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Exhaled gas decontamination by connecting a ventilator exhaust port with an underwater seal system to prevent COVID-19 spread

Airborne infection isolation rooms with negative pressure are not universally available, especially in resource-limited settings like outbreak of corona virus infectious disease-19 (COVID-19).Intensive care unit preparedness in the setting of COVID-19 pandemics have been focused on broad concepts of infection control, increasing staffing capacity, and community engagement [1].Aerosol-generating procedures should be performed on ICU patients with COVID-19 in a negative pressure room to avoid cross-contamination during the SARS epidemic [2]. Other infection precautions for mechanically ventilated patient include the use of closed systems and dual limb circuitry with a High Efficiency Particulate Air (HEPA) filter attached to the exhalation limb to minimize environmental contamination and to minimize the risk of malfunction of expiratory flow sensors due to contamination with aerosol [3]. It is important that expiratory filters are changed after each nebulizer treatment, or every two to 4 h when continuous aerosols are administered. The coronavirus species, ranges in size from 0.06 to 0.2 μm. It is widely believed that HEPA filters are only capable of capturing particles sized 0.3 μm or larger. HEPA filters have been demonstrated to reduce virus transmission in simulated settings [3]. However the tiny mass of particles less than 0.3 μm not able to fly straight stuck into the HEPA filter due to Brownian movement. US government standards require a filter to remove 99.97% of particles sized 0.3 μm in order to qualify as HEPA [4]. In order to provide complete filtration and decontamination of exhaled air, we made an assembly by connecting a ventilator exhalation port (Hamilton C3, SN 2138, Switzerland) with an underwater seal system containing 1% sodium hypochlorite solution, Fig. 1. This assembly allows the passage of exhaled air through 1% sodium hypochlorite solution to make them decontaminated. An earlier study by Kampf G et al. [5] concluded that COVID-19, including SARS coronavirus, Middle East respiratory syndrome (MERS) coronavirus, and endemic human coronaviruses (HCoV), can persist on inanimate surfaces, such as metal, glass, or plastic, for up to 9 days, but are efficiently inactivated by 62%–71% ethanol, 0.5% hydrogen peroxide, or 0.1% sodium hypochlorite within 1 minute**.** This assembly may provide an extra protection from COVID-19 cross infection, especially when negative pressure space is not available. In our ICU setup we didn't measure the environmental Covid 19 virus particles level before and after the use of sodium hypochlorite underwater seal system, and thus further research and testing are necessary to validate this hypothesis.

Fig. 1. Ventilator exhaust port with underwater seal assembly.

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Consent

Taken from the patient.

Declaration of competing interest

Nil.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.tacc.2020.08.007.

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