

Factors associated with mask-induced dermatosis and its impact on patients' quality of life

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Abstract

The COVID-19 pandemic continues to have a significant impact on society, both physically and mentally. Mask use in pub-

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lic places has been made mandatory in many countries, as it is one of the most effective methods to prevent transmission of the virus. However, continuous mask usage has been associated with the emergence of various cutaneous diseases in the areas of contact with the mask. This study aimed to evaluate the effect of various cutaneous manifestations resulting from mask use on patients' quality of life through a questionnaire survey.

This was a cross-sectional study conducted at a hospital from May to July 2022. Patients who had experienced skin symptoms related to mask use in the past or present were included in the study. Participants completed the questionnaire with informed consent. A total of 165 participants participated in the survey, with the most common complaint being itching (58.18%), followed by acne (52.73%). Itching was found to have the highest dermatology life quality index score. Patients with skin redness had a lower quality of life compared to those without it. Prolonged mask-wearing can result in skin diseases that can seriously impair patients' quality of life.

Introduction

In 2019, an epidemic outbreak was caused by a novel coronavirus called SARS-CoV-2 (COVID-19), which continues to affect humanity today. The virus is primarily transmitted through the air, and using a mask remains one of the most effective ways to prevent its transmission. As a result, many governments have made mask-wearing mandatory in public spaces since 2020. However, there are increasing reports of prolonged mask use causing skin reactions or aggravating pre-existing cutaneous conditions such as acne or contact dermatitis.^{1,2} Additionally, more severe dermatological issues have been identified, including eczema, pressure-related injuries, folliculitis, and seborrheic dermatitis.^{3,4}

Although some population-based studies have examined adverse skin reactions resulting from long-term mask-wearing, no previous studies have evaluated the effect of mask-induced cutaneous diseases on patients' quality of life. This led to the purpose of the present study, which was to establish the relationship between quality of life and adverse skin reactions. Previous research has demonstrated a decline in quality of life since the onset of the COVID-19 pandemic,^{5,6} and we believe that skin diseases resulting from wearing masks may play a role in this decline. Our study results may help assess the impact of the pandemic on the general population's overall quality of life and suggest effective preventive measures to improve patients' overall satisfaction with their lives and environment.

Materials and Methods

This was a prospective cross-sectional study with convenience sampling conducted between May and July 2022 at Trung Vuong Hospital in Ho Chi Minh City, Vietnam. Participants over the age

of 18 who exclusively used surgical or cloth masks were eligible. A structured questionnaire was used to collect data on adverse skin reactions in the facial area covered by the mask, either currently or in the past. The demographic information collected in the questionnaire included age, sex, general health status, and any pre-existing skin conditions. The dermatology life quality index (DLQI) was used to evaluate patients' quality of life, with higher scores indicating lower quality of life.⁷ Patients were also asked to self-evaluate the impact of skin symptoms on their quality of life using a 6-point scale, ranging from "not affected" to "severe".

The study received approval from the Board of Ethics at Trung Vuong Hospital in Ho Chi Minh City, Vietnam (548/HĐĐĐ-BVTV). Informed consent was obtained from all participants. The study procedures adhered to the ethical standards set by the responsible institutional committee on human experimentation following the Helsinki Declaration of 1975, as revised in 2013.

The data were analyzed using STATA software version 15 (StataCorp LLC, College Station, TX, USA) for statistical analysis. The Mann-Whitney U test was used to compare the means between the two groups that were not normally distributed. Univariate and multivariate regression analyses were performed to test the associations between DLQI and adverse skin reactions. The significance level was set at $p < 0.05$.

Results

A total of 165 patients (77 females and 88 males) were enrolled in the study. The patients' ages had a mean±standard deviation (SD) value of 31.91 ± 9.84 , ranging from 18 to 72 years. The subjective skin symptoms and the lesion types are described in Table 1.

Table 2 shows that the variable with the highest mean±SD scores in the DLQI was "itching" (1.36 ± 0.63), while the lowest scoring item was "sexual difficulties" (0.49 ± 0.86).

Table 3 presents the analysis of skin reactions affecting DLQI. Out of the various skin symptoms examined, only three showed significant differences. Patients with formication had lower DLQI scores, while patients with cracked skin and redness had higher DLQI scores. Skin reactions with significant differences from the bivariate analysis underwent further testing using multivariate regression, which produced the same outcome. As shown in Figure 1, 52% of the study participants had a significant impact on their quality of life, while only 2% were not affected. According to Table 4, the results of the multivariate regression analysis revealed that redness is the only factor that affects quality of life.

Discussion

The coronavirus is highly contagious and is primarily transmitted through aerosols. This is the rationale for the World Health Organization (WHO) recommending that personal protective equipment (PPE), especially face masks, be worn to prevent transmission. Wearing masks has been proven to be one of the most effective ways to control the COVID-19 pandemic. However, prolonged use of face masks has resulted in the onset of cutaneous symptoms in the areas where the mask is worn.⁸

The mean age of the participants was 31.91 years, with a range from 18 to 72 years, which is comparable to the study by Foo *et al.*, where the mean age was 32.4 years and ranged from 20 to 63 years.⁸ In our study, males (53.33%) outnumbered females (46.67%), in contrast with a previous study by Aravamuthan *et al.*, where 41.4% were males and 58.6% were females.⁹

The percentage of acne in our study was 52.73%, which is

Table 1. Skin reactions to wearing face masks.

Parameters	Patients (n=165)	%
Lesion type		
Itching	96	58.18
Acne	87	52.73
Redness	72	43.64
Burning	21	12.73
Dryness	20	12.12
Formication	13	7.83
Swelling	12	7.27
Erosion	07	4.24
Edema	04	2.42
Scale	04	2.42
Cracked skin	03	1.82
Affected sites		
Cheek	115	69.28
Nasal bridge	73	44.24
Ear	50	30.30
Chin	30	18.18
Perioral	25	15.15

Table 2. Dermatology life quality index scale. Dermatology life quality index scale.

Symptom	Mean±SD
Itching	1.36±0.63
Embarrassment	1.26±0.74
Shopping/home/garden	1.17±0.74
Clothes	1.10±0.70
Social/leisure	1.28±0.72
Sports	1.33±0.73
Work/study	1.70±0.64
Partner/close friends/relatives	1.27±0.75
Sexual difficulties	0.49±0.86
Treatment	1.07±0.98

SD, standard deviation.

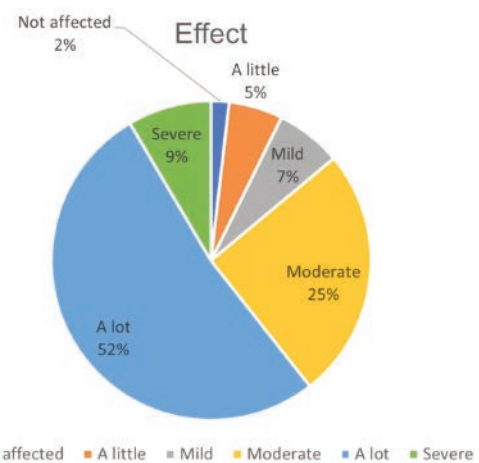


Figure 1. The effect of wearing masks on patients' quality of life (self-assessment).

consistent with the findings of Purushottam *et al.* (56% acne), Foo *et al.* (59.6%), and Mallick *et al.* (56.8%).^{8,10,11} Acne is a common skin disease caused by outbreaks of *Cutibacterium acnes*, an overactive sebaceous gland hair follicle unit, and abnormal keratinization of hair follicles. These factors can be exacerbated by exposure to humid environments.¹² The use of masks, especially N95 masks, creates a moist environment and stimulates sebum production, promoting the development of acne.¹³ The term “maskne” has been used to describe mask-induced acne, the most common skin disease caused by PPE.¹⁴ Pressure and friction can affect the skin and cause inflammation.¹ The temperature inside the mask is often elevated because the air is not well circulated, which increases the risk of acne outbreaks since sebum excretion increases by 10% as the temperature rises by 1°C.^{15,16} In particular,

squalene in the surface lipid layer will be synthesized more as the temperature rises.¹⁷ Furthermore, increased ambient humidity beneath the mask can exacerbate acne by causing clogged pores and damaging the upper part of the pilosebaceous duct. Sweating and increased humidity can also lead to the swelling of keratinocytes, thus clogging hair follicles.¹⁸ Moreover, increased surface sebum secretion, elevated CO₂ concentrations under the mask, and humid environments are conducive to the proliferation of bacteria causing acne and disrupting the skin microbiota.

According to Choi *et al.*, preexisting acne will worsen when patients wear masks for six hours per day or more.² In a study by Aravamuntan *et al.*, obesity, premenstrual syndrome, polycystic ovary syndrome, and high blood sugar were found to aggravate mask-induced acne.⁹ As acne is more prevalent in younger adults,

Table 3. The association between skin reactions and dermatology life quality index.

		DLQI	P*	Adjusted R	P**
Formication	Yes (n=12)	8.08±3.50	0.003	-0.18	0.01
	No (n=153)	12.34±5.35			
Itching	Yes (n=96)	12.46±5.91	0.36		
	No (n=69)	11.43±4.44			
Burning	Yes (n=21)	11.48±5.26	0.37		
	No (n=144)	12.11±5.38			
Scale	Yes (n=4)	17.25±8.42	0.22		
	No (n=161)	11.90±5.23			
Dryness	Yes (n=20)	13.35±7.84	0.73		
	No (n=145)	11.85±4.92			
Swelling	Yes (n=12)	11.50±6.01	0.21		
	No (n=153)	12.07±5.32			
Edema	Yes (n=4)	16.00±9.02	0.45		
	No (n=161)	11.93±5.24			
Acne	Yes (n=87)	11.86±5.68	0.16		
	No (n=78)	12.22±4.99			
Cracked skin	Yes (n=3)	21.67±7.02	0.02	0.21	0.005
	No (n=162)	11.85±5.18			
Erosion	Yes (n=7)	15.71±6.99	0.17		
	No (n=158)	11.87±5.23			
Redness	Yes (n=72)	13.44±5.67	0.002	0.19	0.01
	No (n=93)	10.94±4.85			

DLQI, dermatology life quality index; *Wilcoxon-Mann-Whitney test; **multivariate regression.

Table 4. The correlation between skin reactions and patients' quality of life (self-assessment).

	Crude IRR*	P	Adjusted IRR**	P	95% CI
Itching	1.11	0.04	1.04	0.70	0.87-1.23
Acne	1.04	0.38			
Redness	1.27	<0.001	1.25	0.01	1.05-1.48
Burning	1.13	0.07			
Dryness	1.03	0.74			
Formication	0.91	0.51			
Swelling	1.12	0.06			
Erosion	1.21	0.135			
Edema	1.31	<0.001	1.11	0.72	0.63-1.94
Scale	1.24	0.04	1.08	0.78	0.61-1.91
Cracked skin	1.46	0.15			

IRR, incidence rate ratio; CI, confidence interval. *Poisson regression; **multivariate regression.

the age of the participants in our study could also explain why acne levels were high. Additionally, reusing cotton masks without adequate disinfection can promote the growth of acne-inducing bacteria.² Scarano *et al.* concluded that skin temperature decreases rapidly over the first minute after removing a mask, returning to baseline after five minutes.¹⁵ Therefore, removing a mask for a short period of time will help alleviate acne flare-ups. Furthermore, using oil-free moisturizers before and after wearing a face mask can mitigate the pressure and friction induced by the mask. Thorough face washing with a mild cleanser, preferably twice daily, and keeping makeup to a minimum are also effective methods.¹⁹

In our study, itching accounted for the highest proportion (58.18%) of skin reactions and had the highest DLQI score (1.36±0.63). A burning sensation was reported by 12.73% of 40 patients in our study, which is consistent with the findings of Dash *et al.*, who recorded a percentage of 12.4%.²⁰ The proportion of patients with skin redness in our study was 43.64%; similar results were reported by Hu *et al.* (16.4%), Foo *et al.* (35.8%), and Purushottam *et al.* (39%).^{3,8,10} Dry skin is another common adverse reaction. In our study, patients with redness and cracked skin had significantly lower quality-of-life scores. Additionally, we found that patients with skin redness had a 1.25-times higher risk of experiencing a critically impaired quality of life.

Skin redness, itching, and dryness can be caused by damage to the skin barrier or an allergic reaction to mask materials or parts such as metal clips and rubber straps.^{21,22} Wearing a surgical mask can also increase the likelihood of developing contact dermatitis, with nickel and N-isopropyl-N'-phenyl-1,4-phenylenediamine identified as allergens in an occupational skin disease surveillance study from 1993 to 2013.²³ Formaldehyde and bronopol in polypropylene surgical masks have also been reported as causes of allergic contact dermatitis in a case report.²⁴ Furthermore, wearing a mask too tightly every day can cause repeated friction, leading to cumulative damage to the skin barrier and eventually resulting in irritant contact dermatitis.¹³ Conversely, a damaged skin barrier increases the risk of exposure to allergens, making the skin more sensitive and susceptible to allergic contact dermatitis.²⁵ Therefore, patients with a history of pre-existing contact dermatitis or allergies should be advised to add an extra layer of cotton or gauze inside the mask or apply strong moisturizers to prevent direct contact between the mask and the face, thus reducing discomfort. In patients with eczematous lesions in the nose and cheek areas exposed to masks, allergic contact dermatitis should be suspected, and performing patch tests can confirm the diagnosis. According to a study by Hu *et al.*, scarring of the bridge of the nose is the most common skin manifestation in individuals who wear N95 masks, but our study did not observe this condition.³ One possible explanation for this discrepancy is that our study only focused on patients wearing cloth and medical masks, which are not as tight-fitting as N95 masks and exert less pressure on the bridge of the nose. Although damage to the skin in this area was present in our patients, it did not progress to the point of scarring. Additionally, the patients in our study had diverse occupations, while the study by Hu *et al.* only included healthcare workers required to wear multiple layers of protection, such as goggles and face shields, which can exacerbate skin damage.³ This less stringent protection for our patients not only reduces rubbing caused by masks and goggles but also decreases the temperature and humidity beneath the mask.²⁶ Moreover, healthcare workers are required to wear masks continuously for longer periods of time without the ability to take them off.

Conclusions

In conclusion, long-term mask-wearing during the COVID-19 pandemic can result in skin symptoms, aggravate pre-existing skin conditions, and affect quality of life. Dermatologists must be aware of and proactively treat these conditions to encourage proper and appropriate mask-wearing, thereby improving quality of life and helping to prevent the spread of COVID-19.

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