

LETTER

Topical recombinant human acidic fibroblast growth factor: An effective therapeutic agent for facemask wearing-induced pressure sores

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Abstract

Protecting health care workers is crucial during coronavirus disease 2019 pandemic and facemask wearing is considered an effective measure to prevent severe acute respiratory syndrome coronavirus 2 infection. However, long-time use of a facemask can cause pressure sores on the ears and nose bridge and increase the risk of infection. The topical recombinant human acidic fibroblast growth factor (rh-aFGF) was used to cure pressure sores for health care workers at Zhongfaxincheng campus of Tongji Hospital. The results from a small sample size survey conducted in Zhongfaxincheng campuses of Tongji Hospital showed that treatment with topical rh-aFGF could significantly inhibit the progression of pressure sores and accelerate the wound healing with no apparent ill-effects. Therefore, we propose that topical rh-aFGF is an effective therapeutic agent for facemask wearing-induced pressure sores and worth of popularizing and applying.

KEYWORDS

COVID-19, pressure sore, rh-aFGF, SARS-CoV-2

Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is now overwhelming spreading in the world, and been declared a pandemic by the World Health Organization. Among the infection prevention measures for health care workers, facemask (the N95 health care particulate respirator and surgical mask) wearing is considered as an effective measure to prevent SARS-CoV-2 transmission.¹ However, long-time use of a facemask with earloop-style can result in pressure sores on the ears' skin.² Moreover, pressure sores on nose bridge is also liable to occur while working for long time since the metal strip always needs to be extruded to cling the nose bridge to reach a good respiratory protection.³ These pressure sores could cause intense discomfort, sick leave, even permanent scarring and high risk of infection for users, which would bring adverse impact on the medical service system.

To solve this thorny problem, topical recombinant human acidic fibroblast growth factor (rh-aFGF) was provided to health care workers to help curing pressure sores at Zhongfaxincheng campus of Tongji Hospital in Wuhan, China. Zhongfaxincheng campus of Tongji Hospital

is a designated hospital for severe COVID-19 and nearly 2000 COVID-19 patients were admitted. There are more than 3000 health care workers have participated in the fight against COVID-19, and sizeable numbers of them had suffered pressure sores at varying degrees caused by facemask wearing. Once the pressure sores occur, continuing to wear facemasks daily or every other day without any intervention will make the condition from bad to worse. However, our results from a small sample size survey conducted in the health care workers in Zhongfaxincheng campus of Tongji Hospital who have used the topical rh-aFGF with a concentration of 2500 U/mL to cure the stage I/II facemask wearing-induced pressure sores which were less than 1 cm² in size show that treatment with topical rh-aFGF could significantly inhibit the progression of pressure sore and accelerate the wound healing. The pressure sores healed within 5 days in all these respondents after treated with rh-aFGF consecutively, although masks were still wearing every day or other day along with the treatment.

Topical rh-aFGF is indicated to promote wound healing, including burn wounds and chronic wounds. In the early wound, macrophages

and endothelial cells at damaged parts released acidic fibroblast growth factor (aFGF) to stimulate proliferation of fibroblasts and keratinocytes, and then enhance local generation of tissue collagen, protease, and various cytokine which appear to be involved in the mechanisms underlying wound healing.^{4,5} Actually, numbers of studies have showed that aFGF could improve wound healing in various animal models and clinical trials.^{6,7} Therefore, based on the established role of aFGF, it is not unexpected that rh-aFGF has a good effect on pressure sores induced by facemask wearing.

Considering that rh-aFGF can increase the expression of collagen and muscle fibers, resulting in enhanced tissue remodeling,⁶ a worry that whether excessive tissue repair after long-term repeated rh-aFGF application would result in scar formation was raised. However, there was a research demonstrated that the high-dose, repeated rh-aFGF application did not cause excessive repair of the tissue or scarring.⁸ Moreover, the research also demonstrated that no obvious toxicity to the target organs and tissues was observed during the repeated treatment of rh-aFGF.⁸ These results were consistent with our survey feedback that no health care workers have claimed any discomfort or scarring happened during the use of rh-aFGF.

Therefore, we propose that topical rh-aFGF is an effective therapeutic agent for facemask wearing-induced pressure sores and worth of popularizing and applying. Wounds should be cleaned with chlorhexidine acetate immediately before rh-aFGF sprayed. The dosage and frequency of rh-aFGF is recommended as 100 U/cm² twice daily based on the labeling document and our experience. And if necessary, especially for these nasal pressure sores, cover the wounds with a benzalkonium chloride patch or sterile dressings after the treatment. Moreover, besides aFGF, the fibroblast growth factor family also comprises basic fibroblast growth factor (bFGF). It was reported bFGF has a role in accelerating skin wound healing and reducing scar formation.⁹ Thus, topical bFGF may be also a promising choice for pressure sores caused by facemask wearing.

However, there are also some points that should be noted. Alcohol, iodine, and hydrogen peroxide which are commonly used during the COVID-19 epidemic to kill SARS-CoV-2 can affect the activity of rh-aFGF. Therefore, contact with these substances should be avoided when using rh-aFGF. In addition, proper storage temperature for rh-aFGF is 2 to 8°C, do not exposure the product to a high temperature or froze it. It should be mentioned, though, that the rh-aFGF use is only an expedient measure, improving protective equipment would be meaningful and benefit global health. And measures including wearing facemask with a plastic handle and pasting benzalkonium chloride patch to the nose bridge before wearing mask were proposed as may have a role in preventing facemask wearing-induced pressure sores.^{2,3}

CONFLICT OF INTEREST

The authors declare no potential conflict of interests.

AUTHOR CONTRIBUTIONS

Juan Li and Dong Liu were responsible for the design of the study and revised the final manuscript. Pan Luo conducted the survey and wrote the draft.

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REFERENCES

1. Chughtai AA, Seale H, Islam MS, Owais M, Macintyre CR. Policies on the use of respiratory protection for hospital health workers to protect from coronavirus disease (COVID-19). *Int J Nurs Stud*. 2020;105:103567.
2. Jiang W, Cao W, Liu Q. Wearing the N95 mask with a plastic handle reduces pressure injury. *J Am Acad Dermatol*. 2020;82(6):e191-e192.
3. Yin Z. Covid-19: countermeasure for N95 mask-induced pressure sore. *J Eur Acad Dermatol Venereol*. 2020. <https://doi.org/10.1111/jdv.16490> [Epub ahead of print].
4. Brem H, Tomic-Canic M. Cellular and molecular basis of wound healing in diabetes. *J Clin Invest*. 2007;117(5):1219-1222.
5. Huang Z, Lu M, Zhu G, et al. Acceleration of diabetic-wound healing with PEGylated rhaFGF in healing-impaired streptozocin diabetic rats. *Wound Repair Regen*. 2011;19(5):633-644.
6. Zheng L, Hui Q, Tang L, et al. TAT-mediated acidic fibroblast growth factor delivery to the dermis improves wound healing of deep skin tissue in rat. *PLoS One*. 2015;10(8):e0135291.
7. Ma B, Cheng DS, Xia ZF, et al. Randomized, multicenter, double-blind, and placebo-controlled trial using topical recombinant human acidic fibroblast growth factor for deep partial-thickness burns and skin graft donor site. *Wound Repair Regen*. 2007;15(6):795-799.
8. Zhang L, Huang T, Bi J, et al. Long-term toxicity study of topical administration of a highly-stable rh-aFGF carbomer 940 hydrogel in a rabbit skin wound model. *Front Pharmacol*. 2020;11:58.
9. Huang C, Orbay H, Tobita M, et al. Proapoptotic effect of control-released basic fibroblast growth factor on skin wound healing in a diabetic mouse model. *Wound Repair Regen*. 2016;24(1):65-74.

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