CORONAVIRUS- A REVIEW

Dr. Shilpa Jaryal¹, Dr. Gurpreet Kaur², Dr. Jageer Chhina³, Dr Jannat Sharma⁴, Shreen Mann⁵

¹MDS Post Graduate Student, Department of Periodontology and Oral Implantology, National Dental College and Hospital, Derabassi, Mohali, Punjab.

²HOD, Department of Periodontology and Oral Implantology, National Dental College and Hospital, Derabassi, Mohali, Punjab

³(BDS) Office Administrator Aviation Dental Calagry, Alberta (CANADA)

⁴(BDS), (CANADA)

⁵BDS, Tutor, National Denatal

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Corresponding author: Dr. Shilpa Jaryal

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Abstract:

Coronavirus disease (COVID-19) is an infectious disease caused by a coronavirus. Coronaviruses are a group of enveloped viruses with nonsegmented, single-stranded, and positive-sense RNA genomes. Apart from infecting a variety of economically important vertebrates (such as pigs and chickens), six coronaviruses have been known to infect human hosts and cause respiratory diseases. Among them, severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV) are zoonotic and highly pathogenic coronaviruses that have resulted in regional and global outbreaks. Coronaviruses possess a distinctive morphology, the name being derived from the outer fringe, or coronal of embedded envelope protein. Members of the family Coronaviridae cause a broad spectrum of animal and human diseases. Uniquely, replication of the RNA genome proceeds through the generation of a nested set of viral mRNA molecules. Human coronavirus (HCoV) infection causes respiratory diseases with mild to severe outcomes. In the last 15 years, we have witnessed the emergence of two zoonotic, highly pathogenic HCoVs: severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV). Replication of HCoV is regulated by a diversity of host factors and induces drastic alterations in cellular structure and physiology. In this review all (as we possible) information about Corona viruses are given.

Keywords: Corona virus, respiratory, viruses, Hcov, host, RNA.

Introduction:

In early 2020, after a December 2019 outbreak in China, the World Health Organization identified SARS-CoV-2 as a new type of coronavirus. The outbreak quickly spread around the world. As of January 24, 2020, at least 830 cases had been diagnosed in nine countries: China, Thailand, Japan, South Korea, Singapore, Vietnam, Taiwan, Nepal, and the United States. Twenty-six fatalities occurred, mainly in patients who had serious underlying illness. Although many details of the emergence of this virus such as its origin and its ability to spread among humans remain unknown, an increasing number of cases appear

to have resulted from human-to-human transmission.

Given the severe acute respiratory syndrome coronavirus (SARSCoV) outbreak in 2002 and the Middle East respiratory syndrome coronavirus (MERS-CoV) outbreak in 2012, 2019-nCoV is the third coronavirus to emerge in the human population in the past two decades an emergence that has put global public health institutions on high alert. China responded quickly by informing the World Health Organization (WHO) of the outbreak and sharing sequence information with the international community after discovery of the causative agent.

Figure 1: Timeline of important events between December 2019 to April 2020

The WHO responded rapidly by coordinating diagnostics development; issuing guidance on patient monitoring, specimen collection, and treatment; and providing up-to-date information on the outbreak.

Several countries in the region as well as the United States are screening travelers from Wuhan for fever, aiming to detect 2019-nCoV cases before the virus spreads further. Updates from China, Thailand, Korea, and Japan indicate that the disease associated with 2019-nCoV appears to be relatively mild as compared with SARS and MERS.

Coronaviruses derive their name from the Latin word “corona” meaning crown. The name refers to the unique appearance of the virus under an electron microscope as round particles with a rim of projections resembling the solar corona. They are enveloped, positive-sense, single-stranded RNA viruses which were first isolated from humans in 1965

Coronaviruses make up a large family of viruses that can infect birds and mammals, including humans, according to world health organisation (WHO). These viruses have been responsible for several outbreaks around the world, including the severe acute respiratory syndrome (SARS) pandemic of 2002-2003 and the Middle East respiratory syndrome (MERS) outbreak in South Korea in 2015. Most recently, a novel coronavirus

(SARS-CoV-2, also known as COVID-19) triggered an outbreak in China in December 2019, sparking international concern.

While some coronaviruses have caused devastating epidemics, others cause mild to moderate respiratory infections, like the common cold.

Figure 2: structure of coronavirus

Types Coronaviruses belong to the subfamily Coronavirinae in the family Coronaviridae. Different types of human coronaviruses vary in how severe the resulting disease becomes, and how far they can spread. Doctors currently recognize seven types of coronavirus that can infect humans.

COMMON TYPES

1. 229E (alpha coronavirus)
2. NL63 (alpha coronavirus)
3. OC43 (beta coronavirus)
4. HKU1 (beta coronavirus)

Rarer strains that cause more severe complications include MERS-CoV, which causes Middle East respiratory syndrome (MERS), and SARS-CoV, the virus responsible for severe acute respiratory syndrome (SARS).

In 2019, a dangerous new strain called SARSCoV-2 started circulating, causing the disease COVID19.

S – spike protein; E – envelope protein; M – membrane protein; N – nucleocapsid protein; RNA – genomic RNA. Virion structure adapted from <http://www.expasy.ch/viralzone/>. Genome structure adapted from Decaro and Buonavoglia, 2008.

Figure 3: Coronavirus and comparison of CCoV and FCoV genome.

Transmission Limited research is available on how HCoV spreads from one person to the next. However, researchers believe that the viruses transmit via fluids in the respiratory system, such as mucus. Coronaviruses can spread in the following ways: Coughing and sneezing without covering the mouth can disperse droplets into the air. Touching or shaking hands with a person who has the virus can pass the virus between individuals.

Making contact with a surface or object that has the virus and then touching the nose, eyes, or mouth. Some animal coronaviruses, such as feline coronavirus (FCoV), may spread through contact with feces. However, it is unclear whether this also applies to human coronaviruses.

The National Institutes of Health (NIH) suggest that several groups of people have the highest risk of developing complications due to COVID-19.

These groups include:

1. Young children
 2. People aged 65 years or older
 3. Women who are pregnant
- Coronaviruses will infect most people at some time during their lifetime.

CORONAVIRUSES

Coronaviruses can mutate effectively, which makes them so contagious. To prevent transmission, people should stay at home and rest while symptoms are active. They should also avoid close contact with other people. Covering the mouth and nose with a tissue or handkerchief while coughing or sneezing can also help prevent transmission. It is important to dispose of any tissues after use and maintain hygiene around the home. COVID-19 In 2019, the Centers for Disease Control and Prevention (CDC) started monitoring the outbreak of a new coronavirus, SARS-CoV-2, which causes the respiratory illness now known as COVID-19. Authorities first identified the virus in Wuhan, China. More than 74,000 people have contracted the virus in China. Health authorities have identified many other people with COVID-19 around the world, including many in the United States. On January 31, 2020, the virus passed from one person to another in the U.S.

The World Health Organization (WHO) have declared a public health emergency relating to COVID-19. Since then, this strain has been diagnosed in several U.S. residents. The CDC have advised that it is likely to spread to more people. COVID-19 has started causing disruption in at least 25 other countries.

The first people with COVID-19 had links to an animal and seafood market. This fact suggested that animals initially transmitted the virus to humans. However, people with a more recent diagnosis had no connections with or exposure to the market, confirming that humans can pass the virus to each other. Information on the virus is scarce at present. In the past, respiratory conditions that develop from coronaviruses, such as SARS and MERS, have spread through close contacts.

On February 17, 2020, the Director-General of the WHO presented at a media briefing the following updates on how often the symptoms of COVID-19 are severe or fatal, using data from 44,000 people with a confirmed diagnosis:

Stage of severity	Rough percentage of people with COVID-19
Mild disease from which a person can recover	More than 80%
Severe disease, causing breathlessness and pneumonia	Around 14%
Critical disease, including septic shock, respiratory failure, and the failure of more than one organ	About 5%
Fatal disease	2%

Table 1: The Director-General also noted that the risk of serious complications increases with age.

According to the WHO. Stage of severity Rough percentage of people with COVID-19 Mild disease from which a person can recover More than 80% Severe disease, causing breathlessness and pneumonia Around 14% Critical disease, including septic shock, respiratory failure, and the failure of more than one organ About 5% Fatal disease 2% Few children get COVID-19, although they are still investigating the reasons for this. However, while some viruses are highly contagious, it is less clear how rapidly coronaviruses will spread. Symptoms vary from person-to-person with COVID-19. It may produce few or no symptoms.

However, it can also lead to severe illness and may be fatal.

COMMON SYMPTOMS INCLUDE
1. Fever
2. Breathlessness
3. Cough
4. It may take 2–14 days for a person to notice symptoms after infection.
CORONA VIRUS LIFE CYCLE STEPS
1. Attachment and entry
2. Replicase protein expression
3. Replication and transcription
4. Assembly and release

Figure 4: Life cycle of Corona virus.

EPIDEMIOLOGY

In December 2019, many pneumonia cases that were clustered in Wuhan city were reported and searches for the source have shown Huanan Seafood Market as the origin. The first case of the COVID-19 epidemic was discovered with unexplained pneumonia on December 12, 2019, and 27 viral pneumonia cases with seven being severe, were officially announced on December 31, 2019. Etiologic investigations have been performed in patients who applied to the hospital due to similar viral histories of these patients has strengthened the likelihood of an infection transmitted from animals to humans

.On January 22, 2020, novel CoV has been declared to be originated from wild bats and belonged to Group 2 of beta-coronavirus that contains Severe Acute Respiratory Syndrome Associated Coronavirus (SARS-CoV).

Although COVID-19 and SARS-CoV belong to the same beta coronavirus subgroup, similarity at genome level is only 70%, and the novel group has been found to show genetic differences from SARS-CoV. Similar to the SARS epidemic, this outbreak has occurred during the Spring Festival in China, which is the most famous traditional festival in China, during which nearly 3 billion people travel countrywide.

These conditions caused favorable conditions for the transmission of this highly contagious disease

and severe difficulties in prevention and control of the epidemic. The period of the Spring Festival of China was between January 17 and February 23 in 2003, when the SARS epidemic peaked, while the period of the festival was between January 10 and February 18 in 2020. Similarly, there was a rapid increase in COVID-19 cases between January 10-22. Wuhan, the center of the epidemic with 10 million population, is also an important center in the spring festival transportation network.

The estimated number of travelers during the 2020 spring festival has risen 1.7 folds when compared with the number traveled in 2003 and reached to 3.11 billion from 1.82 billion. This large scale travel traffic has also created favorable conditions for the spread of this difficult-to-control disease.

Figure 5: COVID TIMELINE MARCH TO MARCH

Diagnosis, treatment, and prevention

In most cases of self-limited infection, diagnosis of coronaviruses is unnecessary, as the disease will naturally run its course. However, it may be important in certain clinical and veterinary settings or in epidemiological studies to identify an etiological agent.

Diagnosis is also important in locations where a severe CoV outbreak is occurring, such as, at present, in the Middle East, where MERS-CoV continues to circulate. The identification of cases will guide the development, of public health

measures to control outbreaks. It is also important to diagnose cases of severe veterinary CoV induced disease, such as PEDV and IBV, to control these pathogens and protect food supplies. RT-PCR has become the method of choice for diagnosis of human CoV, as multiplex real-time RT-PCR assays have been developed, are able to detect all four respiratory HCoVs and could be further adapted to novel CoVs. Serologic assays are important in cases where RNA may be difficult to isolate, is no longer present, and for epidemiological studies.

To date, there are no anti-viral therapeutics that specifically target human coronaviruses, so treatments are only supportive. In vitro, interferons (IFNs) are only partially effective against coronaviruses. IFNs in combination with ribavirin may have increased activity in vitro when compared to IFNs alone against some coronaviruses; however, the effectiveness of this combination in vivo requires further evaluation [coronavirus]. The SARS and MERS outbreaks have stimulated research on these viruses and this research has identified a large number of suitable anti-viral targets, such as viral proteases, polymerases, and entry proteins. Significant work remains, however, to develop drugs that target these processes and are able to inhibit viral replication.

Only limited options are available to prevent coronavirus infections. Vaccines have only been approved for IBV, TGEV, and Canine CoV, but these vaccines are not always used because they are either not very effective, or in some cases have been reported to be involved in the selection of novel pathogenic CoVs via recombination of circulating strains. Vaccines for veterinary pathogens, such as PEDV, may be useful in such cases where spread of the virus to a new location could lead to severe losses of veterinary animals. In the case of SARS-CoV, several potential vaccines have been developed but none are yet approved for use. These vaccines include recombinant attenuated viruses, live virus vectors, or individual viral proteins expressed from DNA plasmids.

Therapeutic SARS-CoV neutralizing antibodies have been generated and could be retrieved and used again in the event of another SARS-CoV outbreak. Such antibodies would be most useful for protecting healthcare workers. In general, it is thought that live attenuated vaccines would be the most efficacious in targeting coronaviruses. This was illustrated in the case of TGEV, where an attenuated variant, PRCV, appeared in Europe in the 1980s. This variant only caused mild disease and completely protected swine from TGEV.

Thus, this attenuated virus has naturally prevented the reoccurrence of severe TGEV in Europe and the U.S. over the past 30 years. Despite this success, vaccine development for coronaviruses faces many challenges. First, for mucosal infections, natural infection does not prevent subsequent infection, and so vaccines must either induce better immunity than the original virus or must at least lessen the disease incurred during a secondary infection. Second, the propensity of the viruses to recombine may pose a problem by rendering the vaccine useless and potentially increasing the evolution and diversity of the virus in the wild. Finally, it has been shown in FIPV that vaccination with S protein leads to enhanced disease.

Despite this, several strategies are being developed for vaccine development to reduce the likelihood of recombination, for instance by making large deletions in the nsp1 or E proteins, rearranging the 3' end of the genome, modifying the TRS sequences, mutant viruses with abnormally high mutation rates that significantly attenuate the virus. Owing to the lack of effective therapeutics or vaccines, the best measures to control human coronaviruses remain a strong public health surveillance system coupled with rapid diagnostic testing and quarantine when necessary.

For international outbreaks, cooperation of governmental entities, public health authorities and health care providers is critical. During veterinary outbreaks that are readily transmitted, such as PEDV, more drastic measures such as

destruction of entire herds of pigs may be necessary to prevent transmission of these deadly viruses.

Symptoms

Cold- or flu-like symptoms usually set in from 2–4 days after a coronavirus infection and are typically mild. However, symptoms vary from person-to-person, and some forms of the virus can be fatal.

Figure 6: Symptoms

Scientists cannot easily cultivate human coronaviruses in the laboratory unlike the rhinovirus, which is another cause of the common cold. This makes it difficult to gauge the impact of the coronavirus on national economies and public health.

There is no cure, so treatments include self-care and over-the-counter (OTC) medication. People can take several steps, including:

Figure 7: corona virus prevention covid -19

SELF-CARE
Asymptomatic cases, mild cases of COVID-19:
Isolate yourself in a well ventilated room.
Use a triple layer medical mask, discard mask after 8 hours of use or earlier if they become wet or visibly soiled. In the event of a caregiver entering the room, both caregiver and patient may consider using N 95 mask.
Mask should be discarded only after disinfecting it with 1% Sodium Hypochlorite.
Take rest and drink a lot of fluids to maintain adequate hydration.
Follow respiratory etiquettes at all times.
Frequent hand washing with soap and water for at least 40 seconds or clean with alcohol-based sanitizer.
Don't share personal items with other people in the household.
Ensure cleaning of surfaces in the room that are touched often (tabletops, doorknobs, handles, etc.) with 1% hypochlorite solution.
Monitor temperature daily.
Monitor oxygen saturation with a pulse oximeter daily.
Connect with the treating physician promptly if any deterioration of symptoms is noticed.
INSTRUCTIONS FOR CAREGIVERS:
Mask: The caregiver should wear a triple layer medical mask. N95 mask may be considered when in the same room with the ill person.
Hand hygiene: Hand hygiene must be ensured following contact with ill person or patient's immediate environment.
Exposure to patient/patient's environment: Avoid direct contact with body fluids of the patient, particularly oral or respiratory secretions. Use disposable gloves while handling the patient. Perform hand hygiene before and after removing gloves.

Early supportive therapy and monitoring

Management of patients with suspected or documented COVID-19 consists of ensuring appropriate infection control and supportive care. WHO and the CDC posted clinical guidance for COVID-19.

Immediate therapy of add-on oxygen must be started for patients with severe acute respiratory infection (SARI) and respiratory distress, shock or hypoxaemia. Patients with SARI can be given conservative fluid therapy only when there is no evidence of shock. Empiric antimicrobial therapy must be started to manage SARI. For patients with sepsis, antimicrobials must be administered within 1 hour of initial assessments. The WHO and CDC recommend that glucocorticoids not be used in patients with COVID-19 pneumonia except where there are other indications (exacerbation of chronic obstructive pulmonary disease).

Patients' clinical deterioration is closely observed with SARI; however, rapidly progressive respiratory failure and sepsis require immediate supportive care interventions comprising quick use of neuromuscular blockade and sedatives, hemodynamic management, nutritional support, maintenance of blood glucose levels, prompt assessment and treatment of nosocomial pneumonia, and prophylaxis against deep venous thrombosis (DVT) and gastrointestinal (GI) bleeding. Generally, such patients give way to their primary illness to secondary complications like sepsis or multiorgan system failure.

Convalescent plasma therapy

Guo Yanhong, an official with the National Health Commission (NHC), stated that convalescent plasma therapy is a significant method for treating severe COVID-19 patients. Among the COVID-19 patients currently receiving convalescent plasma therapy in the virus-hit Wuhan, one has been discharged from

hospital, as reported by Chinese science authorities on Monday, 17th February 2020 in Beijing. The first dose of convalescent plasma from a COVID-19 patient was collected on 1st and 9th February 2020 from a severely ill patient who was given treatment at a hospital in Jiangxia District in Wuhan. The presence of the virus in patients is minimised by the antibodies in the convalescent plasma. Guiqiang stated that donating plasma may cause minimal harm to the donor and that there is nothing to be worried about. Plasma donors must be cured patients and discharged from hospital. Only plasma is used, whereas red blood cells (RBC), white blood cells (WBC) and blood platelets are transfused back into the donor's body. Wang alleged that donor's plasma will totally improve to its initial state after one or 2 weeks from the day of plasma donation of around 200 to 300 millilitres.

Antiviral therapy

COVID-19 is an infectious disease caused by SARS-CoV-2, which is also termed the novel coronavirus and is diligently associated with the SARS virus. The Ministry of Science and Technology from the People's Republic of China declared three potential antiviral medicines suitable for treating COVID-19. Those three medicines are, namely, Favilavir, chloroquine phosphate and remdesivir. A clinical trial was conducted to test the efficacy of those three drugs, and the results proved that out of the three medicines above only Favilavir is effective in treating the patients with novel coronavirus. The remaining two drugs were effective in treating malaria.

Likewise a study carried out in the United States by the National Institute of Health proved that remdesivir is effective in treating the Middle East respiratory syndrome coronavirus (MERS-CoV), which is also a type of coronavirus that was transmitted from monkeys. The drug remdesivir was also used in the United States for treating the patients with COVID-19. There has been a proposal to use the combination of protease inhibitors lopinavir-ritonavir for treating the patients affected by COVID-19.

It is also evident that remdesivir was effective in treating the patients who were infected with Ebola virus. Per this evidence, China has already started testing the efficacy of remdesivir in treating the patients with COVID-19, especially in Wuhan, where the outbreak occurred. Chloroquine, which is an existing drug which is currently used in treating malaria cases, was given to more than 100 patients who were affected with novel coronavirus to test its efficacy.

A multicentric study was conducted in China to test the effectiveness of remdesivir in treating the patients with COVID-19. Thus, the results of the clinical trial proved that remdesivir has a considerably acceptable level of efficacy for treating the patients with COVID-19. Therefore, the National Health Commission of the People's Republic of China decided to include remdesivir in the Guidelines for the Prevention, Diagnosis and Treatment of Pneumonia Caused by COVID-19

Chloroquine and hydroxychloroquine are existing anti-malaria drugs also given to more than 30 patients infected with COVID-19 in Guangdong province and Hunan province to test their effectiveness and efficacy. Thus, the results of the clinical trial showed that the patients who were given chloroquine had a significant reduction in their body temperature. The clinical trial also showed better recovery among the patients who were given chloroquine and hydroxy chloroquine. Hydroxychloroquine treatment is significantly associated with viral load reduction as well as disappearance in COVID-19 patients. Further, the outcome is reinforced by azithromycin. The role of lopinavir and ritonavir in the treatment of COVID-19 is uncertain. A potential benefit was suggested by preclinical data, but additional data has failed to confirm it. Tocilizumab is an immunomodulating agent used as adjunct therapy in some protocols based on a theoretical mechanism and limited preliminary data.

Vaccine

Vaccine doses are currently limited. For this reason, the first to receive the vaccine will be

healthcare workers, residents of long-term care facilities, first responders, and people aged 75 years and older. As more doses become available, everyone will be able to receive it.

A person may need to pay an administrative fee for the vaccine. Insurance companies will reimburse this, and people without insurance can seek reimbursement from the Department of Health and Human Services' Provider Relief Fund. Otherwise, the vaccine is free.

To learn when the vaccine becomes available, check with local and state health departments regularly. The CDC provide a directory here.

Types of COVID-19 vaccine

Researchers have used various approaches to developing vaccines that protect against COVID-19. As a result, they have developed different types of vaccine, including:

WHOLE VIRUS VACCINES
RECOMBINANT PROTEIN SUBUNIT VACCINES
REPLICATION-INCOMPETENT VECTOR VACCINES
NUCLEIC ACID VACCINES

Whole virus vaccine

Also known as an “inactivated” or “weakened” virus vaccine, this type contains dead or inactivated forms of the virus.

These vaccines cannot cause an infection because they do not contain the live virus.

The COVID-19 vaccines made by Sinovac, Bharat Biotech, and the Wuhan Institute of Biological Products are of this type.

Recombinant protein subunit vaccine

This type of vaccine triggers a strong immune response to a key part of the virus. It cannot cause an infection because it does not contain a live pathogen, such as a virus.

Researchers are investigating whether they can make a recombinant protein subunit vaccine that targets a protein, called the spike protein, that the new coronavirus uses to latch onto and infect cells.

Novavax is one company taking this approach, using nanoparticle technology.

Replication-incompetent vector vaccine

This type acts as a platform for carrying genes that the body can express to provide immunity.

The AstraZeneca vaccine, which has approval in some countries, is a replication-incompetent vector vaccine. It uses a harmless, weakened adenovirus that causes the common cold in chimpanzees to provoke an immune response.

The scientists then changed the virus to make it suitable for use in humans. In other vaccines, this type of virus has safely produced a strong immune response.

In July 2020, an Ebola vaccine of this type received approval, and it may provide the basis for further COVID-19 vaccines.

Nucleic acid vaccine

This type is also called an mRNA-based vaccine. Vaccination involves injecting genetic material called mRNA into live host cells.

Each of these vaccines is designed to target a particular pathogen. In a COVID-19 vaccine, the mRNA contains instructions for producing coronavirus spike protein. The vaccine presents this information to the immune system, and as a result, the body produces antibodies to combat the virus.

Pfizer, BioNTech, and Moderna have developed this type of vaccine. The Pfizer-BioNTech and Moderna vaccines are already available in the U.S. Covaxin and Covishield are both homegrown vaccines.

Conclusion

The corona virus (COVID-19) spreads at an alarming rate all over the world. The outbreak of

the virus has confronted the world's economic, medical and public health infrastructure. Elderly and immunocompromised patients also are susceptible to the virus's mortal impacts. Currently, there is no documented cure for the virus and no vaccine has been created, although some treatment protocols have been promising. Therefore, the virus can be controlled with the appropriate prevention strategies. Also, attempts have to be made to formulate systematic strategies to prevent such future zoonotic outbreaks.

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