The Effect of Covid-19 on Human Immune System

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Abstract

The coronavirus disease (COVID-19) was first reported at the end of 2019 in Wuhan, China. The COVID-19 outbreak has spread to several countries quickly and transmitted from animals like bats. The COVID-19 pandemic caused by the SARS-CoV-2 virus has had a significant impact on public health globally. One of the main aspects that is affected is the human body's endurance or immune system. This research aims to examine how COVID-19 infection affects the immune response and the underlying menchanisme. This virus is known to trigger an excessive innate and adaptive immune response, which can lead to dangerous conditions such as a cytokine storm. In addition, patients with comorbid conditions such as diabetes, obesity, and heart disease tend to experience a decline in immune function, making them more vulnerale to severe COVID-19 symptoms. On the other hand, COVID-19 infection also impacts the long-term immune system, where some patients exhibit "long COVID" symptomps, indicating prolonged immune dysfunction. This study also reviews the important roles of nutrition, physical acitivity, and stress management in supporting the immune system during the pandemic. The finding suggest the importane of integrated prevention strategies to enhance immune health, particulary among vulnerable

Keywords: COVID-19, pandemic, immune system, immune response

Introduction

In late December 2019, an outbreak of pneumonia with unknown causes in Wuhan, Hubei's Province, China, which quickly spread to various areas in the country. The Chinese Centers for Disease Control and Prevention (CCDC) has successfully identified a new type of beta-koronavirus named 2019-nCoV, which is now officially referred to as a coronavirus of severe respiratory syndrome 2 (SARS-CoV-2)[1]. Pneumonia related to the new coronavirus, named after coronavirus disease 2019 (COVID-19) by the WHO, began to spread in Wuhan, China, in December 2019 and has now become a global public health crisis. As of March 3, 2020, 80,270 confirmed cases and 2,981 deaths in China. Meanwhile, based on the WHO report, there are 10,566 confirmed cases and 166 deaths outside China.[2] As of March 11, 2020, the COVID-19 pandemic has caused 80,955 confirmed cases and 3,162 deaths in China, as well as 37,364 confirmed cases and 1,130 deaths in 113 other countries worldwide. The World Health Organization (WHO) states that it includes in depth to a very fast global spread and the severity of the outbreak, as well as neglecting attention and action from several countries. Therefore, WHO officially stated that COVID-19 can be categorized as a pandemic.[1]

SARS-CoV-2 can cause respiratory tract infections of varying severity, from mild to severe, and has the potential to result in death, especially in elderly people or individuals with comorbidities such as diabetes. COVID-19 triggers a complex immune response, affecting both innate and adaptive immunity with varying impacts. Variations in this response are influenced by factors such as age, the presence of comorbidities, and the condition of a person's immune system.[3] The WHO classification of the severity of COVID-19 includes four main categories. These categories include: mild illness, moderate illness (characterized primarily by pneumonia), severe illness (characterized by severe pneumonia), and critical illness (involving acute respiratory distress syndrome/ARDS, sepsis, and/or septic shock).[3]

The SARS-CoV-2 virus affects immune system through several mechanism, including trigger systemic inflammation and immune response excessive ones are known as cytokine storm (Cytokine Storm). Condition This causes tissue damage which is significant, especially in the lungs and contributes to levels disease severity and number death. In individuals with compromised immunity, such as the elderly or those who have comorbidities, this immune response is frequent times inadequate or not well coordinated and worsen disease progression. On the side otherwise, for the majority of patients with healthy immunity, the body is capable overcome SARS-CoV-2 infection with both through T cell activation and production antibodies by B cells.[4]

One of the main targets of the antibody response to the coronavirus is the spike protein, a surface glycoprotein that plays a role in attachment to host receptors and membrane fusion. The spike protein consists of two subunits: the S1 subunit, which contains the receptor binding domain (RBD) and is important for binding to host receptors; as well as the S2 subunit, which is responsible for the fusion of the virus with the host cell.[5] Memory B cells are an effective protection against new virus variants because they are able to store long-term "antibody memory" and adapt to a diversity of viral antigens. The presence of preformed memory B cells capable of cross-reacting can inhibit the response of new memory B cells produced by the vaccine through an immune imprinting mechanism.[6,7]

Discussion

COVID-19 and Its Severity in Older Populations

COVID-19 is a disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). SARS-CoV-2 leads to severe respiratory illness, typically presenting with mild to moderate symptoms in younger individuals. However, it causes significant morbidity and mortality in older individuals. The virus may contribute to the heterogeneity of the disease, as multiple mutations identified from thousands of viral sequences during the first 9 months of the pandemic suggest that genetic diversity may influence the virus's infectivity and mortality rates. Disease severity and death rates are significantly higher in the elderly, indicating a lack of pre-existing broad and long-lasting adaptive immunity by T or B cells against SARS-CoV-2.[8]

COVID-19 Severity Categories According to WHO

According to the World Health Organization (WHO), COVID-19 is classified into several severity categories. These include mild disease, moderate disease (primarily characterized by pneumonia), severe disease (with severe pneumonia), and critical disease (with acute respiratory distress syndrome). The innate immune system plays a crucial role in defending against SARS-CoV-2. An essential part of innate immunity is the autonomous response of cells infected by the virus, influenced by the biology of the receptors and coreceptors for viral entry and all cellular mechanisms that determine the virus's lifecycle.[9]

The Immune Response to SARS-CoV-2 Infection

The antiviral immune response begins with the recognition of viral particle molecular signatures, known as pathogen-associated molecular patterns (PAMPs), by pattern recognition receptors (PRRs) on innate immune cells. The resolution of damaged immune responses can lead to persistent inflammation in vivo. A major unknown is the relationship between elevated baseline inflammation and hyperinflammation that occurs in COVID-19 patients, particularly in the elderly or those with comorbidities. Pre-existing inflammatory cells, such as those in aged tissue and adipocytes, may contribute to heightened inflammation, exacerbating inflammatory events. During the immune response, monocytes migrate from circulation to tissues, particularly in older individuals, and this also occurs in the lungs of COVID-19 patients with severe disease.[10]

Aging Immune Cells and Their Dysfunction in COVID-19

Differentiated T lymphocytes typically accumulate in older individuals. These cells lose the ability to proliferate after activation, including through histone proteins and kinase inhibitors. However, these aging T cells express NKR (natural killer receptor) and can kill various cell types expressing NKR ligands. As a result, T cells infiltrating the lungs of COVID-19 patients with severe disease are unable to function properly in a targeted manner due to inflammation and failure to recognize specific antigens. The tendency to increase inflammatory responses in tissues and the altered behavior of different leukocyte populations must be considered when addressing the immune response in older individuals during infection. Excessive inflammation, which is a response to the pathogen, may require specific management strategies.[11]

The Need for Combined Anti-inflammatory and Antiviral Treatment

Excessive inflammation during an immune response to COVID-19 in elderly patients must be carefully managed. In such cases, effective treatment for COVID-19 might require a combination of anti-inflammatory medications along with antiviral therapies. This approach could help mitigate both the viral replication and the harmful inflammatory responses in these vulnerable populations.

The immune response to viruses is initiated by recognizing molecular signatures on virus particles, known as Pathogen-Associated Molecular Patterns (PAMP), by Pattern Recognition Receptors (PRR) on innate immune cells. Disturbances in the resolution of the immune response can lead to chronic inflammation in the body. One problem that is not yet fully understood is the relationship between high baseline levels of inflammation and the

hyperinflammatory conditions experienced by COVID-19 patients, especially in the elderly group or individuals with comorbidities.[12]

Conclussion

COVID-19 is a disease that caused by the SARS-CoV-2 virus and attacks human breathing. COVID-19 has had an impact significant impact on endurance humans, especially the immune system congenital and inflammatory. SARS virus- CoV-2 triggers an immune response that unbalanced that can be worsen the condition of the body. On some patients, innate immune sites responding excessively Application of inflammation and tissue damage. Immune system innate which is conservation the body often experiences disorders in recognizing the SARS-CoV-2 virus well, so the virus is able to spread rapidly before active adaptive immune response. Besides that, patients of older age and have comorbid conditions such as diabetes, obesity and hypertension have a greater risk of severe infections due to dysregulation the immune system that makes the body they have a harder time fighting viruses

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