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A Discussion of Corona Virus

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Abstract

Corona viruses are a group of related viruses that cause diseases in mammals and birds. In humans, corona viruses cause respiratory tract infections that can range from mild to lethal. Mild illnesses include some cases of the common cold , while more lethal varieties can cause SARS, MERS, and COVID-19. There are yet to be vaccines or antiviral drugs to prevent or treat human corona virus infections. But everyday preventive actions to help prevent the spread of respiratory viruses will work with this novel corona virus. At the beginning of the outbreak, World Health Organization (WHO) supported access to COVID-19 in-house RT- PCR protocols. The latest areas of sustained community spread include China, South Korea, Japan, Iran, and Italy, Spain, France, UK, USA, Canada, Germany, Australia, India, Pakistan, Bangladesh etc. in about 185 all over countries in world. During this Pandemic situation many states in India have invoked various provisions of the Epidemic Diseases Act of 1897 to control communicable diseases. Now many country Hydroxychloroquine (Plaquenil) and its sister drug chloroquine **(**Aralen**)** are under investigation for treatment of the **COVID-19** coronavirus disease.

Keywords: Corona virus; Morphology; Pathogenesis; Symptoms; Prevention; Regulation & Laws of Pandemic; Laboratory Diagnosis; Hydroxychloroquine

Introduction

Corona viruses constitute the subfamily **Orthocoronavirinae**, in the family Coronaviridae, order Nidovirales, and realm Riboviria.[1][2] They are enveloped viruses with a positive-sense single-stranded RNA genome and a nucleocapsid of helical symmetry. The genome size of corona viruses ranges from approximately 26 to 32 kilobases, one of the largest among RNA viruses.[3] They have characteristic club-shaped spikes that project from their surface, which in electron micrographs create an image reminiscent of the solar corona from which their name derives.[4]

A new respiratory virus that caused severe pneumonia was first identified in Wuhan City, Hubei Province, China. The virus is now spreading person-to-person in growing numbers in greater than 100 countries, but 94% of cases are in China.

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Corona viruses are a large family of viruses that are common in humans, and others, such as animals. Occasionally, we see new (novel) corona viruses that have not previously been described in humans. There are many types of human corona viruses, including some that commonly cause mild upper-respiratory tract illnesses.

This virus was originally thought to have emerged from an animal source that infected humans, but now we are seeing the virus spread from person to person. At this time, it is unclear how easily this virus is spreading between people.

The current understanding of how this virus causes COVID-19 is based on what we know about corona viruses in general. This virus is spread mostly from person to person. Like the common cold, it is spread by droplets, which are often generated when a person coughs or sneezes. One can be exposed when in close contact (within 6 feet) to someone who is sick. People are thought to be most contagious when they have symptoms. There have been reports of people becoming sick after contact with someone with little to no symptoms (asymptomatic) but this is not thought to be the main method of the virus spreading in the community.

The latest areas of sustained community spread include China, South Korea, Japan, Iran, and Italy, Spain, France, UK, USA, Canada, Germany, Australia, India, Pakistan, Bangladesh etc. in about 185 countries in all over world.

The virus that causes COVID-19 seems to be spreading easily and sustainably in a community where it is thought that for every 1 person that is infected, that potentially 2 other people can get the infection if they do not protect themselves with simple preventive measures, such as hand hygiene. There has been a description of one infected person spreading to more than 2 but these are rare scenarios.

This virus is thought to be more contagious than the seasonal flu but much less than other highly contagious viruses, such as measles or chickenpox.

Prevention

Everyday preventive actions to help prevent the spread of respiratory viruses will work with this novel corona virus. Those actions include:

- Wash your hands often with soap and water for at least 20 seconds. Use an alcohol-based hand sanitizer that contains at least 70% alcohol if soap and water are not available.
- Avoid touching your eyes, nose, and mouth with unwashed hands.
- Avoid close contact with people who are sick.
- Stay home when you are sick.
- Cover your cough or sneeze with a tissue, then throw the tissue in the trash.
- Clean and disinfect frequently touched objects and surfaces.
- Follow CDC's recommendations for using a facemask.
- CDC does not recommend that people who are well wearing a facemask to protect themselves from respiratory diseases, including COVID-19.
- Facemasks should be used by people who show symptoms of COVID-19 to help prevent the spread of the disease to others. The use of facemasks is also crucial for health workers and people who are taking care of someone in close settings (at home or in a health care facility).

Symptoms

Current symptoms reported for patients with COVID-19 have included mild to severe respiratory illness with fever, cough, and difficulty breathing.

Symptoms may appear **2-14 days after exposure***:

- Fever
- Cough
- Shortness of breath

Detection of Corona virus

The incubation period ranges from 1-14 days, most commonly around five days. After early symptoms appear, there are three rounds of tests that need to be done to confirm if someone is infected. They are then kept in isolation.

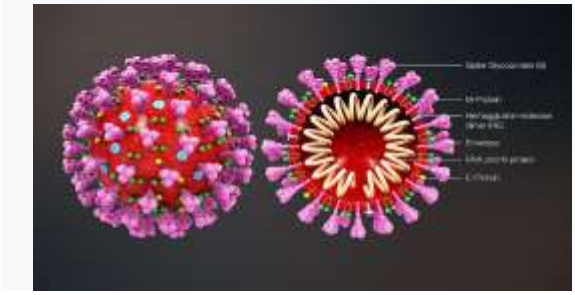
Vaccine

There are no vaccines and no specific medicines to prevent or treat corona virus. However, hospitalisation and care is very important for recovery. Possible vaccines and some specific drug treatments are under investigation. They are being tested through clinical trials.

All countries are taking preventive measures to control the disease and working closely with

health experts to contain it. As research continues on the disease, it's advisable to not panic and not pay heed to rumours about the virus.

Morphology



Corona viruses are large pleomorphic spherical particles with bulbous surface projections.[5] The average diameter of the virus particles is around 120 nm (.12 μm). The diameter of the envelope is ~80 nm (.08 μm) and the spikes are ~20 nm (.02 μm) long. The envelope of the virus in electron micrographs appears as a distinct pair of electron dense shells.[6] [7]

The viral envelope consists of a lipid bilayer where the membrane (M), envelope (E) and spike (S) structural proteins are anchored.[8] A subset of coronaviruses (specifically the members of beta corona virus subgroup A) also has a shorter spike-like surface protein called hem agglutinin esterase (HE).[1]

Inside the envelope, there is the nucleocapsid, which is formed from multiple copies of the nucleocapsid (N) protein, which are bound to the positive-sense single-stranded RNA genome in a continuous beads-on-a-string type conformation.[7] [9] The lipid bilayer envelope, membrane proteins, and nucleocapsid protect the virus when it is outside the host cell.[10]

Pathogenesis

- After the virus enters the body, it needs a special receptor to help it enter the cell. This receptor is called ACE2 [Angiotensin Converting Enzymes 2].
- The ACE 2 is present on the surface of the alveolar cells in the lung.
- Corona virus envelop contains protein called spikes and (S_Spike) that help the virus bind to ACE2.

Types of alveolar cells in the lung:

Type 1: Responsible for gas exchange

a. Type 2: It is responsible for producing "surfactant" which is a mixture of proteins and fats that reduce the surface tension of the alveoli.
b. Type 3: Dust cell, which is Macrophages.

When the association occurs, the genetic material of the virus enters into the cell and the cell is harnessed to produce substance proteins, thus the virus multiplies and the cell dies. When Type 2 Alveolar cells die, they release substance called "Specific inflammatory mediators."

These substances stimulate the existing immune cells "Macrophages" to secrete 3 immun e substances called "Cytokines" which are mainly:

Interleukin_1 (IL_1)
Interleukin_6 (IL_6)
Tumor Necrosis Factor(TNFα)

These three main substances, when they reach the bloodstream, cause the symptoms associated with infection with COVID-19. These three substances go to the "Hypothalamus" and thus increase the body temperature and cause the symptoms of "Fever."

These three substances also lead to an increase in the flow of "Neutrophils"cells to the place of the viral infection as an immune response. Neutrophil cells kill some viruses by secreting two substances such as: Reactive Oxygen Species "ROS" and Proteases". But this "ROS" and "Proteases"also destroy some of the alveolar cells responsible for gaseous exchange and cause a condition called consolidation that causes cough symptoms.

These three cytokines also cause expansion of the blood vessels surrounding the vesicle, as well as increased permeability of the wall of these vessels with Vasodilation and Capillary permeability increased and thus leads to "Alveolar edema"which leads to "Hypoxia" and shortness of breath. The loss of surfactant leads to an increase in the surface tension of the vesicle and consequently leads to Alveolar collapse. It also leads to Hypoxia and shortness of breath.

Regulations and laws of during a pandemic

A worldwide approach to addressing health problems and emergencies is provided by the United Nation's World Health Organization

(WHO), which was established in 1946. The WHO has a Constitution and issues International Health Regulations (IHR).

Corona viruses were first discovered in the 1930s when an acute respiratory infection of domesticated chickens was shown to be caused by infectious bronchitis virus (IBV). In the 1940s, two more animal corona viruses, mouse hepatitis virus (MHV) and transmissible gastroenteritis virus (TGEV), were isolated.[11]

Human corona viruses were discovered in the 1960s.[12] The earliest ones studied were from human patients with the common cold, which were later named human coronavirus 229E and human corona virus OC43.[13] They were first imaged by June Almeida at St. Thomas Hospital in London.[14] Other human corona viruses have since been identified, including SARS-CoV in 2003, HCoV NL63 in 2004, HKU1 in 2005, MERS-CoV in 2012, and SARS-CoV-2 in 2019. Most of these have involved serious respiratory tract infections.[15] [16]

A novel corona virus is a severe acute respiratory syndrome (the SARS-associated corona virus) [SARS-CoV] refers to a severe atypical pneumonia pandemic proportions in 2003. This pandemic affected many Asian countries, particularly China, from which the disease is believed to have emerged, but also Canada, the USA and certain European countries such as Ireland and Germany. Since the 2003 pandemic of SARS, there has been no major outbreak. It is not known whether the disease has been completely eradicated. In 2005, the World Health Assembly agreed on new IHR that create an international pandemic risk management system by requiring the Member States to report on an expanded list of diseases and public emergencies, to control the entry and exit of visitors and goods, and to take other precautionary measures in accordance with WHO recommendations. The system was put to the test in the H1N1 virus influenza that emerged in Mexico in April 2009 and quickly reached global dimensions. Since that time, the WHO has instituted the Pandemic Influenza Preparedness (PIP) Framework to improve preparedness for and response to pandemic influenza and has replaced the 2009 guidance with the 2013 Pandemic Influenza Risk Management WHO Interim Guidance.

In India, the Epidemic Diseases Act, 1897 [17] is a law which was first enacted to tackle bubonic plague in Mumbai in Maharashtra. The law is meant for containment of epidemics by providing special powers that are required for the implementation of containment measures to control the spread of the disease. The Act has been routinely used to contain various diseases in India such as swine flu, cholera, malaria and dengue. In 2018, the Act was enforced as cholera began to spread in a region of Gujarat. In 2015, it was used to deal with dengue and malaria in Chandigarh in Punjab. In 2009 it was invoked in Pune to combat swine flu.

Corona virus disease (COVID-19) is an infectious disease caused by a newly discovered corona virus. Starting in March 2020, the act is being enforced across India in order to limit the spread of corona virus disease 2019. Corona virus disease 2019 (COVID-19) is an infectious disease caused by severe acute respiratory syndrome corona virus 2 (SARS-CoV-2). The disease was first identified in 2019 in Wuhan, the capital of China's Hubei province, and has since spread globally, resulting in the 2019–2020 corona viruses pandemic.

During a pandemic, certain legal authorities External, policies and regulations may apply.

Public Health Service Act (PHS)

The Public Health Service (PHS) Act forms the foundation of the HHS' legal authority for responding to public emergencies by authorizing the HHS Secretary to take key actions, such as lead all federal public health and medical response, declare a public health emergency, assist states in meeting health emergencies, maintain the Strategic National Stockpile, and control communicable diseases. The PHS Act was amended by the Pandemic and All-Hazards Preparedness Act (PAHPA) of 2006 External and the Pandemic and All-Hazards Reauthorization Act (PAHPRA) of 2013External.

The Union government is using various measures to prepare and respond to the COVID-19 pandemic. These are [17]:

- In January, it invoked its powers under the Disaster Management Act, 2005 to enhance

the preparedness and containment of COVID-19 at hospitals. Notifying the pandemic as a disaster enabled the states to use funds from the State Disaster Response Fund on COVID-19.

- In March, the Ministry of Health advised states to invoke the provisions of Section 2 of the Epidemic Diseases Act, 1897.
- As a signatory to the International Health Regulations, 2005 (IHR), India needs to establish an appropriate public health response to international spread of diseases. This is done through the Integrated Disease Surveillance Program (IDSP).

Declarations

The HHS Secretary may, under section 319 of the PHS Act External determine that a disease or disorder presents a public health emergency; or that a public health emergency, including significant outbreaks of infectious disease, otherwise exists. Following a section 319 declaration, the Secretary can take many actions during an influenza pandemic, including making grants; entering into contracts; and conducting and supporting investigations into the cause, treatment, or prevention of the disease or disorder, and waiving or modifying certain Medicare, Medicaid, Children's Health Insurance Program (CHIP) and Health Insurance Portability Accountability Act (HIPAA) requirements. These waivers or modifications are permitted under Section 1135 of the Social Security Act External to ensure sufficient health care items and services are available during a public health emergency.

Under the Public Readiness and Emergency Preparedness Act (PREP Act)External of the PHS Act, the HHS Secretary is also authorized to issue a PREP Act declaration that provides immunity from liability for claims of loss caused, arising out of, relating to, or resulting from administration or use of countermeasures to diseases, threats and conditions determined by the Secretary to constitute a present, or credible risk of a future public health emergency to entities and individuals involved in the development, manufacture, testing, distribution, administration, and use of such countermeasures.

Visit the HHS Office of the Assistant Secretary for Preparedness and Response (ASPR) website for a comprehensive overview of the HHS legal authorities, policies and committees External for responding to public health emergencies. Read the "Public Health Emergency Declarations Q&A External" and the "PREP Act Frequently Asked Questions "External for more information about the legal authorities of the HHS Secretary.

Federal Food, Drug and Cosmetic Act (FD &C)

The Federal Food, Drug and Cosmetic (FD&C) Act is the foundation for Food and Drug Administration's (FDA's) authority and responsibility to protect and promote the public health by, among other things, ensuring the safety and effectiveness of human and veterinary drugs, cosmetic products, and medical devices; and ensuring the safety and security of our nation's food supply. Section 564 of the FD&C Act, authorizes the HHS Secretary to declare an emergency justifying the emergency use authorization (EUA) External of medical countermeasures (MCMs) during public health emergencies. When an EUA is declared, the FDA Commissioner can allow either (i) the use of an unapproved medical product (e.g., drug, vaccine, or diagnostic device) or (ii) the unapproved use of an approved medical product during an emergency to diagnose, treat, or prevent a serious or life-threatening disease or condition caused by a chemical, biological, radiological, or nuclear (CBRN) agent. For example, during the 2009 H1N1 influenza pandemic, the FDA approved the emergency use of antiviral for certain patients and health care settings External.

Isolation and Quarantine

Under section 361 of the PHS Act, the HHS Secretary is authorized to take measures to prevent the entry and spread of communicable diseases from foreign countries into the US and between states. The authority for carrying out these functions on a daily basis is delegated to the Centres for Disease Control and Prevention (CDC), Division of Global Migration and Quarantine. Rapid containment of SARS is a success of public health as well as the power of international collaboration supported at the highest political level.

Conclusion

International health law, which encompasses human rights, food safety, international trade law, environmental law, war and weapons, human

reproduction, organ transplantation, as well as a wide range of biological, economic, and socio cultural determinants of health, now constitutes a core component of global communicable disease architecture. Recently, many states in India have invoked various provisions of the Epidemic Diseases Act of 1897 to control communicable diseases. The Act was reviewed with reference to its relevance in the current context of surveillance and other relevant Acts and legislations at the national and international levels.

The Indian response to COVID-19 has been fragmented. Multiple laws, rules, programmes, regulatory bodies along with national and state level advisories participate in the response. The Epidemic Diseases Act has been a subject of debate as calls for government action grows. Instead of building a public health framework, the limited purpose of the Epidemic Diseases Act is for the states to take special measures for dangerous epidemic diseases. Within this limited framework, the law gives wide powers to the government to undertake coercive actions against individuals.

Laboratory diagnosis: covid-19 testing

Laboratory testing for SARS-CoV-2 includes methods that detect the presence of virus and those that detect antibodies produced in response to infection.

As of 21 March 2020, the US Centres for Disease Control and Prevention (CDC) recommends reverse transcription polymerase chain reaction (RT-PCR) for initial screening.[18] The presence of viruses is generally confirmed by RT-PCR, which detects the coronavirus' RNA. This test detects only the RNA of the SARS-CoV-2 and is used to confirm very recent or active infections.

Detection of antibodies (serology) can be used both for diagnosis and population surveillance. Antibody tests show how many people have had the disease, including those whose symptoms were minor or who were asymptomatic. An accurate mortality rate of the disease and the level of herd immunity in the population can be determined from the results of this test.

Due to limited testing, as of March 2020 no countries had reliable data on the prevalence of the virus in their population.[19] By 23 March, no country had tested more than 3% of their population, and there are variations in how much testing has been done across countries.[20] This variability is also likely to be affecting reported case fatality rates, which have probably been overestimated in many countries, due to sampling bias.[21] [22][23]

Hydroxychloroquine

- Hydroxychloroquine (Plaquenil) and its sister drug chloroquine (Aralen) are under investigation for treatment of the **COVID-19** coronavirus disease
- **Korean doctors used these anti-**malaria drugs **to treat** COVID-19 **with some success, according to a paper filed with Elsevier in March 2020, but effectiveness is unproven.**

Hydroxychloroquine is classified as an anti-malarial drug. It is similar to chloroquine (Aralen) and is useful in treating several forms of malaria as well as lupus erythematosus and rheumatoid arthritis. Its mechanism of action is unknown. Malarial parasites invade human red blood cells. Hydroxychloroquine may prevent malarial parasites from breaking down (metabolizing) hemoglobin in human red blood cells. Hydroxychloroquine is effective against the malarial parasites *Plasmodium vivax, P. malariae, P. ovale,* and susceptible strains of *P. falciparum*. Hydroxychloroquine prevents inflammation caused by lupus erythematosus and rheumatoid arthritis.

Side effects of Hydroxychloroquine:

- Irritability,
- Headache,
- Weakness,
- Hair lightening or loss,
- Stomach upset,
- Nausea,
- Dizziness,
- Muscle pain,
- Rash and
- Itching.

Rarely, hydroxychloroquine can affect the bone marrow leading to reduced white blood cells (leucopoenia) or platelets (thrombocytopenia) and abnormal red blood cells (anaemia).

Rare but potentially serious eye toxicity can occur. This toxicity affects a part of the eye called the retina and can lead to colour blindness and even loss of vision. An ophthalmologist (eye

specialist) often can detect changes in the retina that suggest toxicity before serious damage occurs. Therefore, regular eye examinations, even when there are no symptoms, are mandatory.

Patients who are genetically deficient in a certain enzyme, called G6PD, can develop a severe anaemia resulting from the rupture of red blood cells. This enzyme deficiency is more common in persons of African descent and can be evaluated by blood testing. Hydroxychloroquine may worsen psoriasis.

In conclusion Hydroxychloroquine (Plaquenil) is a drug that is classified as an anti-malarial drug. Plaquenil is prescribed for the treatment or prevention of malaria. It is also prescribed for the treatment of rheumatoid arthritis, lupus, and the side effects of lupus such as hair loss, joint pain, and more. Some experts think hydroxychloroquine might be effective against COVID-19 coronavirus, but this is unproven. **Do not use these medications to treat COVID-19 unless your doctor recommends that you do so.**

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