1. Introduction

COVID-19 (Coronavirus Disease 2019) is a new type of disease caused by a virus from the coronavirus group, namely the Severe Acute Respiratory Syndrome Coronavirus 2 or SARS-CoV-2. COVID-19 can cause respiratory system disorders, ranging from mild symptoms such as flu to lung infections, such as pneumonia. Coronaviruses are single-stranded and positive-chain RNA viruses with a particle size of 120-160 nm. This virus in humans attacks the respiratory tract, especially in the cells lining the alveoli. This virus mainly infects animals, including bats and camels.

The community that has become the concern of the whole world, namely the Public Health Emergency of International Concern (PHEIC). The spread of the first case of COVID-19 in Indonesia on March 2nd, 2020, was confirmed by as many as 2 patients from Jakarta. Currently, there are 223 infected countries and 185 countries of local transmission. Data in Indonesia there are 2,093,962 confirmed cases with a death rate of 56,729 (case fatality rate / CFR 2.7%). In South Sumatra, confirmed cases as of June 26th, 2021, there were around 27,370 cases with 1386 people who died (CFR 5.06%). For the Palembang city area, there were 15,029 confirmed people with a death rate of 654 people (CFR 4.35%).
Etiology

Coronavirus which is the etiology of COVID-19 is included in the betacoronavirus genus. The results of phylogenetic analysis show that this virus belongs to the same subgenus as the coronavirus that caused the Severe Acute Respiratory Illness (SARS) outbreak in 2002-2004, namely Sarbecovirus. On this basis, the International Committee on Taxonomy of Viruses proposed the name SARS-CoV-2.6-9

Coronavirus is a single-stranded and positive-chain RNA virus with a particle size of 120-160 nm. This virus in humans attacks the respiratory tract, especially in the cells lining the alveoli. This virus mainly infects animals, including bats and camels. Before the COVID-19 outbreak, there were six types of coronavirus that could infect humans, namely alphacoronavirus 229E, alphacoronavirus NL63, betacoronavirus OC43, betacoronavirus HKU1, Severe Acute Respiratory Illness Coronavirus (SARS-CoV), and Middle East Respiratory Syndrome Coronavirus (MERS-CoV). The bat coronavirus is the main source of the Middle East Respiratory Syndrome-associated Coronavirus (MERS-CoV) and the Severe Acute Respiratory Syndrome-associated Coronavirus.9

The coronaviridae family has eleven generations of coronaviruses as of June 11th, 2021, namely alpha coronaviruses (alphaCoV), beta coronavirus (betaCoV), delta coronavirus (deltaCoV), gamma coronavirus (gammaCoV), and the latest variants are Epsilon, Zeta, Eta, Theta, Iota, Kappa and Lambda. The mechanism of virulence of the coronavirus is related to structural proteins and non-structural proteins. Coronavirus provides messenger RNA (mRNA) that can help the translation process of the replication/transcription process. The genes that play a role in this replication/transcription process include 2/3 of the 5'-end RNA sequence and two overlapping Open Reading Frames (ORFs), namely ORF1a and ORF1b.

In the host’s body, the Coronavirus performs synthesis of the polyprotein 1a/1ab (pp1a/pp1ab). The transcription process in pp1a/pp1ab synthesis takes place through the transcription-replication complex in double-membrane vesicles and also through the synthesis of subgenomic RNA sequences. There are 16 non-structural proteins encoded by ORF. The other 1/3 of the viral RNA sequence, which does not play a role in the replication/transcription process, plays a role in encoding 4 structural proteins, namely S protein (spike), E protein (envelope), M protein (membrane), and N protein (nucleocapsid) as shown in Figure 1.7,8,9

Figure 1. Structure of the coronavirus9
Pathogenesis

Transmission of SARS-CoV-2 from symptomatic patients occurs through droplets released when coughing or sneezing. SARS-CoV-2 has also been shown to infect the gastrointestinal tract based on the results of biopsies of gastric, duodenal, and rectal epithelial cells. The virus can be detected in the feces. In fact, there are 23% of patients reported that the virus was still detected in the feces even though it was not detected in respiratory samples. These two facts confirm the possibility of fecal-oral transmission.

In humans, SARS-CoV-2 primarily infects cells in the airways lining the alveoli. SARS-CoV-2 will bind to receptors and make its way into cells. The glycoprotein contained in the viral envelope spike (Protein S) will bind to cellular receptors in the form of target organs that express Angiotensin Converting Enzyme 2 (ACE2), such as the lungs, heart, renal system, and gastrointestinal tract in SARS-CoV-2.

Figure 2. The life cycle of SARS-CoV-2 in host cells

The S protein in SARS-CoV-2 facilitates entry of the coronavirus into target cells. Inside the target cell, SARS-CoV-2 duplicates the genetic material and synthesizes the required proteins, then forms new virions that appear on the cell surface. Viral entry depends on the ability of the virus to bind to ACE2, an extracellular membrane receptor expressed on epithelial cells, and depends on the priming of protein S to the cellular protease, TMPRSS2 serine protease for the protein source. TMPRSS2 functions to reduce viral recognition by neutralizing antibodies and fusion of viral cells and cells.

It is known that the entry of SARS-CoV into cells begins with the fusion of the viral membrane with the plasma membrane of the cell. After entering the cell, the virus will then release the RNA genome into the endoplasmic reticulum or Golgi cell membrane and then be translated into two lipoproteins and structural proteins to be able to replicate. Next, the viral genome will begin to replicate. Glycoproteins in the newly formed viral envelope go inward. The formation of a nucleocapsid which is composed of the RNA genome and nucleocapsid proteins. Virus particles will grow into the endoplasmic reticulum and Golgi cells. In the final stage, vesicles containing viral particles will fuse with the plasma membrane to release new viral components.
2. Conclusion

COVID-19 (Coronavirus Disease 2019) is a new type of disease caused by a virus from the coronavirus, namely the Severe Acute Respiratory Syndrome Coronavirus 2 or SARS-CoV-2. COVID-19 can cause respiratory system disorders, ranging from mild symptoms such as flu to lung infections, such as pneumonia.

3. References


