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Immunization with Sars-Cov-2 Nucleocapsid Protein Triggers a Pulmonary Immune Response in Rats

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Abstract

Coronavirus infection disease 2019 (COVID-19), caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), was firstly reported in China, in December 2019, and in January 2020 was defined by the World Health Organization (WHO) as a public health emergency of international importance. COVID-19 outbreak quickly reached virtually all the countries in the world, leading the WHO to change it classification, defining the disease as a pandemic. Less than 2 years after the notification of the first COVID-19 patient, the world records more than 206 million of registered cases of the disease, 4,34 million of deaths caused by this pathology and the emergence of several SARS-CoV-2 variants.

The range of clinical presentations of COVID-19 is extremely wide and may vary from an asymptomatic condition to severe respiratory and multiple organ failure, which may lead to death [1,2]. The most common clinical symptoms include; dry cough, fatigue, loss of taste and smell, fever and dyspnea, which vary in intensity and may be moderate and comparable to the manifestations of a common cold, or severe, leading to the need for hospitalization and respiratory support due to acute lung injury. In addition to the classic respiratory syndrome symptoms, other clinical and laboratory features, such as changes in the activation of blood coagulation pathways, were observed in COVID-19 patients, who may present fibrin deposition and disseminated intravascular micro thrombosis affecting nervous central system (NCS), the urinary system, among other organs. The pathophysiological mechanisms that determine the severity of COVID-19 manifestations are still unclear, and may depend on genetic susceptibility, preexisting conditions; such as diabetes, hypertension and obesity, and individual general health. Main articles and case reports published to date, show the presence of at least two distinct phases in the evolution of COVID-19 pathology: The first, directly triggered by the viral infection, and the second, more severe and generally correlated with a worse prognosis for the patient, promoted by the exacerbated immune response of the host organism, a life-threatening systemic inflammatory syndrome known as “Cytokine Storm” [3, 4].

Keywords: Endoscopic sub mucosal dissection (ESD);esophageal structure; Cell sheet technology; Oral mucosal Epithelial cell sheet

Introduction

The SARS-CoV-2 is the seventh member of the coronavirus family able to infect the human beings. In this family, the SARS-CoV (responsible for the severe respiratory syndrome outbreak in China, in 2003), MERSCoV (from the Middle East respiratory syndrome in 2012) and the new SARS-CoV-2 subtypes can cause serious illness in humans, while the subtypes HKU1, NL63, OC43 and 229E are associated with milder presentations. SARS-CoV-2 is an ssRNA-virus, externally protected by a spherical-shaped phospholipid envelope of about 125 nm of diameter, covered by glycosylated Spike proteins (SP), which promote the chemical affinity of the virus to the mammalian cells. SARS-CoV-2 binds the host cell through the interaction between its SP and the trans membrane isoform of the angiotensin-converting enzyme 2 (ACE2) of host cells, that serves as a receptor, mediating viral entry. The SARS-CoV-2 genome consists of approximately 30,000 nucleotides, which encode the structural viral proteins; SP, Envelope protein (EP), Membrane protein (MP) and Nucleocapsid protein (NP), associated with protein units of NP, which in turn regulates viral replication. SARS-CoV-2 seems to be less lethal than the SARS-CoV or the MERS-CoV, but more infectious, which could contribute to its pandemic potential [5-8].

With the rapid spread of COVID-19 throughout the world, the development of vaccines against SARS-CoV-2 became necessary and urgent. Vaccines contribute to the development of immunological memory, thus minimizing the effects of infectious diseases, in a “second” exposition to the pathogen. Pathogen attenuation or inactivation, as well as the production of recombinant bacterial/viral-derived proteins are among the most employed biotechnology strategies for the production of vaccines. Such elements stimulate both cellular and humoral adaptive immune response of the host, triggering the synthesis of specific antibodies against the pathogen, thus preparing it for future infections [9]. Immunization through the vaccines is one of the most effective strategies for the prevention of infectious disease, and have being applied very successfully over the last decades, since it protects not only the patient who receives the immunizing agent, but the whole community, as the immunized person is unlike to become a vector of transmission to other people. The greater the number of people immunized, the lower the chances of a disease develops and becomes pandemic.

Based on this assumption, research centers all over the planet, as well as pharmaceutical industries, public and private bodies have been working incessantly on the development of immunizers against SARS-CoV-2 since the beginning of 2020. Currently, a number of different vaccines against COVID-19 are already in emergency use, although the potential of immunizing action of each of these products, as well

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as the possible side effects that may be caused by them, have not yet been completely clarified. Moreover, in spite of the recent increase in the number of immunized people around the world, some countries are still suffering from the scarcity of available vaccines. Therefore, experimental and pre-clinical studies are still required to provide more details on the physiological mechanisms of immunization, and to contribute to the development of further immunizers against SARS-CoV-2.

Taking the above into consideration, the aim of the present study was to verify the effects of the application of a recombinant protein derived from the viral NP of SARS-COV-2 virus, carried out by our research group through the culture of genetically modified bacteria, in 2 different strains of rats *(Rattus norvegicus)*: Wistar and Lewis, thus verifying the safety of recombinant NP applications and the potential of this protein as an immunizing agent, by evaluating the production of specifics antibodies by sensitized animals [10].

Description

A community-based cross-sectional study was conducted. The study used a quantitative approach for collecting data from 384 youths using a survey method. Not practicing preventive measures was measured to determine whether or not youths applied hygiene practices, kept their distance, restricted their movements, and sought self-help or support in the past two months. Descriptive statistics were used to assess the distribution of study participants, and a binary regression model was executed to examine the association factors with inability to practice preventive measures with a p-value < 0.05 statistically significant.

Conclusion

The current study contributed to research into the risk factors associated with youths' failures to practice preventive measures for COVID-19. Lower practice to preventive measures was observed among younger, male, less educated youths, and lower-income level youths. To be able to practice the preventive measures of the disease, more intervention efforts using different tools should be used by either communicating to or reaching out to these groups. Although the government and stakeholders have taken significant steps to limit the spread of the disease, more efforts should be needed for equipping all segments of the population with the facts about the disease. There was no proven vaccine or treatment for the disease; hence, a high level of understanding on how to practice preventive measures must be achieved in the community to stop the spread of the virus. Lastly, youths should refrain from risky behaviors, such as involvement in substance use, social gathering for passing time, and join the crowded places. The author recommended for future studies to incorporate more variables to identify factors that can result in more adherence to the preventive measures of the disease.

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Conflict of Interest

None

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