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Review Article

COVID-19 Vaccine Candidates - Current Status

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ABSTRACT

Introduction: Coronavirus belongs to the RNA group of viruses. Coronaviruses, first discovered in domestic poultry in the 1930s, is known to infect mostly the birds and mammals. A few strains can cause mild infection in the upper respiratory tract, like the common cold, but also more serious lower respiratory tract infections including pneumonia primarily in infants, older people, and the immunocompromised. This caused an impact on the current issue of the outbreak of COVID-19. COVID-19 vaccine is a theoretical vaccine against coronavirus 2019. Scientists are seriously working to produce effective vaccines that are under clinical trial. The outbreak of novel coronavirus caused by the SARS-CoV-2 has spread rapidly around the globe. Considering the potential threat of a pandemic, scientists, and physicians have been trying to develop a vaccine to eradicate the virus.

Aim: The main aim of the review is to establish the current scenario on the development of the COVID-19 vaccine.

Materials and Method: Around 50 articles from PubMed, Google Scholar, etc. were collected using keywords, analyzed, and review has been written.

Conclusion: There is an increasing urge in the production of a vaccine for COVID infection. Many countries like the US, Russia, Australia, India, and other countries have successfully completed Phase-I and Phase-II trials and entered the human trail. In India, the vaccine produced by the Serum Institute of India the "Covi shield" and the one produced Bharat Biotech Ltd., the "Covaxin" have successfully entered the human trail. The Food and Drug Administration (FDA) has said that it was up to the vaccine developers to make the application for emergency use authorization, and if the application was found to be "appropriate", it may consider granting approval.

Key Words: Coronavirus, Vaccine, Prophylaxis, Development, SARS-CoV-2, COVID-19

INTRODUCTION

Coronavirus belongs to the RNA family. COVID-19 was discovered recently in China in December, 2019 [1]. More than thousands of patients were admitted to the hospital with symptoms like fever, cough, shortness of breath and throat pain, etc [2]. The patients were scanned by computed tomography which showed various opacities in the initial diagnosis; later the pathogen was identified as "CORONAVIRUS" [3]. Coronavirus causes disease in mammals, birds, etc. The most common symptoms were common cold [4]. This common cold then became lethal to life as it was in combination with SARS, MERS, and COVID-19 [5]. The most pathogenic structure of the virus was the glycoprotein spikes which were presented in the capsule of the virus [6]. It was transmitted by contact with an infected person [7]. It caused multiple organ failure which includes pneumonia, fever, cough, and also found to affect kidney, heart, and GIT [8]. The coronavirus became more contagious as it was able to stay on any surface for a minimum of 2 hours [9]. The mortality and the morbidity rate increases, scientists are drilling down to find the mechanism of the virus, to discover a vaccine to eradicate this disease.

Vaccines are the substance used to activate the immune response of a person by evoking the production of antibodies [11]. There are different techniques for the synthesis of COVID vaccines. The mechanism of the vaccine is to evoke antibodies artificially. The traditional way of producing vaccines is by culturing the virus in a medium and injecting them into a

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trial object in inactivated form [12]. Due to the increasing threat of the pandemic, scientists and physicians have been racing to understand the pathophysiology virus, the disease to uncover the possible treatment regions, and discover effective vaccines [13]. The vaccine mainly aims at antiviral strategies involving small molecule and biological targeting complex molecular interaction involved in coronavirus infection [14]. The need to rapidly develop a vaccine against SARS-COV2 comes at a the time of explosion in basic scientific understanding including in areas such as genomics and structural biology that is supporting a new area in vaccine development [15]. The main drawback is that the synthesis of vaccines requires a minimum of one year of trial, since Phase-3 of vaccine preparation is the longest [16]. So this study analyses the challenges faced by the scientists in the preparation for a vaccine and its current status against COVID-19 [17].

COVID-19 vaccine development - Current status

Many countries are on the verge of developing potential vaccines to stop the spread of Covid-19. Scientists from London's Imperial College are working to bring a low-cost vaccine to the world early next year. They are in the process of developing a coronavirus vaccine based on self-amplifying RNA technology. The vaccine is now due to enter phase one and two human clinical trials with 300 people. There are nearly 224 candidate vaccines in development globally, according to the data collected by the Coalition for Epidemic Preparedness Innovations (CEP).

MERS vaccine development

Scientists are working on finding the sequence of SARS and MERS n-CoV for vaccine synthesis but still the sequence remains unclear [18]. In the *in silico* method, the prediction of epitopes was carried, this showed MEIC allele sequence of spike glycoprotein [19]. But then later it was found it showed various nucleation alany bioinformatics tools were used to identify the epitopes, which included IEDB analysis to find the epitope mapping [20]. Glycoprotein spike protein sequence was analyzed among which KRSFIELDLC FNKV sequence which showed a notable relation between SARS and COVID-19. The other drawback is that, for the development of vaccines, more time is needed for proper analysis of its effects and use. The development of vaccines is a complex and time-consuming process, which differs from the development of conventional processes. Normally a time required for the development of a vaccine is 12-15 years [21,22]. If a person comes into contact with a native pathogen, the immune system will already have the necessary antibody ready and will multiply them much faster because it has already been sensitized by vaccination [23].

SARS-COV-2 vaccine

The pandemic coronavirus seems to be a highly sophisticated evasion of pathogens caused by the failure of novel vaccines [24]. The spike proteins of the virus showed structural variability of the receptor domain was not clear [25]. Scientists faced a challenge in identifying the receptor-binding domain [26,27]. The whole-cell antigen method was then employed to identify the vaccine, but the viral strains of SARS-COV-2 did not show enough pathogenicity [28]. Then the N-terminal domain which has the S-protein was chosen as RBD, but it showed high variability with different epitopes that tend the virus to escape from the immune response [29,30]. The 2019-nCoV causes an outgoing outbreak of lower respiratory tract disease called Novel coronavirus pneumonia (NCP) by the government initially [31,32]. This disease name was subsequently recommended as COVID-19 by the world health organisation[33]. Meanwhile, 2019-nCoV was renamed SARS-COV-2 by the international committee on the Taxonomy of virus [34].

Techniques in vaccine preparation

A vaccine created through the binhering of synbio-looks is not only scalable to a level of billions but also like it will work without the need for refrigeration [35,36]. Design and build nanoparticles out of protein and attach viral molecules in a repository array so that when the whole thing is patched into a vaccine it can make people resistant to the new coronavirus [37]. Protein vaccine also known as the recombinant vaccine used to vaccinate against viral infections like HPV. These are simple to produce but need more time to develop [38]. Gene -based vaccine is the fastest way to make a vaccine, could be to have a person's own cells produce minute quantities of the viral protein that triggers an immune response [38].

Non-specific vaccine

There is some evidence that the tuberculosis vaccine Bacillus-Calmette-Guerin (BCG) has non-specific beneficial effects against non-related infections [39,40]. Some studies claim that there is a correlation between the mortality of COVID-19 rate and BCG vaccine [41]. The amount of variance in case and deaths explained by BCG vaccination policy ranges between 12.5% and 38% by roughly dividing the countries into 3 categories showing a high, middle, or low growth rate of cases [42,43]. BCG which can remain alive in the human skin for several months triggers not only specific memory B and T cells but also stimulates the blood cells for a prolonged period.

S-Protein based vaccine

The S protein of SARS-COV, a type-1 transmembrane glycoprotein, responsible for virus binding fusion and entry and is a major inducer of neutralizing antibodies [44]. S-protein consists of a single peptide[45]. It targets the cell membrane into close proximity, which results in virus fusion and entry [46]. Several recombinant vector-based vaccines expressing SARS-COV S protein have been assessed in preclinical studies[47,48].

CONCLUSION

Though several vaccines against COVID 19 are under experimental trials, no effective vaccine has been released so far. All the countries across the globe are in the process of developing an effective vaccine to put an end to this rapidly spreading dreadful coronavirus disease. There is an increasing urge in the production of the vaccine for COVID infection. Many countries like the US, Russia, Australia, India, and other countries have successfully completed Phase-I and Phase-II trails and entered the human trail. In India the vaccine produced by Serum Institute of India the "Covi shield" and the one produced Bharat Biotech Ltd., the "Covaxin" have successfully entered the human trail. The Food and Drug Administration (FDA) has said that it was up to the vaccine developers to make the application for emergency use authorization, and if the application was found to be "appropriate", it may consider granting approval. From the scientific perspective, new technologies have been carried out in the development of a potential vaccine with unprecedented speed and take it to human trials in just a few months.

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