



Iberoamerican Journal of Medicine

ISSN: 2695-5075

ISSN-L: 2695-5075

iberoamericanjm@gmail.com

Hospital San Pedro

España

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SARS-CoV-2 (COVID-19) Pandemic Remains a Global Public Health Threat
Iberoamerican Journal of Medicine, vol. 3, núm. 3, 2021, pp. 264-270
Hospital San Pedro
España

DOI: <https://doi.org/10.5281/zenodo.4892651>

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**IBEROAMERICAN
JOURNAL OF
MEDICINE**

iberoamericanjm

Journal homepage: www.iberoamericanjm.tk

Review

SARS-CoV-2 (COVID-19) Pandemic Remains a Global Public Health Threat

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ARTICLE INFO

Article history:

Received 26 March 2021

Received in revised form

17 April 2021

Accepted 17 May 2021

Keywords:

Coronavirus

COVID-19

Emerging infectious
disease

Public health

RT-PCR

SARS-CoV-2

ABSTRACT

Recently, an upsurge in the incidence of several emerging infectious diseases is causing great challenges to the health professionals throughout the globe. Since early 2020, an outbreak of coronavirus disease 2019 (COVID-19), now a pandemic, is hitting the world severely. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), causative agent of COVID-19, gain entry through the respiratory systems (nasopharyngeal) route causing infection. This disease is reported from all continents except Antarctica and it most commonly affects the lungs rather than the other organs. In affected person, pneumonia, cough, sore throat, dyspnea, fever, headache, and rhinorrhea is the main symptoms of COVID-19. There are different investigation methods to diagnose a patient suspected of COVID-19 like radiography and different laboratory technique like RT-PCR, which remains the investigation of choice. Social distancing, practicing hand hygiene, and use of facemask are mandatory to prevent the disease. Many of the drug trials are underway with the recent FDA approval of remdesivir. Very recently, immunization programme against COVID-19 is going on in many countries of the world. However, the efficacy and safety of the vaccines are not yet fully established.

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<http://doi.org/10.5281/zenodo.4892651>

La pandemia de SARS-CoV-2 (COVID-19) sigue siendo una amenaza para la salud pública mundial

INFO. ARTÍCULO

Historia del artículo:

Recibido 26 Marzo 2021

Recibido en forma revisada
17 Abril 2021

Aceptado 17 Mayo 2021

Palabras clave:

Coronavirus

COVID-19

Enfermedad infecciosa
emergente

Salud pública

RT-PCR

SARS-CoV-2

RESUMEN

Recientemente, un aumento en la incidencia de varias enfermedades infecciosas emergentes está causando grandes desafíos a los profesionales de la salud en todo el mundo. Desde principios de 2020, un brote de la enfermedad por coronavirus 2019 (COVID-19), ahora una pandemia, está afectando al mundo de forma severa. El síndrome respiratorio agudo severo coronavirus 2 (SARS-CoV-2), agente causante de COVID-19, ingresa a través de la ruta del sistema respiratorio (nasofaríngeo) causando infección. Esta enfermedad se informa en todos los continentes excepto en la Antártida y afecta más comúnmente a los pulmones que a otros órganos. En la persona afectada, la neumonía, la tos, el dolor de garganta, la disnea, la fiebre, el dolor de cabeza y la rinorrea son los principales síntomas del COVID-19. Existen diferentes métodos de investigación para diagnosticar a un paciente con sospecha de COVID-19 como la radiografía y diferentes técnicas de laboratorio como RT-PCR, que sigue siendo la investigación de elección. El distanciamiento social, la práctica de la higiene de manos y el uso de mascarilla son obligatorios para prevenir la enfermedad. Muchos de los ensayos de fármacos están en marcha con la reciente aprobación de remdesivir por parte de la FDA. Muy recientemente, se está llevando a cabo un programa de inmunización contra COVID-19 en muchos países del mundo. Sin embargo, la eficacia y seguridad de las vacunas aún no están completamente establecidas.

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HOW TO CITE THIS ARTICLE: Pal M, Bulcha MR, Banu MG, Ketchakmadze D. SARS-CoV-2 (COVID-19) Pandemic Remains a Global Public Health Threat. *Iberoam J Med.* 2021;3(3):264-270. doi: 10.5281/zenodo.4892651.

1. INTRODUCTION

Emerging infectious diseases caused by a diverse etiological agent, are significant causes of morbidity and mortality both in developing as well as developed nations of the world. Since early 2020, an outbreak of coronavirus disease 2019 (COVID-19), now pandemic has caused the devastation of human life and the world economy [1]. This new coronavirus was identified as the cause of a cluster of pneumonia cases in Wuhan, a city in the Hubei Province of China [2]. It rapidly spread, resulting in an epidemic throughout China, followed by an increasing number of cases in other countries throughout the world [3]. Originally, the World Health Organization (WHO) called this infectious disease novel coronavirus-infected pneumonia (NCIP) and the virus named as 2019 novel coronavirus (2019-nCoV). On 11 Feb 2020, the WHO officially renamed the clinical condition COVID-19 (a shortening of Corona Virus Disease-19) which was announced in a tweet and declared this a global health emergency at the beginning of February 2020.

The ongoing outbreak of this COVID-19 is in the city of Wuhan in Hubei Province of central China and the Human seafood wholesale market was thought to be at least one of the places where SARS-CoV-2 from an unknown animal

source might have crossed the species barrier to infect humans [4, 5]. The virus that causes this COVID-19 is designated severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) by the International Committee on Taxonomy of Viruses. Since, the phylogenetic analysis showed that this virus entered the same subgenus as the coronavirus that caused the outbreak of severe acute respiratory illness (SARS) in 2002-2004, namely *Sarbecovirus* [6].

The diseases of coronavirus usually caused a respiratory infection ranging from the common cold to more severe diseases [2] such as Middle East respiratory syndrome (MERS) and severe acute respiratory syndrome (SARS) and the most recently discovered Coronavirus (COVID-19) infectious disease [7].

Before the outbreak of COVID-19, 6 types of coronaviruses could infect humans, namely severe acute respiratory illness coronavirus (SARS-CoV), the Middle East respiratory syndrome (MERS) 1virus, 229E, and NL63 (alpha coronavirus), OC43 and HKU1 (beta coronavirus). Coronavirus, which is the etiology of COVID-19, belongs to the genus Beta coronavirus [8].

According to reports of WHO (2021), the highest numbers of new cases were recorded from India (2,597,285 new cases; 20 percent increase), Brazil (421,933 new cases; 4 percent increase), the United States of America (345,692

new cases; 15 percent decrease), Turkey (257 992 new cases; a 32 percent decrease), and France (a 32 percent decrease) (163,666 new cases; 23 percent decrease). Globally, According to reports of WHO may 2021, 157,973,438 confirmed case and 3,288,455 confirmed death was reported.

2. MICROBIOLOGICAL ASPECT OF SARS-COV-2

2.1. TAXONOMY AND ETIOLOGY

The family *Coronaviridae* was established in 1975 by the International Committee on the Taxonomy of Viruses. The name coronavirus is derived from the “corona”-like or crown-like morphology observed for these viruses in the electron microscope [9]. Coronaviruses are a group of large, enveloped, positive-sense, single-stranded RNA viruses belonging to the order *Nidovirales* [4].

Twenty-six different species are known and have been divided into four genera (alpha, beta, gamma, and delta) characterized by different antigenic cross-reactivity and genetic makeup [10]. The subfamily of the *Coronaviridae*, are positive-strand RNA viruses with the largest genome of all known RNA viruses (≥ 27 Kb) [11]. The genomic RNA is capped, polyadenylated, and associated with nucleocapsid proteins within an enveloped virion [12]. The envelope is covered by the characteristic surface glycoprotein that gives the virus particles their characteristic crown-like (Latin: corona) appearance [4].

2.2. REPLICATION AND PATHOGENESIS

Angiotensin-converting enzyme 2 (ACE2) found in the lower respiratory tract of humans, is known as a cell receptor for SARS-CoV and regulates both cross-species and human-to-human transmission [13]. Isolation from the bronchoalveolar lavage fluid (BALF) of a COVID-19 patient has confirmed that the SARS-CoV-2 uses the same cellular entry receptor, ACE2, as SARS-CoV [14].

The virion S-glycoprotein can attach to the receptor, ACE2 on the surface of human cells. S glycoprotein includes S1 and S2 units. S1 determines the virus-host range and cellular tropism with the key function domain while S2 mediates virus-cell membrane fusion by two tandem domains, (HR1) and HR2 [5, 14].

The viral genome RNA is released into the cytoplasm, and the uncoated RNA translates two polyproteins, pp1a and pp1ab, which encode non-structural proteins and form a replication-transcription complex (RTC) [9]. Mediating

endoplasmic reticulum (ER) and Golgi, newly formed genomic RNA, nucleocapsid proteins, and envelope glycoproteins assemble and form viral particle buds [15]. Lastly, the virion-containing vesicles fuse with the plasma membrane to release the virus. Systematic detection of β -CoV receptors showed that human cells expressing ACE2 [13].

2.3. EPIDEMIOLOGY (HOST, MODE OF TRANSMISSION AND RISK FACTORS)

Since the first reports of cases from Wuhan, a city in the Hubei Province of China, at the end of 2019, the COVID-19 cases have been reported from all continents except Antarctica [16]. Coronavirus has been identified in both avian hosts and various mammals, including a bat, camels, dogs, and masked palm civets, and is previously regarded as pathogens that only cause mild diseases in the immune-competent people until the emergence of the coronavirus causing SARS-CoV in late of 2002. Currently, at least seven coronavirus species are known to cause diseases in human beings [17].

The main mode of transmission is close or direct contact (person-to-person) through close-range contact, mainly via respiratory droplets; virus released in the respiratory secretions when a person with infection coughs, sneezes [18], or talks can infect another person if it makes direct contact with the mucous membranes; infection might also occur if a person's hands are contaminated by droplets or by touching contaminated surfaces and then they touch their eyes, nose, or mouth with infected secretions or large aerosol droplets [19]. There is also a fomite transmission because; the virus can exist in nature on surfaces and can last for up to 4 hours on copper, 24 hours on cardboard, and up to 72 hours on plastic and stainless steel surfaces leading [20].

Indirect contact with surfaces in the immediate environment or object used on the infected person can also pose a risk to infection. It is mentioned that pregnancy, age (mainly old age), different diseases (asthma, COPD, high blood pressure, immune-compromised state (blood or bone marrow transplant, HIV), smoking and diabetes are the major risk factors of this emerging viral disease [15].

2.4. CLINICAL SPECTRUM

There is no specific clinical feature that can yet reliably distinguish COVID-19 from other viral respiratory infections [1]. The patients infected with COVID 19 can either be asymptomatic (without any symptoms) or symptomatic [4]. The most commonly reported symptoms

in the symptomatic case are pneumonia, fever, cough, dyspnea, headache, sore throat, and rhinorrhea are main symptoms of covid-19. In addition to respiratory symptoms, gastrointestinal symptoms (e.g., nausea and diarrhea) have also been reported and in some patients, they may be the presenting complaint [17].

2.5. DIAGNOSIS

The efforts to control the spread of COVID-19, institute quarantine and isolation measures, and appropriately clinically manage patients all require useful screening and diagnostic tools [4]. The clinical diagnosis of COVID-19 is similar to those of other human coronaviruses. The most common diagnostic tools of COVID-19 are; Radiography test includes Chest X-ray, CT chest finding, and chest ultrasound. The radiological finding of a patient with this disease may vary based on the age of the patient, disease progression, immunity status, co-morbidity, and initial medical intervention [21].

The COVID-19 can also be investigated by different laboratory tests, such as serological technique of antibody titer measurement, electron microscopy for examination of viral particles, conventional and real-time reverse transcriptase-polymerase chain reaction [3, 22].

The polymerase chain reaction method is considered the “gold standard” for the detection of some viruses because of its high sensitivity, specificity, and rapid detection. RT-PCR has been used for the detection of SARS-CoV-2 due to these benefits [18, 23]. There is also serum-based testing, such as rapid diagnostic kits, ELISA using IgM/IgG antibodies that have been developed throughout the world. The test detects early marker and late marker, IgM/IgG antibodies in human finger-prick (capillary) or venous whole blood, serum, and plasma samples. The other common laboratory techniques, such as complete blood count, coagulation profile, and serum biochemical tests [8].

2.6. TREATMENT

There is no specific antiviral treatment recommended for COVID-19. The treatment is only supportive care to help alleviate symptoms is the best current approach being followed by all the medical centers worldwide [24]. Supportive care includes isolating the patient to a negative pressure isolation room and providing adequate rest, hydration, nutritional support, and electrolyte balance [2, 4, 7]. Complicated cases developing respiratory failure, ARDS, heart failure, and septic shock also require a high level of care and other life support like invasive ventilation, extracorporeal membrane oxygenation (ECMO), renal

replacement therapy, and so on [16]. However, on May 1 2020 FDA issued an emergency use authorization for the Investigational antiviral drug remdesivir for the treatment of suspected or laboratory-confirmed COVID-19 in adults and children hospitalized with severe disease. The investigational drug has been shown in a clinical trial to shorten the time to recovery in some patients [23].

2.7. PREVENTION AND CONTROL

Currently, there is no effective treatment is available to date for covid-19. As the infection spreads through droplets and close contact so following preventive measures have been advocated [7, 23]. In locations where community transmission is widespread, preventive strategies for all individuals in a health care setting are warranted to reduce potential exposures by the following methods [13, 19].

2.7.1. SOCIAL DISTANCING

Social distancing is a prevention and control intervention implemented to decrease or avoid contact between those who are infected with a disease and those who are not to decrease or stop the disease transmission in a community. WHO recommends maintaining at least 1 meter (3 feet) distance between each individual [25].

2.7.2. HAND HYGIENE

Frequent and proper hand hygiene is a must for the prevention of COVID 19. Like any other corona viruses, SARS-COV-2 has a lipid envelope, which on washing with soap can break that fat in the envelope apart thereby making it impossible or difficult for the virus to infect human cells. Hence, hand washing with soap, water, and use of hand sanitizer that contains at least 60 percent alcohol is a reasonable alternative and more powerful weapon than any other preventive measure [26].

2.7.3. USE OF FACEMASK AND VACCINES

Wearing a mask is one of the prevention measures that can limit the spread of certain respiratory viral diseases including COVID-19 [7]. However, the use of a mask alone is insufficient to provide an adequate level of protection and other measures should also be adopted [13]. Specialized respirator, N95, which technically is a good fit mask preventing the entry of droplets and thereby minimizing the chance of acquiring the infection [17].

Finally, In addition to personal preventive measures (examples, hand hygiene, respiratory etiquette, and face covers, environmental disinfection), transmission reduction strategies include social/physical distancing orders, stay-at-

home orders, school, venue, and nonessential business closure [10]. In addition, there should be bans on public gatherings, travel restriction with exit and/or entry screening, aggressive case identification, and isolation (separating individuals with infection from others). Contact tracing and quarantine (separating individuals who have been exposed from others) are the preventative measures of the COVID-19 [11, 19].

Very recently, vaccine for COVID-19 has been developed by few countries including the USA, India, Israel, Russia, and China. It is heartening to note that Indian Government has donated COVID-19 vaccine to many nations of the world. Hitherto, the data on immunization has not been analysed to elucidate the efficacy and safety of COVID-19 vaccine in various age groups (Pal, Personal communication).

Vaccines are an important new weapon in the fight against COVID-19, and the fact that so many vaccines are proving to be effective and are being developed is extremely promising. Scientists from all over the world are working and innovating as rapidly as they can to bring us experiments, medications, and vaccines that can save lives and put an end to the pandemic [19].

Simultaneously, more than 200 additional vaccine candidates are being developed, with more than 60 of them in clinical trials. COVAX is a component of the ACT Accelerator, which WHO and collaborators launched in 2020. COVAX, the ACT Accelerator vaccines pillar convened by CEPI, Gavi, and WHO, aims to end the COVID-19 pandemic's acute period by: accelerating the production of safe and reliable COVID-19 vaccines; encouraging the development of production facilities; and collaborating with governments and producers to ensure that vaccines are distributed fairly and equally to all countries – the only global effort to do so [11, 17].

WHO has identified two variants of the vaccine – AstraZeneca-SKBio (Republic of Korea) and the Serum Institute of India – for the emergency use. The vaccine had already been reviewed by the European Medicines Agency (EMA) before it was considered by SAGE. The EMA has closely reviewed the evidence on the vaccine's consistency, reliability, and effectiveness and has advised that a conditional marketing authorization be granted for people aged 18 and up. The WHO is Global Advisory Committee on Vaccination Protection collects and assesses evidence of possible adverse reactions to vaccines [27-29].

In patients who administered two doses of the Moderna vaccine and had no signs of being previously affected, the vaccine was 94.1 percent successful in reducing laboratory confirmed COVID-19 infections. In clinical trials, the

vaccine proved to be highly successful (efficacy) among individuals of various ages, sexes, races, and ethnicities, as well as those with existing medical conditions [30-32].

On December 31, 2020, the WHO granted the Pfizer BioNTech vaccine an emergency use listing (EUL). The vaccine's quality, reliability, and efficacy have all been carefully evaluated by the WHO, and it is now approved for people over the age of 16. The COVID-19 vaccine from Pfizer BioNTech has a 95 percent effectiveness against symptomatic SARS-CoV-2 infection. There are currently no solid evidence on the effects of the Pfizer BioNTech vaccine on viral replication or shedding [33-35].

3. CONCLUSIONS AND RECOMMENDATIONS

In the twenty-first century, an increase in various emerging infectious diseases has posed significant challenges. Vaccines typically take years to develop and test before entering clinical trials, but in 2020, scientists embarked on a race to develop safe and effective coronavirus vaccines in record time. The majority of people infected with the COVID-19 virus will experience mild to moderate respiratory symptoms and will recover without the need for further treatment. Professional advice is essential for reducing the risk of contracting the virus, promoting patient safety, treatment, and compliance, and relieving patients' stress.

Based on the reviewed literature, the following recommendations are frequently suggested.

1. Every concerned body should have to help the researcher to deal more about Covid-19 to create the vaccines that are potent, safe, and cost effective.
2. Social awareness creation on public health and economic effects through different media should be continued. Every person must wear the face mask when going out of the home and immediately sanitize his hands after returning home.
3. Special attentions for older adults, as well as those with underlying conditions like heart or lung disease, chronic kidney disease requiring dialysis, liver disease, diabetes, immune deficiency, or obesity, are at a higher risk of experiencing more severe COVID-19 complications.

4. ACKNOWLEDGEMENTS

The authors are very thankful to Prof. Dr. R. K. Narayan

for his suggestions during the preparation of manuscript and Anubha Priyabandhu for computer help.

5. CONTRIBUTION OF AUTHORS

All the authors contributed equally. They read the final version, and approved it for publication.

6. CONFLICT OF INTEREST

The authors declare that they do not have conflict of interest.

7. SOURCE OF FINANCIAL GRANT

There was no financial support for this manuscript.

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