Acta Scientific Microbiology (ISSN: 2581-3226)

Volume 7 Issue 5 May 2024

Editorial

Prophylactic Protection Against COVID-19 By ACE-2-Expressing-Lung Exosomes Inhalation

Attapon Cheepsattayakorn[1-4]*, Ruangrong Cheepsattayakorn[5] and Porntep Siriwanarangsun[2]

[1]*Faculty of Medicine Vajira Hospital, Navamindradhiraj University, Bangkok, Thailand*

[2]*Faculty of Medicine, Western University, Pathumtani Province, Thailand*

[3]*10th Zonal Tuberculosis and Chest Disease Center, Chiang Mai, Thailand*

[4]*Department of Disease Control, Ministry of Public Health, Thailand*

[5]*Department of Pathology, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand*

***Corresponding Author:** Attapon Cheepsattayakorn, 10th Zonal Tuberculosis and Chest Disease Center, Chiang Mai, Thailand.

Received: March 27, 2024

Published: April 01, 2024

SARS-CoV-2 infectivity depends on binding its S protein with the entry-receptor " hACE-2" a promising strategic treatment, therefore, is this interaction inhibition [1-3]. Some SARS-CoV-2 variants, such as B.1.1.7 (Alpha), B.1.617.2 (Delta), and B.1.1.529 (Omicron) variants were highly resistant to mRNA-1273 vaccine-induced humoral immunity or BNT162b2 [4-6]. A recent study demonstrated that in a female mouse model, inhalation of ACE-2-expressing-human-lung-spheroid-cells (LSC)-derived exosomes (LSC-Exo) (Figure 1) could protect the host throughout the whole lung by biodistribution and deposition against COVID-19 (SARS-CoV-2) infection by SARS-CoV-2 binding, blocking the interaction of host cells with SARS-CoV-2, and virus neutralization both in vitro and in vivo [7]. This study also revealed decrease of viral loads and protection of SARS-CoV-2-induced disease [7]. Three different types of inhalation devices are commonly used; jet, ultrasonic, and vibrating mesh (all are nebulizer) (Figure 2) [8]. In non-human primates and rats studies, when nebulized with eFlow, human immunoglobulin preparations were deposited into the airways as well as treated-lung alveoli [9]. VR942, an anti-interleukin (IL)-13 mAb is a first-in-class for dry-powder inhalers (DPIs) [10].

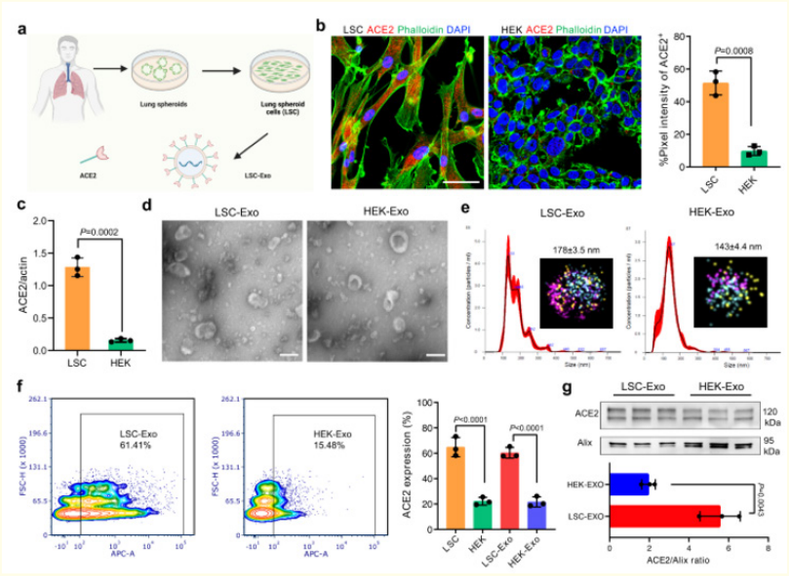

Figure 1: A. Demonstrating extraction scheme of LSC and LSC-Exo from healthy donors, created with Biorender.com. B. Demonstrating immunofluorescence staining and quantification analysis of ACE-2 on LSC and HEK. Scale bar: 50 μm. n = 3. C. Demonstrating Western blot quantification of ACE-2 expression in LSC and HEK, which derived from the same experiments and processed in parallel. n = 3. D. Demonstrating representative TEM images of LSC-Exo and HEK-Exo from 3 independent experiments. Scale bar: 100 μm. E. Demonstrating measurements of size distribution of LSC-Exo and HEK-Exo via nanoparticle tracking analysis. Inset: 3-colar dSTORM image of CD63-Alexa Fluor®-488, PE-CD9, APC-CD81 of LSC-Exo or HEK-Exo. F. Demonstrating quantification of ACE-2 expression on LSC-Exo and HEK-Exo by flow cytometry. n = 3 [7].

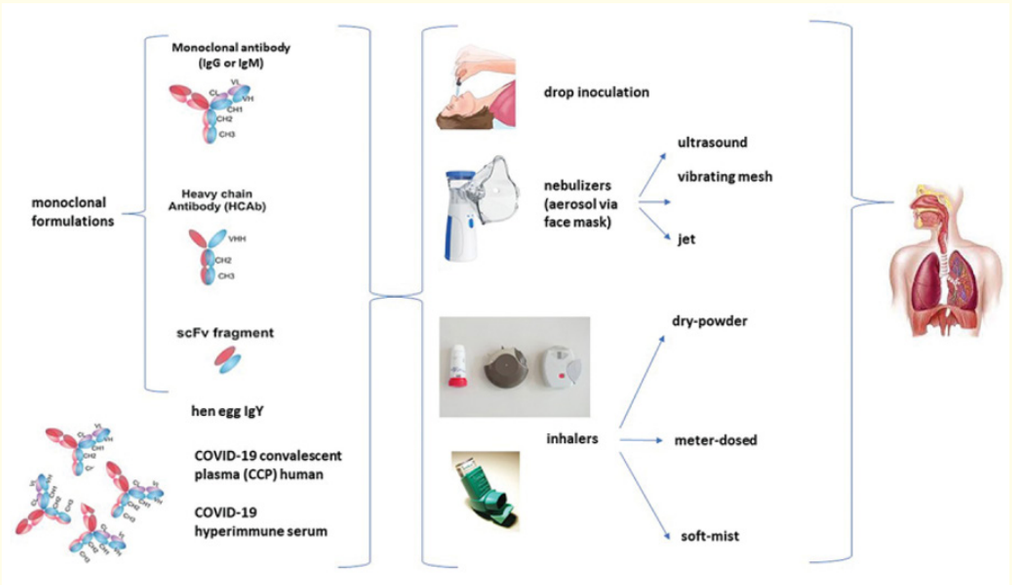

Figure 2: Demonstrating potential therapeutic approaches for respiratory delivery of passive immunotherapeutics against SARS-CoV-2 (COVID-19) [8].

In conclusion, ACE-2-expressing-human-lung-spheroid-cells-derived exosomes could be a promising-broad-spectrum bioprotectant against SARS-CoV-2 variants and other emerging virus variants.

Bibliography

1. Lan J. "Structure of the SARS-CoV-2 spike receptor-binding domain bound to the ACE-2 receptor". *Nature* 581 (2020): 215-220.

2. Huang X., *et al*. "Nanotechnology-based strategies against SARS-CoV-2 variants". *Nature Nanotechnology* 17 (2022): 1027-1037.

3. Zhang L., *et al*. "An ACE-2 decoy can be administered by inhalation and potently targets omicron variants of SARS-CoV-2". *EMBO Molecular Medicine* 14 (2022): e16109.

4. Garcia-Beltran WF., *et al*. "Multiple SARS-CoV-2 variants escape neutralization by vaccine-induced humoral immunity". *Cell* 184 (2021): 2372-2383.e2379.

5. Pouwels KB., *et al*. "Effect of Delta variant on viral burden and vaccine effectiveness against new SARS-CoV-2 infections in the UK". *Nature Medicine* 27 (2021): 2127-2135.

6. Hui KPY., *et al*. "SARS-CoV-2 Omicron variant replication in human bronchus and lung ex vivo". *Nature* 603 (2022): 715-720.

7. Wang Z., *et al*. "Inhalation of ACE-2-expressing lung exosomes provides prophylactic protection against SARS-CoV-2". *Nature Communications* 15 (2024): 2236.

8. Moroni-Zengraf P., *et al*. "Inhalation devices". *Canadian Respiratory Journal* (2018): 5642074.

9. Vonarburg C., *et al*. "Topical application of nebulized human IgG, IgA, and IgAM in the lungs of rats and non-human primates". *Respiratory Research* 20.1 (2019): 99.

10. Burgess G., *et al*. "Randomized study of the safety and pharmacodynamics of inhaled interleukin-13 monoclonal antibody fragment VR942". *EBioMedicine* 35 (2018): 67-75.