Brief Communication

Coronavirus Disease 2019 (COVID-19): Immune Responses, Transmission, and Clinical Features: An Update

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Abstract

A novel beta-coronavirus was reported in Wuhan, Hubei Province, China, which in December 2019, which was named SARS-CoV-2. It causes Coronavirus Disease 2019 (COVID-19) that can affect lung tissue and airways. The immune system can respond to SARS-CoV-2 infection via various mechanisms. Cytokines play crucial roles in COVID-19. In the present study, the latest information on the immune responses, transmission, symptoms, diagnosis, and treatment of COVID-19 is reviewed.

Keywords: SARC-CoV-2, COVID-19, Immune Responses, Cytokines

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Introduction

Recently, a novel beta-coronavirus has been reported in Wuhan which is called SARS-CoV-2. SARS-CoV2 causes COVID-19, a disease that affects the lung tissue and airways (1). Since this virus has been spread rapidly in many countries, it is deduced that SARS-CoV-2 can be a threat to global public health (2), COVID-19 was declared a worldwide pandemic by the World Health Organization (WHO) on 11 March 2020 (3). Until 5th July 2020, more than 200 countries reported cases of COVID-19. There were 10922324 people diagnosed with COVID-19 worldwide and the death toll was announced at 523011 (4).

Immune Responses

The immune system is made up of two arms: the innate immune system and the adaptive immune system. The

innate immune system initiates immune responses by the recognition of pathogens and the induction of pro-inflammatory cytokines and chemokines. Pattern recognition receptors (PRRs) are responsible for the detection of microbes in the innate immune system (5,6). Major sensors of RNA viruses such as Retinoic acid-inducible gene I and Melanoma DifferentiationAssociated Protein 5 cause the activation of nuclear factor-κB (NF-κB) and IFN regulatory factor 3 (IRF3) cascades, which ultimately leads to an increase in IFN-I (7).

It has been suggested that both the innate and adaptive responses play a significant role in SARS-CoV-2 outcomes. Besides, evidence suggests that T cells responses are essential to the effectiveness of the immune system against severe acute respiratory syndrome (SARS) and the Middle East respiratory syndrome (MERS) infections. Such immunity responses are probably similar to those against COVID-19. Nonetheless, T lymphocyte helper 1 (Th1) and TCD8+ cells mediate the main protection against SARS-CoV-2 (8).

Furthermore, B-cell responses also play a fundamental role in the immune response to SARS-CoV-2 by the production of virus-neutralizing antibodies. Given the effectiveness of TCD8+ cells in most cases, TCD8+ may lead to lung tissue damages. It has been reported that the level of cytokines and chemokines such as IL2, IL7, IL10, GSCF, IP10, MCP1, MIP1A, and TNFα increase in ICU patients with SARS-CoV-2 infection compared to non-ICU patients with COVID-19 (8,9). Besides, it reported increased levels of anti-inflammatory cytokines such as IL-4 and IL10 in a patient with COVID-19 (9,10).

Although IL-4 shows a decrease in SARS-CoV infection, (11) however it increases in SARS-CoV-2 infection (10). Thus, there is a significant difference between cytokine profiles in SARS-CoV infection and SARS-CoV-2 infection. It is noteworthy that coronaviruses use numerous strategies to evade the immune system. Previous studies have shown that SARS-CoV, MERS-CoV, and SARS-CoV-2 can directly or indirectly suppress the production of IFN (8).

Transmission

Our knowledge about SARS-CoV-2 is still limited, however, direct transmission of COVID-19 has been confirmed. Thus, it can spread from person to person via viral particles in naturally produced droplets from sneezes or coughs. Also, SARS-CoV-2 transmission can occur through oral, nasal, eye mucous membranes contact, and through the aerosols (12). Coronaviruses can survive on surfaces such as glass, metal, and plastic for up to 9 days, and can be inactivated with lipid solvents containing 70% ethanol and 0.1% sodium hypochlorite (13).

Symptoms of COVID-19

The main symptoms of COVID-19 include malaise, cough, fever, shortness of breath, headache, diarrhea, and sore throat (14). Recently, researchers found that the average incubation period of the COVID-19 is approximately 5 days, however, it may take up to 14 days (15, 16). Other complications of the COVID-19 include acute respiratory distress syndrome (ARDS), acute heart damage, secondary infections, abnormal clotting, sepsis, damages to the liver, and kidneys (17, 18).

Conclusion

SARS-CoV-2 is spreading rapidly all over the world. Both arms of the immune system mediate immune responses to SARS-CoV-2. The main route of SARS-CoV-2 transmission is the droplet transmission. Currently, our knowledge of the mysterious behaviors of SARS-CoV-2 in terms of transmission, diagnostics, prevention, and therapeutic strategies is increasing. In general, prevention seems to be the best way to reduce the transmission of the virus since no vaccine or effective treatment has yet been found.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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