監測醫院空氣新冠病毒及紫外線消毒的成效評估

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摘要

Coronavirus disease 2019 (COVID-19) 是由高度傳染性的severe acute respiratory syndrome coronavirus 2 (SARS-Co V -2)造成，全球確診人數已經超過6 億並造成超過650 萬人死亡。SARS-CoV-2 傳播方式有兩種，一種是吸入或是接觸其有傳染性的飛沫，另一種是吸入經由空氣傳播中含有具傳染性的病毒的氣懸膠體。

SARS-CoV-2 空氣傳播於醫院非常重要，院內COVID-19 病人可能污染周圍空氣並傳播給醫療照護人員而造成群突發事件，而檢測空氣中SARS-Co V -2 RNA 是一個了解SARS-CoV-2 空氣傳播的方式。執行產生氣溶膠的醫療程序可能會使醫護人員暴露SARS-CoV-2 而增加戚染風險，目前少有研究偵測不同產生氣溶膠的醫療程序之空氣中SARS-CoV-2 RNA 是否有差別。此外，之前的研究指出紫外線C 可以抑制空氣中氣懸膠體99.9% 的冠狀病毒，然而目前並無研究比較照射紫外線C 前後空氣中SARS-CoV-2 是否有差異。

此計畫目標將透過偵測醫院內不同區域之空氣中SARS-CoV -2 ，評估是否可以及早發現COVID-19 院內傳播;我們也將比較醫護人員執行不同產生氣溶膠的醫療程序之空氣中SARS-CoV -2 RNA 是否有差別，評估不同產生氣溶膠的醫療程序對於COVID-19 傳播的差異性;我們將比較同一地點照射紫外線C 前後空氣中SARS-CoV-2 的差別，進而評估照射紫外線C 對於抑制空氣中SARS-CoV-2 的效率。總的來說，我們將評估主動監測醫院內空氣中SARS-CoV-2 是否可以及早發現並減少COVID-19 傳播，也將評估使用紫外線C 是否為一有效抑制空氣中SARS-CoV-2 之消毒方式。

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Abstract

Coronavirus disease 2019 (COVID-19), caused by the highly transmissible severe acute respiratory syndrome coronavirus 2 (SARS-Co V -2), has spread globally and resulted in 617,597,680 confirmed cases and 6,532,705 deaths as of 3 October 2022. Reported transmission pathways of SARS-Co V -2 include inhalation or contact potentially infective respiratory droplets. Airborne transmission is suggested to be an additional pathway by inhalation of aerosols containing infectious virus.

Airborne transmission of SARS-Co V -2 is important in indoor air environrnents. In hospital settings, investigation of the possibility of airborne transmission is of utmost importance because viral contamination of the air surrounding patients with COVID-19 and health care professionals (HCPs) may have serious implications for outbreak control strategies. The detection of SARS-CoV-2 RNA in the air sample is a way to gain understanding of the risk of airborne transmission. A recent systemic review showed 17.4% of air samples from close patient environrnents were positive for SARS-Co V-2 RNA. The findings of SARS-Co V -2 RNA in air samples in different areas of hospitals support current guidance on the universal masking in the health facility. However, studies involving the effectiveness of active surveillance of the SARS-CoV-2 RNA in air samples to control the transmission of COVID-19 in hospitals are limited.

Aerosol-generating procedures (AGPs) may elevate aerosol concentrations in the surrounding air and expose HCPs to pathogens causing acute respiratory tract infectìon. The definition of AGPs included intubation, noninvasive positive-pressure ventilation, tracheotomy, cardiopulmonary resuscitation, bronchoscopy, and sputum induction. In the context of COVID-19, AGPs are considered to be of special concern for infection control and required higher grade of personal protective equipment. However, recent studies raised questions that AGPs are unlikely to be associated with generation of infectious aerosol that poses a risk to HCPs. In addition, studies comparing presence of SARS-Co V -2 RNA in air samples during different AGPs are limited.

Disinfection methods that can inactivate virus suspended in the air may contribute substantially to reduce the transmission. Previous study showed ultraviolet C (UV -C) can efficiently inactivate up to 99.9% of aerosolized coronaviruses.In the context of COVID-19,the installation of an upper room UV-C irradiation device in healthcare facilities,indoor spaces that accommodate a large number of people,or even in household settings,can be beneficial.However,studies comparing the SARS-CoV-2 RNA in air samples before and after UV-C irradiation have never been reported.

In current proposal,we aim to detect the SARS-CoV-2 RNA in the air in different areas in our hospital.We will evaluate the effectiveness of monitoring the SARS-CoV-2 RNA in the air to control COVID-19 transmission in our hospital. We will compare the SARS-CoV-2 RNA in the air duing different AGPs. We will also try to demonstrate whether UV-C irradiation is an effective way to decontaminate the air.In conclusion,we will try to determine that detection of the SARS-CoV-2 RNA in the air is important in the hospital setting for infection control of COVID-19.