



Contents lists available at ScienceDirect

Clinical Complementary Medicine and Pharmacology

journal homepage: www.elsevier.com/locate/ccmp

Views on News

COVAX-19® Vaccine: Completely blocks virus transmission to non-immune individuals

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ARTICLE INFO

Keywords:

COVAX-19® Vaccine
SARS-CoV-2
Pandemic
Advax™
SpiikoGen® etc

ABSTRACT

Various vaccine platforms are geared against COVID-19 vaccine development to produce immunogens in cells. To design a recombinant protein-based COVID-19 vaccine, Vaxine Pty Ltd used computer models of the spike protein and its human receptor, ACE2, to identify how the virus infects human cells. Based on this, the COVAX-19® vaccine is synthesized. It does reduce not only COVID-19 disease but also blocks virus shedding and transmission. Researchers are optimistic that this vaccine candidate could be clinically available soon with sufficient vaccine efficacy with a considerable amount of reduction in vaccination-related side effects.

1. Background

Currently, the world is dealing with the SARS-CoV-2 pandemic, and the vaccine is the prominent option to fight against it. Around 119 vaccine candidates are under development, and 15 vaccines are approved for COVID-19. There is increasing demand for newer safe and efficacious candidates as the currently practiced vaccines are proved to be ineffective against the new variants of the viral strain dominated in the different parts of the world. There are a total of 20 vaccine candidates approved for emergency use while 131 vaccine candidates are under development with 383 ongoing clinical trials.

2. COVAX-19® Vaccine

Because of EUA (Emergency Use Authorization), long term safety and efficacy data of vaccines are not available, and there are potential risk of outbreak (Table 1). Apart from that, the vaccines available currently are not on par with the treatment against rapidly mutating covid virus. Additionally, the immunization provided by them is not more than a year. The vaccines cannot stop the disease transmission, leading to widespread health, social, and economic disruption (Li et al., 2020). To overcome these problems, Professor Nikolai Petrovsky of Flinders University and Research Director at Vaxine Pty Ltd of Adelaide, South Australia, developed a novel synthetic vaccine called COVAX-19®. It consists of a harmless insect cell-based recombinant spike protein of SARS-CoV-2 in combination with Vaxine's proprietary non-inflammatory Advax™, a polysaccharide adjuvant derived

from delta inulin. The immunity against SARS-CoV-2 is because of the generation of neutralizing antibodies and T cells that prevent the virus from attaching to the human angiotensin-converting enzyme 2 (ACE2) receptor in the respiratory epithelium (Fig. 1) (Vaxine Pty Ltd 2020).

Further, the use of an anti-inflammatory adjuvant, Advax™ (GMP-grade delta-inulin), is believed to cut down vaccine administration problems like high fevers, fatigue, and muscle aches which are commonly observed in the currently approved vaccine (Petrovsky, 2020). The team identified and confirmed the role of SARS-CoV-2's spike protein with the help of Etaluma Luma Scope LS620 provided by AXT Pty Ltd (Chai, 2021). For determining the targets, the team utilized oracle cloud-based supercomputing and artificial intelligence (AI) to develop COVAX-19® in only five weeks, which usually takes around 15 years.

Along with their target for COVAX-19®, they also found out around 80 possible targets against SARS-CoV-2 and made it available to the world for research (Piplani et al., 2020). For carrying out product and process development, clinical trial programs, and commercial scale-up for the Australian and Asian markets, the company signed a memorandum of understanding with highly experienced GMP manufacturing firm Medytox biopharma of South Korea (Vaxine and Medytox partner on Covid-19 vaccine development 2020). Furthermore, APC, an Irish pharmaceutical research firm that designs, develops, and distributes patented engineering platform technologies to minimize time, cost, and risk in developing medications, collaborated with Vaxine to expedite the development and marketing of COVAX-19® (Taylor, 2021).

COVAX-19® moved to Phase I clinical trial after obtaining long-lasting protection with superior safety and tolerability results from pre-

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Table 1
Commercialized vaccine candidates against COVID-19 and their pitfalls.

Vaccine Platform	Name of Vaccine Candidate	Innovator	Target Moiety	Pitfalls	References
mRNA Based Vaccine	mRNA-1273	Moderna, USA	Nucleoside-modified mRNA (modRNA) encoding a spike protein of SARS-CoV-2	Limited efficacy against beta and delta variant and requires booster dose. Anaphylactic reactions were also reported in 2.5 % of the cases. Inflammation of The Covering of The Heart or Pericardium.	(Shimabukuro et al., 2021)
	BNT162b2 (Tozinameran, Comirnaty)	Pfizer/BioNTech, USA and Germany	Nucleoside-modified mRNA (modRNA) encoding a mutated form of the full-length spike protein of SARS-CoV-2	It requires ultralow temperature storage. Limited efficacy against beta and delta variant and booster dose needed. Vaccination-related side effects were reported.	(Polack et al., 2020)
	TAK-919	Takeda, Japan	mRNA-1273.351, that could be used as a booster shot against the Beta variant	Limited efficacy against delta variant and requires booster dose. Vaccination-related side effects were reported.	(Moderna's vaccine update 2021)
Protein Subunit Vaccine	ZF2001 (RBD-Dimer)	Anhui Zhifei Longcom, China	An adjuvanted protein subunit containing CoV spike receptor-binding domain (RBD)	Limited efficacy and requires booster dose even after 2 doses.	(Yang et al., 2021)
	EpiVacCorona	The foundation for Biomedical Research and Innovation at Kobe (FBRI), Japan	Having three synthetic viral peptides (One Spike, One N protein and one bacterial peptide) that are conjugated to a large carrier protein	Limited efficacy and requires booster dose even after 2 doses.	(Dobrovidova, 2021)
Adeno viral vector based vaccine	Covishield	Serum Institute of India	ChAdOx1 vector encode for Viral Spike Protein	Many reports of serious allergic reactions to this vaccines were documented.	(Mohammad S Razai and Osama, 2021)
	Vaxzevria (AZD1222)	Oxford/AstraZeneca, UK	ChAdOx1 vector encode for Viral Spike Protein	234 reports of serious allergic reactions to AstraZeneca vaccines. 30 cases of anaphylaxis have been reported for the Oxford–AstraZeneca vaccine	(Mohammad S Razai and Osama, 2021, Shimabukuro et al., 2021)
	Ad26COVS1, JNJ-78436735	Janssen (Johnson & Johnson), USA	Ad26 vector encode for Viral Spike Protein	Rare blood-clotting disorder after the delivery and comparatively less efficacious	(Viswanath, 2021)
	Gam-COVID-Vac	Gamaleya: Sputnik V, Russia	Ad26 vector encode for Viral Spike Protein and booster dose with Ad5 vector encode for Viral Spike Protein	Requires frozen storage, comparatively less efficacious, and multiple dosing are needed.	(Logunov et al., 2021)
Inactivated Vaccine	Ad5-nCoV	CanSino, China	Ad5 vector encode for Viral Spike Protein		
	CoronaVac	Sinovac Pharma Inc., China	Inactivated whole virus i.e. SARS-CoV-2	Requires frozen storage, comparatively less efficacious and multiple dosing is required.	(Han et al., 2021)
	BBIBP-CorV	Sinopharma, Beijing, China		Requires booster dose and vaccination-related side effects reported.	(Al Kaabi et al., 2021)
	WIBP-CorV	Sinopharma, Wuhan, China		Requires booster dose and vaccination-related side effects reported.	(Al Kaabi et al., 2021)
	SARS-CoV-2 Vaccine (Vero Cells)	Minhai Biotechnology Co., Beijing, China		Requires booster dose and vaccination-related side effects reported.	(Zhang et al., 2021)
	QazVac	Research Institute for Biological Safety Problems in Kazakhstan		Requires booster dose and vaccination-related side effects reported.	(Batyrov, 2021)
	KoviVac	Chumakov Center, Russia		Requires booster dose and vaccination-related side effects reported. Less effective against the variants of SARS-CoV-2.	(Mir, 2021)
Covaxin	Bharat Biotech, India		Neurological problems reported, requires booster dose and vaccination-related side effects reported. Less effective against the variants of SARS-CoV-2.	(Thiagarajan, 2021)	

clinical studies on mice, ferret, and monkey that are conducted in collaboration with the University of Georgia, U.S (Petrovsky, 2020). The Phase I trial was also undertaken independently by the PARC clinical trial team, a University of Adelaide-based research group at the Royal Adelaide Hospital, including 40 healthy participants aged between 18 and 65 years (NCT04453852). The participants were randomized on a 3:1 ratio to receive two intramuscular doses three weeks apart of either active vaccine at a dose of 25 µg spike protein plus 15 mg Advax™ and 0.15mg CpG55.2 (30 participants) or saline placebo (10 participants) (Vaxine Pty Ltd 2020). Phase II trial is going on in Iran at Espinas Palace Hotel, Tehran, with the enrolment of 400 participants (18 and 65 years) to evaluate the immunogenicity and safety (IRCT20150303021315N23),

which is a two-armed double-blinded placebo-controlled study. The results are not yet declared in the detailed form, but the team has ensured that the vaccine is very safe and tolerable, along with no transmission of Covid-19 between the individuals. They are also suggesting that COVAX-19® will provide effective herd immunity. According to the company's recent news, COVAX-19® vaccine will enter into phases II and III clinical trials with a cooperation agreement with Iran. And if these studies are successful, the vaccine will roll out in Iran under the brand name "SpikoGen®" by the CinnaGen Company (Spikogen®, 2021). As compared to the other emergency-approved vaccine candidates against SARS-COV-2 infection, the COVAX-19® leads to lesser vaccine administration-related side effects due to the anti-inflammatory

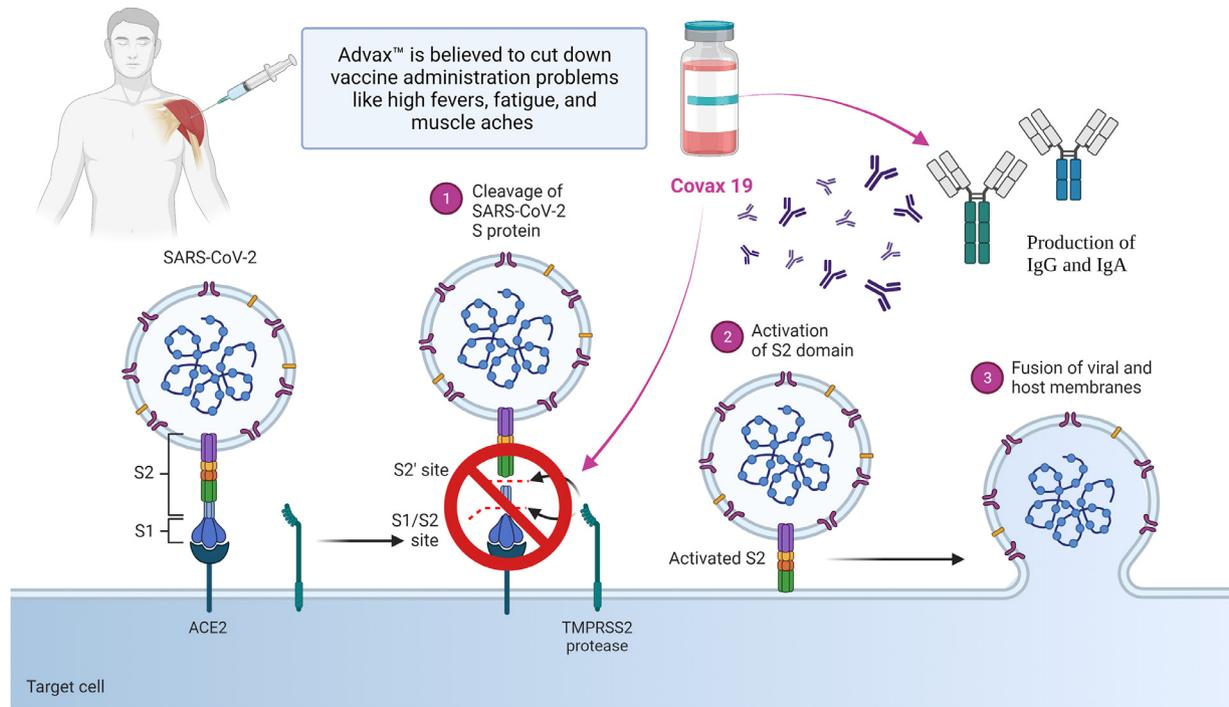


Fig. 1. COVAX-19® mode of action for SARS-CoV-2 eradication.

adjuvant present in the vaccine formulation. The anti-inflammatory adjuvant and synthetic viral spike protein elements in the vaccine formulation also indicate this vaccine candidate's better safety margin and tolerability. Further, Nikolai Petrovsky expects the vaccine to be effective on new mutant strains of South Africa (Beta Variant), Brazil (Gamma Variant), and India (Delta Variant), with immunity lasting for at least two years.

Ethical Approval

Not applicable.

Data Availability

Nil.

Funding

Nil.

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CRediT authorship contribution statement

Vivek P Chavda has prepared the backbone of the manuscript, wrote the original draft of the manuscript with Disha Vihol. Lalitkumar K Vora and Vivek P Chavda refined the draft, and all authors approved the submitted version. The figure is created with BioRender.com

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

Nil.

Supplementary material

Nil.

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