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COVID-19: Important Updates and Developments

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Could injured skin be a reservoir for SARS-CoV-2 virus spread?



Coronavirus disease 2019 (COVID-19), which is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is still rapidly spreading worldwide. The authors focus a spotlight on the injured skin as a reservoir of SARS-CoV-2 to decrease the infection rate. Angiotensin-converting enzyme-2 (ACE2) receptor has been identified as the functional receptor of SARS-CoV-2. ACE2 receptor is expressed in many tissues, including alveolar epithelial type II cells in lungs. When the spike protein of SARS-CoV-2 binds with the ACE2 receptor on the lung cells, the lungs then serve as a reservoir for viral invasion and replication. The oral mucosa and intestine act also as alternative routes of viral transmission.¹ In the skin, immunoreactivity for ACE2 receptors was detected in the basal cell layer of the epidermis and hair follicles, eccrine glands, blood vessels and capillaries, sebaceous glands, and its surrounding smooth muscle cells. As such, skin cells expressing ACE2 receptors can act as home cells and are prone to SARS-CoV-2 invasion, facilitating cellular viral entry and replication.¹

COVID-19 not only is airborne through aerosols formed during medical procedures but also can be transmitted through saliva directly or indirectly even between patients without coughing or other respiratory clinical manifestations. The virus can also be carried out in infectious respiratory secretions, small or large droplets, and body fluids to contaminate oral, nasal,² and ocular mucous membranes.³ SARS-CoV-2 RNA was detected to be strongly positive in samples of both eyes from two patients with COVID-19, suggesting that this virus may spread through conjunctival contact.⁴ SARS-CoV-2 virus can be detected for up to 72 hours on some surfaces despite decreasing infectivity over time.⁵ This has brought attention to patients with defective skin barriers and receiving immunosuppressive therapy for diseases like psoriasis, atopic dermatitis, and autoimmune and nonautoimmune bullous diseases affecting skin and mucous membranes. We hypothesize that these diseases, which affect skin and mucous membranes and disrupt the normal barrier, and their treatments make these patients prone to SARS-CoV-2 invasion.⁶ Of course, further

studies are needed to isolate SARS-CoV-2 from active skin lesions caused by these diseases and find out the best way of protecting these patients. In addition, skin protective measures such as prolonged use of protective gloves lead to occlusion, epidermal maceration, and erosions; frequent hand washing with soaps and disinfectants causes irritation, epidermal barrier injury, and contact dermatitis; and long-term water exposure induces skin irritation and epidermal barrier disruption.⁷ In addition, on the Wound Care Learning Network, Amit Gefen has discussed skin failure under a medical face mask and how it will be a portal for the coronavirus to penetrate the body through skin abrasions.⁸ In our country, we notice an increased number of infections and deaths of health care providers as a result of COVID-19; one of them was a nurse from our dermatology department, for whom no obvious source of infection was specified, and this was despite following the protective measures, which raised questions about the route of infection; moreover, various forms of skin dermatitis were demonstrated in COVID-19⁹; this means that COVID-19 does not have a specific skin dermatitis like other viral diseases, which signifies different mechanisms of dermatitis development. Individuals with normal skin can simply get rid of skin contamination of SARS-CoV-2 by proper washing and antiseptics. On the other hand, patients with injured skin may be exposed to SARS-CoV-2 through their damaged skin barrier from respiratory droplets, saliva, or contaminated surfaces, giving the virus an opportunity to survive for a while after binding to ACE2 receptors expressed in skin cells, which facilitates cellular viral entry and replication, and thus the virus protects itself from washing and antiseptics.¹ Under this setting, the skin may act as an incubator and reservoir for SARS-CoV-2. Then, the virus spreads to the patient's hands upon touching, rubbing, or scratching injured skin, leading to self-infection by putting the hand in the mouth and remote infection to contacts who do not follow adequate social distancing. This may be one of the explanations for the rapidly increasing number of patients with COVID-19.

This prediction should not be ignored and the required protective measures for patients and health care providers should be put in consideration. It is highly recommended to apply a skin barrier cream under the face mask and on the

hands after thoroughly washing and sanitizing the hands to guard against skin injury. For patients with skin injury, active skin lesions should be properly covered with sterile dressings to guard against viral invasion. For suspected COVID-19 cases suffering from skin disease, we recommend upper respiratory swabs as well as active skin lesion swabs for SARS-CoV-2.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

1. Zhao Y, Zhao Z, Wang Y, et al. Single-cell RNA expression profiling of ACE2, the putative receptor of Wuhan COVID-19 [e-pub ahead of print]. *bioRxiv*. doi:10.1101/2020.01.26.919985, accessed MONTH DAY, YEAR.
2. To KK, Tsang OT, Chik-Yan Yip C, et al. Consistent detection of 2019 novel coronavirus in saliva [e-pub ahead of print]. *Clin Infect Dis*. doi: 10.1093/cid/ciaa149, accessed MONTH DAY, YEAR.
3. Colavita F, Lapa D, Carletti F, et al. SARS-CoV-2 isolation from ocular secretions of a patient with COVID-19 in Italy with prolonged viral RNA detection [e-pub ahead of print]. *Ann Intern Med*. doi:10.7326/M20-1176, accessed MONTH DAY, YEAR.
4. Xie HT, Jiang SY, Xu KK, et al. SARS-CoV-2 in the ocular surface of COVID-19 patients. *Eye Vis* 2020;7:23.
5. van Doremalen N, Bushmaker T, Morris DH, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *N Engl J Med* 2020;382:1564-1567.
6. Segre JA. Epidermal barrier formation and recovery in skin disorders. *J Clin Invest* 2006;116:1150-1158.
7. Lan J, Song Z, Miao X, et al. Skin damage among healthcare workers managing coronavirus disease-2019. *J Am Acad Dermatol* 2020;82: 1215-1216.
8. Gefen A. Avoiding skin damage from prolonged use of face masks during COVID-19. Available at: <https://www.woundcarelearningnetwork.com/content/avoiding-skin-damage-prolonged-use-face-masks-during-covid-19>. Accessed MONTH DAY, YEAR.
9. Joob B, Wiwanitkit V. Reply to: various forms of skin rash in COVID-19: petechial rash in a patient with COVID-19 infection [e-pub ahead of print]. *J Am Acad Dermatol*. doi:10.1016/j.jaad.2020.04.035, accessed MONTH DAY, YEAR.