Etiology, Structure and Pathophysiology of COVID – 19.

# Etiology of Covid-19

COVID-19 is a Coronavirus. It is caused by an infection with SARS-CoV-2. COVID-19, stands for coronavirus disease 2019.

Coronaviruses are zoonotic meaning that a person has to come into close contact with an animal that carries the infection.

In people, coronaviruses can be spread from person to person through respiratory droplets (liquid particles that move through the air when we cough or sneeze). The virus is present in these droplets and can be breathed into the respiratory tract (windpipe and lungs), where the virus can then cause an infection.

The 2019 coronavirus hasn’t been definitively linked to a specific animal. Researchers believe that the virus may have been passed from bats to another animal, either snakes or pangolins and then transmitted to humans. The transmission is suspected to have occurred in the open food market in Wuhan, China.

# Structure

SARS-CoV-2 particles are spherical enveloped particles containing single-stranded (positive-sense) RNA associated with a nucleoprotein within a capsid comprised of matrix protein. The envelope has club-shaped glycoprotein projections called spikes protruding from their surface.

These spikes latch onto human cells, then undergo a structural change that allows the viral membrane to fuse with the cell membrane. The viral genes can then enter the host cell to be copied, producing more viruses. SARS-CoV-2 spikes bind to receptors on the human cell surface called angiotensin-converting enzyme 2 (ACE2).

# Pathophysiology

The lungs are the organs most affected by COVID-19 because the virus accesses host cells via the enzyme ACE2, which is most abundant in the type II alveolar cells of the lungs. The virus uses a special surface glycoprotein called a "spike" (peplomer) to connect to ACE2 and enter the host cell. The density of ACE2 in each tissue correlates with the severity of the disease in that tissue. As the alveolar disease progresses, respiratory failure might develop and death may follow.

The virus also affects gastrointestinal organs as ACE2 is abundantly expressed in the glandular cells of gastric, duodenal and rectal epithelium as well as endothelial cells and enterocytes of the small intestine.

When the virus enters the body it binds to two cells in the lungs, goblet cells that produce mucus and cilia cells which have hairs on them and normally prevent the lungs filling up with debris and fluid such as virus and bacteria and particles of dust and pollen. The virus attacks these cells and starts to kill them, so the lungs begin to fill with fluid making it hard to breathe. This phase of the disease is thought to last about a week.

At this point the immune system will start to kick in and fight off the invaders. The patient will develop a fever and the high body temperature will create a hostile environment for the virus. The body will attempt to get rid of the mucus in the form of coughing and a runny nose.

But in some people - particularly the elderly and those with other health conditions - the immune system can go into overdrive. As well as killing the virus it also starts to kill healthy cells.

This heightened immune response can trigger a “cytokine storm” - white blood cells activate a variety of chemicals that can leak into the lungs, which along with the attack on the cells damages them even further. Bacterial infections can also take hold at this point and the weakened immune system will struggle to fight them off. This heightened immune response can lead to organ failure and death.

Some people who recovered from severe acute respiratory syndrome (SARS) which swept the world in 2002 to 2003 had long-term respiratory problems as their lungs were permanently damaged. COVID-19 is similar to SARS in some respects, although it is much less lethal, so those who have recovered from more serious symptoms may also suffer some long-term effects.

Common symptoms of COVID-19 include fever, cough, and shortness of breath. Other symptoms may include muscle pain, sputum production, diarrhea, sore throat, loss of smell, and abdominal pain. While the majority of cases result in mild symptoms, some progress to viral pneumonia and multi-organ failure.