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COVID-19, an Emerging Coronavirus Infection: Current Scenario and Recent Developments – An Overview

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ABSTRACT

During December 2019, a novel coronavirus virus (2019-nCoV) emerged in China, which posed an International Public Health Emergency in a couple of weeks, and very recently attained the position of a very high-risk category by World Health Organization (WHO). This virus was named the Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) by the International Committee on Taxonomy of Viruses (ICTV), and the disease referred to as Coronavirus Disease-19 (COVID-19). Till March 8, 2020, the virus has claimed the lives of nearly 3,600 humans out of a total of approximately 110,000 confirmed cases affected by this infection. The present editorial is a brief overview highlighting the most salient features and facts with regards to COVID-19, an emerging coronavirus infection, its causative virus (SARS-CoV-2), the current worldwide scenario, recent developments and currently ongoing progresses to contain and control this disease which have now spread to more than 100 countries across the globe. Of note, worldwide researchers and various health agencies are all together doing their best to halt the spread of this virus and avoid any possible pandemic situation to be faced, which otherwise would threaten the lives of millions of human beings.

Keywords: COVID-19, SARS-CoV-2, current situation, recent developments, prevention, control.

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INTRODUCTION

Coronaviruses are continually evolving. Examples include the Severe Acute Respiratory Syndrome (SARS) and the Middle East Respiratory Syndrome (MERS) that caused fatal outbreaks earlier, and now the present emerging Coronavirus Diseases 2019 (COVID-19), caused by the SARS-2 Coronavirus (SARS-CoV-2), initially expressed as pneumonia of unknown origin, thus posing a significant threat to public health across the globe¹⁻³. COVID-19 has represented a high negative impact on the economy of China as well as a few other nations^{4,5}. The lessons from such earlier threats of SARS, MERS and of the current COVID-19 situations need to be kept in mind for formulating plans for countering such and other emerging and zoonotic pathogens that could pose pandemic threats while putting human lives at bay⁶.

Current Scenario

After its initial emergence in Wuhan, China, during December month of the year 2019, this novel emerging CoV was included under the Public Health International Emergency category on January 30, 2020^{7,8}. Besides affecting mainly China, SARS-CoV-2/COVID-19 has now spread to more than 100 countries (9). Out of cumulative 111,354 confirmed cases, 3,892 human deaths have been documented as of March 9, 2020^{10,11}. Due to such a quick jump with regards to the total number of confirmed SARS-CoV-2 infected persons as well as affecting several countries in a short time interval, the WHO designated it under a very high-risk category. Few of the reports have mentioned the possibility of probable pandemic risks and threats with the bloom. They loom in rapidly increasing cases of COVID-19, alarming us to put very high efforts to check the spread of this widely circulating virus among world population by following appropriate prevention and control measures along with formulating global solutions and modified strategies with future perspectives¹²⁻¹⁹.

The Virus (SARS-CoV-2)

The SARS-CoV-2 is an enveloped, spherical shape, single-stranded plus sense RNA virus with helical symmetry belonging to beta coronaviruses of *Coronaviridae*²⁰. The virus has peplomers made up of glycoprotein projected over the envelope in a manner of crown (hence named *corona*), and these spike proteins help in binding with

receptors present in the body of animals (bats, rodents, civets, cats, Malayan pangolins, camels, among other potentially competent hosts) and humans²¹⁻²³. Modifications at the level of spikes on receptor binding ligands are responsible for zoonotic spillover and crossing of the species barrier. As per high genomic similarities, it is suggested that SARS-CoV-2 producing COVID-19 in humans has its origin from bats as bats acted as natural ancestral host²⁴⁻²⁸. Scanning electron microscopy, transmission electron microscopy, and cryo-electron microscopic images of the structure of the SARS-CoV-2 confirmed the change in spike glycoprotein of SARS coronavirus-2²⁹. In the Coronaviridae family, seven viruses affect mainly human beings, four producing mild respiratory illness, while three including- SARS-CoV-1, MERS, and current SARS-CoV-2 were dangerous as produced epidemics. ICTV named this pneumonia-causing virus as SARS-CoV-2 instead of 2019-nCoV as genetic studies revealed the similarity between SARS (2002-2003 severe acute respiratory syndrome outbreak) coronavirus and COVID-19 producing coronavirus³⁰. Genomic studies indicated that there is a difference of merely five nucleotides in between SARS coronavirus and SARS-CoV-2 and emphasized that 2019-nCoV has emerged from SARS CoV³¹. SARS-CoV-2 can be transmitted from animal to person or person to person via airborne particles/drops. The virus infects type 2 pneumocytes and ciliated bronchial epithelial cells through ACE2 receptors^{18,32}. The virus can be transmitted through respiratory droplets, tears, and body fluids if exposed to the mucous membranes of the eyes, mouth, or nose. Other transmission modes are yet to be further elucidated if so.

The Disease (COVID-19)

COVID-19 is the third CoV outbreak in humans that occurred in last two decades, causing clinical manifestations of respiratory, digestive, and systematic affections, mainly expressed by pneumonia^{33,34}. The case fatality rate is around 2-3%, but severely affected patients may die due to excessive alveolar damage, which leads to progressive respiratory failure as evident from many countries including Italy and China³⁵. Due to close contact, few persons may remain as asymptomatic carriers without manifesting any clinical symptoms of cold, fever, fatigue or lung

pathology. As competent carrier they can shed virus till 21 days of period to other persons who will come in contact to them³⁶. Initial symptoms include fever, mild chills, dry cough, fatigue and shortness of breath, severe respiratory distress, pulmonary pneumonia, which worsen if timely not diagnosed and not appropriately medicated³⁷. As lung inflammation advances hypoxemia triggers and to compensate shortness of breath, sometimes cardiac arrest takes place, and hence patient sinks. Therefore, it is advised as soon as symptoms of dry cough and fever begin to appear, consult a medical practitioner to prevent further pathology within the body³⁸. Histological examination performed over biopsy tissues obtained from lung, liver, and heart tissue elaborated detailed picture of desquamation of pneumocytes, the formation of hyaline membrane, bilateral diffused alveolar damage, presence of cellular fibromyxoid exudate. As marked cytopathic effects, multi nucleated syncytial cells along with atypical enlarged pneumocytes and interstitial mononuclear inflammatory infiltrates with the majority of lymphocytes in the affected lungs are prominent features³⁹.

Zoonotic links

Recently, few of the reports have highlighted the role of animals, veterinary, cross-species jumping, zoonotic links and spillover events of SARS-CoV-2 and its transmission to humans, before acquiring human to human transmission, as have been implicated with SARS and MERS^{2,6,40-46}. Atypical exposure point of SARS-CoV-2 has pointed out towards the implication of seafood market in Wuhan, China⁴⁷, as a wet-market that sells different kinds of poultry, bats, snakes, marmots and other wildlife animals for human consumption at a single place, that can act as hot spot acting as a human-animal interphase/interaction event, where zoonotic viruses can jump to cross-species barrier-or spillover to humans through seafood tanks, presence of live-dead animals body fluids, blood, excretion or air born mode of transmission leading to the emergence of novel pathogens such as SARS-COV-2 and others⁴⁸. Still in some parts of world, western medicines are not much popular or in practice and people yet rely on using traditional medicines which uses not only various herbs but bat saliva, dung and other

body parts are also used. As bats are employed as materia medica, so we can not deny the probability of zoonotic spillover through bats^{24,28}. By involving intermediate hosts (bridge hosts), SARS-CoV-2/2019-nCoV attained altered pathogenicity and enhanced transmissibility through modified receptor binding domain (RBD)^{2,18,26,49-57}.

Diagnosis

For prompt diagnosis of SARS-CoV-2, molecular tools are widely preferred⁵⁸⁻⁶². Serological diagnosis is not of much help at the peak of the epidemic, though serum samples of recovered patients can be tested to know the titer of IgG. In severely infected patients, computed tomography technique (CT) and X-Ray can be of help to observe the lesions of pulmonary pneumonia in the lungs in correlation with clinical symptoms to depict the picture of COVID-19³⁷. For the diagnosis of exposed but asymptomatic carriers, detection of viral nucleic acid (RNA) is of pertinent help, and by using pharyngeal swab the viral RNA can be detected, such carriers should be kept in isolation to prevent the transmission and spread risk^{25,36}. Most popularly, real-time RT-PCR (rRT-qPCR) is performed over respiratory secretions so that within a short period, viral RNA can be detected⁶³. Researchers have also developed a reverse transcriptional loop-mediated isothermal amplification (RT-LAMP) diagnostic technique for rapid and colorimetric detection of COVID-19 coronavirus. This isothermal LAMP-based method for COVID-19 detection is referred to as iLACO. In this technique, a fragment of the ORF1ab gene was amplified by using six primers, and phenol red are used as a pH indicator when amplification takes place color changes from pink to light yellow. At the same time, in negative cases, it remains pink⁶⁴. In addition to that, multiple reference laboratories are progressing sequencing the complete genome from the rRT-PCR positive isolates.

Therapeutics/Drugs and Vaccines

As infected individuals are hospitalized, human patients should immediately be given symptomatic and supportive treatment as per severity of symptoms^{65,66}. Therapy may be comprised of supplementary oxygen or high-flow nasal cannula (HFNC) oxygen therapy through nasal route to reduce breathing stress if needed

methylprednisolone intravenously to correct hypoxemia and in extreme cases adrenaline by intravenous route (IV), any repurposed drug such as lopinavir plus ritonavir as anti-viral drug by oral way, moxifloxacin or any antibiotic to prevent secondary bacterial infection by IM/IV route^{37,65}. Nevertheless, multiple drugs are under study, including other antiretrovirals, such as is the case of remdesivir, but also antivirals such as oseltamivir and other therapies, including chloroquine and even indomethacin. Researchers are making high efforts to design and develop suitable vaccines for COVID-19, which may take some time^{2,67-69}. In this context, efficient management of COVID-19 pneumonia by active prevention and control in a scientific manner is of utmost importance following the national and international developed guidelines⁷⁰.

Prevention and Control

It is imperative to prevent the spark (origin at the new place) and spread (transmission between susceptible and infected) risk both to avoid the conversion of COVID-19 epidemic to pandemic and for this purpose rigorous surveillance screening should be done to know-how the pattern of emerging zoonotic epidemics^{71,72}. Individual protection and community protection both need to be robust. World Health Organization (WHO), Centre for Disease Control and Prevention (CDC) and Food and Agriculture Organization (FAO) have issued instruction and COVID-19 containment strategies for the ordinary people, clinicians, travelers and for infected patients to follow so that transmission to healthy population can be prevented^{11,73-79}. It is advised to share awareness programs through social networking sites and platforms and follow intense epidemiological surveillance so that any new case (symptomatic and asymptomatic both) of COVID-19 can be notified to WHO⁸⁰⁻⁸². Epidemiological screening of bat CoVs should be done at large global scale to have a datasheet which will be a pathfinder for newly emerging and re-emerging zoonotic pathogens⁸³. The governments should encourage travelers to postpone their tours to avoid exposure to COVID-19 affected countries and those who are returning back from affected countries must be isolated and quarantined for health check-ups and evaluation of their health status^{5,54-57,84-86}. People should wash their hands with soap-water

or prefer to use sanitizers, should remain inside home, should refrain from crowded places and avoid contacts with live-dead animals especially wild animals, children, and older adults must take precautions as they are more prone to the severe respiratory distress syndrome of COVID-19⁸⁷. If people presents respiratory symptoms should wear face mask in order to avoid further transmission to other susceptible people. China has forced a temporary ban on the sale of wild animals in Wuhan animal market and planning to forbid the wildlife trading permanently⁸⁸.

Indeed, considering previous experiences of epidemics and pandemics in different regions of the world, with other emerging infectious diseases, as the case of SARS, MERS^{16,27}, but also swine flu and avian flu, Ebola, Nipah, Chikungunya and Zika^{2,67-69,89-91}, health authorities and healthcare providers including hospitals must apply the learned experiences on previous epidemics and pandemics to frame some implementable protective strategies^{14,16,92-95}. That includes the rational use of quarantine and appropriate disease prevention, management and control procedures to be timely implemented^{15,19,70,96}. Besides all the, One health approach also need due attention for prevention and control of this disease and other probable future epidemics^{2,50-52,67-69,97}.

CONCLUSIONS AND FUTURE PROSPECTS

Worldwide scientists, researchers, and various health agencies are working days and nights with very high efforts to stop the further transmission and spread of SARS-CoV-2 by following strict vigilance, intervention strategies, heightened prevention and control policies, and are in a race to fight COVID-19 by designing appropriate vaccines and therapeutics to keep away any pandemic situation which may arise otherwise if this virus could not be halted. Although that many aspects, derived from the research, are still to be developed, as is the case that facing the pandemic of COVID-19 many elements in certain age groups, as occurs in pediatricis not year clear^{14,98}. Finally, One health approach would play an essential role in combatting COVID-19 as well as such diseases in the future. That is not a magic bullet, but yes, the world needs global solutions to prevent still or mitigate a pandemic¹⁹.

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CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

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AUTHOR'S CONTRIBUTIONS

All the authors substantially contributed to the conception, design, analysis, and interpretation of data, checking and approving the final version of the manuscript, and agree to be accountable for its contents.

DISCLOSURE STATEMENT

All authors declare that there exist no commercial or financial relationships that could, in any way, lead to a potential conflict of interest.

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