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Editorial

COVID-19 Vaccines, a Global Marathon Between Methodical Heritages and Future Challenges

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The world leads off an exceptional 2021 year, burdened with unprecedented uncertainties and challenges. Since the first days of 2020 and the unmatched pandemic has not recovered or retreated. The burden of the health sector and the unparalleled number of deaths around the World have been the biggest challenges that sparked many protests and spread fears in various societies, especially in the absence of any operative treatment and the long wait for an effective vaccine that provides the "social" adaptive immunity and helps restoring the institutional abilities to approach the financial crises and economic collapse resulting from the contagious spread and the pecuniary damages resulting from the total lockdown that has been imposed to establish relative social distancing as a lone solution to limit the spread of the virus. As recent events have shown, especially with the appearance of mutated strains that pandemics do not respect geographical boundaries, therefore a globally focused effort is direly needed to combat the viral drift representing the current but the unique threats to humanity amid the complexities of climate change and globalisation.

As 2020 closes, regulatory FDA approval of COVID-19 vaccines has raised hopes and expectations that the world can overthrow the pandemic by the end of 2021. However, vaccines production and delivery challenges suggest that beating the COVID-19 pandemic will be a long-winded marathon whose finish line still far away from being realized [1]. The rapid approval of vaccines, just a year after the novel coronavirus was detected in Wuhan, is indisputable evidence to the gigantic global effort made to confront a pandemic that has killed no less than 1.75 million people, battered economies and upended life. Scientists identified

promising candidates after just weeks, not the years normally needed, and millions of doses are already rolling out of factories [2].

Despite the great challenges encountered during earlier vaccines developmental projects, the scientists found that SARS-CoV-2, the causing agent of the COVID-19 is anatomically related and comparable to the SARS-CoV-1 and the MERS-CoV strains, which were behind the viral epidemics in 2003 and 2012 respectively [3].

The mentioned strains displayed similar affinity level towards Type-II alveolar pneumocytes angiotensin converting enzyme-2 (ACE-2) receptor binding domains and consequently, related pathophysiology and similar virulence [3].

There is currently a global contest to develop an effective vaccine predominantly dedicated for individuals at increased risk of developing symptomatic infections, mainly, those who are vulnerable and most disposed to show fatal clinical symptoms of the COVID-19. They include patients having high morbidities rate, aged 60 and above, and those risking the contraction of a high viral load, such those working in the frontlines as healthcare providers at COVID intensive care units and hospitals emergency rooms.

Traditionally, all vaccines work by exposing the body to molecules from the target pathogen to trigger an immune response, but the method of exposure varies from one formulation to another. These vaccines consist of either killed or weakened forms of a virus or bacterium. These provoke an immune response that allows the body to fight off the actual pathogen later on. However, the world scientific and medical communities perceived an unexpected new technology-based preparation, draped under the umbrella of nucleic acids vaccines, the mRNA based formula, as the COVID-19 is a positive-sense single-stranded RNA (+ssRNA) virus [4,5].

For decades, many scientists have been exploiting the use and manipulating the mRNA vaccines. A leading advantage of these vaccines is the versatility of their production based on readily available material that could be chemically synthesized. Consequently, the protocols of their industrial manufacture could be standardized and scaled up for mass production within a short period compared to the traditional methods of vaccines production.

The basic mode of action is also revolutionary; instead of inoculating the patients with attenuated viruses or purified viral proteins bearing the antigenic determinants, the RNA vaccines are based on the delivery of the genetic information that incites the cells to encode for the corresponding viral protein based on the sequence of injected mRNA. As soon as the COVID-19 genomic material has been totally sequenced, the strands that encode for the spike proteins were designed and chemically synthesized. The manufactured RNA molecules, on which the vaccine has been based, make use of the cell's translational machinery to produce a number of viral proteins that will be expressed at the surface of the nucleated cells. These proteins will be able to excite the immune system that will be activated to mount an adaptive immune response without being exposed to a viral infection [5]. If this category of nucleic acids-based vaccine will prove its effectiveness in impeding the global spread of the viral pandemic across continents and countries, we will be witnessing many additional vaccines dedicated for many other infectious diseases (i.e. HIV, Hepatitis, Malaria…) and malignant tumors.

Being aware about the urgent, vital, and imperative need for securing safe and effective COVID vaccines, the FDA is currently operating the different authorities and recruited expertise to guarantee the prompt development and ensure the accessibility and affordability of the vaccines that would meet the rigorous and systematic standards for the quality, safety, and medical effectiveness of the formulation. As early as the global pandemic has been officially announced, the FDA authorities provided many communicates directed towards pharmaceutical industrial companies setting the scientific data and clinical outcomes required to endorse the authorization of vaccines and their distribution plans to cover the affected continents and regions with a clear strategy to cover, by order of priority, the most vulnerable people and exposed individuals. This issue requires a systematic and collective international collaboration to secure a consistent and operative vaccination campaigns [6].

The expected endeavours of the authorized vaccines will be also facing various obstacles that scientists should overcome during and shortly after the development of safe formula. The maintenance of the anti-SARS-CoV-2 IgG antibodies in the serum of vaccinated individuals for a considerable period is equally challenging for the industrials and researchers [6].

The stimulating immunological conditions known as the Antibody-Dependent Enhancement (ADE) which promote antibody assisted viral attachment and cellular entry, promoting the viral replication and exacerbating infection, are to be medically assessed in the post inoculum injection [7,8].

The Vaccine-Associated Enhanced Respiratory Disease (VAERD) should not be neglected as it could be reported in children inoculated with attenuated live vaccines (i.e. Measles vaccine) containing alum adjuvants [9].

The elderly, the patients with underlying disorders, pregnant women, immunocompromised individuals and those under chemotherapy or immunotherapy are highly vulnerable to develop serious diseases and fatal complications. Their close and rigorous follow up are highly recommended to avoid any detrimental outcomes [6,7].

Needless to mention the prominence of targeting healthcare professionals working at the frontlines and highly exposed to COVID-19 infection. A well developed, systematic, and highly organized immunization strategy should be adopted in each country addressing the specific attributes based on the availability, the supply chain, and the order of priority.

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