

Updates on COVID-19 Vaccine Development and India's Roles in Vaccine Preparation

Shalmali Nath

Manipal Academy of Higher Education, Kasturba Medical College, Light House Hill road, Hampankatta, Mangalore, Karnataka, India-575001

Abstract: *The pandemic has not only infected countless in many countries but also has disrupted the economic activities of the developed and developing nations. During such difficult times we all have our hopes bound to the vaccines and the pharmaceutical companies that will prepare it. This article gives a brief information of the front runners in vaccine R&D and also India's crucial role in vaccine development in this race against time.*

Keywords: vaccine, COVID-19, trial phases, pharmaceutical companies

1. Introduction

As we all know, Corona or COVID-19 (SARS-CoV-2) as we call it, started around November- December, 2019 from Wuhan, China and was declared a pandemic on 11th March, 2020 by WHO, has disrupted the economy and lifestyle of many countries.

With Corona gaining rapid spread in different countries with some countries facing a second wave of attack; many countries and their pharmaceutical companies have started preparing the COVID-19 vaccine...a huge relief in these difficult times.

Now both the developed and developing countries are vying to develop a Vaccine for COVID-19 and it is reported that many advanced countries are advance booking the vaccines being developed by the Pharmaceutical companies.

2. Who are the frontrunners in COVID-19 vaccine development?

Following are some of the front runners included in the article in developing a Vaccine:

- Oxford University and AstraZeneca
- CanSino Biological Inc. and Beijing Institute of Biotechnology.
- Moderna and National Institute of Allergy and Infectious Diseases

2.1 Oxford University and AstraZeneca

This UK based University along with the UK-Swedish drug company AstraZeneca have partnered to prepare *ChAdOx1 nCoV-19* vaccine against COVID-19, has shown promising results in the clinical trials and received WHO acclamation as being advanced than other vaccines. The vaccine is under phase 3 clinical trial and we hope it is made available to public as soon as possible.

The *ChAdOx1 nCoV-19* vaccine consists of the replication-deficient simian adenovirus vector *ChAdOx1*, containing spike protein (the crucial tool the virus uses to invade our cells) of SARS-CoV-2[1]. It is made from a genetically

engineered virus that causes the common cold in chimpanzees. This means the vaccine resembles the coronavirus and the immune system can learn how to attack it.

They did a phase 1/2, single-blind, randomised controlled trial in five trial sites in the UK of the chimpanzee adenovirus-vectored vaccine (*ChAdOx1 nCoV-19*) expressing the SARS-CoV-2 spike protein compared with a meningococcal conjugate vaccine (*MenACWY*) as control as it might risk unblinding since the group receiving the vaccine is bound to show some side effects which the saline assigned groups will not. Ten participants assigned to a non-randomised, unblinded *ChAdOx1 nCoV-19* prime-boost group received a two-dose schedule, with the booster vaccine administered 28 days after the first dose. [2]

ChAdOx1 nCoV-19 proved to be safe and boosting increased antibody responses. These results, together with the induction of both humoral and cellular immune responses, support large-scale evaluation of this candidate vaccine in an ongoing phase 3 programme.[3]

It is going to start Phase 3 trial in India in August with 50% of the Oxford vaccine and if successful will launch it under the name Covashield in India.[4]

2.2 CanSino Biological Inc. and Beijing Institute of Biotechnology

Ad5-nCoV, the COVID-19 vaccine prepared by the Chinese based company CanSino Biological Inc. collaborated with Beijing Institute of Biotechnology also showed promising results in the clinical trials done so far. The phase 2 trial adds further evidence on safety and immunogenicity in a large population than the phase 1 trial [5]. It has also become one of the forerunners in vaccine preparation.

Nonreplicating adenovirus 5 (Ad5) vector carrying the gene for the SARS-CoV-2 spike protein was injected into the arm and antibodies were produced generating immune response. The Ad5 vectored COVID-19 vaccine is tolerable and immunogenic at 28 days post-vaccination. Humoral responses against SARS-CoV-2 peaked at day 28 post-vaccination in healthy adults, and rapid specific T-cell responses were noted from day 14 post-vaccination. [6]

Volume 9 Issue 8, August 2020

www.ijsr.net

Licensed Under Creative Commons Attribution CC BY

There is potential for further investigation of the Ad5 vectored COVID-19 vaccine for the control of the COVID-19 outbreak. An ongoing phase 2 trial in China will provide more information on the safety and immunogenicity of the Ad5 vectored COVID-19 vaccine. [7]

2.3 Moderna and National Institute of Allergy and Infectious Diseases

The US based vaccine mRNA-1273 showed promising results in phase 1 clinical trials and is currently undergoing phase 2 showcasing good immune response. The vaccine proved to be safe with minor side effects and was well tolerated generating antibodies.

mRNA-1273 is a mRNA vaccine against SARS-CoV-2 encoding for a prefusion stabilized form of the Spike (S) protein, which was selected by Moderna in collaboration with investigators from the Vaccine Research Center (VRC) at the National Institute of Allergy and Infectious Diseases (NIAID), a part of NIH. [8]

In the interim reports submitted in the 'The New England Journal of Medicine' the phase 1 volunteers were divided into 3 groups (different age and doses) and received two doses of vaccine 28 days apart. Lipid nanoparticles containing mRNAs for the SARS-CoV-2 spike protein were injected into the arm and immune response was developed.

Moderna has already started its multi-site phase 3 trials in India and if successful will be first mRNA vaccine to seek marketing authority. [9]

3. India's Corona Virus Vaccine updates

Bharat Biotech, National Institute of Virology and Indian Council of Medical Research:

Indian COVID-19 vaccines are in the global race to end the coronavirus pandemic. ICMR has partnered with Bharat Biotech International Limited to develop COVAXIN, whereas Zydus Cadila is working on ZyCoV-D Vaccine.

Covaxin has completed its phase 1 trial and is trusted to show positive results. This will be India's first such indigenous COVID-19 vaccine. Part 1 of phase 1 trial of Covaxin human trials at Post-Graduate Institute (PGI) of Medical Sciences, Rohtak showed encouraging results. 50 people across India were administered the vaccine and the results were encouraging. Six people were administered vaccine under second part of phase1. [9]

The vaccine candidate was developed by BBIL in collaboration with the National Institute of Virology (NIV). NIV isolated a strain of the novel coronavirus from an asymptomatic COVID-19 patient. the firm then used it to work on developing an "inactivated" vaccine — a vaccine that uses the dead virus — Once the vaccine is injected into a human, it has no potential to infect or replicate, since it is a killed virus. It just serves to the immune system as a dead virus and mounts an antibody response towards the virus. [10]

Indian Council of Medical Research (ICMR) had written to 12 Medical Institutes in the country to start the first phase of Human Clinical Trials by registering volunteers. Maximum numbers of these Institutes had begun the subject enrolment process. After the beginning of enrolment of volunteers, the two Indian vaccine candidates will now be tested on 1,125 healthy volunteers in the two phases of trials. The vaccines are being evaluated for its safety, reactogenicity, tolerability and immunogenicity. Volunteers will be administered two intramuscular shots. The proposed age groups for the trials are 18-55 years for Phase I and 12-65 years for Phase II. [11]

4. Can India develop and produce a Vaccine for Corona?

4.1 India's Vaccines manufacturing facilities

India currently is one of the leading manufacturers and suppliers of vaccines in the world. It solely accounts for around 60% of the total vaccines supplied to the UNICEF, since the cost of manufacturing and clinical trials in India is relatively lower than in developed countries. The report says that the Indian vaccine market reached a value of around INR 59 Billion in 2016, growing at a CAGR of nearly 18% during 2009-2016. [12]

Indian vaccine industry with many state-of-the-art manufacturing facilities has earned India the recognition of having the largest global capacity for WHO prequalified vaccine manufacturing. Along with other factors, increased public awareness about vaccination and public immunization programs, coupled with government support to develop new vaccine act as key factors driving India's vaccine industry. Moreover, technological advancements and improved cold chain storage facilities have led to increased vaccine production capacity in the country. Since India has emerged as one of the significant vaccine manufacturing hubs of the world, the vaccine for COVID-19 may be developed anywhere in the world, but the production of required quantities may not be feasible without the involvement of Indian manufacturers, sources say. Currently, more than two thirds of the total volume of the vaccines manufactured is exported while the rest is utilised domestically. [13]

In the last two decades India has made significant progress in improving health indicators, particularly those related to child health. The country was certified polio-free in 2014 and eliminated maternal and neonatal tetanus in 2015. [14]

The strong growth of the market can be attributed to numerous favourable factors. One of the primary forces that is stimulating the market growth is the increasing investments in research and development (R&D) by government funding agencies like the Department of Biotechnology, the Indian Council of Medical Research, and the Ministry of Health and Family Welfare India currently represents one of the leading manufacturers and suppliers of vaccines in the world. [15]

'Indian vaccine manufacturers have several products in their R&D pipeline and as they roll out, the dominance of the multinational companies will subside in the coming years', says Dr Anand Kumar Managing Director Indian

Immunologicals Ltd & Director Pristine Biologicals (NZ) Ltd, in an interaction with BioSpectrum Asia Magazine. [16]

4.2 Which companies in India are developing Corona vaccines?

At least seven Indian pharma companies are working to develop a vaccine against coronavirus. These are:

- Bharat Biotech,
- Serum Institute,
- Zydus Cadila,
- Panacea Biotec,
- Indian Immunologicals,
- Mynvax and
- Biological E.

Bharat Biotech has received approval to conduct phase I and II clinical trial for its vaccine candidate Covaxin, that has been developed and manufactured in the company's facility in Hyderabad. "At present, we are working on the AstraZeneca Oxford vaccine which is undergoing phase III clinical trials. In addition to this, we will also start human trials in India in August 2020. Based on the current situation and most recent updates on the clinical trials, we are hoping that the AstraZeneca Oxford vaccine will be available towards the end of this year," Serum Institute of India CEO Adar Poonawalla told PTI. Pharma major Zydus Cadila has said that it is looking to complete clinical trials of its COVID-19 vaccine candidate ZyCoV-D in seven months. [17]

5. Conclusion

Surely, India can and is actively participating in making the COVID-19 vaccine for past few months. Although it is in its early phases of clinical trials we can hope it to be a success making it India's first such indigenous vaccine for COVID-19. It is difficult to say during such crucial time as to when will it be available for marketing since the vaccine is still under the initial stages when compared to the above vaccine developers and the number of cases keep on rising exponentially making it in the top 3 of the countries battling this virus. But, India's active participation and the results of initial trials have shown us that it has a potential to be the vaccine we all have been looking for. If successful, it will not only bring the number of cases down but also boost the economy and India's recognition in the world. Until we get a COVID-19 vaccine we should resort to maintaining sanitization, social distancing and wearing of masks to keep our family safe.

6. Acknowledgement

I would like to acknowledge and thank all the people who have helped me write this article.

References

- [1] -[3] Pedro M Folegatti, MSc Katie J Ewer, PhD Parvinder K Aley, PhD Brian Angus, MD Prof Stephan Becker, PhD Sandra Belij-Rammerstorfer, PhD et al "Safety and immunogenicity of the ChAdOx1 nCoV-19 vaccine against SARS-CoV-2: a preliminary report of a phase 1/2, single-blind, randomised controlled trial", *thelancet.com*, para 2, 3 and 4, July 20, 2020. Available: [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(20\)31604-4/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)31604-4/fulltext)
- [4] "India will get 50% of Oxford Coronavirus vaccine doses produced; Serum Institute of India will start Phase 3 trials of vaccine in August: Adar Poonawalla", *timeofindia.com*, Jul 22, 2020. Available: <https://timesofindia.indiatimes.com/life-style/health-fitness/health-news/india-will-get-50-of-oxford-coronavirus-vaccine-doses-produced-serum-institute-of-india-will-start-phase-3-trials-of-vaccine-in-august-adar-poonawalla/photostory/77108059.cms>
- [5] -[7] Prof Feng-Cai Zhu, MSc, Prof Yu-Hua Li, PhD, Prof Xu-Hua Guan, PhD, Prof Li-Hua Hou, PhD, Wen-Juan Wang, MSc, Prof Jing-Xin Li, PhD et al., "Safety, tolerability, and immunogenicity of a recombinant adenovirus type-5 vectored COVID-19 vaccine: a dose-escalation, open-label, non-randomised, first-in-human trial", *Jun 13, 2020*, 395(10240):pp1845-1854.
- [8] "Moderna Announces Positive Interim Phase 1 Data for its mRNA Vaccine (mRNA-1273) Against Novel Coronavirus", *investors.modernatx.com*, May 18, 2020. Available: <https://investors.modernatx.com/news-releases/news-release-details/moderna-announces-positive-interim-phase-1-data-its-mrna-vaccine>
- [9] "Covaxin trials: Results from first part of phase 1 encouraging, says PGIMS Rohtak Health" *www.timesnownews.com*, Jul 27, 2020. Available: <https://www.timesnownews.com/health/article/covaxin-first-phase-part-1-clinical-trials-of-covaxin-completed-at-pgi-rohtak/627238>
- [10] Prabha Raghavan, Edited by Explained Desk, "Explained: What is Covaxin, India's COVID-19 vaccine candidate; how long before approval?", *www.indianexpress.com* July 2, 2020. Available: <https://indianexpress.com/article/explained/explained-what-is-covaxin-indias-COVID-19-vaccine-candidate-how-long-before-approval-6483553/>
- [11] "ICMR selects 12 institutes for clinical trial of COVID-19 vaccine", *healthworld.com*, PTI, July 03, 2020. Available: <https://health.economictimes.indiatimes.com/news/pharma/icmr-selects-12-institutes-for-clinical-trial-of-COVID-19-vaccine/76760506>
- [12] [13] [15] "Indian Vaccine Market Report and Forecast 2020-2025", *www.imarcgroup.com*, Available: <https://www.imarcgroup.com/indianvaccine-market>
- [14] "Immunization", para 2, *www.unicef.org*, <https://www.unicef.org/india/what-we-do/immunization>
- [16] "Indian manufacturers account for 60% of vaccine supplies made to UNICEF", *www.biospectrumasia.com*, 22 August 2017. Available: <https://www.biospectrumasia.com/opinion/37/9356/indian-manufacturers-account-for-60-of-vaccine-supplies-made-to-unicef.html>
- [17] "Seven Indian pharma players in race to develop COVID-19 vaccine", *PTI*, Jul 19, 2020. Available: thehindu.com/news/national/seven-indian-pharma-players-race-to-develop-COVID-19-vaccine/article32130198.ece

Author Profile



Shalmali Nath is an aspiring doctor who is currently pursuing her MBBS degree at Kasturba Medical College, Mangalore. She is in her 3rd year and during the lockdown period she decided to write an informative article to help everyone understand the current status.