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CORONAVIRUS: ORIGIN, SPREAD, DIAGNOSTIC TESTS, LIFE CYCLE, TREATMENT AND PREVENTIVE MEASURES FOR COVID-19

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ABSTRACT

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).It was first identified in December 2019 in Wuhan, China, and has since spread globally, resulting in an ongoing pandemic. The World Health Organization (WHO) on March 11, 2020, has declared the novel coronavirus (COVID-19) outbreak a global pandemic. According to the CDC Trusted Source, SARS-CoV-2 has an incubation period of 2 to 14 days. This means that someone who's carrying the virus may come into contact with many people before symptoms begin. The virus is primarily spread between people during close contact, often via small droplets produced by coughing,sneezing, and talking.To date, there are no specific vaccines or medicines for COVID-19 but by using some anti-viral and anti malarial drugs such as hydrochlroquine and chloroquine it can be treated out. The epidemic preventive measures are epidemic lockdown and social distancing.

Keywords: COVID-19, SARS-CoV-2, epidemic prevention and control, social distancing, epicenter lockdown.

INTRODUCTION

Corona viruses belong to the class:-pisoniviricetes, family:Corona viridae, kingdom:-orthornavirae and are characterized by causing respiratory tract infections ranging from mild diseases such as common cold to pneumonia with a lethal outcome.The SARS-CoV-2 virus is a single-stranded RNA beta-coronavirus, similar to SARS-CoV and MERS-CoV.Researchers first identified a coronavirus in 1937, isolating one that was responsible for a type of bronchitis in birds that had the potential to devastate poultry stocks.Scientists found evidence of human coronaviruses in the 1960s, in the noses of people with the common cold. In the context of human coronaviruses, it was thought that they caused only mild self-limitinginfections until the SARS-CoV outbreak in 2002–2003 [2]. Two humanα-coronaviruses (HCoV-229Eand HCoV-NL63) and twoβ-coronaviruses (HCoV-OC43 and HCoV-HKU1) were identified asendemic in human populations, responsible for 15%–30% of annual respiratory tract infections.However, a more severe disease has been detected in neonates, elderly people and in individuals withpre-existing illnesses

Human coronaviruses that are particularly prevalent include 229E, NL63, OC43, and HKU1.The name "coronavirus" comes from the crown-like projections on their surfaces. "Corona in Latin means "halo" .

Origin and cause

The coronavirus likely originated in bats or pangolins. The first transmission to humans was in Wuhan, China. Since then, the virus has mostly spread through person-to-person contact.

Coronaviruses are a group of viruses that can cause disease in both animals and humans. The most common in certain species of animals, such as cattle and camels. Although the transmission of coronaviruses from animals to humans is rare, this new strain likely came from bats, though one study suggests pangolins may be the origin. The severe acute respiratory syndrome (SARS)

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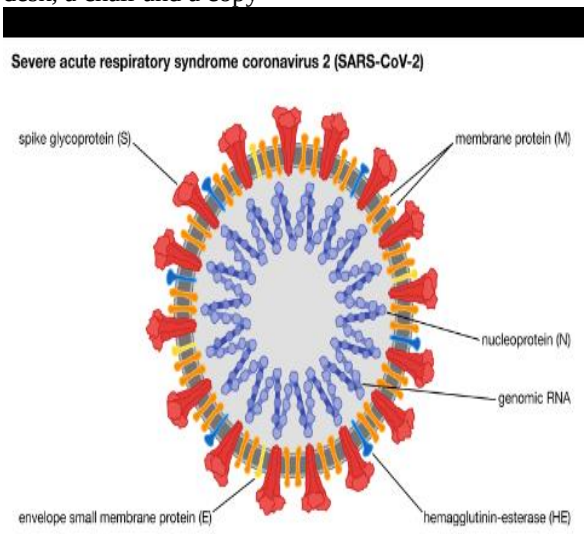
virus strain known as SARS-CoV is an example of a coronavirus. SARS spread rapidly in 2002–2003.The new strain of coronavirus is called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The virus causes coronavirus disease 19.

Anatomy any physiology

SARS-CoV-2 is big — its genome is more than twice the size of that of the average flu virus and about one-half larger than Ebola's. But it is still tiny: 10,000 times smaller than a millimeter, barely one-thousandth the width of a human hair, smaller even than the wavelength of light from a germicidal lamp. If a person were the size of Earth, the virus would be the size of a person. Picture a human lung cell as a cramped office just big enough for a desk, a chair and a copy



machine. SARS-CoV-2 is an oily envelope stuck to the door. Our coronavirus, like the others, is a string of roughly 30,000 biochemical building blocks called nucleotides enclosed in a membrane of both protein and lipid.

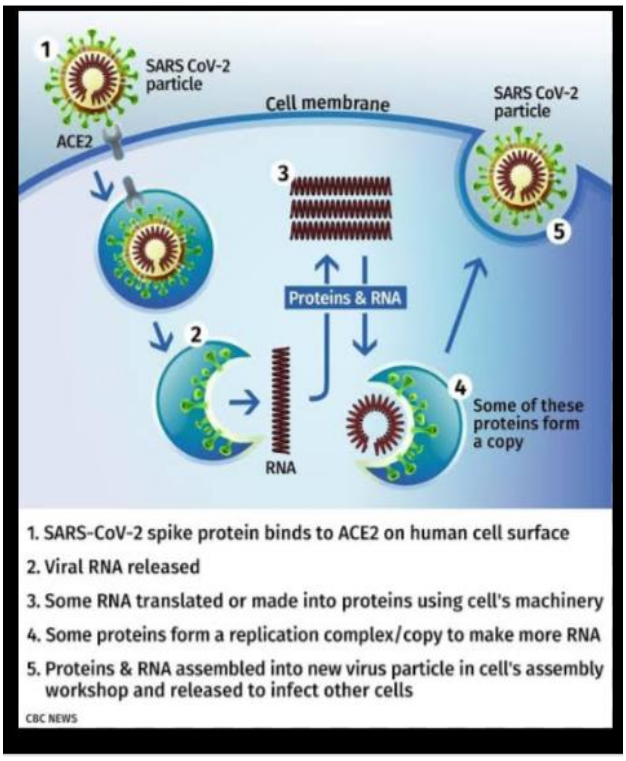
They are extremely complex in the way that they get around and start to take over a cell. They make more genes and more proteins than most other RNA viruses, which gives them more options to shut down the host cell. The core code of SARS-CoV-2 contains genes for as many as 29 proteins: the instructions to replicate the code. One protein, S, provides the spikes on the surface of the virus and unlocks the door to the target cell. The others, on entry, separate and attend to their tasks: turning off the cell's alarm system; commandeering the copier to make new viral proteins; folding viral envelopes, and helping new viruses bubble out of the cell by the thousands.

Life cycle

The novel coronavirus and SARS-CoV enter cells,the incubation period is (1 to 14 days)the researchers identified key mechanisms by which SARS-CoV-2 evades the host immune system, and enters cells. They said the spike protein on the surface of SARS-CoV-2 binds to the host cell receptor ACE2 through a portion on its surface called the receptor-binding domain, or RBD.

The RBD, is activated by biological molecules in humans called proteases. SARS Classic settled quickly into human lung cells, causing a person to cough but also announcing its presence. In contrast, its successor tends to colonize first the nose and throat, sometimes causing few initial symptoms. Some cells there are thought to be rich in the surface enzyme ACE2 — the doorknob that SARS-CoV-2 turns so readily. The high ACE2 binding affinity of the RBD, furin preactivation of the spike, and hidden RBD in the spike potentially allow SARS-CoV-2 to maintain efficient cell entry while evading immune surveillanceing SARS-CoV-2 .The virus replicates quietly, and quietly spreads: One study found that a person carrys most contagious two to three days before they are aware that they might be ill.

From there, the virus can move into the lungs. The delicate alveoli, which gather oxygen essential to the body, become inflamed and struggle to do their job. The texture of the lungs turns from airy froth to gummy marshmallow. The patient may develop pneumonia; some, drowning internally and desperate for oxygen, go into acute respiratory distress and require a ventilator.



The virus can settle in still further: damaging the muscular walls of the heart; attacking the lining of the blood vessels and generating clots; inducing strokes,

seizures and inflammation of the brain; and damaging the kidneys. Often the greatest damage is inflicted not by the virus but by the body's attempt to fight it off with a dangerous "cytokine storm" of immune system molecules.

Note on furin:As the findings of the new study indicates that the new SARS-CoV-2 coronavirus has a mutated gene similarly found on the HIV virus, it is also able to attack human cells via the target called furin, which is an enzyme that works as a protein activator in the human body.

How the COVID-19 virus propagates in the human body:

- STEP 1: Virus enters a cell:Viruses can't multiply without using a cell's protein-making machinery. So they first need to gain entry into a healthy cell. Coronaviruses, like the one that causes COVID-19, have a shell of Spiky proteins that allow them to bind to cells.
- STEP 2: Virus releases genetic code:The virus fuses with the cell and, once inside, releases a strand of RNA. Like a blueprint, RNA is a string of genetic code that has instructions to make exact copies of the virus.
- STEP 3: Genetic code converts to proteins:Tiny particles in the host cell, called ribosomes, are equipped to read genetic material. When the virus's RNA passes through the ribosme, the ribosome produces viral proteins.
- STEP 4: Proteins make copies:Viral proteins are needed to make copies of the viral RNA, as well as other parts of the virus like the outer spikes and membrane. As more proteins and RNA strands are made, they proliferate, making exponentially more copies that fill up the cell.
- STEP 5: Viral parts get assembled:The viral parts use mechanisms in the host cell to come together, forming a complete virus. When fully assembled, the virus can exit the cell to seek other healthy cells and start the process again.
- STEP 6:Depending upon the nature of drugs they will blocks replication,inhibits the count of cells etc.,,..

Spread: SARS-CoV-2 spreads from person to person through close communities.

When people with COVID-19 breathe out or cough, they expel tiny droplets that contain the virus. These droplets can enter the mouth or nose of someone without the virus, causing an infection to occur. Droplets containing the virus can also land on nearby surfaces or objects. Other people can pick up the virus by touching these surfaces or objects. Infection is likely if the person then touches their nose, eyes, or mouth.

Diagnosis: The use of reverse transcriptase polymerase chain reaction (RT-PCR) is the gold standard. This molecular biology technique detects genetic material that is specific for the SARS-CoV-2 virus.computed tomography (CT) scans, which combine a series of X-ray images, serve as an alternative.

Symptoms

COVID-19 symptoms range from mild to severe. It takes 2-14 days after exposure for symptoms to develop. Symptoms may include: Fever, cough, shortness of breath, chills, repeated shaking with chills, muscle pain, headache, sore throat, loss of taste or smell. Those with weakened immune systems may develop more serious symptoms, like pneumonia or bronchitis.

Treatment

Chloroquine and hydroxychloroquine have been shown to kill the COVID-19 virus.

Experimental studies have suggested that chloroquine is a proven anti-malarial drug that has the capability of inhibiting the replication of several intracellular micro-organisms including coronaviruses in vitro. It is also believed that chloroquine may have a varied mechanism of action which may differ depending upon the pathogen studied. It has been increasingly learnt that the anti-viral and anti-inflammatory activities of chloroquine may have a role in the treatment of patients with novel COVID-19. Chloroquine increases endosomal pH and interferes with the glycosylation of cellular receptor of SARS-CoV and thereby it has the potential to block viral infection . In addition, chloroquine also inhibits the quinone reductase-2, which is involved in sialic acid biosynthesis (an acidic monosaccharides of cell transmembrane proteins required for ligand recognition) that makes this agent a broad antiviral agent. It is important to note that both human coronavirus HCoV-O43 and orthomyxoviruses uses sialic acid moieties as a receptor. Moreover, chloroquine changes the pH of lysosomes and likely inhibits cathepsins, that leads to the formation of the autophagosome which cleaves SARS-CoV-2 spike protein. Furthermore, chloroquine through the inhibition of MAP-kinase interferes with SARS-CoV-2 molecular crosstalk, besides altering the virion assembly, budding and interfering with the proteolytic processing of the M protein . Previous experimental studies have also demonstrated that chloroquine has potent anti-SARS-CoV-1 effects in vitro, primarily attributable to a deficit in the glycosylation receptors at the virus cell surface, so that it cannot bind to the angiotensin-converting enzyme 2 (ACE2) expressed in lung, heart, kidney and intestine. Since SARS-CoV-2 utilizes the similar surface receptor ACE2, it is believed that chloroquine can also interfere with ACE2 receptor

glycosylation thus prevents SARS-CoV-2 attachment to the target cells.

Chinese researchers who studied the effect of chloroquine in vitro (using Vero E6 cell line infected by SARS-CoV-2) found chloroquine to be highly effective in reducing viral replication that can be easily achievable with standard dosing due to its favorable penetration in tissues including the lung .

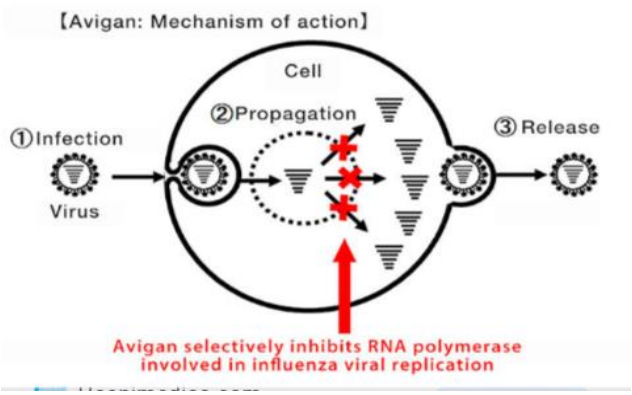
Since the structure and mechanism of action of chloroquine and hydroxychloroquine (HCQ) are exactly same except an additional hydroxy moiety in one terminal in HCQ, both act as a weak base that can change the pH of acidic intracellular organelles including endosomes/lysosomes, essential for the membrane fusion. It is believed that both the agents could be effective tools against SARS-CoV-1 and SARS-CoV-2.

However, an important question that still remains is whether HCQ has a similar effect on SARS-CoV-2 infection. Some data show HCQ effectively inhibited both the entry, transport and the post-entry stages of SARS-CoV-2, similar to the chloroquine.

Dosage: Chloroquine phosphate 500 mg BID for 10 days. Moderate to severe COVID-19: Lopinavir 400mg/Ritonavir 100 mg BID or Chloroquine 500 mg orally per day or Hydroxychloroquine 400 mg orally per day for 7–10 days.

COVID-19 Pneumonia: Chloroquine phosphate 500 mg BID for 5 days plus Darunavir 800 mg/Cobicistat 150 mg OD for 2 weeks. Atazanavir 400 mg OD for 2 weeks plus Oseltamivir 150 mg BID for 5 days.

2.Favipiravir(AVIGAN):



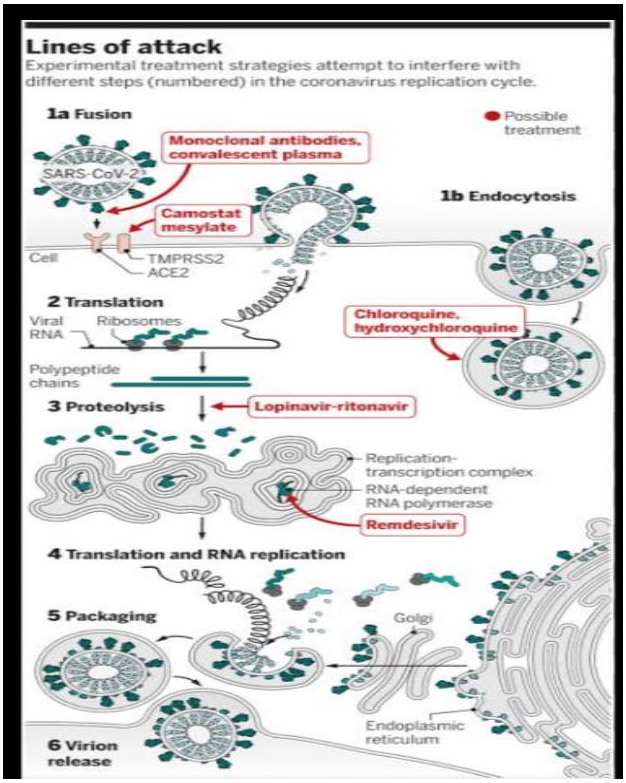
Antiviral drug Favipiravir/Avigan is effective as it works by preventing the virus from copying its genetic material.It was discovered while searching for drugs to treat a common flu and has strong inhibitory activity on RNA-polymerase RNA, which is dependent on most viruses with RNA genomes. Among them, influenza viruses have been shown to be sensitive to this new antiviral drug, including strains with genetic resistance to neuraminidase inhibitors.

Dosage:1000 mg favipiravir BID x 1 day, and 400 mg favipiravir BID x 4 days

3.**The antiretroviral drug lopinavir** is a protease inhibitor, which is widely used for the treatment of HIV and is a potential candidate for the treatment of COVID-19. Lopinavir is formulated in combination with another protease inhibitor, ritonavir (lopinavir/ritonavir, branded as Kaletra or Aluvia). Ritonavir inhibits the metabolising enzyme cytochrome P450 3A and therefore increases the half-life of lopinavir2.LPVr is a protease inhibitor, it inhibit the action of 3CLpro, thereby disrupting the process of viral replication and release from host cells.

4. **Antiviral drug remdesivir,** that's because the coronavirus that causes COVID-19 is similar to the coronaviruses that caused the diseases SARS and MERS.Remdesivir mimics a part of the viral RNA. During the copying process, it inserts itself into the RNA strand. When attached, the drug prevents any further copying, leaving the RNA strand incomplete and unable to produce critical viral parts.Hampered by the drug, the entire replication process slows down. This means fewer viruses are assembled. Defective viruses with partial RNA can't replicate in other cells.

5. **Convalescent plasma therapy:** When people recover from COVID-19, their blood contains antibodies that their bodies produced to fight the coronavirus and help them get well. Antibodies are found in plasma, a component of blood.



Convalescent plasma — literally plasma from recovered patients — has been used for more than 100 years to treat a variety of illnesses from measles to polio, chickenpox, and SARS. In the current situation, antibody-containing plasma from a recovered patient is given by transfusion to a patient who is suffering from COVID-19. The donor antibodies help the patient fight the illness, possibly shortening the length or reducing the severity of the disease. Though convalescent plasma has been used for many years, and with varying success, not much is known about how effective it is for treating COVID-19.
Miscellaneous (additional therapy):
1).Vitamin C is an important nutrient that keeps your immune system functioning properly. Vitamin C is an essential nutrient with several roles in your body. It's a potent antioxidant, meaning it can neutralize unstable compounds in your body called free radicals and help prevent or reverse cellular damage caused by these compounds and it is found in fruit and vegetables that may help shorten the duration and severity of colds. High doses are being studied for their potential to decrease lung inflammation, but more research is needed.Additionally, a 2019 review found that both oral and IV high dose vitamin C treatment may aid people admitted to intensive care units (ICUs) for critical illnesses by reducing ICU stay length by 8% and shortening the duration of mechanical ventilation by 18.2% .
2).Newly a advanced process of mutation of a gene in virus is under process.We have developed an analysis pipeline to facilitate real-time mutation tracking in SARS-CoV-2, focusing initially on the Spike (S) protein because it mediates infection of human cells and is the target of most vaccine strategies and antibody-based therapeutics,"
The mutation "Spike D614G" is of urgent concern for prevention.

Preventive measure:

- Epidemic lockdown and social distancing
- Use alcohol-based disinfectants to clean hard surfaces in your home
- Cover your mouth and nose when you cough and sneeze and sanitize hands.
- Use warm water and soap and rub your hands for at least 20 seconds. Work the lather to your wrists, between your fingers, and under your fingernails. You can also use an antibacterial and antiviral soap.
- Avoid eating or drinking in public places.

Do not gather in groupsAccording to me something happens for a good and a better reason.

Post preventive measure

- Don't suddenly plan a vacation
- Don't party in clubs or bars
- Maintain respiratory hygiene in public places
- Don't throw a big party at home

Natural remedies

Plenty intake of fluids, drinking boiled water ,kada(ginger,cinnamon,blackpepper,black salt),taking steam bath etc.
some immune boosting supplements such as Black seeds,jaggery,B complex etc
Impact of Lock down: Earth is healing, Animals are reclaim free human habitat, Blind people can walk and cross the road free and independent types of pollutions and pollutants are lowered which is giving a mesmerize impact to the nature. Through the social distancing not only the covid- 19 but many other effective viruses and diseases can be prevented.

DISCUSSION AND CONCLUSION

This literature review and analysis was conducted based on recently published studies on treatment of COVID-19 diseases. This review clearly demonstrates that the available data are not sufficient to suggest any treatment for eradication of COVID-19 to be used at the clinical level. All human studies lack comparative data so that it remains unclear whether the patient recovered because of the use of particular drug or the general clinical care received. Most in vitro studies, however, are suggestive of potential beneficial effects although the data are too preliminary to be used as rationale for clinical use. The motivation for the use of antiviral drugs to treat COVID-19 infection, a viral disease, is obvious. However, the interest in the use of antimalarial drugs stems in the unexpected finding of beneficial effect of hydroxychloroquine in the treatment of HIV patients . Nevertheless, the beneficial effects of chloroquines in patients with COVID-19 needs to be tested through appropriately conducted clinical trials. However, a point that needs careful attention is the safety profile of these two antimalarial drugs. The toxicity of chloroquine is well-acknowledged, but it is often ignored that hydroxychloroquine is a relatively safe drug being used by a vast population of patients with early rheumatoid arthritis .

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