Short Communication

About Coronaviruses and COVID-19

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Viruses are small, obligate, and intracellular parasites. They are not biological organisms, but merely strands of DNA or RNA surrounded by a protective protein coat called capsid. Viruses are classified by phenotypic characteristics, such as morphology, nucleic acid type, mode of replication, host organisms, and type of disease they cause.

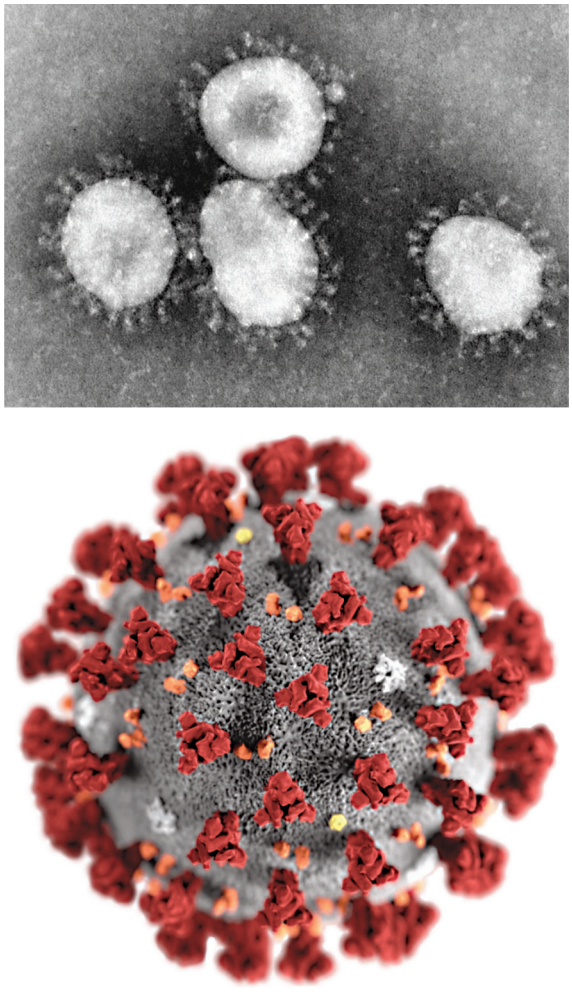

Figure 1 Crown-shaped coronavirus
From Wikipedia. The free encyclopedia. En.wikipedia.org/wiki/Coronavirus

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Coronaviruses (crown-shaped viruses; Figure 1) are a large family of viruses which cause illness in animals, including camels, cattle, cats, bats and humans. Several coronaviruses are known to cause respiratory diseases ranging from the common cold to severe, potentially fatal diseases, such as the Middle East Respiratory Syndrome (MERS), Severe Acute Respiratory Syndrome (SARS), and the coronavirus disease 2019 (COVID-19).

Regarding pathogenesis, *alphacoronaviruses* and *betacoronaviruses* infect mammals, *gammacoronaviruses* and *deltacoronaviruses* infect birds and fish, but some of them can infect mammals too.

COVID-19

Respiratory diseases caused by a new coronavirus were first detected in December 2019 in Wuhan City, Hubei Province, China. The causative virus was identified as a *Betacoronavirus* similar to MERS-CoV and SARS-CoV, named SARS-CoV-2. All three viruses (MERS-CoV, SARS-CoV, and SARS-CoV-2) have their origins in bats. The disease caused by SARS-CoV-2 is named Coronavirus Disease 2019, for short "COVID-19".

The initial outbreak of COVID-19 produced symptoms of illnesses ranging from the common cold to fatal pneumonia; the outbreak occurred in Wuhan, where many patients were linked to having been at a seafood and live animal market, suggesting an animal-to-person spread, and suggestive of emergence of the virus from an animal reservoir. Subsequently, there was evidence of person-to-person spread as well.

The situation at the time of this writing is still in flux. Community spread has been detected in at least 49 countries and territories besides China, moving closer toward the pandemic spread of the new virus. Last updated: February 27, 2020, 07:55 GMT view by country: Coronavirus cases 82,220; Deaths 2,807; Recovered 32.914. (From: https://www.worldometers.info/coronavirus/ Accessed 27/2/2563)

The followings are countries and territories with confirmed COVID-19 cases.

- China
- Hong Kong
- Macau
- Taiwan
- Afghanistan
- Algeria
- Australia
- Austria
- Bahrain
- Belgium
- Brazil
- Cambodia
- Canada
- Croatia
- Denmark
- Estonia
- Egypt
- Finland
- France
- Georgia
- Germany
- Greece
- India
- Iran
- Iraq
- Israel
- Italy
- Japan
- Kuwait
- Lebanon
- Malaysia
- Nepal
- North Macedonia
- Norway
- Oman
- Pakistan
- Philippines

- Romania
- Republic of Korea
- Russia
- Singapore
- Sri Lanka
- Spain
- Sweden
- Switzerland
- Thailand
- United Arab Emirates
- United Kingdom
- United States
- Vietnam

The outbreak of the illnesses in Wuhan since December 2019 has drawn worldwide attention. The sporadic emergence and outbreaks of the new type of coronaviruses are a warning sign of a severe global health threat. It is likely that new CoV outbreaks will be unavoidable in the future due to changes in climate and ecology, and increased interactions between human and animals. Thus, there is an urgent need to develop effective therapies and vaccines against CoVs. In this regard, the role of precision medicine would offer the best solution, from which the knowledge of coronavirus genome structure and replication is mandatory as guides for developing vaccines for the protection and targeted therapies.

It is worth noting that the genome of CoVs is a single-stranded positive-sense RNA (++ssRNA) (-30kb) with 5'cap structure and 3'-poly-A tail. The genome RNA is used as a template to directly translate polyprotein 1a/1ab (pp1a/pp1ab), which encodes non-structural protein (nsps) to form the replication-transcription complex (RTC) in a double-membrane vesicles (DMVs).

While waiting for the development of absolutely effective drugs and vaccines to cope with the current situation, the best measures at the moment is to control the source of infection, making early diagnosis, requiring strict isolation of infected cases, and giving supportive treatment.

Acknowledgements

This portion of the article was written from information retrieved almost entirely from via the Google searches, especially the CDC situation summary of Coronavirus Disease 2019, and from the paper entitled *Emerging coronaviruses: Genome structure, replication, and pathogenesis* published by Yu Chen, Qianyun Liu and Deyin Guo in *J Med Virol*. 2020;92:418-423, which contains valuable information from extensive reviewing of 70 published articles

Further Understanding of COVID-19

This portion has been written with the purpose of elucidating three interesting questions or facts highlighted by Katarina Zimmer, Shu-Tuan Xiao and colleagues, and Tara Haelle.

1. Why are some COVID-19 cases worse than others? *(Twitter @katarinazimmer; Feb 24, 2020)*:

Current data from the present outbreak indicated that the vast majority of confirmed cases suffered symptoms ranging from only those of the common cold to mild pneumonia, but the elderly and those with pre-existing illnesses were affected worse than others. The pattern of increasing severity, especially among the elderly and ill, may be due to dysfunctional immune systems that fail to keep the body's response to pathogens in check. This could cause an uncontrolled immune response, triggering an overproduction of immune cells and their signaling molecules, leading to a so-called ***cytokine storm***, associated with a flood of immune cells into the lung, ending up with inflammatory conditions, such as severe pneumonia. The same outcome could occur if the virus replicates faster than the immune system can respond.

On the other hand, the "cytokine storm" hypothesis may explain the rare incidence of COVID-19 in children under 10 years of age, in whom the immune system is not yet strong enough to execute the overproduction of immune cells.

There are also genetic and environmental factors that could explain the severity of infections. Environmental factors, such as smoking tobacco cigarettes or the quality of air being breathed, may also play a role in disease severity. As for genetic risk factor, the current situation would offer an opportunity for researchers to tease out specific genes or variants in currently infected subjects.

It has been noted that men are more affected by COVID-19 than women, the incidence of which may have something to do with the fact that *the gene for the ACE-2 receptor*, which is used by the SARS-CoV-2 to enter host cells, is found on the X chromosome, which makes people more susceptible to the virus, but then females could compensate for the bad variant because they have two copies of the X chromosome, whereas men would be stuck with only one copy.

2. The first ever description of the early pathology of the SARS-CoV-2 infection was made before symptoms developed. *(Tian S, Hu W, Niu L, Liu H, Xu H, Xiao S-Y. Pulmonary pathology of early phase 2019 novel coronavirus (COVID-19) pneumonia in two patients with lung cancer. Journal of Thoracic Oncology . doi.https://doi.org/10.1016/jtho.2020.02.010.).*

In their report, Shu-Yuan Xiao and colleagues described their examination of lung tissue surgically removed from two patients undergoing lung lobectomies for adenocarcinoma, which retrospectively were found to have been infected with COVID-19. Pathological examinations revealed that the lungs exhibited edema, proteinaceous exudate, focal reactive hyperplasia of pneumocytes with patchy inflammatory cellular infiltration, and multinucleated giant cells. Fibroblastic plugs were noted in air spaces.

3. We do not need face masks to prevent coronavirus infection – they might actually increase infection risk. *(A note from Tara Haelle in Editors: Pick2. 438,941 views Feb 29, 2020, 10:29pm)*

It is worth noting that the coronavirus is not air-born; it is transmitted through droplets, not on its own through the air. So far, all documented case of transmission of COVID-19 have involved droplets. This means that people cannot randomly breathe it in, and the standard surgical masks, which people have been encouraged by some authorities to wear, will not help. Those masks are designed to keep wearers who are ill from infecting others. Therefore, a mask should be worn only if one is ill. In addition, wearing a mask is tricky because it can create a false sense of security. If a person does not wash his or her hands after taking off the mask, he or she could even increase the risk of getting infected.

(From Bangkok Post, Thursday, March 12, 2020)

One can be protected by social distancing: if seeing someone who looks ill, coughing and sneezing, stay a distance away from them since most droplets will not travel much farther than a meter or two. Social distancing and washing hands frequently are the most important and effective forms of protection.

What should one do to prepare for COVID-19? Do not buy masks; be prepared for the outbreak, especially in the cities, and make sure that one has a supply of food and other necessities for at least 3-4 weeks if he or she is not able to leave home for a certain amount of time.

Additional Readings

1. Bovornkitti S. Correct pronunciation of the acronym MERS. *Thammasat Med J*. 2015;15:530.
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