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Comparison of Efficacy of Various COVID-19 Vaccines Available in India

Satvik, Swarupa Chakole, K Himabindu Reddy*

Department of Community Medicine, Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences, Wardha, Maharashtra, India

ABSTRACT

At the dawn of the year 2021 India began an extensive vaccination program aiming to vaccinate one hundred percent of its population. India's medication controller has endorsed utilization of COVISHIELD and COVAXIN, several vaccines are yet to be approved but are in various phases of trial and may be available in the near future and are hence assessed in this article.

The recent surge in number of COVID-19 cases across Europe even in nations having relatively high vaccination rates demanded a review of the efficacy of the available vaccines in our country. The risk of reinfection and need for booster doses needed to be assessed.

In this review the articles on trials and efficacy of vaccines along with the protection provided against the delta variant of the virus have been assessed and the possible need of revaccinating the public in the event of another wave of infections sweeping the country and the preparedness of the country against the new variant in already vaccinated individuals has also been assessed.

After assessing the cases, vaccine efficacy has reduced but hospitalization rates and mortality ratios are significantly lower in vaccinated population and the second/booster doses have shown significant increase in antibody titres in individuals with low titres after initial dose and significant decrease in hospitalization rates and mortality ratios even with the delta variant.

Vaccinating the public is still the top priority along with other measures including maintain proper hygiene, social distancing, wearing masks to avoid another COVID wave as more mutations like omicron may further decrease the efficacy of currently deployed vaccines.

Key words: Vaccination, Delta variant, COVID-19, COVAXIN, COVISHIELD

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Corresponding author: Dr. K Himabindu Reddy
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INTRODUCTION

Almost an entire year has passed since the principal instance of COVID-19 disease was recognized in Wuhan district in China. Throughout the course of the pandemic, the endeavours were focused on forestalling and dealing back the number of cases and breaking the chain of spread [1,2]. Worldwide investigation of crowd invulnerability in the pandemic has shown the dire requirement for effective vaccines against COVID-19 [3]. Right now, the immunization improvement endeavours have begun to work out as expected as a portion of the main vaccine up and comers have shown positive outcomes in the anticipation of clinical sickness [4-8].

Albeit not compulsory, India with its assessed populace of 1380 million (starting at 2020) wants to direct the immunization to every one of its residents.

India, which has a vigorous immunization advancement program, but the recent surges in cases, especially in Europe in countries with high vaccination rates has been a cause of concern for the nation. The delta variant has been attributed to the recent rise in COVID-19 cases across Europe and hence we are trying to assess the efficacy of various vaccines available in the country through articles on Google scholar, PubMed to assess the risk of surge of cases leading to another wave of infection.

Objective: To compare the efficacy of various vaccines available in India against COVID-19. By reviewing articles from Google scholar and PubMed

Vaccines available in India

- COVISHIELD
- COVAXIN
- SPUTNIK V

Vaccine not undergoing clinical trials in country but may be available in near future

- Pfizer vaccine
- Moderna vaccine

Here we begin with clinical trial details of each vaccine and will proceed to assess their efficacy. Although most of the data currently available is of alpha and beta variants some recent foreign studies on delta variant have also been assessed.

COVISHIELD: The vaccine in the country is being made available by the serum Institute of India which has consented to arrangements with Oxford AstraZeneca. It is manufacturing the Adenovirus vector based vaccine AZD1222 developed by Oxford AstraZeneca which is recognized as COVISHIELD in the country and it has was the first vaccine to be mass administered and hence has seen over 50 million doses been administered [9]. The vaccine is being delivered after approval from the regulatory bodies of the country.

The regulatory bodies have mutually organized the Phase II/III trials, for the trials arrangements were made for a randomized controlled review in sound grownups at various centres across the country, for correlation of efficacy and safety of the locally manufactured version of the vaccine named COVISHIELD against the original ChAdOx1 vaccine developed by Oxford AstraZeneca in the anticipation of COVID-19 infection. The study was based on 1600 qualified members of ≥ 18 years of age volunteering for the study. 400 members were randomly selected essentially for studying the immunogenicity of the vaccines and were haphazardly relegated in a 3:1 proportion to get either COVISHIELD vaccine or ChAdOx1 vaccine, individually. The leftover 1200 members were haphazardly allotted to get either the COVISHIELD vaccine or Placebo, separately in a 3:1 proportion. The wellbeing, adequacy and immunogenicity, information of the Oxford AstraZeneca ChAdOx1 controlled in two dosages ≥ 18 years or more established from clinical examinations outside India demonstrated the viability to be 70.42% [10]. The immunogenicity and security information created from the preliminary clinical trials was viewed as tantamount with the information from past preliminaries directed overseas.

COVAXIN: It is country's first home-grown vaccine to be approved by the regulatory bodies for mass administration. It is a type of an inactivated viral vaccine. To improve the efficacy of the vaccine the inactivated form of the virus is joined with an adjuvant to help invulnerable reaction and longer enduring resistance. The use of adjuvants moves the T lymphocyte cell reaction towards Th1 helper cell aggregate which is viewed as more secure than Th2 reactions against the virus [11]. The regulatory bodies started Phase-III preliminaries of the vaccine with 26,000 volunteers across various centres in the country. Initial phases of the clinical preliminaries were directed on around 800 subjects and it has have shown that the immunization is protective and gives a powerful resistant reaction and insurance. The after the third round of trials it was concluded that the vaccine was 80.7% compelling in forestalling COVID-19. The vaccine contains epitopes from different proteins, so the vaccine is not completely dependent on the spike proteins and thus has more potency to neutralize variations like the UK variant referred as N501Y variant [12]. Besides, information from the trials also showed that it delivered antibodies in every one of the members and also sharpened the T lymphocytes especially CD_4 response that give a solid insusceptible reaction. The innovation utilized for COVAXIN creation permits it to target different parts of the infection, similar to the layer glycoprotein and nucleoprotein, notwithstanding the spike protein the regulatory bodies are testing of its immunization in youngsters matured 2-15 years.

Sputnik V: This vaccine has been developed outside the country but was recently approved for usage in the country by the regulatory bodies. Gam COVID Vac which is recognized by the name Sputnik V is a vaccine developed in Russia. This vaccine is based on use of two vectors in the form of human adenoviruses. The adenoviruses employed are Ad2618 and Ad5 [13]. The adenoviruses are transformed into recombinant adenoviruses types containing S protein cDNA of the SARS-CoV-2. The Ad26 put together immunization is utilized with respect to the principal day. The Ad5 vaccine is given after 3 weeks to boost the immune response.

For the phase III trials a randomized controlled study was carried out in which 14,964 adults were randomly selected and were given two doses of the vaccine and remaining 4,902 people were provided with placebo. The trial found that only 16 individuals who received the vaccine went on to develop symptomatic disease whereas 62 individuals who received the placebo developed symptomatic disease, hence, the trial concluded that the vaccine showed an efficacy of 91.6%. Furthermore, it was noted that not a single case of moderate to severe disease was noted in individuals who received the vaccine, but 20 individuals receiving the placebo developed moderate to severe disease [14,15].

A private laboratory has gotten administrative endorsement from the regulatory bodies to conduct mid to late organize human preliminaries for the vaccine in the country.

LITERATURE REVIEW

BNT162b2 by Pfizer: It is vaccine developed by Pfizer and has been studied and is in use in various countries across Europe and America but has not undergone trials in India and is currently not available for vaccination in the country although the manufacturer has applied for approval to the regulatory bodies.

This vaccine is known to provide protection merely 12 days after the administration of the initial dose as cited in review of phase III trials. The review also evaluated the efficacy of the vaccine between the first and second doses as 52%, as the number of individuals who developed the disease in the placebo group were almost double the

number of individuals contacting the disease from the group that received the vaccine. The efficacy of the vaccine evaluated one week after the administration of second dose was found to be 95% (90.3% to 97.6%), showing substantial decrease in COVID-19 cases in the people who received the vaccine. 43 448 adults worldwide participated in the phase III trials of the vaccine. Out of which 21 720 individuals were given two doses of the vaccine at an interval of 3 weeks, the remaining 21 728 individuals were given a placebo. The trial evaluated the efficacy of the vaccine seven days after administration of the second dose and results ranged between 89% to 100%. The study found 9 individuals for the group that received placebo developed severe disease compared to only 1 individual in the group receiving the vaccine [16,17].

Moderna vaccine: It is also a vaccine developed and studied outside the country and has not undergone clinical trials in the country. It is also approved and in use in various European countries and in the United States. It was approved in these countries after phase III trials of the vaccine showed the efficacy of vaccine to be 94.1%. The trial reported 196 individuals to have developed the disease out of which 185 individuals had received the placebo. Another randomised controlled study was conducted in which participants were randomly given vaccine and placebo in 1:1 proportion included 30,000 individuals in the US was organized in collaboration with the regulatory authorities of the country. It tested the mRNA 1273 vaccine, which was administered in two doses of 100 mcg each at an interval 1 month apart. The manufacturer had previously reported a vaccine efficacy of 94.5% based on data from trial based on 95 cases [18,19].

Here we note that most of these clinical trials had already taken place before the delta variant surge and hence their efficacy against the delta variant cannot be assessed using these studies.

Hence we reviewed the data currently available on efficacy against delta variant in various foreign/Indian studies and enlisted the findings in the Table 1 below.

Table 1: The reviewed the data currently available on efficacy against delta variant in various foreign/Indian studies and enlisted.

SrNo.	Vaccine	Source of data	Country	Age	Total no. of cases	No of cases according to each variant	Dose	Vaccine efficacy (%)	Reference
1	BNT162b2	real world	Canada	≥ 16	4,21,073 (Symptomatic infection)	506 (other); 3905 (alpha); 305 (beta/ gamma); 277 (delta)	1	61 (other); 66 (alpha); 60 (beta/gamma); 56 (delta)	[20]
	mRNA-1273					18 (other); 92(alpha); 9 (beta/gamma); 6 (delta)	2	93 (other); 89 (alpha); 84 (beta/gamma); 87 (delta)	
						91 (other); 695 (alpha); 58 (beta/gamma); 56 (delta)	1	54 (other); 83 (alpha); 77 (beta/gamma); 72 (delta)	
	ChAdOx1					≤ 5 (other); 12 (alpha); 0 (beta/gamma); ≤ 5 (delta)	2	89 (other); 92 (alpha)	
						25 (other); 647 (alpha); 62 (beta/gamma); 22 (delta)	1	67 (other); 64 (alpha); 48 (beta/gamma); 67 (delta)	
	BNT162b2					0 (other); ≤ 5 (alpha); 0 (beta/gamma); 0 (delta)	2	/	
				≥ 16	14,168 (Hospitalization/death)	107 (other); 1122 (alpha); 127 (beta/ gamma); 50 (delta)	1	68 (other); 80 (alpha); 77 (beta/gamma); 78 (delta)	
	mRNA-1273					≤ 5 (other); 26 (alpha); ≤ 5 (beta/gamma); ≤ 5 (delta)	2	96 (other); 95 (alpha); 95 (beta/gamma);	
						74 (other); 211 (alpha); 18	1	57 (other); 79 (alpha); 89	

						(beta/gamma); 50 (delta)		(beta/gamma); 96 (delta)	
	ChAdOx1					≤5 (other); 17 (alpha); ≤ 5 (beta/gamma); ≤ 5 (delta)	2	96 (other); 94 (alpha)	
						≤ 5 (other); 142 (alpha); ≤ 13(beta/ gamma); ≤ 5 (delta)	1	85 (alpha); 83 (beta/gamma); 88 (delta)	
						0 (other); ≤ 5(alpha); 0 (beta/gamma); ≤ 5 (delta)	2	/	
2	BNT162b2	real world	UK	≥ 16	7429	344 (alpha); 49 (delta)	1	49.2 (alpha); 33.2 (delta)	[21]
					6453	28 (alpha); 13 (delta)	2	93.4 (alpha); 87.9 (delta)	
	ChAdOx1				27,034	1137 (alpha); 230 (delta)	1	51.4 alpha); 32.9 (delta)	
					2131	46 (alpha); 14 (delta)	2	66.1 (alpha); 59.8 (delta)	
3	BNT162b2	real world	Scotland	≥ 5	2,65,220	14,324 (alpha); jhu14,214 (delta)	1	38 (alpha); 30 (delta)	[22]
					3,43,936	53,575 (alpha); 53,679 (delta)	2	92 (alpha); 79 (delta)	
	ChAdOx1				2,66,682	15,137 (alpha); 14,863 (delta)	1	37 (alpha); 18 (delta)	
					3,01,989	32,588 (alpha); 32,719 (delta)	2	73 (alpha); 60 (delta)	
4	BNT162b2	real world	Israel		/	/	/	64 (total); 93.4 (severe cases/ hospitalization)	[23]
5	BNT162b2	real world	Israel		/	/	/	39 (total); 88 (hospitalizatio n); 91.4 (severe cases)	[24]
6	BBV152	Phase III clinical trial (NCT0464148 1)	India		25,798	8471 (delta); 8471 (kappa)	2	65.2 (delta); 90.1 (kappa)	[11]

DISCUSSION

Because of the delta variant, the currently used vaccination is effective against hospitalisation and severe illness. Accelerating vaccination promotion and increasing the inclusion rate is a compelling way to restrict the spread of the current delta mutation as well as other variations. However without intervening measures even with mass vaccination might result in on-going propagation and there still remains the possibility of the virus to undergo further mutations resulting in introduction of newer variants. The delta variant has a unique resistance to departure. The vaccination invulnerable serum's balancing titter drop against the delta variant is larger than alpha but lower than beta.

The efficacies of most of the currently deployed vaccines were based mostly upon data regarding individual's susceptibility towards the D614G, alpha, beta, and gamma variations. The proliferation of the delta version calls into question their ability to provide real world protection. The vaccines had similar efficacies after single injection, according to real world data gathered from Pfizer and Oxford AstraZeneca as the protection rates against the alpha and delta versions of 51.1% and 33.55%, respectively. However, after two shots of the vaccines had been administered the protective efficacies of the Pfizer vaccine against the alpha and delta variants were 93.4% and 87.9% respectively which was substantially greater as compared to the efficacy of ChAdOx1 which was observed to be 66.1% and 59.8% after two shots [21]. These findings are mostly in line

with scottish data [22-26]. In general, BNT162b2 outperforms ChAdOx1 in terms of defending against alpha and delta variants.

However, the efficacy of the Pfizer vaccine against the delta variant observed in data obtained from Israel has found to be significantly lower due to the early completion of population vaccination. During the alpha variant caused outbreak, BNT162b2 had overall protection rates of 95.3% and 94.5% against COVID-19 and the alpha variant, respectively [27-31]. According to information provided by Israel's ministry of health, Because of the delta variant, the efficacy of vaccine manufactured by Pfizer was lowered to 39% in Israel. However, protection against infection that required hospitalisation and severe illness was 88%, and 91.4% respectively.

In moderate and severe instances, the real world data obtained from cases reported Canada reflects the protective efficacy of various vaccines employed and also factors the number of doses received. It was found that protection rates against the delta variant after two doses of BNT162b2 and single dose of ChAdOx1 against the delta variant were 87% and 67%, respectively. The protective effectiveness of mRNA 1273 vaccinations after two doses is unknown, however after one shot, efficacy of vaccine to provide protection against the virus was found to be 83% for alpha variant, 77% for beta/gamma variant, and 72% for delta variant, surpassing projections for the other two vaccines. When compared to one injection of BNT162b2/mRNA-1273, full immunisation with two doses of the BNT162b2 vaccine or the mRNA 1273 vaccine provided much better protection against most variants. The protection rates of the three vaccinations after one and two doses were greater in the hospitalized/deceased population than in those with mild symptoms. BNT162b2 vaccine or the mRNA 1273 vaccine can protect against 94-96% of severe cases and fatalities. Despite the fact that the efficacy of ChAdOx1 vaccine in preventing severe cases and mortality is around 83-8%, it is 21-35% greater than for people with mild symptoms.

In Phase III clinical research, the BBV152 vaccine which is an inactivated viral vaccine that has been developed in India has shown an overall efficacy of preventing the development of symptomatic disease of 77.8% and abs efficacy of 65.2% preventing disease caused by the delta variant, with an excellent efficacy of 93.4% for preventing severe cases of the disease, including those due to the delta variant infection.

CONCLUSION

ChAdOx1, mRNA-1273, BNT162b2 as well as the inactivated vaccines being used in India have shown protective delta form, according to reported research. It should be emphasised that after two doses, the efficacy of vaccine for protecting against various COVID-19 strains which also includes the delta variant have been found to be much higher when compared to single dose so vaccine. In order to successfully control the pandemic caused by COVID-19, the need for vaccinating the public has to be stressed upon as well as need for complete vaccination has to recognize and the possibility for booster doses in individuals who were vaccinated earlier needs to be inquired based on review of decreased efficacy of vaccines in Israel.

The percentage of protection against the delta variation after two doses of the Pfizer developed vaccine was 79-87%, while the rate of protection after completion of two doses of the Oxford AstraZeneca vaccine was around 60%, the efficacies of both the vaccines were found to lower than demonstrated against the alpha variant. Current immunisation approaches are less successful in preventing the disease caused to the delta variant, but they are still effective in providing protection against severe sickness and mortality, according to real world data from various nations.

Vaccination against COVID-19 must be accelerated worldwide to adjust to the surge in number of cases due to the delta variant. The major method to prevent the hospitalization crisis and mortality due to this variant is to increase vaccination coverage. The death toll has not increased in nations with relatively high vaccination rates as observed in most of the European countries, but the epidemic is more real in nations with poor immunisation rates, as observed in certain south Asian countries of Indonesia and Thailand.

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