

Adverse cutaneous reactions in doctors wearing personal protective equipments (PPE) during COVID-19 pandemic in Dhaka city, Bangladesh

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ABSTRACT

Background: The COVID-19 pandemic in Bangladesh is a part of the pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The virus was confirmed to have spread to Bangladesh in March 2020. The first three known cases were reported on 8th March 2020 by the country's epidemiology institute, IEDCR. Due to highly contagious nature and nationwide spread of COVID-19, doctors who volunteered in different health sectors were required to wear different types of personal protective equipments (PPE) and were therefore susceptible to variety of skin reactions.

Objective: To evaluate the spectrum of adverse cutaneous reactions among doctors wearing personal protective equipments (PPE).

Methods: A cross sectional questionnaire survey was conducted among 61 doctors over a period of 3 months in different hospitals of Dhaka city during COVID pandemic. A self-administered semi structured study-specific survey questionnaire was designed and also a Google form was created using the questionnaire. The survey results were exported to and analyzed using latest version of SPSS. Means with standard deviations (SD) were used to describe continuous variables and for categorical variables frequency distribution was done. Categorical data were compared using the Chi-square. A p-value <0.05 was deemed to represent significance for all comparisons.

Result: Almost all the doctors developed facial erythema and puffiness after using PPE, and most of them suffered from indentation over nasal bridge. Most of the doctors worked in hot humid environment without any facility of air conditioners. Strong association was found between the housing condition of working place with facial erythema and puffiness and also with the nasal bridge indentation.

Conclusion: This study reveals that the use of PPE lead to an array of skin reactions. Improvements in guidelines along with infrastructure of working environment are required to protect skin health.

KEY WORDS: Adverse cutaneous reactions in doctors, personal protective equipments(PPE), COVID-19 pandemic

INTRODUCTION

In 2020, a new global pandemic emerged, caused by a new strain of CoV called SARS-CoV-2. This

pandemic started in Wuhan, China in December 2019, possibly due to cross-species transmission,¹ and involved almost every country in the

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world causing mostly mild upper respiratory tract symptoms and in a minority of cases lower respiratory tract infections (LRTI) called coronavirus disease-19 (COVID-19).^{2, 3} As of May 25th, 2020, more than 5,305,000 cases were reported and more than 342,000 deaths with a case fatality rate of 6.4%.⁴ The SARS-CoV-2 virus is different from its previous predecessors in that it is highly contagious and easily transmitted from human to human via respiratory droplets and direct contact, which led to this enormous number of infected people.⁵

The worldwide spread of COVID-19 has imposed a considerable strain on both healthcare systems and professionals, who are required to adopt strict protective measures in order to ensure safety while managing affected patients.⁶ Healthcare providers constituted 4.83% (76) of the detected cases and among them 85.5% were doctors. Doctors are at a high risk of catching coronavirus, because of their prolonged exposure to confirmed Covid-19 patients.⁷

For COVID-19 exposure, PPE is specialized protective equipment used to prevent contact with hazardous substances. Its use is an integral part of infection control and prevention measures that protect workers from exposure to blood, body fluids, and other potentially infectious materials.⁸

PPE such as gowns, gloves, masks, and goggles act as physical barriers that prevents the hands, skin, clothing, eyes, nose and mouth from coming in contact with infectious agents and play a prominent role in ensuring overall health and safety of health workers by reducing the chances of the transmission of COVID-19.⁹

However, the prolonged application of PPE during clinical shifts can affect skin health. Due to the mental and physical stress on clinical staff

managing COVID-19 patients, the skin can be further compromised by moisture, originating from excess sweating. Indeed, the exposure to moisture leads to the reduction of the strength and stiffness of the stratum corneum (SC), thereby reducing the overall tolerance to mechanical loading.¹⁰ Although there are reports of skin damage from using PPE, there is a paucity of empirical evidence detailing factors associated with PPE-related skin reactions in HCWs. Nonetheless, some recent studies have examined the proportion of HCWs reporting skin reactions from PPE.^{11,12} Multiple studies have been done to assess the cutaneous adverse effect on health care workers but no study has focused to explore the adverse cutaneous consequence on doctors.

Personal protective equipment (PPE) has been essential to protect HCWs from the novel coronavirus. Still it presents its own set of challenges to their health, notably respiratory complications, sweating and skin damage associated with prolonged use of PPE.¹³ We designed the present study to notify the array of skin problems validated by a dermatologist, among doctors working in different institutions using PPE as well as to focus on the factors that contributed to such vulnerable skin health.

METHODS & MATERIALS

A cross sectional survey was conducted in order to find out the PPE use related skin condition among the doctors working in different COVID and Non COVID hospitals during COVID 19 pandemic in Bangladesh. Participation was voluntary and anonymous. Informed consent was taken from the participant before collecting the data. As it was a cross sectional survey, there was no more than minimal harm to the study partici-

pants. No identity of the participants were disclosed and only group data was used in the study results.

Survey instrument

The survey target population was all doctors of any discipline or training background or level who were either directly involved in the management of COVID-19 patients in a general ward or critical care setting or working in non COVID hospital or working in academic or lab settings during the COVID 19 pandemic. A self-administered semi structured study-specific survey questionnaire was designed and also a Google form was created using the questionnaire. The questionnaire had 2 parts. In the first part, questions surrounding basic demographic and institutional work characteristics were elicited. No specific identifying data was requested the second part comprised of a series of questions regarding the use of PPE, along with skin conditions developed due to the use of PPE.

Survey administration

The hard copy of the questionnaire was supplied to the doctors and they filled it up immediately and for the others the Google form of the questionnaire was e-mailed and they filled it up and mailed it back. Questions were developed and the survey pre-tested for ease of administration, flow, and content by some volunteers. Following extensive revisions, the final survey was developed. The questionnaire was prepared in English.

Data management and analysis

Survey results were exported to and analyzed using latest version of SPSS. Means with standard deviations (SD) were used to describe continuous variables and for categorical variables frequency distribution was done. Categorical data were compared using the Chi-square. A p-value

less than 0.05 was deemed to represent significance for all comparisons.

RESULTS

Table 1 Demographic profile of the study subjects

Demographic Variables		% (frequency)
Age in years; mean±SD	38.23±4.5	
Sex	Male	39.3% (24)
	Female	60.7% (37)
	Total	100% (61)
Working place	Covid hospital	41% (25)
	Non covid hospital	49.2% (30)
	Laboratory	3.3% (2)
	Academic area	6.6% (4)
	Total	100% (61)
Housing condition of working place	Air conditioned	27.9% (17)
	Non air conditioned	72.1% (44)
	Total	100% (61)
Working institution	KBFGH	32.8% (20)
	NICRH	37.7% (23)
	Others	29.5% (18)
	Total	100% (61)
Time needed to reach working place from the residence in minutes; mean±SD	39.67±28.85	

A total 61 doctors were surveyed by questionnaire. The mean age of all the participants was 38.23+4.5 years and majority of the participants were female (60.7%). Among the participants, most of the physicians (72.1%) worked in non-air conditioned place and 41% doctors were from COVID Hospitals, 49.2% from non COVID Hospitals, 3.3% from laboratories and remaining 6.6% from academic institution. The mean time needed to reach the working place was 39.67+28.85 minutes (Table 1)

Among the participants, 41% doctors had to put

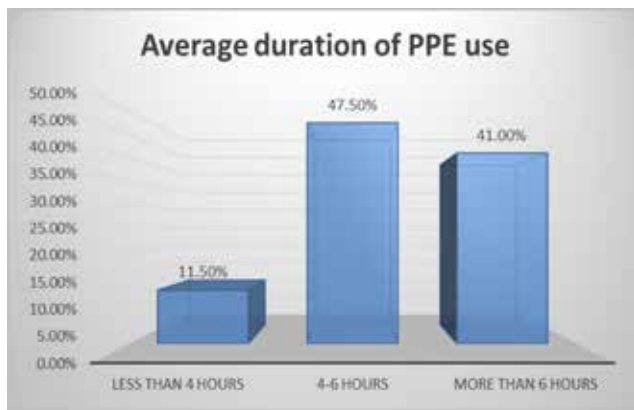


Fig. 1 Distribution of the participants by working hour on PPE for longer duration (more than 6 hours), 47.50% doctors used on an average 4 to 6 hours and remaining 11.5% used PPE less than 4 hours. 98.45% doctors used surgical mask and 86.9%

Table 2 Distribution of the study participants by pattern of PPE used by them

	Frequency	Percentage (%)
Surgical Mask	60	98.4
N -95 Mask	53	86.9
Hand gloves	53	86.9
Face Shield/ Goggle	52	85.2
Gown	40	65.6
Head cover	33	54
Shoe cover	28	45.90

used N95 Mask. The other forms of PPE were hand gloves (86.9%), goggles (85.2%), gown (65.6%), and head cover (54%), shoe cover (45.9%). Table 2 summaries the different types of PPE used by the doctors during their shift. Face was the most common site (90.2%) in-

Table 3 Site involvement

Site	Frequency	Percentage (%)
Face	55	90.2
Scalp	24	39.3
Hands	22	36.1
Foot	5	8.2
Trunk	9	14.6
Other sites	2	3.27

involved by PPE usage. The other involved sites were scalp (24%), hands (39.3%), trunk (14.6%) and foot (8.2%).

Almost all the doctors (100%) developed facial

Table 4 PPE related adverse cutaneous reactions

Cutaneous reactions	Frequency	Percentage (%)
Indentation over nasal bridge	50	82
Facial erythema and puffiness	61	100
Acne	24	39.3
Hand eczema	16	26.2
Miliaria	5	8.2
Fungal infection	2	3.2
Hair loss	12	13.7
Other	13	21.3

erythema and puffiness after using PPE (Table 4). About 82% doctors suffered from indentation over nasal bridge and 39.3% from acne. The other cutaneous reactions were hand eczema (26.2%), seborrheic dermatitis (23%), hair loss (19.7%), miliaria (8.2%) and fungal infection (3.2%).

DISCUSSION

The present study provides a perspective on the incidence of adverse skin reactions in doctors following PPE usage. The average age of the participants was 36.23+4.5 years (mean+ SD) with a female predominance (60.7%). The finding regarding gender is quite similar to the Wuhan study.¹⁴ But that study¹⁴ focused on health workers including doctors, nurses and other staffs. On the other hand, our study focused on doctors only, that's why the participants were older than that of Wuhan¹⁴ study.

Almost 100% doctors showed changes of the skin health as a direct consequence of PPE use which is higher than the Abiakam study (87%).⁶ This may be due to temperature, humidity, pressure and shear, all of which could lower the tol-

Table 5 Association of housing condition of the working place with facial erythema and puffiness

			PPE related facial erythema and puffiness		
			Yes	No	Total
Housing condition of working place	Air conditioned	Count	7	10	17
		% within housing condition of working place	41.2%	58.8%	100.0%
	Non-air conditioned	Count	32	12	44
		% within housing condition of working place	72.7%	27.3%	100.0%
Total		Count	39	22	61
% within housing condition of working place		63.9%	36.1%	100.0%	

*Pearson Chi Square test; P value=0.02; statistically significant

Table 6 Association of housing condition of the working place with indentation over nasal bridge

			PPE related indentation over nasal bridge		
			Yes	No	Total
housing condition of working place	Air conditioned	Count	9	8	17
		% within housing condition of working place	52.9%	47.1%	100.0%
	Non air conditioned	Count	41	3	44
		% within housing condition of working place	93.2%	6.8%	100.0%
Total		Count	50	11	61
% within housing condition of working place			82.0%	18.0%	100.0%

*Pearson Chi Square test; P value=0.00; statistically significant

erance of skin to PPE application.^{15,16} Most of the working places in this study were hot, not air conditioned which showed significant association with the adverse skin reactions. Wuhan study also showed association with working environment.¹⁴

About 47.50% doctors were put on full body PPE on an average for 4 to 6 hours during their duty, 41% for more than 6 hours and remaining 11.5% for less than 4 hours. Both Wuhan study¹⁴ and Abiakam et al study⁶ showed significant association of duration with the skin damage, but in our study it was not significant.

Our study shows a diverse range of skin manifestations involving face, scalp, hand, trunk and

other areas of the body. Excessive sweating due to wearing sealed of mask, goggles, gloves, waterproof gown, head cover and shoe cover can lead to weakness of the skin barrier and skin becomes vulnerable. The moist environment is the perfect breeding ground for bacteria and fungus.¹⁷ Most of the doctors in our study developed heavy sweating due to hot humid environment that contributed to facial puffiness and erythema, nasal indentation, hand eczema, miliaria and fungal infection. Some of the doctors also developed fungal infection of scalp that caused significant hair loss.

Hu et al demonstrated that nasal bridge seemed to be most vulnerable due to pressure damage.

In this study the most common adverse reaction was nasal bridge scarring followed by facial pruritus.¹⁸ Foo et al reported the most common presentation were acne, facial itching and pruritus.¹⁹ In Abiakam et al study, bridge of the nose and cheeks represented the most commonly affected location.⁶ Our study shows that 100% doctors developed facial erythema and puffiness, 82% developed nasal indentation and 39.3% developed facial acne. This study represents similarity with the other studies.^{6,13,18,19}

The indentation over nose may be caused by excessive pressure of mask and hardness of metal clip. Facial redness, swelling, scaling, maceration may be caused by prolonged usage of mask combined with excessively internal humid environment. Facial erythema and swelling can be caused by itching resultant from allergic reaction to mask material. Skin damage occurs due to excessive binding of mask in close contact with skin, coupled with wearing the mask for a long period of time.²⁰ In context of our country, excessive humidity caused such type reaction even in shorter duration.

The main reason for these adverse cutaneous condition was probably due to protective clothing being so much soggy in a high humid environment. Maintenance of proper ventilation and regulation of temperature by placing air conditioners in the working atmosphere and seeking advice from dermatologist can effectively reduce the occurrence of the above symptoms.

CONCLUSION

The adverse skin reactions reported in this study were not the subjective assessment of the participants. All the features were verified and diagnosed by dermatologists. Our aim was to propose

possible solution in order to help the doctors who are still fighting against COVID-19. The dermatologists can come forward to provide additional dermatological knowledge with a view to improve the PPE guideline and modernizing the infrastructure of the working environment. This will help to lessen the hazard of skin damage in future.

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