



COVID VACCINES – THE LIFE SAVER OF THE RECENT ERA

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ABSTRACT

Corona Virus (CoV) disease – 2019 (COVID-19) is an infectious disease caused by the severe acute respiratory syndrome CoV-2. Muscle Pain, Sputum Production and sore throat are some common symptoms. These mild symptoms can result into pneumonia and multi organ failure. However most patients have mild symptoms and good prognosis. In order to prevent the severe fatal consequences of COVID, vaccination becomes essential. This article discusses about various vaccines being developed against COVID-19.

Key words:- COVID vaccines, SARS CoV-2, COVAXIN, COVISHIELD.

Access this article online

Home page:

<http://www.mcmed.us/journal/ajomr>

Quick Response code



Received:25.12.21

Revised:12.01.22

Accepted:14.02.22

INTRODUCTION

The advent of Severe Acute Respiratory Syndrome (SARS COV-2) pandemic has caused a public health crisis. The SARS COV-2 Syndrome and associated emergency fatal conditions caused by it makes the development of vaccines against COVID-19 vital. The need for vaccines have emerged a greater extent to combat for the social and psychological welfare of people. However vaccines are not the ultimate cure for the disease they help in reducing the complications of disease. According to Mohammed Yunus, a Noble Price Winner, Covid -19 vaccines are a GLOBAL COMMON GOOD. There are various vaccines produced all over world in different stages of trials. Here we discuss the knowledge of various COVID-19 concerning vaccines. [1,2]

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Some of the most common vaccines developed for COVID-19 disease are

Moderna Vaccine by Moderna Cambridge,

Covaxin by Bharat Biotech,

Covishield by Astrazeneca,

Johnson and Johnson Vaccine by Janssen Vaccines, Janssen Pharmaceuticals,

Tozinameran by Pfizer & BioNTech,

Sputnik – V COVID -19 Vaccine or Gam-COVID-Vac,

CoronaVac SARS COV -2 Vaccine by Sinovac Life Sciences,

Novavax COVID -19 Vaccine.

Structure of SARS CoV-2 Virus:

SARS-CoV-2 is a spherical or pleomorphic enveloped virus with a diameter in the range of 70–110 nm containing a large unsegmented single-stranded RNA. The genome size of SARS-CoV-2 is between the genome sizes of severe acute respiratory syndrome

coronavirus (SARS-CoV). The SARS-CoV-2 S protein is composed of two subunits S1 and S2. [3]

CONCEPTS FOR VACCINE DEVELOPMENT:

The S2 filament facilitates the entry of the genome into host cells by fusing the host and viral membranes. The trimeric S protein is the main surface glycoprotein, which binds to the human angiotensin-converting enzyme for viral entry and the serine host-cell protease for S protein priming. Therefore, SARS-CoV-2 S glycoprotein is the most relevant source of antigens for vaccine development. [3]

MODERNA:

On December 18, 2020, the Food and Drug Administration of America issued an Emergency Use Authorization for the Moderna COVID-19 (mRNA-1273) vaccine. It is produced by Moderna TX, Inc; Cambridge, Massachusetts. Vaccination with the Moderna COVID-19 vaccine consists of 2 doses (100 µg, 0.5 mL each) administered intramuscularly, 1 month (4 weeks) apart. [4]

The vaccine is a lipid nanoparticle, encapsulated, nucleoside-modified mRNA vaccine encoding the stabilized prefusion spike glycoprotein of SARS-CoV-2. They contain dead virus, incapable of infecting people but still able to instruct the immune system to mount a defensive reaction against an infection. Inactivated vaccines do not replicate and are therefore unlikely to revert and cause pathological effects. [4]

The Moderna COVID-19 Vaccine uses mRNA to provide a blueprint for your cells to build your body's defence against the virus. This allows the body to generate an antibody response, and to retain the information in memory immune cells, with the goal of attacking the virus if the vaccinated individual is exposed. The nucleoside-modified mRNA in the Moderna COVID-19 Vaccine is formulated in lipid nano particles, which enable delivery of the nucleoside-modified mRNA into host cells to allow expression of the SARS-CoV-2 Spike antigen.

By January 10, 2021, a reported 4,041,396 first doses of Moderna COVID-19 vaccine had been administered in the United States, and reports of 1,266 (0.03%) adverse events after receipt of Moderna COVID-19 vaccine were submitted to the Vaccine Adverse Event Reporting System (VAERS). Among these, 108 case reports were identified for further review as possible cases of severe allergic reaction, including anaphylaxis. Among these case reports, 10 cases were determined to be anaphylaxis (a rate of 2.5 anaphylaxis cases per million Moderna COVID-19 vaccine doses administered), including nine in persons with a documented history of allergies or allergic reactions, five of whom had a previous history of anaphylaxis. [5]

COVAXIN:

Covaxin (BBV152), developed by Bharat Biotech, India, in collaboration with the Indian Council of Medical Research, is an inactivated severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) vaccine. [6]

COVAXIN is an inactivated vaccine obtained from the SARS-CoV-2 strain isolated at the NIV, Pune, an Indian virology research institute. The vaccine is used along with immune stimulants, commonly known as vaccine adjuvants (Alhydroxiqum-II), to improve immune response and longer-lasting immunity.

COVAXIN mainly contains 6µg of whole-virion inactivated SARS-CoV-2 antigen (Strain: NIV-2020-770), and the other inactive components such as 250µg aluminium hydroxide gel, 15µg TLR 7 / 8 agonist (imidazoquinolinone), 2.5mg TM 2-phenoxyethanol, and phosphate buffer saline up to 0.5ml.

JOHNSON AND JOHNSON:

In February 2021, FDA issued an EUA for the Janssen (Johnson & Johnson) COVID-19 vaccine by Janssen Vaccines in Leiden, Netherlands, and its Belgian parent company Janssen Pharmaceuticals, subsidiary of American company Johnson & Johnson.

Janssen COVID-19 vaccine, administered as a single dose, is a recombinant replication-incompetent adenovirus-vector vaccine. It is a viral vector vaccine based on a human adenovirus that has been modified to contain the gene for making the spike protein of the SARS-CoV-2 virus that causes COVID-19. The body's immune system responds to this spike protein to produce antibodies. The vaccine requires only one dose and does not need to be stored frozen. [7]

It is composed of a non-replicating adenoviral vaccine (adenovirus serotype 26, Ad26) encoding a prefusion-stabilised SARS-CoV-2 S glycoprotein, which contains a mutation at the Furin cleavage site and two proline stabilising mutations. An interim analysis of the phase 3 trial showed that VE was 66% against symptomatic disease.[3]

Unlike mRNA vaccines, which must be stored at -20 degrees C, adenovirus vaccines can be refrigerated for up to three months at 36–46 degrees F. That means it can be distributed more easily in doctor's offices, pharmacies, clinics, or anywhere else. This vaccine is said to promote a robust immune response after just one dose.

COVISHIELD (Astrazeneca):

COVISHIELD was developed by Oxford University and the Sweden-based pharmaceutical company AstraZeneca. It is a monovalent vaccine composed of a single recombinant, replication-deficient chimpanzee adenovirus (ChAdOx1) vector encoding the

S glycoprotein of SARS-CoV-2. Following administration, the S glycoprotein of SARS-CoV-2 is locally expressed by stimulating neutralising antibodies and cellular immune response. The SARS-CoV-2 virus is studded with proteins that it uses to enter human cells. These so-called spike proteins make a tempting target for potential vaccines and treatments. [6]

PFIZER & BIONTECH:

Tozinameran vaccine was developed by the German biotechnology company BioNTech and for its development collaborated with American company Pfizer, for support with clinical trials. The mRNA is packaged in LNP and encodes the entire spike protein, modified after including two prolines in one of the subunits to stabilise the prefusion conformation and increase its immunogenicity. [3]

After injection, the vaccine particles bump into cells and fuse to them, releasing mRNA. The cell's molecules read its sequence and build spike proteins. The mRNA from the vaccine is eventually destroyed by the cell, leaving no permanent trace.

Some of the spike proteins form spikes that migrate to the surface of the cell and stick out their tips. The vaccinated cells also break up some of the proteins into fragments, which they present on their surface. These protruding spikes and spike protein fragments can then be recognized by the immune system

When a vaccinated cell dies, the debris will contain many spike proteins and protein fragments, which can then be taken up by a type of immune cell called an antigen-presenting cell. Other immune cells, called B cells, may bump into the coronavirus spikes on the surface of vaccinated cells, or free-floating spike protein fragments. A few of the B cells may be able to lock onto the spike proteins. If these B cells are then activated by helper T cells, they will start to proliferate and pour out antibodies that target the spike protein.

The most common side effects are mild to moderate pain, swelling and redness at the site of injection, chills, tiredness and headache. Diarrhea, nausea, vomiting, dermatitis, and deep tiredness. Some cases of Visual acuity are also noted in some cases. Cases of Herpes Zoster after vaccination have also been noted who had history of chicken pox earlier during childhood. [8, 9]

SPUTNIK-V:

Sputnik V was manufactured by the Gamaleya Research Institute of Epidemiology and Microbiology (Russia). It is an adenovirus- based vaccine composed of two adenoviral vectors (Ad26 and Ad5) carrying the gene coding for full-length S protein The Sputnik V (Gam-COVID-Vac) vaccine reduces the time taken for the actual development of immunity to SARS-CoV-2, the virus behind the COVID-19 pandemic. It is a vector

vaccine based on adenovirus DNA, in which the SARS-CoV-2 coronavirus gene is integrated. The Sputnik V uses a weakened virus to deliver small parts of a pathogen and stimulate an immune response. Sputnik V is a two-component vaccine in which adenovirus serotypes 5 and 26 are used. The first vaccination leads to humoral cellular immunity, and once a second vaccination is administered, memory cells are formed. [3] SINOVAC:

Sinovac-CoronaVac vaccine by Sinovac Life Sciences, Beijing is a 2 dose vaccine (0.5 ml) given intramuscularly. WHO recommends an interval of 2–4 weeks between the first and second dose. It is recommended that all vaccinated individuals receive two doses. If the second dose is administered less than 2 weeks after the first, the dose does not need to be repeated. If administration of the second dose is delayed beyond 4 weeks, it should be given at the earliest possible opportunity. A large phase 3 trial in Brazil showed that two doses, administered at an interval of 14 days, had an efficacy of 51% against symptomatic SARS-CoV-2 infection, 100% against severe COVID-19, and 100% against hospitalization starting 14 days after receiving the second dose. [3, 10]

CoronaVac does not need to be frozen, and both the vaccine and raw material for formulating the new doses could be transported and refrigerated at 2–8 °C (36–46 °F), temperatures at which flu vaccines are kept. Sinovac's vaccine is based on inactivated whole virus, a mature vaccine technology that's also been used to produce vaccines against influenza and polio.

NOVAVAX:

Novavac Vaccine (NVX-CoV2373) was co-developed by the American biotechnology companies Novavax Inc, Gaithersburg, Maryland, USA and the Coalition for Epidemic Preparedness Innovations foundation. The recombinant subunit vaccine was produced in the baculovirus- Sf9 insect cell expression system. It contains the full- length S glycoprotein stabilised in the prefusion conformation with a saponin-based Matrix-M™ adjuvant. [3]

Novavax saponin-based Matrix-M improves immune responses and enables vaccine dose-sparing. matrix-M adjuvant is a valuable component of vaccine development, providing multiple immune system enhancements.

NVX-CoV2373 is a subunit vaccine, which means that the vaccine particle makes the body's cells to manufacture the parts of the virus that then trigger the immune system, it is made up with proteins from the virus already attached to a carrier and these trigger the immune system directly. These proteins have been developed using Novavax's recombinant nanoparticle technology, and are encoded by the genetic sequence of the Covid-19 spike protein produced in insect cells. The

vaccine’s adjuvant then helps to enhance the immune response.

COVAXIN	SPUTNIK-V
Inactivated Virus 2 Shot Vaccine 2 nd Dose after 28 - 42 days Developed by India	Viral Vector (Modified Adeno) 2 Shot Vaccine 2 nd dose after 28 days Developed by Russia
JOHNSON & JOHNSON	PFIZER & BIOTECH
Viral Vector (Human Adeno) 1 shot vaccine Developed by US – BELGIUM	mRNA BASED 2 shot vaccine 2 nd dose after 21 days Developed by US – Germany
ASTRAZENECA – COVISHIELD	MODERNA
Viral Vector (Modern Chimpanzee adeno) 2 Shot Vaccine 2 nd dose after 84 days Developed by UK	mRNA BASED 2 shot vaccine 2 nd dose after 21 days Developed by US

What to do Before, During and After Getting The COVID-19 Vaccination:

Before The Vaccination

Learn about the different types of approved COVID-19 vaccines that are being administered across the country. If you are currently taking any medications or undergoing treatment, discuss this with your healthcare provider, to understand if it is safe for you to get vaccinated.

After consulting your doctor, register yourself for getting the vaccination slot. You can discuss with your general practitioner and follow his/her guidance as well for registration.

You should be aware of the proofs needed to be produced at the time of the vaccination. Once you have a confirmed vaccination slot, ensure to block your calendar in advance and keep your family, friends, and managers at work informed.

If you have any symptoms of COVID-19 such as fever, breathlessness, sore throat, cold, cough, body ache, headache, or loss of sense of taste or smell, a day or two before the vaccination appointment or on the day of your appointment, consult your doctor immediately and do NOT go for your vaccination.

Ensure to eat nutritious meals and stay hydrated, at least 2 to 3 days prior to your vaccination appointment. Avoid drinking alcohol and smoking.

On The Day of Vaccination

A. Before Reaching The Center

Keep all necessary documents (medical prescription or a letter from your healthcare provider), photo identification proof, and the notification or message of confirmation of your vaccination appointment, ready.

Wear loose or short sleeves shirts or tops that can be rolled up easily, so that the medical staff/healthcare workers can have easy access to your upper arm.

Wear a proper-fitting and comfortable face mask (you may choose to wear two layers of mask), carry a hand sanitizer and a bottle of water if you wish.

Ensure to drink an adequate amount of water and eat a proper meal (breakfast or lunch) before heading to the vaccination center.

B. At The Center

Strictly adhere to the protocols of the vaccination center.

Maintain a distance of at least 6 feet at all times, especially while in the waiting room and the observation room. Wear your face mask always at the vaccination center.

Avoid touching common surfaces such as railings, rods, doorknobs and handles, etc., and do not touch your face. Sanitize your hands after touching any common surfaces.

During The Vaccination

The available vaccine will be injected into the deltoid muscle (thick, triangular muscle forming the rounded contour of the human shoulder) of your upper arm.

Administration of the vaccine shot will take no longer than a few seconds.

Remember to:

Keep your mask on while receiving the coronavirus vaccine and turn your face away from the face of the vaccinator. In case you are feeling anxious or nervous, take slow deep breaths and do not look at the needle.

After Vaccination

After receiving the vaccine for COVID-19, you will be asked to wait in the observation room at the center and monitored for 20-30 minutes for any untoward allergic reaction. You can expect to have slight pain and redness at the injection site while at the center.

If you are doing fine and do not show any signs of allergic reaction to the vaccine, the health workers will ask you to leave and advise you to speak to your doctor in case of any emergency.

Before leaving the center, know approximately when you have to go back for receiving the second dose of the COVID-19 vaccine.

Expect minor side effects after receiving the vaccine. You may have swelling, pain or discomfort at the injection site, pain in your injected arm, headache, body pain, muscle or joint pain, fever (with or without chills).

Call your doctor immediately if you experience extreme discomfort after taking the coronavirus vaccine and take the necessary medications.

Eat nutritious food to improve your immunity and ensure to get good sleep and avoid alcohol, smoking, etc.

Remember there is a gap of about 4 to 8 weeks depending on the vaccine being injected between receiving the second dose of the coronavirus vaccine. Even after receiving the first jab, it is important to wear proper masks and follow all social distancing measures while stepping out.

CONCLUSION:

COVID-19 vaccination can be concluded as that the benefits outweigh the risks for rare serious adverse events after COVID-19 vaccination. Hence vaccination against COVID – 19 is mandatory and an important factor required for social and psychological well being of people.[7]

Stay Home, Stay Safe & Get Vaccinated!

Taking the vaccination is a small, yet significant step towards fighting the corona pandemic. Get yourself vaccinated and encourage others too!

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Cite this article:

Dr Tamilselvan D, Dr Balasiddharth S, Dr Sabarigirinathan C, Dinesh Venkatesan, Dr Kailash Krishnan H, Dr Subramanianathan K, Covid Vaccines – The Life Saver Of The Recent Era. *American Journal of Oral Medicine and Radiology*, 2022, 9(1), 1-7.



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