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COVID-19 Vaccines and therapeutics

Samara Yahya Kraidi[1] Safa Azhar Razzaq[1] Walaa Ali mahdii [2]

samarayahay@mu.edu.iq safaazhar@mu.edu.iq walaaaali732@gmail.com

[1 1] Department of Pharmacology, College of pharmacy, Al-Muthana University

Karbala university, college of pharmacy

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Abstract:

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that first appeared in Wuhan, China, gave rise to the coronavirus disease 2019 (COVID-19), a highly contagious and pathogenic viral infection. COVID-19 is not currently being treated with a specific therapy. Remdesivir is the first medication to be approved by the Food and Drug Administration (FDA) to treat COVID-19. However, numerous alternative therapy modalities are being looked for as COVID-19 therapies. As part of this review, we discussed the development of various drugs, their mechanism of action, and how they might be applied to different cases of COVID-19 patients. This review also offers an update on the development of novel COVID-19 preventive or therapeutic vaccines. We aimed to include the most recent published data from phase III trials about various COVID-19 vaccines and include clinical data made available on networks or peer-reviewed journals in addition to vaccines approved by the Food and Drug Administration (FDA) or The World Health Organization (WHO).

Keywords: COVID-19, FDA, SARS-CoV-2, Vaccines

Introduction

Coronavirus is a big intracellular parasite that mostly targets the respiratory system of humans. SARS-CoV and Middle East Respiratory Syndrome (MERS-CoV) were previously identified coronaviral (CoV)

epidemics that posed a major health risk (1) A series of pneumonias with unknown etiology was declared in Wuhan City, Hubei Province, China (2) in December 2019. On December 31, the Chinese Disease Management and Prevention Centre dispatched an emergency response team to Wuhan. As potential causes, influenza, avian influenza, adenovirus, SARS-CoV, and MERS-CoV were all ruled out. (3)

. The virus then spread outside China, causing a pandemic in a number of other nations (4), (5) The global number of documented infections was over 515,755,796 through May 5, 2022, with over 6,271,647 fatalities and over 470,499,907 recoveries (6). The search for medicinal chemicals that can be utilized to treat severe infections remains a key priority.

Many investigation groups from various nations obligate set out to develop an antiviral drug against SARS-CoV-2; researchers have looked into repurposing existing drugs due to the essential demand for effective therapies.

covid vaccine development

The creation of a new vaccination has until now been a drawn-out procedure that normally takes between 10 and 15 years (8). The mumps vaccination took about five years to develop and get licensed for use, making it the quickest. Therefore, it is obviously difficult to create a COVID-19 vaccine within a time frame of 12 to 24 months. Early in the vaccine development process, fundamental laboratory bench research and computational modeling are required to identify natural or artificial antigens that could be employed as a vaccine candidate to help prevent or treat a disease. Just the once efficacy, immunogenicity, and safety have been established in animal models, the next step is to go on to clinical trials on humans, which assess immunogenicity and safety in small and large groups over the course of three phases, as is described below

Phase 1 - Safety

This is the initial phase in which humans receive the vaccine. A minor group of well and immunocompetent persons receive the vaccine in order to test its safety, dosage, and as a side effect, and to check the immunological response.

Phase 2 - Expanded Safety

Hundreds of people receive the vaccine, distributed into various sets established on demography. those once again inspect for side effects such as immunological response, as well as safety, dosage, and interval between doses. The vaccine's safety and immunogenicity are verified during this phase, and the ideal dose for Phase 3 trials is also established

Phase 3 - Efficacy

Thousands of patients will receive the vaccine in this extensive experiment in order to gauge its effectiveness. The proportion by which the risk of illness incidence is decreased in groups who have received vaccinations as opposed to placebo is known as vaccine effectiveness (VE) (9) The sample size is impacted by disease prevalence at the time of the Phase 3 trials. To properly assess vaccination efficacy in the situation of low illness incidence in the population, a huge taster size will be mandatory.

COVID-19 vaccines technology

Numerous processes are taken during the creation of a vaccine; following preclinical research, the vaccine candidate must then go through clinical testing, obtain FDA authorization or approval, manufacture the vaccine, and then distribute it (11)

Inactivated viral vaccines

This kind of vaccine comprises the entire viral particle, with the exception of sentient genetic material, , which is destroyed chemically or thermally. The immunogenic components are so unaltered as a result. Viral vaccinations that have been inactivated are less dangerous than live immunizations but offer less protection(12). This method has been utilized successfully in the production of many well-known vaccinations, including the hepatitis A and rabies vaccines (13)

Sinopharm vaccine.

They boost antibody synthesis and prepare the body to respond to an infection with live SARS-CoV-2. The BBIBP-CorV vaccination was found to be harmless and well-accepted in age groups of 18–59 and 60, and all recipients of the vaccine displayed a significant humoral immune response.

As a consequence, the adult group's rate of seroconversion to 100% was higher than that of the elder group. At day 14, more than 75% of adult vaccination recipients had undergone seroconversion following the initial dose. On day 28, the seroconversion rates for the 4 g and 8 g dosage recipients reached 100%, while in the elder group, the seroconversion rates for the 2 g group reached 100% on day 42 (14).

Pfizer COVID-19 vaccine

BioNTech SE in Germany and Pfizer Inc. in the United States revealed the findings of the principal clinical research for Biotech's BNT162 immunization platform to avoid COVID-19 contagion on April 22, 2020.

The initial phase 1/2 trial study, which included 60 persons 18 years of age and elder, revealed that the vaccination had slightest side effects. A additional study included 43,998 adults aged 12 or older from diverse nationalities in phase 1/2/3 trials. All of these scientific judgments have demonstrated the vaccine's 95% usefulness in stopping corona-19 and producing potent levels of neutralizing antibodies

(15) Another research conducted on 2260 12- to 15-year-old adolescents verified the remarkable efficiency (100%) and safety profile of the BNT162b2 vaccination against Covid-19 (24). Results from a phase 2/3 trial published on September 20, 2021, revealed that children between the ages of 5 and 11 who received two doses of 10 ug spaced three weeks apart experienced robust neutralizing antibody responses with excellent safety profiles (16) compared to those who received 30 ug (17). The BNT162b2 vaccination was also examined against COVID-19 emerging lineages (18)

Moderna COVID-19 vaccine

On February 24, 2020, Moderna, a biotech company with headquarters in Cambridge, Massachusetts, finished producing their vaccine candidate, mRNA-1273.351, and sent doses to the National Institutes of Health for a phase 1 clinical trial that was organized and financed by NIAID (19). On December 18, 2020. (EUA). The additional injection to be permitted in the USA under an EUA to prevent COVID-19 was this one (20). Preclinical research shown that the mRNA-1273 vaccination significantly increased T cell responses and secure against a extraordinary dosage of covid-19 infection. In a Phase 2 research, 400 healthy participants aged 20 and older were enrolled to assess the immunogenicity and safety of two vaccines administered 30 days apart (21).

Therapeutic strategies

There are presently no potential therapeutic strategies available to control this endemic, despite the regulatory authorities' recent clearance of a little vaccinations against SARS-CoV-2 infections. Vaccine price and deployment, as well as vaccine circulation and manufacture in sufficient capacities, are challenges that governments and developers must address (22). Governments have employed a range of pharmaceutical interventions to manage the disease, such as COVID-19-beneficial antiviral drugs, various forms of oxygen therapy, and artificial respiration. Three guidelines can be used to quickly develop effective and efficient therapies and drugs: (i) Researching and assessing the therapeutic efficacy of already available antivirals is the first strategy (23).

Molecular repositories, archives, and libraries that support continual analysis of a huge number of potential medications and high processing capacity (24) .The goal of targeted therapy is to interfere with viral signals (molecular pathways) and the immune response (25).

Antibodies

SARS-CoV-2 antibodies bind to the SARS-CoV-2 RBD directly, break up the connections between the SARS-CoV-2 RBD and the hACE2 receptor, and effectively stop SARS-CoV-2 S protein pseudotyped virus infection (26).

Immunotherapeutic drugs

Monoclonal antibodies

Combination of tocilizumab and siltuximab. Siltuximab and tocilizumab have been proven in laboratory tests to be effective therapies in individuals with severe lung lesions (28). Passive immunization with weak and strong neutralizing antibodies offered significant protection in mice infected with a deadly MERS-CoV assault.. These antibodies, which target several epitopes and functions of S proteins, may represent a unique way for enhancing humoral defense against emerging CoVs. Regeneron is seeking to differentiate mAbs that are effective against COVID-19.

Conclusion

There are several COVID-19 treatments available to stop the disease's spread and lower its morbidity and fatality rates. The most recent information regarding the development of the COVID-19 therapy and/or vaccine is covered in the current review study. Repurposing antiviral and immunomodulatory medications is a good strategy because their safety profile is well documented..

Clinical trials must be open and publicly published in order to evaluate the possible benefit for the patients receiving COVID-19 medication. Although the covid-19 virus is spreading, only a small percentage of toxicities will occur in vaccinated individuals. The effectiveness of a vaccination is not based on the quantity of illnesses. Every vaccination only works in part, however COVID-19 has a rather high level of efficacy. Additionally, immunization shields individuals most susceptible to serious illness from emerging strains. There is also a chance that these serums will produce extended-lasting protection and protect people from the illness caused by this brand-new coronavirus. A small percentage of infections will happen in patients who have finished the advised immunization schedule as long as the covid-19 virus is still in circulation.

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