Review Article

A Novel 2019: Coronavirus

Prof. Sayali Dudhal[1]*, Prof. Meenal Mahajan[2], Prof.Geetanjali Mehetre[3], Prof.Reshma Pawar[4], Prof.Nikhil Bhujbal[5]
Department of Pharmaceutical Chemistry, GS Moze College of Pharmacy, Wagholi Pune- 412207, India.
Department of Pharmacognosy, GS Moze College of Pharmacy, Wagholi Pune- 412207, India.
Department of Pharmaceutics, MMM College of Pharmacy Pune- 411033, India.
Department of Pharmacology, GS Moze College of Pharmacy, Wagholi Pune- 412207, India.
Department of Pharmaceutics, GS Moze College of Pharmacy, Wagholi Pune- 412207, India.
***Corresponding author's E-mail:** sayali.dudhal555@gmail.com

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ABSTRACT

A novel coronavirus (SCoV) is the etiological agent of severe acute respiratory syndrome (SARS). SCoV- like viruses were isolated from Himalayan palm civets found in a live-animal market in Guangdong, China. Evidence of virus infection was also detected in other animals (including a raccoon dog, *Nyctereutes procyonoides*) and in humans working at the same market. The detection of SCoV-like viruses in small, live wild mammals in a retail market indicates a route of interspecies transmission, although the natural reservoir is not known. This review summarizes both classical and contemporary discoveries in the study of the molecular biology of these infectious agents, with particular emphasis on the nature and recognition of viral receptors, viral RNA synthesis, and the molecular interactions governing viral assembly.

Keywords: Coronavirus (SCoV), Severe acute respiratory syndrome coronavirus (SARS-CoV), molecular biology, Middle East Respiratory Syndrome Coronavirus (MERS-CoV) etc.

INTRODUCTION

Coronaviruses were first identified in the 1960s. The recent emergence of a novel coronavirus (2019-nCoV), which caused an outbreak of unusual viral pneumonia in tens of people in Wuhan, a central city of China, restated the risk of coronaviruses posed to public health. They get their name from their crown-like shape.[1] Sometimes, but not often, a coronavirus can infect both animals and humans. Most coronaviruses spread the same way other cold-causing viruses do: through infected people coughing and sneezing, by touching an infected person's hands or face, or by touching things such as doorknobs that infected people have touched. Almost everyone gets a coronavirus infection at least once in their life, most likely as a young child. In the United States, coronaviruses are more common in the fall and winter, but anyone can come down with a coronavirus infection at any time.[2, 3]

In this review, the general features of coronaviruses and describe various diseases caused by different coronaviruses in humans and animals. It will help understand the biology and potential risk of coronaviruses that exist in richness in wildlife such as bats.[4]

A coronavirus is a kind of common virus that causes an infection in your nose, sinuses, or upper throat. Most coronaviruses are not dangerous. Some types of them are serious, though. About 858 people have died from Middle East respiratory syndrome (MERS), which first appeared in 2012 in Saudi Arabia and then in other countries in the Middle East, Africa, Asia, and Europe.[5] In April 2014, the first American was hospitalized for MERS in Indiana and another case was reported in Florida. Both had just returned from Saudi Arabia. In May 2015, there was an outbreak of MERS in Korea, which was the largest outbreak outside of the Arabian Peninsula. In 2003, 774 people died from a severe acute respiratory syndrome (SARS) outbreak.[2] As of 2015, there were no further reports of cases of SARS. MERS and SARS are types of coronaviruses. But in early January 2020, the World Health Organization identified a new type: 2019 novel coronavirus (2019-nCoV) in China. By late January, there were 300 confirmed cases in China and a death count that was still in the single digits, but rising. And despite airport screenings, a traveler had brought the first case to the U.S.[8]

Often a coronavirus causes upper respiratory infection symptoms like a stuffy nose, cough, and sore throat. You can treat them with rest and over-the-counter medication. The coronavirus can also cause middle ear infections in children.

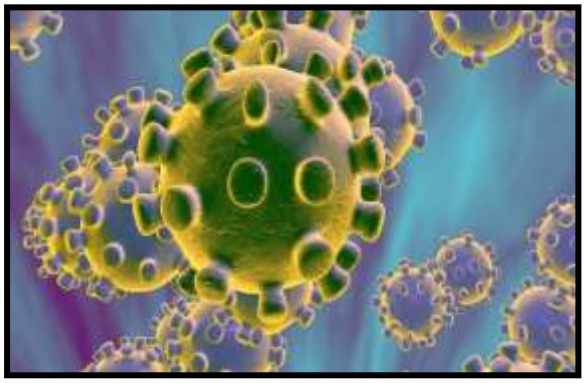

Figure 1: Coronavirus

A NOVEL CORONAVIRUS (2019 n CoV)

In 2019 novel Coronavirus (2019-nCoV) is a virus identified as the cause of an outbreak of respiratory illness first detected in Wuhan, China. Early on, many of the patients in the outbreak in Wuhan, China reportedly had some link to a large seafood and animal market, suggesting animal-to-person spread. However, a growing number of patients reportedly have not had exposure to animal markets, indicating person-to-person spread is occurring. At this time, it's unclear how easily or sustainably this virus is spreading between people.[6]

Middle East Respiratory Syndrome Coronavirus (MERS-CoV) was first reported in 2012 in Saudi Arabia and has since caused illness in people in more than 25 other countries, including the United States. Most people reported to have MERS-CoV infection developed severe acute respiratory illness, including fever, cough, and shortness of breath.

Only two patients in the U.S. have ever tested positive for MERS-CoV infection—both in May 2014. Coronaviruses are common in many different species of animals, including camels and bats. Rarely, these coronaviruses can evolve and infect humans and then spread between humans. Recent examples of this include SARS-CoV and MERS-CoV.[7]

Human Coronavirus Types

Coronaviruses are named for the crown-like spikes on their surface. There are four main sub-groupings of coronaviruses, known as alpha, beta, gamma, and delta. Human coronaviruses were first identified in the mid-1960s. The seven coronaviruses that can infect people are:

Common human coronaviruses

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

Other human coronaviruses

5. MERS-CoV (the beta coronavirus that causes Middle East Respiratory Syndrome)
6. SARS-CoV (the beta coronavirus that causes severe acute respiratory syndrome)
7. 2019 Novel Coronavirus (2019-nCoV)

People around the world commonly get infected with human coronaviruses 229E, NL63, OC43, and HKU1. Sometimes corona viruses that infect animals can evolve and make people sick and become a new human coronavirus. Three recent examples of this are 2019-nCoV, SARS-CoV, and MERS-CoV. [6,8]

SARS-CoV

Severe acute respiratory syndrome coronavirus (SARS-CoV) was first recognized in China in November 2002. It caused a worldwide outbreak in 2002-2003 with 8,098 probable cases including 774 deaths. Since 2004, there have not been any known cases of SARS-CoV infection reported anywhere in the world.

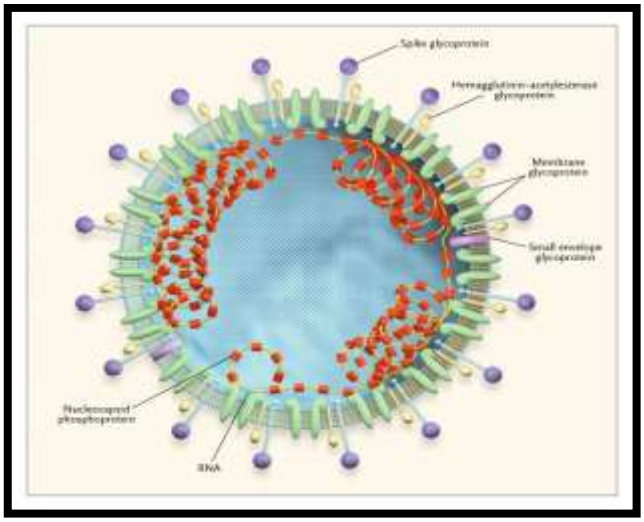

Figure 2: SARS-CoV

Cause

SARS coronavirus (SARS-CoV) – virus identified in 2003. SARS-CoV is thought to be an animal virus from an as-yet-uncertain animal reservoir, perhaps bats, that spread to other animals (civet cats) and first infected humans in the Guangdong province of southern China in 2002.[7]

Transmission

An epidemic of SARS affected 26 countries and resulted in more than 8000 cases in 2003. Since then, a small number of cases have occurred as a result of laboratory accidents or, possibly, through animal-to-human transmission (Guangdong, China).

Transmission of SARS-CoV is primarily from person to person. It appears to have occurred mainly during the second week of illness, which corresponds to the peak of virus excretion in respiratory secretions and stool, and when cases with severe disease start to deteriorate clinically. Most cases of human-to-human transmission occurred in the health care setting, in the absence of adequate infection control precautions. Implementation of appropriate infection control practices brought the global outbreak to an end.[7,8]

MERS-CoV

Middle East Respiratory Syndrome Coronavirus (MERS-CoV) was first reported in Saudi Arabia in 2012. It has since caused illness in people from dozens of other countries. All cases to date have been linked to countries in or near the Arabian Peninsula. CDC continues to closely monitor MERS globally and work with partners to better understand the risks of this virus, including the source, how it spreads, and how infections might be prevented.[9]

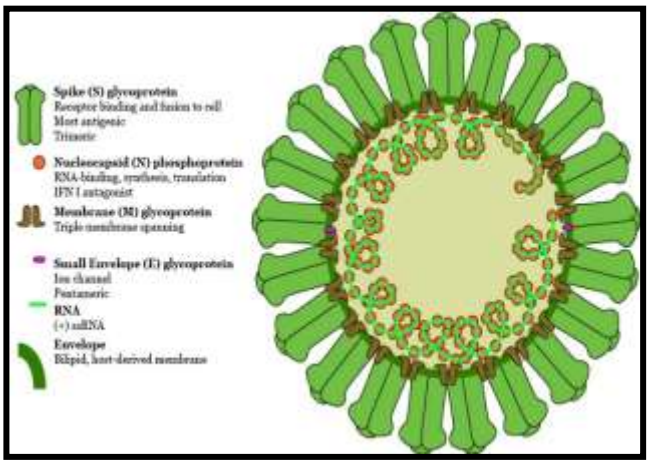

Figure 3: MERS -CoV

Cause

MERS-CoV is a zoonotic virus, which means it is a virus that is transmitted between animals and people. Studies have shown that humans are infected through direct or indirect contact with infected dromedary camels. MERS-CoV has been identified in dromedaries in several countries in the Middle East, Africa and South Asia.

The origins of the virus are not fully understood but, according to the analysis of different virus genomes, it is believed that it may have originated in bats and was transmitted to camels sometime in the distant past.

Transmission

Non-human to human transmission: The route of transmission from animals to humans is not fully understood, but dromedary camels are the major reservoir host for MERS-CoV and an animal source of infection in humans. Strains of MERS-CoV that are identical to human strains have been isolated from dromedaries in several countries, including Egypt, Oman, Qatar, and Saudi Arabia.

Human-to-human transmission: The virus does not pass easily from person to person unless there is close contact, such as providing unprotected care to an infected patient. There have been clusters of cases in healthcare facilities, where human-to-human transmission appears to have occurred, especially when infection prevention and control practices are inadequate or inappropriate. Human to human transmission has been limited to date, and has been identified among family members, patients, and health care workers. While the majority of MERS cases have occurred in health care settings, thus far, no sustained human to human transmission has been documented anywhere in the world.[14]

Since 2012, 27 countries have reported cases of MERS including Algeria, Austria, Bahrain, China, Egypt, France, Germany, Greece, Islamic Republic of Iran, Italy, Jordan, Kuwait, Lebanon, Malaysia, the Netherlands, Oman, Philippines, Qatar, Republic of Korea, Kingdom of Saudi Arabia, Thailand, Tunisia, Turkey, United Arab Emirates, United Kingdom, United States, and Yemen.[10]

Molecular Biology

Coronaviruses are large, enveloped RNA viruses of both medical and veterinary importance. Interest in this viral family has intensified in the past few years as a result of the identification of a newly emerged coronavirus as the causative agent of severe acute respiratory syndrome (SARS).[13] At the molecular level, coronaviruses employ a variety of unusual strategies to accomplish a complex program of gene expression. Coronavirus replication entails ribosome frame shifting during genome translation, the synthesis of both genomic and multiple subgenomic RNA species, and the assembly of progeny virions by a pathway that is unique among enveloped RNA viruses. Progress in the investigation of these processes has been enhanced by the development of reverse genetic systems, an advance that was heretofore obstructed by the enormous size of the coronavirus genome.[1, 2]

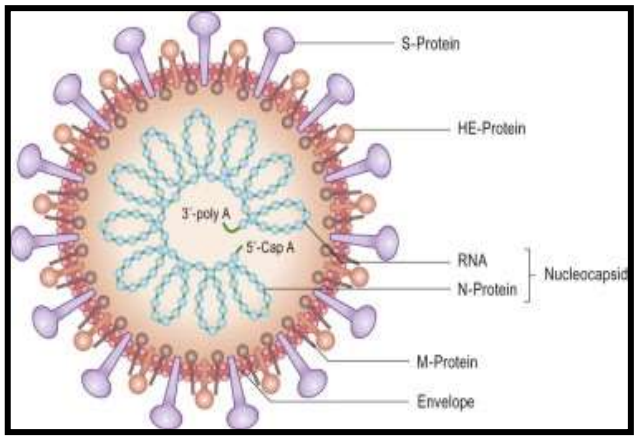

Figure 4: Molecular Biology

Symptoms of Coronavirus

In 2019-n CoV infections, reported illnesses have ranged from infected people with little to no symptoms to people being severely ill and dying. Symptoms can include:

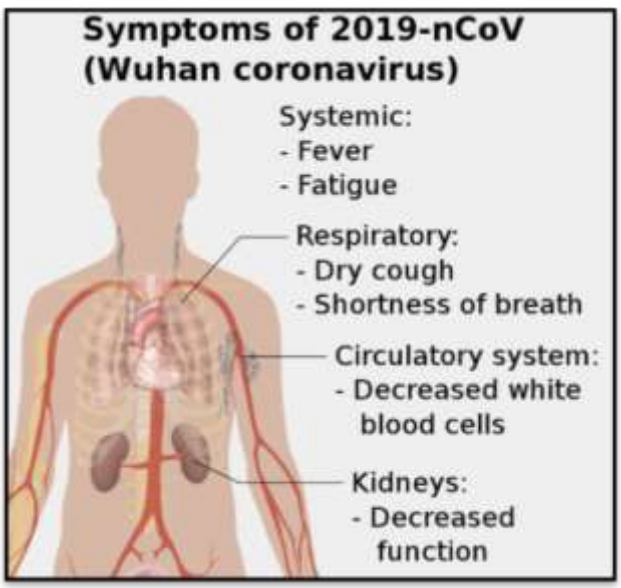

Figure 5: Symptoms of Coronavirus

- The symptoms of most coronaviruses are similar to any other upper respiratory infection, including runny nose, coughing, sore throat, and sometimes a fever.
- But if a coronavirus infection spreads to the lower respiratory tract (windpipe and lungs), it can cause pneumonia, especially in older people, people with heart disease, or people with weakened immune systems.
- Human coronaviruses commonly cause mild to moderate illness in people worldwide. Two newer human coronaviruses, MERS-CoV and SARS-CoV, have been known to frequently cause severe illness.[7]

Prevention and Treatment

Prevention

There is currently no vaccine to prevent 2019-n CoV infection. The best way to prevent infection is to avoid being exposed to this virus. Its preventive actions to help prevent the spread of respiratory viruses, including:[10]

- Wash your hands often with soap and water for at least 20 seconds.
- If soap and water are not available, use an alcohol-based hand sanitizer.
- 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.

These are everyday habits that can help prevent the spread of several viruses.

Treatment

There is no specific antiviral treatment recommended for 2019-nCoV infection. People infected with 2019-nCoV should receive supportive care to help relieve symptoms. For severe cases, treatment should include care to support vital organ functions.[1]

CONCLUSION

In this mini-review, we give a brief introduction of the general features of coronaviruses and describe various diseases caused by different coronaviruses in humans and animals. This review will help understand the biology and potential risk of coronaviruses that exist in richness in wildlife such as bats.

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