



COVID - 19 AND AIR CONDITIONING OF HOSPITALS

Community Medicine

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ABSTRACT

Coronavirus disease (COVID-19) is an infectious disease caused by novel virus Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). Various modes of spread of this disease include respiratory droplets, physical contact, and contact with surface and fomites. Air Conditioning is an important component of a HVAC system but in case of COVID 19 scenario, the AC could be dangerous in spreading the disease if not controlled and wisely operated. Though there is evidence that hospital HVAC systems play a vital role in mitigating the spread of diseases like Middle East respiratory syndrome, Severe acute respiratory syndrome (SARS) and tuberculosis but with the increasing number of COVID -19 positive patients and their admission in hospitals, various queries regarding use of AC has been raised worldwide and the question still remains "Whether to use or not to use AC in hospitals during COVID-19 Pandemic?"

KEYWORDS

COVID-19, Air Conditioning, HVAC systems, Hospitals

INTRODUCTION

Coronavirus disease (COVID-19) is an infectious disease caused by novel virus Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). Various modes of spread of this disease include respiratory droplets, physical contact, and contact with surface and fomites. Containment of COVID-19 requires isolation of patients and contacts, proper ventilation of hospitals, offices, public places and residential buildings as the main route of spread is respiratory. Air-conditioning (AC) is the process of treating air so as to control its temperature, humidity, cleanliness and distribution, to meet the requirements of the conditioned space. With the increasing number of COVID -19 positive patients and their admission in hospitals, various queries regarding use of AC has been raised worldwide and the question still remains "Whether to use or not to use AC in hospitals during COVID-19 Pandemic?"

Hospital Heating, ventilation and air conditioning (HVAC) system play crucial role in mitigating diseases like COVID-19.

According to the Center for disease control and prevention (CDC) and American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), hospital HVAC systems play a vital role in mitigating the spread of diseases like COVID-19, Middle East respiratory syndrome, Severe acute respiratory syndrome (SARS) and tuberculosis. Use of AC is a double edge sword in the present COVID-19 scenario as on one hand AC provides comfort and climate control but on the other its usage increases risk of spread of corona virus to other parts of the hospital, through the air-conditioning system. When an infected person coughs or sneezes, respiratory droplets can travel through the air and be inhaled by people in close proximity, so it is critical to ensure airborne infection controls are working properly. The CDC recommends placing patients in airborne isolation infection rooms (AIIRs). AIIRs are negative pressure single-patient rooms with a minimum of six air changes per hour. (12 are recommended for new construction).

Stability of COVID-19 and treatment of Vented Air is another important aspect. COVID-19 is stable for a period from several hours to days in aerosols and on surfaces, especially on plastic and stainless steel. One suggested solution is using portable furnaces to sterilise contaminated building exhaust. Recent study results from National Institutes of Health, CDC, UCLA and Princeton University scientists (van Doremalen N et al. 2020), shows that the novel coronavirus can be detected in aerosols for up to 3 hours, on copper for up to 4 hours, on cardboard for up to 24 hours and on plastic / stainless steel for 2-3 days. These observations suggest that the infection can spread through the air as well as by touching contaminated surfaces. Based on data about similar viruses (SARS, influenza, foot-and-mouth disease) Yin and his collaborators preliminary estimate that treating exhaust to temperatures of 125°C for 3 seconds before release would deactivate 99.99% of COVID-19. (1-4)

RECOMMENDATIONS

Recommendations as per the publications in various peer reviewed

journals and reports from relevant organisations around the world to provide safe ventilation for Fever Clinics, Wards, Intensive care units and Operating Theatres. (5-11)

(a) FEVER CLINIC

Fever Clinic is an earmarked area for screening of COVID-19 suspected cases. Here the patient spends less time because only screening examination is done but the medical staff has to be there for an entire shift. It should be established in a non AC room having adequate circulation of air and effective exhaust system. Alternatively separate AC, preferably split air conditioner can be provided.

(b) WARD

Isolation ward has COVID-19 positive patients usually with mild to moderate symptoms. Wards are having continued occupancy and therefore the role of ventilation is to provide environment comfort, removal of contaminants, non turbulent unidirectional airflow and prevention of leak of contaminated air. Adequate number of exhaust fans can be installed in wards where there is no provision of AC. In centrally AC areas, dedicated Air Handling Unit (AHU) should supply air to Isolation wards. AHU can provide better ventilation, filtration and Coil disinfection. Droplet nuclei and viral particles can pass through the micro filters and therefore room air should not be recirculated and 100% fresh air should be pumped in. Blocking of return of air vents may be done as an urgent measure before admitting COVID-19 positive patients and maintain a negative pressure in the ward. The ward should have 12 air changes/hour, temperature should be maintained between 24° + 2°C and relative humidity at 40-60 %. The exhausted air should be let off into the atmosphere through an upward plume at a height of 3m above the tallest point of the building and at least be 25 feet away from air intakes or nearest inhabited areas.

(c) INTENSIVE CARE UNIT

The Intensive care unit (ICU) has high risk of infection due to many aerosol generating procedures and continued occupancy, both of the patient and staff. Isolation ICU should be established as single occupancy hermetically sealed room with dedicated air-conditioning. In central AC facility the Air Handling Units should supply 100% fresh air and the dampers of the system should be adjusted to ensure that there is no recirculation of air. ICU should be maintained at a negative pressure of 2.5 Pascal's (preferably >5 Pa) to prevent leakage of contaminated air from ICU into surrounding areas. An anteroom should always be established at the entrance to ICU to moderate the pressure change while opening doors. Should have 12 air changes/hour. Temperature to be maintained between 20°C to 24°C and relative humidity at 40-60 %. Air treatment should be with HEPA filtration of exhausted air. HEPA filters shall be a minimum of H13 (EN1822-1) filter class or equivalent. Alternatively exhausted air could be passed through chemical disinfection by using diffused air aerator tank having 1% sodium hypochlorite solution or passing through a heated duct of more than 100° C temperature for at least 03 seconds.

(d) OPERATION THEATER

Hospitals should designate at least 01 or 02 Operation Theater (OT) for surgeries of COVID 19 positive patients. This OT should be separate from the main OT of the hospital. The OT should be maintained at a negative pressure of 05 Pascals to prevent leakage of contaminated air from OT into surrounding areas. Self closing, hermetically sealed doors should be there. The OT should have 15 air changes/hour supplied through a Non-aspirating diffuser with temperature maintained between 20°C to 24°C and relative humidity at 40-60%.

CONCLUSION

Air Conditioning is an important component of a HVAC system but in case of COVID 19 scenario, the AC could be dangerous in spreading the disease if not controlled properly. The role of AC in COVID facility should be environment comfort for patient / staff, removal of infection carrying particles, prevention of recirculation of air and safe disposal of exhaust air. Room pressurization, air change rates, humidity, and temperature all play an integral role in mitigating airborne contaminants to provide a healing space for patients while also providing a high level of protection for healthcare personnel. In the end it can be finally stated that Hospital HVAC systems, if operated wisely can play an important role in mitigating COVID-19.

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