Adverse skin reactions due to use of face masks: a prospective survey during the COVID-19 pandemic in Korea

Editor

We can no longer live in a world without facial masks. Due to the COVID-19 pandemic,[1] mask-associated dermatitis is no longer limited to occupational diseases, occurring in the general population as well. This study aimed at estimating the prevalence of and factors associated with mask-associated dermatitis.

From December 2020 to March 2021, a self-administered online survey was conducted through the intranet system of Chung-Ang University Hospital. Overall, 303 individuals participated in this study. Table 1A shows the study population characteristics. The overall prevalence rate of skin lesions caused by facial masks was 59.4% (180/303). Acne (folliculitis) was the most frequent, followed by rashes and scales. In patients with pre-existing dermatoses, the prevalence of skin lesions induced by wearing facial masks was 71.31%, which is higher than the overall prevalence of 59.4%. The most common pre-existing dermatitis was acne vulgaris (65/303, 21.45%), followed by urticaria, contact dermatitis, atopic dermatitis and rosacea. In particular, 21/26 patients with a history of contact dermatitis complained of skin lesions, and 13/15 patients with a history of atopic dermatitis complained of dermatitis lesions caused by masks. We constructed a questionnaire to separate skin lesions and symptom complaints. The overall prevalence rate of skin symptoms caused by facial masks was 58.09% (176/303). The most frequent symptoms associated with mask use were itching, followed by dryness/tightness, stinging sensation and flushing. Table 1B,C show a bivariate analysis among factors associated with skin lesions and symptoms associated with mask use. The factor associated with adverse skin lesions in the

Table 1 (A) Clinical features of skin reactions. (B) Bivariate analysis among factors associated with face mask-associated skin lesions. (C) Bivariate analysis among factors associated with face mask-associated skin symptoms

(A) Clinical features of skin reactions	
Participants with skin lesions	
Total number of participants (*n* = 303)	
Overall prevalence	59.4% (180 of 303)
Female (*n* = 243, 80.20%)	60.49% (147 of 243)
Male (*n* = 60, 19.80)	55% (33 of 60)
Types of masks used (*n* = 303)	
Kf94 (*n* = 151, 49.84%)	63.58% (96 of 151)
N95 (*n* = 21, 6.93%)	61.9% (13 of 21)
Surgical mask (*n* = 131, 43.23%)	54.2% (71 of 131)
Participants with pre-existing dermatosis	
Having pre-existing dermatosis (*n* = 122, 40.26%)	71.31% (87 of 122)
None (*n* = 181, 59.74%)	51.38% (93 of 181)
HCW vs non-HCW	
HCW (*n* = 256, 84.49%)	60.9% (150 of 256)
Non-HCW (*n* = 47, 15.51%)	36.8% (30 of 47)
Type and site of skin lesion induced by the mask	
Clinical features of skin lesions	
Acne	68.98% (124 of 180)
Rash	26.67% (48 of 180)
Scale	12.22% (22 of 180)
Sites affected by skin lesions	
Area where the edge of the mask made contact with the skin	32.78% (59 of 180)
Area covered by the mask (including the cheeks)	62.22% (112 of 180)
Area covered by the mask straps	12.78% (23 of 180)
Participants with skin symptom	
Overall prevalence	58.09% (176 of 303)
Itching	72.73% (128 of 176)
Dryness/tightness	58.52% (103 of 176)
Stinging sensation	30.11% (53 of 176)
Flushing	16.48% (29 of 176)

Table 1 Continued

(B) Bivariate analysis among factors associated with face mask-associated skin leslies				
	No adverse skin lesion	**Presence of adverse skin lesion**	**Crude OR (95% CI)**	***P***
Age (years)			0.991 (0.964–1.018)	0.524
Sex				0.686
Male	27 (22%)	33 (18.3%)	1	
Female	96 (78%)	147 (81.7%)	1.129 (0.626–2.035)	
Mask				0.178
Surgical	60 (48.8%)	71 (39.4%)	1	
KF94	55 (44.7%)	96 (53.3%)	1.609 (0.974–2.657)	
N95	8 (6.5%)	13 (7.2%)	1.294 (0.487–3.435)	
Time			1.066 (0.974–1.167)	0.165
Pre-existing dermatosis				**0.001**
None	88 (71.5%)	93 (51.7%)	1	
Yes	35 (28.5%)	87 (48.3%)	**2.326 (1.409–3.84)**	
Reuse				0.846
No reuse	81 (65.9%)	123 (68.3%)	1	
Reuse	42 (34.1%)	57 (31.7%)	0.951 (0.573–1.578)	

(C) Bivariate analysis among factors associated with face mask-associated skin symptoms				
	No symptom	**Symptom**	**Crude OR (95% CI)**	***P***
Age (years)			0.982 (0.954–1.011)	0.234
Sex				**0.010**
Male	29 (30.2%)	31 (15%)	1	
Female	67 (69.8%)	176 (85%)	**2.244 (1.211–4.158)**	
Mask				0.190
Surgical	47 (49%)	84 (40.6%)	1	
KF94	43 (44.8%)	108 (52.2%)	1.657 (0.962–2.852)	
N95	6 (6.3%)	15 (7.2%)	1.243 (0.430–3.695)	
Time			**1.183 (1.068–1.312)**	**0.001**
Pre-existing dermatosis				**0.017**
None	68 (70.8%)	113 (54.6%)	1	
Yes	28 (29.2%)	94 (45.4%)	**1.953 (1.127–3.384)**	
Reuse				0.800
No reuse	63 (65.6%)	141 (68.1%)	1	
Reuse	33 (34.4%)	66 (31.9%)	1.074 (0.620–1.859)	

Bold text indicates statistical significance.

study population was a history of pre-existing dermatosis. Female participants, longer mask use and pre-existing dermatosis showed significant association with adverse skin symptoms on the face.

This study focused on mask-related facial skin complications and associated factors. Although our research revealed no sex-related difference in the skin lesion occurrence, female sex showed a high prevalence of skin symptoms induced by mask use. Women complained of more unpleasant symptoms than men, consistent with a previous report on sensitive skin.[2] The working site was not associated with prevalence. As the N95 and KF94 masks provide higher air impermeability than the surgical mask, a higher prevalence of skin reactions due to N95 and KF94 use is expected. The present study showed that surgical masks showed lower skin lesion prevalence, consistent with the findings of Hua *et al.*[3] However, the difference was not statistically significant.

Concurrently, facial masks worn for longer durations resulted in more frequent skin lesions than those worn for shorter time, as shown in previous studies.[4-7] We confirmed that the extended duration of face mask wearing was associated with a higher risk of adverse skin symptoms than skin lesions.

Bothra *et al.*[8] reported that their patients presented with an exacerbation of pre-existing dermatoses during mask use. In our study, people with pre-existing dermatoses had a significantly higher incidence of mask-related dermatitis. Moreover, individuals

with a history of atopic dermatitis, rosacea and contact dermatitis were found to be susceptible to dermatitis induced by masks.

The exact pathobiology of mask-induced dermatitis remains relatively unexplored. However, frequent friction, trapping of sweat and elevation of temperature may be the causative factors. Hua et al. showed that skin reaction to a mask is characterized by a compromised skin barrier function, as indicated by increased TEWL.[3] Individuals with a history of atopic dermatitis, contact dermatitis and rosacea experienced compromised skin barrier function. Therefore, these people were more susceptible to increased temperature, extreme moisture and friction induced by their masks. Physicians need to educate the general population with a history of pre-existing dermatosis regarding their susceptibility to mask-induced dermatitis.

Acknowledgment

None.

Conflict of interest

None.

Funding source

None.

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DOI: 10.1111/jdv.17447

Chilblain-like lesions after BNT162b2 mRNA COVID-19 vaccine: a case report suggesting that 'COVID toes' are due to the immune reaction to SARS-CoV-2

Editor

Several skin manifestations have been described in association with the COVID-19 pandemic since March 2020. Acral chilblain-like lesions (CBLL), usually referred to as 'COVID toes', are among the most common and characteristic ones, even though the direct causative role of SARS-CoV-2 has been debated. Indeed, although some authors have reported the detection of SARS-CoV-2 within the lesions with immunohistochemistry and electron-microscopy,[1,2] the majority of patients with CBLL have had negative tests for SARS-CoV-2 (including serological tests and nasopharyngeal and *in situ*-skin PCR).[3] A more likely hypothesis for the causation of CBLL in the setting of the COVID-19 pandemic is the development of a high interferon response to the virus, leading to a very efficient antiviral response and the development of CBLL, similar to the scenario observed in type 1 interferonopathies.[4,5] The recent observations of CBLL following anti-SARS-CoV-2 vaccination in patients with no COVID-19 infection[6,7] support this hypothesis. We present a new case of CBLL that developed shortly after vaccination with the BNT162b2 mRNA COVID-19 vaccine and discuss the significance of this and similar observations from the literature.

An 82-year-old non-smoker woman had a history of psoriasis and had been treated with methotrexate for more than 10 years. She had no history of chilblains or Raynaud's syndrome. She denied any symptoms suggestive of COVID-19 since the beginning of the pandemic and had not been in contact with patients suffering from COVID-19. She consulted urgently in our department for slightly painful lesions on both hands and feet that occurred 24 h after the first injection of the BNT162b2 mRNA vaccine. Physical examination revealed macular violaceous and erythematous lesions of the fingers and toes, suggestive of CBLL (Fig. 1). The patient reported neither general symptoms nor unusual exposure to cold. Laboratory workup yielded normal results, concerning namely markers of inflammation, renal and hepatic function and tests for autoimmunity (antinuclear antibodies, cryoglobulinaemia, complement levels, D-dimers). Histological examination of a skin biopsy taken from a lesion of the hand showed a characteristic aspect of CBLL,[8] including namely a partly necrotic epidermis overlying a dense dermal lymphocytic infiltrate forming rather well-circumscribed aggregates around blood vessels, eccrine sweat glands and occasionally