A Review_General Outlook of Coronavirus and SARS-CoV-2

Belgin Siriken
bsiriken@omu.edu.tr

Ceren Baskan
cerennyavuz@hotmail.com

Ayhan Guler
ayhanguler93@gmail.com

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Coronavirus Disease

(COVID-19)

Editors
Prof.Dr. Belgin SIRIKEN & Asst. Prof.Dr. Ayhan GULER

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In the historical process, there have been pandemic periods that affect the whole world from time to time. According to the definition of WHO (World Health Organization), a pandemic is considered to have started only when the following 3 conditions are met:

- The emergence of a disease that the population has not been exposed to before
- The causative agent of the disease infecting people and causing a dangerous disease
- Spread of the disease factor easily and continuously among people

A disease or medical condition cannot only be considered a pandemic because it is widespread and kills large numbers of people, but must also be contagious. For example, although cancer is a disease that causes many deaths in humans, it is not considered a pandemic because it is not contagious. There have been major epidemics in world history. Antoninus (Galen) Plague (165-180 AD), Justinian plague epidemic (AD 541-542) Black Plague (1346 - 1350), Fifth Cholera Pandemic (1879 - 1881), Modern Plague (third plague pandemic) (1894-1903) , Sixth Cholera Pandemic (1899-1923).


It is also obvious that these pandemics, which affect the history and development of humanity, will cause bigger problems in the future with the increasing human population and the depletion of world resources. As scientists, this study aims to provide information to the public about the definition, development and spread of the virus that causes the current
Covid-19 pandemic and to present it as a book section to share with researchers.

We would like to thank the publishing house and our colleagues who contributed to the publication of this publication.

Best regards

Prof.Dr. Belgin SIRIKEN
Asst. Prof. Dr. Ayhan GULER
CONTENTS

Preface.................................................................................................I
Referees.................................................................................................V

Chapter I
A Review: General Outlook of Coronavirus and SARS-CoV-2........1

Chapter II

Chapter III
Epidemiology of Covid-19.................................................................29

Chapter IV
Effect of ACEIs (Angiotensin-Convertinng Enzyme Inhibitors) and
ARBs (Angiotensin II Receptor Blockers) on as Coronavirus
Disease 2019 (Covid-19).................................................................41

Chapter V
Covid-19 and Food Safety.................................................................49

Chapter VI
“Covid-19” in the Framework of a Dystopian Element..............59
Referees

Prof. Dr. Birgül IŞIK, Dicle University, Turkey
Prof. Dr. Hasan YELER, Cumhuriyet University, Turkey
Assoc. Prof. Dr. Rana ISIK, American Hospital, Turkey
Chapter I

A REVIEW: GENERAL OUTLOOK of CORONAVIRUS and SARS-CoV-2

Belgin Siriken*1 & Ceren Baskan 2 & Ayhan Guler3

1* Aquaculture Diseases Department, Faculty of Veterinary Medicine, 19 Mayis University, Samsun, Turkey.

2 Physical Therapy and Rehabilitation Department, Şerefeddin Sabuncuoğlu Health School, Amasya University, Amasya, Turkey.

3 Education Faculty of Physical Education and Sports Department, University of Hakkari, Turkey.

1.Introduction

SARS-2 CoV or COVID-19 coronavirus is a contagious disease seen recently in worldwide. Although most people infected with the virus will experience mild or moderate respiratory illness and healing without requiring special treatment, older people and people with chronic diseases and immunosuppressive problems such as cardiovascular diseases, diabetes, chronic respiratory disease, and cancer etc. are more likely to develop quite serious diseases even resulting in death (WHO,2020a,c).

Coronaviruses (CoVs) belong to Coronaviridae family (order Nidovirales). They are enveloped viruses, and contain extraordinarily large single-stranded RNA genomes ranging from 26 to 32 kb in length (Figure 1 and 2) (Zumla et al., 2016; Su et al., 2020). CoVs have been identified various animals such as avian hosts like bat, and mammalian such as camels, dogs and masked palm civets. Before 2002, it was considered that they caused mild diseases in the immunocompetent people. However, late of 2002, they
caused severe acute respiratory syndrome called SARS-CoV (Zhong et al., 2003; Drosten et al., 2003). Nowadays, for human, at least seven coronavirus species are identified as pathogens. These are HCoV-229E, HCoV-OC43, HCoV-NL63 and HCoV-HKU1, MERS-CoV (Middle East respiratory syndrome), SARS-CoV and SARS-CoV-2 (CoVID-19). There is variation for pathogenesis among these 7 species. For instance, HCoV-229E, HCoV-OC43, HCoV-NL63 and HCoV-HKU1 lead to only mild upper respiratory disease. They seldom cause to disease for in infants, young children, and elderly people (WHO, 2020c). Remaining three species are more dangerous and can cause lower respiratory tract and trigger a severe respiratory condition in humans. SARS-CoV caused outbreak in 2002 and 2003 (Zhong et al., 2003; Drosten et al., 2003), and responsible for the Middle East respiratory syndrome (MERS-CoV), which emerged in 2012 and remains in the circulation in camels (Zaki et al., 2012). SARS-CoV-2, firstly emerged in December 2019 in Wuhan of China and a great effort is being undertaken to contain its spread.

**Figure 1.** Single-stranded RNA genome of SARS-CoV2 (Rohan Bir Sing in Cascella et al., 2020).
Initially, the new virus was called 2019-nCoV (2019-novel coronavirus disease-COVID 19). Subsequently, the International Committee on Taxonomy of Viruses (ICTV) termed it the SARS-CoV-2 (the severe acute respiratory syndrome coronavirus-2) virus as it is very similar to the one that caused the SARS outbreak (SARS-CoVs) (Cascella et al., 2020; Zheng, 2020). The type coronavirus emerged from December 2019 in Wuhan, then has alarmed all over the world as of February 2020 (Zheng, 2020).

2. Variation and Origin of Quite Pathogenic Coronaviruses

Coronaviruses contain four genera: 1) Alpha-coronavirus (alphaCoV) like 229E and NL63, 2) Beta-coronavirus (betaCoV), 3) Gamma-coronavirus (gammaCoV), and 4) Delta-coronavirus (deltaCoV) (Cui et al., 2019).
The betaCoV genus divides into five sub-genera or lineages (Chan et al., 2013). Genomic characterization has shown that while Gamma and Delta-coronavirus generally infect birds and occasionally humans, alfa and beta-coronavirus infect both human and animal (Cui et al., 2019). Among 4 genera, beta-coronaviruses are the most important group and the most highly pathogenic viruses against humans such as SARS-CoV-2, MERS-CoV and SARS-CoV (Su et al., 2016; Forni et al., 2017; Cui et al., 2019). Although pathogenic MERS and SARS coronaviruses originated from bats, the newly emerged SARS-CoV-2 still debatable (Wang et al., 2004; Cui et al., 2019). According to investigation findings, SARS-CoV strains determined in market civets were transmitted from horseshoe bats, and they found to be phylogenetically associated with SARS-CoV in bats from China, Europe, Southeast Asia, and Africa (Lau et al., 2005; Hu et al., 2017; Cui et al., 2019). Besides these, SARS-CoV strains isolated from humans were highly similar to those in bats in terms of genomic sequences except that S gene and ORF3 and ORF8 gene sequences. Because, it was detected some variation these genes regions. However, some regions in SARS-CoV from bats have major variations compared to from human’s origin SARS-CoV (Song et al., 2005; Cui et al., 2019).

Camels origin MERS-CoV were found to be similar to human origin MERS-CoV. But there were some variations among S, ORF4b, and ORF3 genomic regions. According to genome sequencing-based researches have demonstrated that MERS-CoV strains from humans are phylogenetically related to those from bats (Cui et al., 2019).

Different strains of MERS-CoV obtained from camels were found to be similar to those isolated from humans except for variations among the S, ORF4b, and ORF3 genomic regions. Furthermore, genome sequencing-based studies have revealed that the strains have identical genomic and protein structures except for the S proteins. In addition, recombination analysis of genes encoding orf1ab and S revealed that MERS-CoV originated from the exchange of
genetic elements between coronaviruses in camels and bats (Chu et al., 2018; Lau et al., 2013; 2018).

The zoonotic source of SARS-CoV-2 is not confirmed but according to genomic sequence of it showed that there was close relatedness (88% identify) with two bat-derived SARS-like coronaviruses (bat-SL-CoVZC45 and bat-SL-CoVZXC21). Obtained from phylogenetic analyses results of them, SARS-CoV-2 is genetically distinct from SARS-CoV and MERS-CoV (Zhou et al., 2020; Wu et al., 2020). However, both SARS-CoV and CoV-2 have similar receptor binding domain structure, whereas the primary protease is highly conserved between them. In conclusion, bats are the source of origin, while an animal sold at the Wuhan seafood market may represent an intermediate host facilitating the emergence of the virus in humans (Lu et al., 2020; Provincial et al., 2020).

3. Epidemiology and Clinical Characteristic of Human Coronaviruses

Coronaviruses cause respiratory and intestinal infections in humans. In 2002 and 2003, they caused the outbreak of severe acute respiratory syndrome (SARS) in Guangdong, China and rapidly spread around the World (Cui et al., 2019). During this outbreak, an epidemic of pneumonia with a high rate of transmission to other people occurred in the region, followed by subsequent outbreaks (138 people) in Hong Kong (Zhao et al., 2003; Zumla et al., 2016). In these outbreaks, SARS-CoV infected 8,098 people and caused 774 fatalities in 29 different countries by the end of the epidemic (Zumla et al., 2016). Then, during 2012, in Jeddah, Saudi Arabia, a patient with MERS-CoV died because of the severe pneumonia causing MERS-CoV (Zumla et al., 2016; de Groot et al., 2013). The same year, in Jordan, it was an outbreak causing MERS-CoV (Hijawi et al., 2013). MERS-CoV, then, was continued to spread to Middle East (Zumla et al., 2016). By 2020, it was seen 2,468 cases and 851 of them resulted from died in the World (Sheahan et al., 2020; Kilber et al., 2020). In Wuhan, China, during 2019, many patient
with atypical pneumonia were reported (Zhu et al., 2020). The first 6 weeks of the outbreaks, several patients were seen in more than 37 countries (WHO, 2019). Then the infection spread from Wuhan, China to across the World (Huang et al., 2019). SARS-CoV-2 caused 79,331 confirmed cases and 2,618 deaths around the World (WHO, 2019). However, COVID-19 caused 77,262 confirmed cases and 2,595 deaths inside mainland China alone. After China, Iran is the secondary country, the highest fatalities, due to SARS-CoV-2 infection (WHO, 2020a,c).

4. Symptoms of Patient with Sars-Cov-2

A typical symptom of patient with SARS-CoV-2 infection is pneumonia, which is detected using computer tomography (CT) or chest X-ray (Zhong et al., 2003; Zhu et al., 2019). At the beginning stage of disease, the patients showed the acute respiratory infection symptoms and sometimes quickly developed acute respiratory failure and other serious complications (WHO, 2020c). The first cases of coronavirus infection in the United States also showed basilar streaky opacities in both lungs by chest radiography. However, the pneumonia for this patient was only detected on the day 10 of his illness (Holshue et al., 2020).

Generally, the most common signs and symptoms of patients are fever and cough (Chen et al., 2020). Sometimes can show fatigue, shortness of breath or dyspnea, muscle ache, headache, chest pain, diarrhea, hemoptysis, sputum production, rhinorrhea, nausea and vomiting, sore throat, confusion, and anorexia were also observed in a proportion of the patients (Chen et al., 2019; Huang et al., 2020) (Figure 3).

Generally, SARS, MERS and COVID-19 cause severe acute respiratory syndrome. When compared to fatality rate of three types, COVID-19 causes much lower (2.3 %) than SARS (about 10 %) and MERS (about 36%) (Xu et al., 2020; Wu et al., 2020).
5. Virus Transmission

SARS-CoV-2 can be transmitted by human-to-human through droplets, contact and fomites (Figure 4). SARS-CoV is commonly transmitted through indirect or direct contact with mucous membranes in the mouth, eyes or nose. It has been shown that unprotected eyes and exposed mucous membranes are vulnerable to SARS-CoV transmission. Average incubation period is 3 – 7 days, and continued up to 12 -24 days (Peiris et al., 2003; Belser et al., 2013; Chan et al., 2020; Guan et al., 2020; Li et al., 2020).

Sometimes, asymptomatic contact can also cause contamination of the SARS-CoV-2 viruses. According to the issue, a German businessman was found infected by SARS-CoV-2 after attending a conference together with a colleague with no signs or symptoms of infection but had become ill due to the SARS-CoV-2 infection later (Rothe et al., 2020). This case shows us that patient with the viruses but no symptom can spread the viruses. Therefore, it can preventive for measuring body temperature.
6. The number of Coronavirus cases and death in the some of the country

According to Worldometers (2020), last updated June 18, has reported that more than 8,418,040 coronavirus cases and 451,664 death have seen so far around the world. The number of cases according to country; In the United State, it has been seen 2,221,000 confirmed cases and 119,484 death, and the number is the highest number of confirmed coronavirus cases. In Russia is second range, and the number of SARS CoV-2 cases is 561,091 cases. A total COVID-19 number are 7,660 death. and China with 83, 293 cases and 4,634 death, England with 299,251 and 42,153 death, Germany with 190,179 and 8,927 deaths, Brazil with 960,309 cases and 46,665 deaths, Iran with 195 cases and 9185 deaths, Spain with 291,763 cases and 27,136 deaths, Italy with 237,828 cases and 34,448 death, Pakistan with 160,118 cases and 2,093 deaths, France with 158,174 cases and
29,575 deaths, Canada with 99,853 cases and 8,254 deaths, Sweden with 54,562 cases and 5,041 deaths, Netherlands with 49,204 cases and 6,074 deaths. In Turkey, 4,861 death and 182,727 cases were seen (Worldometer, 2020).

7. Preventive measure of SARS CoV-2

It was taken community measures against SAR-CoV-2 to control the spread of infection and diseases. To SARS CoV-2, there has been no vaccine and specific anti-viral drugs so far. Therefore, public health measures are considered as an effective tool for community. For this aim, hand hygiene, use of mask, hospital environment, droplet, airborne and contact precautions, institutional safeguard and standard measures.

The most important measure to control the spread of COVID-19 infection is frequent hand wash with soap and water or with an alcohol-based hand sanitizer. If hands are not visibly dirty, they should preferably have washed with alcohol-based sanitizer for at least 20 to 30 seconds (Siddharta et al., 2017). But, if hand dirty, they should wash with soap and water for 40-60 seconds (WHO, 2009). It must avoid to contracting person or other people, and hand must not contact eye or mouth like that mucosa. Susceptible or infected surfaces and other surfaces must be clean with appropriate disinfection technique with 1.0% hypochlorite solution or 70.0% alcohol to limit the spread of infection (Khan, 2020). To prevent of infection spread by aerosol or droplet infection, it must mandatorily use mask. In the hospital, it is mandatory wear surgical mask. As air-droplet seldom crosses beyond 1 meter, within 1 meter between health and infected people, all health care workers must wear medical/ surgical mask along with face shield or goggles to protect eye from accidental spiting from patients. Personal protective equipment such as masks, gloves, gown, and goggles are necessary to prevent infection to health care workers. Dedicated instruments like stethoscope and thermometer) should be used for each patient however in case of sharing each instrument must be disinfected with alcohol
or hypochlorite solution. Health care worker must avoid touching their mouth, nose or eye, frequent hand wash (WHO, 2020c).

8. Conclusion

The CoVs have become the major pathogens of emerging respiratory disease outbreaks. They are a large family of single-stranded RNA viruses and can be isolated in different animal species. These viruses can cross species barriers and can cause, in humans, illness ranging from the common cold to more severe diseases such as MERS and SARS. The potential for these viruses to grow to become a pandemic worldwide seems to be a serious public health risk. In the last twenty years, several viral epidemics such as SARS-CoV in 2002 to 2003, and H1N1 influenza in 2009, have been recorded. Most recently, MERS-CoV was first identified in Saudi Arabia in 2012 (Cascella et al., 2020). Then, in 2009, SARS-CoV-2 emerged from Wuhan, China. It spreads quickly globally and can result in death of the infected patients. The mortality rate is 2.3% (Wu et al., 2020). The large number of patients within short period of time could result in the collapse of health care system. Thus, the mortality rate might be elevated. Anyone who has had close contact with a patient with laboratory-confirmed COVID-19 within 14 days of symptom onset or a history of travel from affected geographic areas (presently China, Italy, Iran, Japan, and South Korea) within 14 days of symptom onset (Cascella et al., 2020).
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A Review: General Outlook of Coronavirus and SARS-CoV-2


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