NOUS Comments on ISHRAE COVID 19 Guidance Document for Air-conditioning and Ventilation

COVID-19 Transmission Routes
The size of a coronavirus particle is in the range of 80-160 nanometers. It is transferred via infected microscopic airborne particles and contaminated aerosol droplets. Droplets and small particles of a broad spectrum of diameters get generated during the course of coughing & sneezing and, to a lesser extent, even by talking and breathing (refer Figure 2, which is indicative).

NOUS Comments

(Reference: J Exp Med. 2005 Aug 1; 202(3): 415–424, doi: 10.1084/jem.20050828, PMCID: PMC2213088, PMID: 16043521, Multiple organ infection and the pathogenesis of SARS report on autopsies of symptomatic patients, using RT-PCR and Electrone Microscopy)

Based on detailed study of pathogenesis of the new infectious disease, severe acute respiratory syndrome (SARS), the virus seemed to be capable of infecting multiple cell types in several organs; immune cells and pulmonary epithelium were identified as the main sites of injury. SARS viral particles and genomic sequence were detected in a large number of circulating lymphocytes, monocytes, and lymphoid tissues, as well as in the epithelial cells of the respiratory tract, the mucosa of the intestine, the epithelium of the renal distal tubules, the neurons of the brain, and macrophages in different organs in Humans. Viral particles, with diameters of 80–120 nm, were located in the cytoplasm.

The target organ of SARS is believed to be the lungs, but patients often have evidence of other organ dysfunction, including gastrointestinal symptoms, abnormal liver function, splenic atrophy, and lymphadenopathy. This reflects widespread immune cell injury (immunopathology) or the presence of extrapulmonary SARS-coronavirus (CoV) dissemination and replication, as has been observed in other species infected with animal coronavirus.

It is postulated, the SARS virus enters the body through the respiratory tract and first infects the epithelial cells of the trachea, bronchi, bronchioles, and lungs. The virus infects resident, infiltrating, and circulating immune cells. The circulating immune cells carry the virus to other organs. The virus infects and damages the immune cells of the spleen, peripheral and central lymph nodes, and other lymphoid tissues. The immune defence is weakened significantly, which leads to rapid deterioration of the pneumonia. In the same manner, the blood-borne SARS virus infects other organs. As such, patients who have compromised immune function, such as those who have chronic diseases and aged individuals, suffer a more severe illness and have a much higher mortality from SARS.

These infected epithelial cells and infected immune cells, when transferred by coughing or sneezing, transmit the disease from one human to another. They travel in the air as respiratory droplets and on reaching the nasopharyngeal mucosa of another person, infect his or her epithelial cells and circulating immune cell. The travel distance for respiratory droplets is considered to be 1.8 M (maximum 2 M).

When the droplet particles are >5-10 µm in diameter they are referred to as respiratory droplets, and when then are <5µm in diameter, they are referred to as droplet nuclei.

These infected cells are generally not aerosolised, as they are heavy mot droplet nuclei. But they can travel as fomites in the immediate environment and can be transmitted by contact.

Airborne transmission is only possible when these respiratory droplets are aerosolised which happens when these patients are intubated or given Oxygen therapy. The Oxygen delivery at 4Kg pressure is sufficient to aerosolise the patient's Nasal secretions. Aerosols travel much more than 2 M, depending upon force of aerosolization. This is the reason for higher infection rate in Healthcare Workers treating Covid-19 positive cases.

(Therefore, all other descriptions in the ISHRAE COVID 19 Guidance Document refer to experimental conditions)

Routes of Transmission in Human Body : Mucosa (mouth and nose) or conjunctiva (eyes) exposed to potentially infective respiratory droplets.

Room Ventilation: Ideally, all COVID -19 patient treatment area is kept at negative pressure by deploying calibrated airflow, which prevents contaminated air from flowing into adjacent areas. The air flows from "clean" to "dirty," entering at the ceiling, near the patient bed's foot end and exiting at the

room's most infectious point, just above the floor at the head of the patient bed. It Requires 2 Fresh ACH and minimum 12 Total ACH.

The healthcare team should not cross 2/3 of patient bed starting at foot end to keep themselves safe.

If patients need oxygen therapy or ventilation, use a barrier to protect the Healthcare Providers face and breathing zone.

Ideal treatment of exhaust air is a **Virus Burn Out Unit** with forced dilution. It is used in all RT PCR rooms.

Diffused air aerator tank may also be deployed.

Use of Ultraviolet light is not supported by ASHRAE.

Plasma Bipolar ionisation can be used, though its effectiveness is 95%.

Hope you find this informative. Thx for contacting us.

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