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Role of Aerosols in the Spread of Covid-19- A Review

Ashwini K[1], Anjali A K*[1], Vinay Sivaswamy[2]

[1]Department of General Pathology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai-77, Tamil Nadu, India
[2]Department of Prosthodontics and Implantology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai-77, Tamil Nadu, India

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Abstract

The COVID-19 pandemic was identified in late 2019 at Wuhan, China. Its outbreak causes respiratory illness. It is considered to be a potential zoonotic disease and is asymptomatic or flu-like.SARS is a new clinical entity of the COVID-19 outbreak. The other symptoms are fever, sore throat, cold. They spread through droplets, saliva, or sneeze. They are also transmitted to the child by placental transmission. The airborne transmission is by aerosols where droplets are >5μm. They become bioaerosols and are found to travel more than 100 meters. In experimental work, it is found that the particles of COVID can be detected 3 hours after no clinical setting. The only way to stop the spread is appropriate preventive measures like PPE, respiratory etiquette, and social distancing. There are some recent advances in the field to stop the spread of COVID-19. In this review, we discuss the transmission and spread of coronavirus by aerosols and the various preventive measures used by medical practitioners to stop the spread of this pandemic.

*Corresponding Author

Name: Anjali A K
Phone: 9387957805
Email: anjaliak.sdc@saveetha.com

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INTRODUCTION

The new public health crisis threatening the world with the emergence and spread of 2019 novel coronavirus (2019-n CoV) (Singhal, 2020). The virus was first originated in bats and was transmitted to humans through unknown intermediary animals COVID-19 originated in the city of Wuhan, Hubei province, China also named as severe acute respiratory syndrome coronavirus (SARS-CoV 2) (Adhikari, 2020). It is asymptomatic or flu-like. It belongs to a subfamily Orthocoronavirinae in the family Coronaviridae (Wu *et al.*, 2020). It is an enveloped RNA virus and has caused the pandemic in early 2020, spreading to nearly 72 countries (Li, 2020a). It is a potential zoonotic disease and endangers life (Singhal, 2020). Some of the symptoms are fever, sore throat, common cold, GI symptoms, and if it exceeds even death (Brundha, 2015). Human to human transmission via droplets, direct contamination, saliva, and sneeze is described with incubation for 14 days (Zhai, 2020). Its cytopathological features include Vero E6 inoculated in throat specimens and tested pathologically (Brundha and Nallaswamy, 2019). If the smear taken from the throat gets dried, liquid paraffin is used as a rehydrating agent (Harsha and Brundha, 2017). It is proven to have promising results due to the better marginal nuclear details than the routine wet fixed smear (Hannah, 2019).

Intensive research on the newly emerged SARS-CoV 2 is urgently needed to elucidate pathological mechanisms and spread the transmissions (Kalaiselvi and

Brundha, 2016). In addition to this, the investigated treatment options for COVID-19 infection has to be found immediately due to the alarming rate of its spread (Prashaanthi and Brundha, 2018).

Discussion

Mode of transmission and origin

The SARS-CoV 2 is a β-coronavirus which is enveloped with an RNA genome. They have four genera.β and α CoV infect mammals and γ and δ CoV tend to infect birds.β-CoVs and SARS-CoV are severe and potentially fatal respiratory tract infections (Yin and Wunderink, 2018). It was found that the genomic sequence of SARS-CoV 2 is 96.2% identical to that of a bat CoVRaTG13.Based on this, it is suspected that the bat is a natural host of origin and might be transmitted via unknown intermediate hosts to infect humans (Zhou, 2020).

In humans, it is transmitted via respiratory droplets of cough, sneeze, direct contact with objects, and even maternal transmission during the 3rd trimester of pregnancy (Desai and Patel, 2020). The person within 6 meters radius is infected with COVID when an infected person sneezes. The droplets travel by aerosols as in an airborne transmission and affect the people around (Wang and Du, 2020). It is considered to be contagious. The maternal transmission is an asymptomatic carrier transmission (Preethikaa and Brundha, 2018).

Based on that data collected in Wuhan, incubation time ranges generally within 7-14 days (Li, 2020b). The reproduction is doubled after one week. Further studies are needed to understand the mechanisms of transmission and duration of infectivity (Wang and Du, 2020).

Role of aerosols

Transmission through aerosols is possible in case of protracted exposure to elevated aerosol concentrations in closed spaces (Cascella, 2020). Aerosols are solid or liquid particles suspended in the air. When coughed or sneezed, the virus is dissolved in aerosol and becomes bio-aerosols (Quadri, 2020). The particles in bio-aerosols are generally 0.3-100 μm in diameter. The bio-aerosols of the size that range from 1-5 μm generally remain in air and layer particles are surface deposited (Yu, 2004). Droplets of saliva are 1-5 mm (Doremalen, 2020). They spread in a space of about 1-2 m from the source of infection. The aerosols can even travel more than 100 meters (Zhang, 2013). Viruses are even detected 3 hrs after aerosolization (Adhikari, 2020). The two possible modes of COVID-19 aerosol transmission are (Lu *et al.*, 2020).

During a sneeze/cough, “droplet sprays” of virus-laden respiratory tract fluids, >5 μm diameter (Todd and Belteton, 2014). Susceptible persons initiate microscopic aerosol particles consisting of residual solid components of evaporated droplets (>5 μm) to remain airborne for hours (Ningthoujam, 2020).

In the dentistry field, there is a significant aerosol transmission due to direct contact with droplets making it a high risk for people under this field (Ge, 2020).

Experimental work

The experimental work involved artificially generated aerosols using a nebulizer and maintained in the suspended air with a Goldberg drum. It was found that the virus present in aerosol even after 3 hours, has no clinical setting or infection (Asadi, 2020).

Reducing aerosol transmission

In order to reduce the transmission, appropriate Personal Protective Equipment (PPE) should be used (Ravichandran and Brundha, 2016). Hand Hygiene is a must and hands should be sterilized with soap and water or sterlium every 2 hours for 20 seconds (Kumar and Brundha, 2016). Proper respiratory etiquette should be maintained and the mouth should be covered whenever sneezed (Brundha, 2016). Environmental cleaning, like fogging and fumigation, should be done on a daily basis (Shreya and Brundha, 2017). Social distancing among people should be maintained. The public gathering should be availed and for the safety being, home quarantined is the best way possible (Sohrabi, 2020).

Recent advances in COVID-19 treatment

These are some of the treatments uptaken and studied experimentally to reduce the transmission of COVID-19.

1. Convalescent Plasma Transfusion (CPT) is one of the new advances that was found to reduce mortality and is appeared to be clinically safe and effective (Balaji *et al.*, 2016). The convalescent patients were asked to donate blood and the convalescent plasma was collected within two weeks after recovery to ensure the neutralization of antibody titer (Shenoy and Brundha, 2016). The difficulty in obtaining plasma is its clinical application (Rajendran *et al.*, 2020).

2. The most promising antiviral therapy is Remdesiver and it has an in vitro activity against SARS-CoV 2.Other antivirals like chloroquine, arbidol, etc. Are still under research (Senanayake, 2020).

3. The discovery of vaccines is still under progress. It is a long process and further findings and studies are needed to optimize vaccination strategies for the emerging infection (Dong *et al.*, 2020).

4. Radiation therapy is widely used for cancer. But it may be introduced in the treatment of COVID to slow down the rate of growth and killing the pathogen (Rajendran *et al.*, 2020).

5. It was scientifically proven that regenerative medicine using dental pulpal stem cells can cure any diseases (Brundha *et al.*, 2019). But still, a clinical trial needs to be carried out and can be introduced into the medical field after testing (Timothy *et al.*, 2019).

CONCLUSION

The droplets generated by talking, laughing, coughing, and sneezing potentially lead to a generation of an infectious aerosol. The survival of such aerosolized pathogens depends upon environmental conditions such as temperature and RH which both can vary with season and environment. Such aerosols can be transmitted over short and long distances. The airborne transmission can be restricted in 3 ways: Controlling the source of infection by quarantine and isolation, Controlling the use of negative pressure ventilation systems and stopping the transmission routes, Protocol exposed susceptible individuals from both aerosols and contact transmission by use of appropriate PPE.

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Conflict of Interest

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