

COVID-19: Persistence, Precautions, Diagnosis and Challenges

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Abstract

After a century, the whole world fighting against the pandemic viral infection: a novel coronavirus, COVID-19. Currently, more than 210 countries are suffering from COVID-19 with the number of affected countries and patients are exponentially increasing day by day. It became a global health issue where more than 2.7 million cases were reported with a death ratio of approximate 7% globally by World Health Organization (WHO) (as of 24 April 2020) which is a 22 times higher numbers in 1.5 month and this figure increasing day by day at an alarming rate. The maximum infected cases reported from the most developed country and the world leader America however, the maximum death cases are from the world's second health service provider country Italy. China, the origin country of COVID-19, has taken serious actions in terms of prevention, control against the spreading of this coronavirus through lockdown, sanitation, medication, and social distancing. The risk of transmissions of coronavirus from humans to humans is more and thus a social distancing is the best way for its persistence and precautions. Thus, the COVID-19 outbreak continues must explore and evolve, certain strict and mandatory precautions to stop this dangerous devil virus. Also, it is a major challenge for all global scientists to find out an effective remedial drug to control this deadly coronavirus before uncontrolled conditions. Thus, considering the depth of the spreading of coronavirus and its impact on global health, it is necessitating to know the dos and don'ts for persistence, precautions, and diagnostic strategies against the challenging COVID-19.

Keywords: COVID-19, coronavirus, persistence, precautions, diagnosis, challenges

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INTRODUCTION

In recent years, several viruses emerged with pandemic potential and a variety of human diseases with unknown etiology are still present¹. A viral origin has been suggested for many of these diseases hence must need to focus on the importance of searching for new viruses²⁻⁴. Coronavirus (*Coronaviridae*), an enveloped virus with a genome size of 27–32 kb RNA^{5, 6}. A very first report of isolation of prototype murine coronavirus strain JHM was in 1949 by Bailey and Cheever research group⁷⁻⁹. Based on the host-specific characterization and genome sequences, three different groups of coronaviruses were investigated⁶. These viruses were identified from different animal sources such as cats, cattle, chickens, dogs, horses, rabbits, swine, turkeys, and humans as well^{5, 6}. The resultant infectious diseases developed for the upper respiratory tract, gastrointestinal tract, hepatic, and central nervous system. Upper respiratory tract infections were the primary infection found in humans and fowl, while the enteric infection was caused by porcine and bovine coronaviruses which resulted in a severe economic loss^{5-6, 10-12}.

Besides this, coronaviruses caused respiratory diseases called Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV), where a total of six species were involved for human infections¹³. First two species, HCoV-229E and HCoV-OC43 were identified in the mid-1960s, which causes a common cold¹⁴, however, rest 4 species were Severe Acute Respiratory Syndrome coronavirus (SARS-CoV), Middle East Respiratory Syndrome Coronavirus (MERS-CoV), HCoV-NL63, identified in the Netherlands from an infant with bronchiolitis⁶, and HCoV-HKU1, identified in an adult patient with severe pneumonia in Hong Kong⁵¹. Among these, SARS-CoV and MERS-CoV were found to be highly pathogenic and SARS-CoV identified as the most pathogenic human coronavirus which causes life-threatening pneumonia¹⁵⁻¹⁷. It transmits to humans through the zoonotic way, as this virus resided in animals^{18, 19}. The most recently a challenging and deadly COVID-19 coronavirus causing the respiratory infection is reported for its epidemiology, etiology and clinical characteristics²¹⁻²⁷.

COVID-19 a rapidly progressive disease reported first time with 29 pneumonia cases of

unknown etiology at WHO office, (Wuhan, Hubei province, China) on 31st December 2019 and based on genetic sequence, it was quickly identified as novel β -coronavirus on 12th January 2020. After a month, WHO named the disease as COVID-19 (Coronavirus Disease 2019), caused by the novel coronavirus²⁷⁻³⁰. Rapid progression indicators of COVID-19 were high infectivity and insufficiency of an effective treatment. It is the utmost importance to develop efficient strategies to control the pathogenesis of COVID-19. Though many therapeutic options were already introduced such as the use of existing and new generation antiviral, steroids and different medicinal treatment, still the optimal strategy for severe COVID-19 remains unclear. During the last two months, the confirmed cases of COVID-19 rapidly accumulated, but due to the limited information on novel coronavirus and its pathogenesis, it becomes a challenging issue for all global scientists. Nevertheless, no definite treatment has been identified so far, which makes it extremely difficult for clinical studies. Thus, considering the death rate of COVID-19 infected cases and to get a concrete remedial action, this paper provides combined information of coronavirus sources, infections, symptoms, and its preventive, precautionary measures need to apply and new scientific challenges for citizens, scientist, and societies which may help to find out effective strategies for COVID-19 treatment.

Routes of infection

Viruses including, SARS-CoV, MERS-CoV, and influenza can survive on different surfaces from hours to extended periods up-to months. The factors influencing the survival of these viruses are surface type, suspension medium, type of strain, temperature, and relative humidity¹. Direct and indirect contact plays an important role in the transmission of such viral infections. Indirect contact transmission such as contamination of inanimate surfaces is uncertain when compared with direct contact transmission of independent of surface contamination such as droplet or airborne routes³¹⁻³³. Boone and Gerba³³, and Spicknall et al³⁴, reported transmission of SARS-CoV from different surfaces of the environment to the hand of patients and healthcare workers. The test was done in Homes and day-care centers in Tucson, Arizona, USA³³. It was also reported that the hands of the patient can then initiate self-inoculation

through mucous membranes of the nose, eyes or mouth. Thus, contact transmission is the most common route of transmission suggested through the intervention studies of mathematical and animal models¹.

Clinical Symptoms

COVID-19's common symptoms include fever, cough, breathing problem and myalgia or fatigue. Preliminary stage symptoms are diarrhea and nausea, and a dominating fever but may not premier symptom of infection. Some patients may suffer from headaches or hemoptysis and even relatively asymptomatic^{18, 25, 35}. However, older age patients have respiratory failure due to severe alveolar damage²². With time, the disease spread rapidly resulting in the dysfunction of cardiac or kidney organs²⁵⁻²⁸. COVID-19 infected patients showed low immunity by lowering defensive white blood cell count, lymphopenia, or thrombocytopenia, with extended and activated thromboplastin time and increased C-reactive protein level^{18,22,25,28}. Thus, COVID-19 act rapidly on a low immune patient and act very fast in the host patient. So it necessitates checking the most common symptom related to this disease regularly and ignorance of this may result in a national/global damage.

Persistence and precautions

Center for Disease Control and Prevention (CDC) and the WHO released official documents to provide interim guidelines for the collection, handling, and testing of clinical specimens that might contain SARS-CoV-2^{36, 37}. The guidelines showed preventive measures under 5 different subheadings such as hygiene maintenance, use of biocidal agents, social distancing, quarantine people and mentality.

Hygiene Maintenance

Hygiene and health effectively reduce the transmission of respiratory infections. Therefore, personal protective measures including frequent hand washing and use of face mask have been widely deployed risk of respiratory droplets or aerosols³⁸.

The use of different concentrations of alcohol-based hand sanitizers and disinfectants such as bleach has played an important role in inactivating SARS-CoV-2. However, the use of high-quality N95 or FFP3 masks prevents respiratory tract infections. Environmental

disinfection such as surfaces and substances that can pose a risk, with appropriate sanitizers is also recommended^{38, 39}.

Use of Biocidal Agents

Various types of biocidal agents such as hydrogen peroxide, alcohols, sodium hypochlorite or benzalkonium chloride were used worldwide for disinfection, mainly in healthcare settings^{40, 41}. From above all biocidal agents, 95% ethanol with 30 seconds treatment found to be highly effective in disinfection in COVID-19⁴¹. Due to the huge demand for biocidal requirements, WHO released a guide to local production of alcohol-based hand rub formulations for patient's safety⁵².

Social Distancing

Social gathering is the main source of widespread community transmission of COVID-19 and thus, community mitigation measures to curb local transmission must be carefully considered and applied wherever possible. It includes the closure of public places such as schools, colleges or private companies, transportations, etc. Its extended version includes banning on mass grouping, the mandatory wearing of masks, isolation of ill persons, and appropriate disinfection/hygiene measures could reduce mortality. Curfew and long-time country lockdown will be an effective way to decrease transmission and spread the epidemic over a longer period. Thus, the overall impact of social distancing regulates the height of the epidemic peak, by reducing the overall number of infected persons and the overall health impact too⁴².

Quarantine People

Quarantine the people having preliminary symptoms or COVID-19 confirmed patients in hospitals. The close contacts of such quarantine peoples must be carefully tracked, tracked and quarantined at home or in designated quarantine facilities. Most of the countries (Hong Kong, Singapore, Taiwan, etc.) use these practices to avoid the transmission of this disease. To date, these containment measures appear to have been able to prevent sustained local transmission. However, quarantine measures can be costly challenging to enforce and introduce location-specific ethical and legal challenges that may hamper control efforts³⁹.

Mentality

Any preventive or precautionary measure

is behavioral and the personal or community mentality with positive thinking resulted in a synergistic effect and fighting spirit against deadly viral infections. Thus, the mentality concept related to COVID-19 will be selfishness about us first followed by the community. Thus, self-declaration about the asymptomatic patient and its isolation initiative as well as acceptance of health department and governmental decisions is of great importance³⁹.

Diagnosis

COVID-19 has very rapid progression, high infectivity, and unavailability of sufficient and effective treatments are the major concerns, to control the COVID-19 pathogenesis. Though many therapeutic options of antiviral steroids, ayurvedic, allopathic, and traditional Chinese medicine are in existence still, the most favorable and effective medicine against COVID-19 remains unclear^{39, 43}. From December 2019 to date COVID-19 cases to death rate are exponentially increasing due to very limited information on the pathogenesis of this virus. So far, no definite treatment has been identified, which makes it extremely difficult for clinical and global management⁴³.

PCR based method or deep sequencing genomic techniques used currently for the detection of virus and diagnosis^{24,44,45}. But for detection with these techniques, a sufficient quantity of sample collection (presence of viral genome) for amplification must be needed. But, the probability of false results will be more, if the viral replication time window is missed. Similarly, an incorrect sample collection can limit the usefulness of qPCR-based assay. A false negative diagnosis can have critical consequences, especially at the peak stage of the pandemic by allowing infected patients to spread the infection and hampering the efforts to contain the spread of the virus⁴⁶. In such a scenario, an additional screening method is needed to ensure the timely and reliable diagnosis of an infected person. To enhance the detection sensitivity and accuracy, a combined method of PCR with IgM antibodies production was developed by Li et al. which significantly improve in the diagnosis of COVID-19²⁴. Another antibody-based COVID-19 treatment and recovery were observed by the application of a high-dose intravenous immunoglobulin (IVIg) by blocking the progression of disease cascade⁴⁷. To conquer

COVID-19 viral infections, proteolytic processing of viral polyprotein and such protease inhibition could be a therapeutic strategy. Virtually a total of 687 million compounds were screened and identified as novel coronavirus protease inhibitors⁴⁸. Sommerstein and Grani reported that angiotensin-converting enzyme (ACE) inhibitors (ACE-Is) could act as a potential risk factor for fatal COVID-19 by up-regulating ACE2⁴⁹. However, Kuster et al. reported the opinion that inhibition of the RAAS (Renin-Angiotensin Aldosterone System) might be protective in COVID-19⁵⁰.

A physical treatment method could be an effective tool to control the COVID-19, thus Zu and his research group recently reported radiological treatment in an understanding of clinical and chest CT imaging features of coronavirus disease 2019 (COVID-19) which will help for early detection of the infection⁵¹. Thus, it is essential to develop a strategic plan and its rapid execution through medication, vaccination, genomics, and proteomics or by any physical radiation ways to treat and control the deadly SARS-CoV-2.

Challenges

A novel coronavirus causing COVID-19 is challenging research due to: a) in vitro replication limitation of viruses and its use in viral diagnostics; b) in-vitro replication limitation of those viruses that cause a cytopathic effect get failure in virus identification methods; c) elucidate wrong recognitions of antibodies and PCR based viral genome amplification of known viruses and novel cultured viruses; d) investigate the host-specific mechanism of pathogenicity; e) find out effective, potential, easier, cheaper therapeutic agent, treatment method or vaccine for COVID-19; and f) to find the use of Virus discovery based on cDNA-AFLP (Amplified Fragment Length Polymorphism) (VIDISCA) method to cure the COVID-19; g) strategies the people's mindset and fighting spirit against COVID-19. Thus, COVID-19 treatment is not an as easy challenge for scientist and need to explore diagonally by considering all possibilities of science, bioengineering, analytical tools, as well as psychology.

CONCLUSIONS

The whole world is suffering with the most deadly COVID-19 and all health agencies working 24x7 to stop spreading of it as well discovering

novel vaccine or drugs to control the COVID-19 infections now and in future. Thus, the present paper showed a brief and the basic information about the COVID-19 as well as its precautionary and preventive measures to control this pandemic disease. The best cleaning and hygiene practises could control this recent and most challenging disease, but not limited to this, There is a need of permanent solution for mitigation of COVID-19, globally.

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CONFLICT OF INTEREST

The listed author(s) declare no conflict of interest in any capacity, including competing or financial.

AUTHORS' CONTRIBUTION

All listed author(s) have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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ETHICS STATEMENT

This article does not contain any studies with human participants or animals performed by any of the authors.

AVAILABILITY OF DATA

Not applicable.

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