses and motivate HCWs in their fight against pandemic.

Keywords: COVID-19, PPE, HCW, Occupational dermatoses

INTRODUCTION

COVID-19 has changed various hospital infection control practices, mainly requirement for wearing personal protective equipment (PPE). Prolonged contact with PPE (including facemask, face shield, goggles, N95 respirators, gloves, gowns and head cover) may cause various dermatoses.

During COVID-19, up to 97% of healthcare workers experience skin reactions secondary to enhanced infection control measures.[1] HCWs at greater risk for adverse reactions during COVID-19 wore PPE >6 hours daily.[7]

This study not only aims at highlighting the various PPE related dermatoses but also suggesting ways to mitigate these health risks thus maintaining compliance among HCW's.

METHODS

Design

This study uses the method of quantitative descriptive research. Comprehensive research summary is generated by analysis of data. Quantitative research enabled to find out the incidence of various adverse skin reactions and its relation to usage of PPE for long hours in HCW.

Setting and participants

This study uses a purposeful sampling method to select qualified research participants. Based on this method, we selected participants according to the following criteria: All HCWs (medical and paramedical staff) fighting COVID-19 in hospitals; those often-wearing N95/ surgical masks, protective clothing, latex gloves; staff who contacted with patients directly; and those willing to participate questionnaire survey. According to standard, we selected total of 430 HCWs who met criteria.

Data collection

The survey was conducted by distribution of 700 questionnaires to participants who met the criteria. The questionnaire covers the information about age, designation, duration of the total exposure of PPE, adverse skin reactions, various preventive measured used, frequency of washing and sanitizing hands. Out of total questionnaires given, 430 were collected back.

RESULTS

Population statistics

Table 1: Maximum patients belonged to age group 21-25 year mainly including medical staff.

Age (Years)	Percentage (%)
21-25	58.1
26-30	31.6
31-35	9.2
40 and above	1.1

Table 2: Maximum participants were from medical staff.

Category	Numbers	Percentage (%)
Medical staff	390	90.7
Paramedical staff	40	9.3

Exposure to PPE

No. of hours (per day) of PPE donned

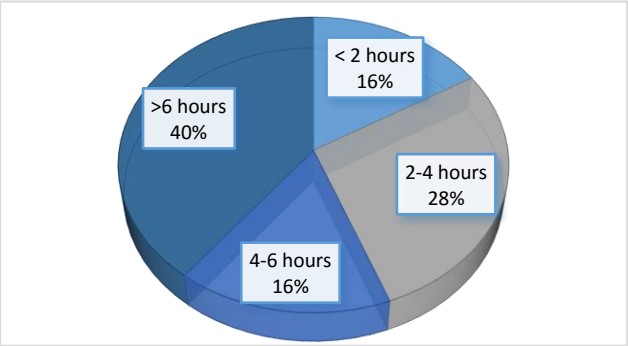

Figure 1: Majority of the affected HCW's reported to wear PPE for more than 6 hours.

No. of days (per week) of PPE donned

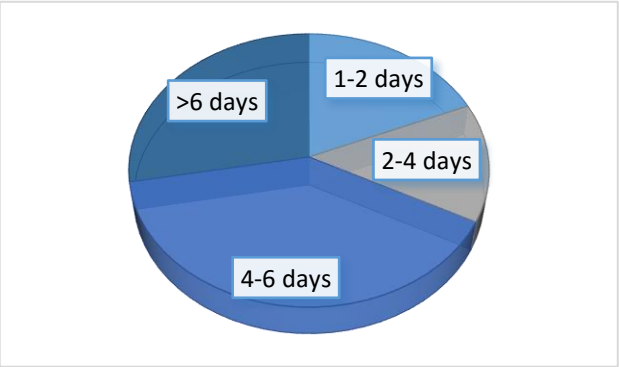

Figure 2: Maximum HCWs reported to wear PPE for 4-6 days in a week; though a fair number reported to wear it for more than 6 days.

Time interval between 2 duties where PPE is to be donned

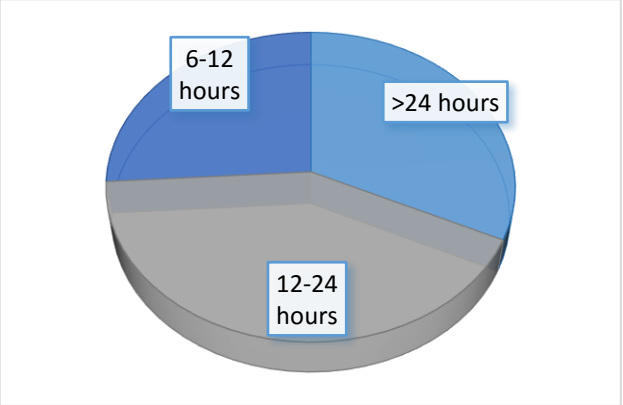

Figure 3: Around 40% of the HCW's in study reported to have time interval of 12-24 hours between two shifts.

Chief complaints (after PPE use)

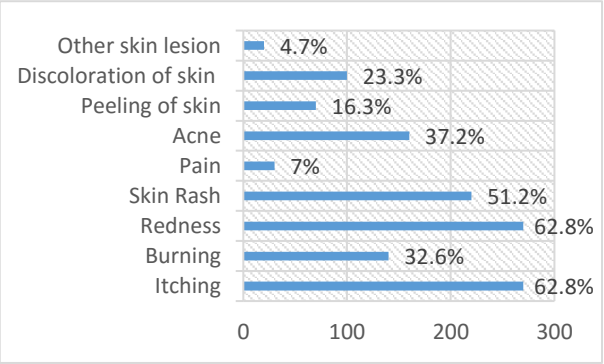

Figure 4: Majority of HCW's reported to have redness and itching as predominant complaint (62.8%) followed by skin rash (51.2%) and acne (37.2%). The other complaints were erythematous eruptions and maceration.

Site of involvement

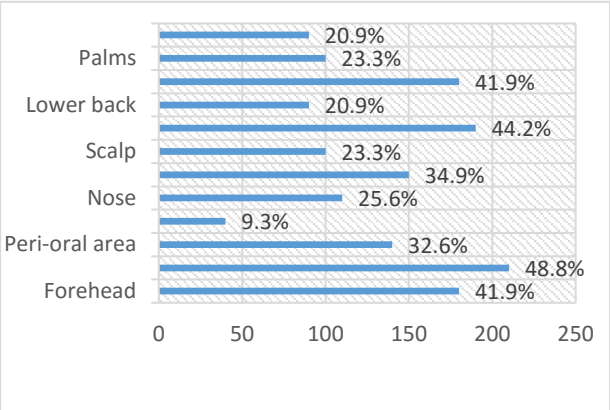

Figure 5:Multiple sites involvement was reported by HCWs. Cheek, upper back, forearms and forehead were the four most common affected sites.

History of consultation for above complaints

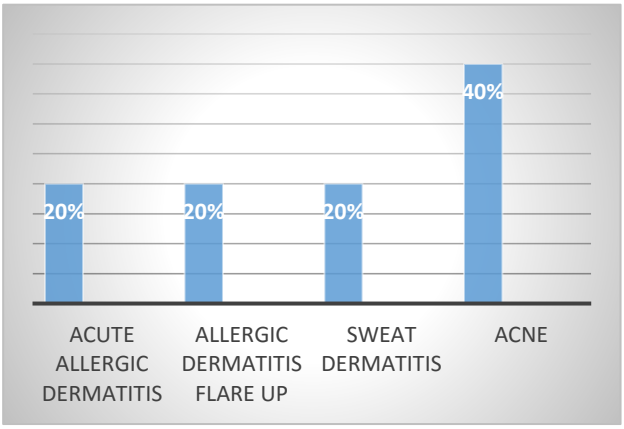

Figure 6: Acne and acne form eruption has been the most common presenting feature among all the HCWs using PPE. Other dermatitis posing as concern include allergic and sweat dermatitis.

Use of preventive measures

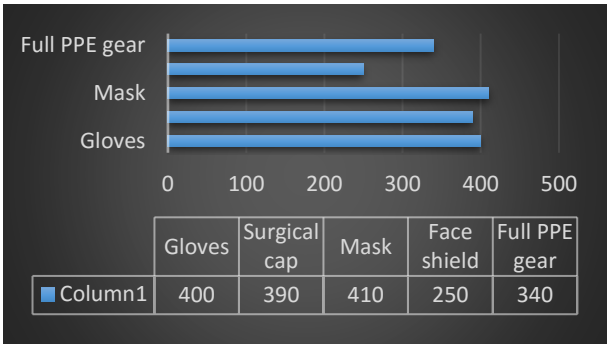

Figure 7: All the participants enrolled in study documented the use of mask (N95 and surgical). Use of full PPE gear, surgical cap and gloves were donned by 85% of HCW enrolled in study.

Frequency of washing hands

Use of hand sanitizer for more than 8 times per day was also a significant causative factor in hand related dermatitis.

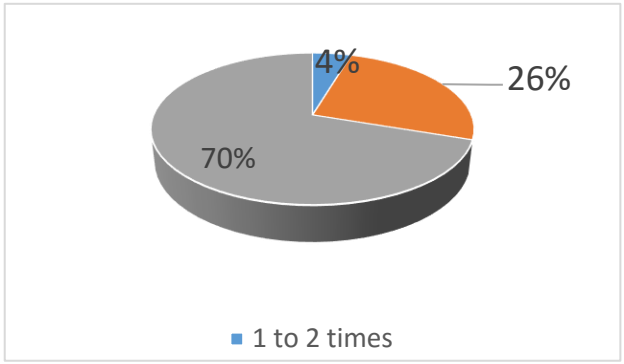

Figure 8: Incidence of hand eczema and allergic dermatitis involving hands was most common in HCWs washing hands for more than 4 times a day.

DISCUSSION

Accelerated burden of COVID-19 infection with the persistent dearth of PPEs has reportedly endangered the life of healthcare workers. Grave skin consequences as a result of long hours of wearing PPE gear arise by virtue of hyper hydration, friction, epidermal barrier breakdown and contact reactions, along with aggravation of pre-existing dermatoses.

The donning of full PPE gear has affected not only the mask wearing area due to stringent mask guidelines, but almost entire body extending to mental health of HCWs.

A systematic review of facial occupational dermatoses due to PPE revealed that allergic and irritant contact dermatitis are most common, followed by acne form eruptions and contact urticaria.[6] Acne has been reported in HCWs wearing face masks for prolonged periods of time, likely due to rubbing (acne mechanica) or occlusion [(6)]. Our study noted itching and redness as the predominant complaint in 62.8% of HCWs and is comparable to study conducted by Lin et al reporting dryness and erythema in 68.6% and 60.4% respectively.[7]

Mask induced allergic contact dermatitis and contact urticaria can occur due to adhesives, rubber in straps, free formaldehyde released from the non woven polypropylene and from metals in clips.[3,11,12] Formaldehyde in N95 respirators has also been described as an allergen.[11] In our study, allergic and sweat dermatitis constitutes 40% of all dermatitis flare ups. Facial and post auricular skin is also prone to indentation due to inability of stratum corneum to resist external pressure and shear forces leading to device related pressure injury. Other factors contributing to skin

involvement include poor local blood circulation, tissue hypoxia and continuous friction.

The use of protective hats and the accompanying occlusions may induce pruritus and folliculitis or exacerbate seborrheic dermatitis.[13]

Hand eczema leading to impairment of daily life activities is a major concern. In our study 53.5% of medical staff with hand eczema wash their hands for more than 8 times a day which is similar to study conducted by Ibler et al.[16] Irritant contact dermatitis occurs as a result of repeated hand washing by soap and water and inadvertent use of sanitizers. Though, alcohol-based hand rubs cause less hand dryness and irritation than traditional antiseptic hand wash preparations and soap.

The IgE mediated hypersensitivity to latex in gloves, atopic diathesis, low humidity, frequency of hand washing, wet work, glove use and duration of employment are important risk factors for development or aggravation of hand dermatitis.[14]

The other major health issues faced by the healthcare workers were mainly due to the inappropriate PPE size, jumpsuits that hinder in performing procedures, and difficulty in walking. Excess materials also cause the risk of contamination due to dragging it across surfaces. Heat and moisture generated inside the PPE after the prolonged period make the healthcare workers more uncomfortable, with sweating profusely, restlessness, headache, weakness, and giddiness. Another major problem was the limited visibility due to the fogging of the goggles.[9]

Skin damage among health care workers reduce their enthusiasm for overloaded work and make them anxious [(4)]. Occupational contact dermatitis is known to have a significant impact on health-related quality of life and work loss.[8] Studies have shown an increased risk of depression from hand eczema and acne.[4,10]

PPE can be used effectively by careful selection of its material, size and careful donning and doieing according to proper protocol. Soft plastic PPE has a strong compliance with the skin and relatively uniform pressure distribution.

Moisturizers (water soluble) or emollients (with ceramides or petrolatum) are needed to restore the integrity of skin barrier and should be applied no less than 30 min before donning PPE. Barrier sprays, films and wipes should be allowed to dry for at least 30 seconds.[1] In areas of concentrated pressure and friction, application of dressings can help prevent pressure injuries. Hydrogel dressing, hydrocolloid dressing and foam dressing can be used.

Air-conditioning, proper fitting masks, use of better material (latex straps to be avoided) in the goggles, wearing layer of plastic gloves inside the latex gloves, frequent rotation and regular breaks with removal of the mask and wiping of skin to remove sweat, may help in alleviation of dermatoses.[2] Adequate hydration is also useful to avoid dehydration induced dermatoses and dry skin.[3]

Healthcare workers should also be advised that areas of skin affected by dermatitis are more likely to be colonised with bacteria, and the risk is higher with acute and severe lesions; therefore, they should seek early treatment to minimise skin symptoms.[8]

Limitations

Limitations of this study include response bias, as HCWs with adverse skin reactions were more likely to respond. Also, reported adverse reactions of the PPE could not be verified as the study was based on the self-reported questionnaire. In addition to these, the present study failed to evaluate problems experienced in communication with other healthcare workers and practical problems in providing nursing care and administration of medications.

CONCLUSION

Use of PPE among healthcare workers leads to myriad of skin related manifestation; affecting their physical and mental well-being. Decrement in length of wear, correct fitting masks and use of better material for PPE production could be potential modifications to alleviate this problem. It is of important to recognize these occupationally induced dermatoses and take preventive measures to motivate HCWs in their fight against pandemic.

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Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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