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ETIOLOGY AND ORIGIN

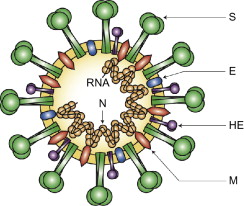
The coronavirus disease (COVID-19) has been identified as the cause of an outbreak of respiratory illness in Wuhan, Hubei Province, China beginning in December 2019. As of 31 January 2020, this epidemic had spread to 19 countries with 11 791 confirmed cases, including 213 deaths. The World Health Organization has declared it a Public Health Emergency of International Concern.

The coronavirus belongs to a family of viruses that may cause various symptoms such as pneumonia, fever, breathing difficulty, and lung infection. These viruses are common in animals worldwide, but very few cases have been known to affect humans. The World Health Organization (WHO) used the term 2019 novel coronavirus to refer to a coronavirus that affected the lower respiratory tract of patients with pneumonia in Wuhan, China on 29 December 2019. The WHO announced that the official name of the 2019 novel coronavirus is coronavirus disease (COVID-19). And the current reference name for the virus is severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It was reported that a cluster of patients with pneumonia of unknown cause was linked to a local Huanan South China Seafood Market in Wuhan, Hubei Province, China in December 2019.

On 29 December 2019, the first four cases of an acute respiratory syndrome of unknown etiology were reported in Wuhan City, Hubei Province, China among people linked to a local seafood market (“wet market”). Research is underway to understand more about transmissibility, severity, and other features associated with COVID-19. It appears that most of the early cases had some sort of contact history with the original seafood market. Soon, a secondary source of infection was found to be human-to-human transmission via close contact. There was an increase of infected people with no history of exposure to wildlife or visiting Wuhan, and multiple cases of infection were detected among medical professionals. It became clear that the COVID-19 infection occurs through exposure to the virus, and both the immunosuppressed and normal population appear susceptible. Some studies have reported an age distribution of adult patients between 25 and 89 years old. Most adult patients were between 35 and 55 years old, and there were fewer identified cases among children and infants. A study on early transmission dynamics of the virus reported the median age of patients to be 59 years, ranging from 15 to 89 years, with the majority (59%) being male . It was suggested that the population most at risk may be people with poor immune function such as older people and those with renal and hepatic dysfunction.

STRUCTURE

The coronavirus spike protein is a multifunctional molecular machine that mediates coronavirus entry into host cells. It first binds to a receptor on the host cell surface through its S1 subunit and then fuses viral and host membranes through its S2 subunit. Two domains in S1 from different coronaviruses recognize a variety of host receptors, leading to viral attachment. The spike protein exists in two structurally distinct conformations, prefusion and postfusion. The transition from prefusion to postfusion conformation of the spike protein must be triggered, leading to membrane fusion. This article reviews current knowledge about the structures and functions of coronavirus spike proteins, illustrating how the two S1 domains recognize different receptors and how the spike proteins are regulated to undergo conformational transitions. I further discuss the evolution of these two critical functions of coronavirus spike proteins, receptor recognition and membrane fusion, in the context of the corresponding functions from other viruses and host cells.



PATHOPHYSIOLOGY

Coronaviruses primarily infect the upper respiratory and gastrointestinal tract of mammals and birds. Four to five different currently known strains of coronaviruses infect humans. The most publicized human coronavirus, SARS-CoV which causes SARS, has a unique pathogenesis because it causes both upper and lower respiratory tract infections and can also cause gastroenteritis. Coronaviruses are believed to cause a significant percentage of all common colds in human adults. Coronaviruses cause colds in humans primarily in the winter and early spring seasons. The significance and economic impact of coronaviruses as causative agents of the common cold are hard to assess because, unlike rhinoviruses (another common cold virus), human coronaviruses are difficult to grow in the laboratory.

These viruses infect a variety of mammals and birds. The exact number of human isolates are not known as many cannot be grown in culture. In humans, they cause:

* Respiratory infections (common), including Severe Acute Respiratory Syndrome (SARS).
* Enteric infections (occasional - mostly in infants <12 months).
* Neurological syndromes (rare).

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