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Research Article

Expected Usefulness of Fourth Dose of COVID-19 for Cases with Underlying B cell Malignancy

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Abstract

COVID-19 vaccination has been shown to be beneficial in preventing the disease. In most cases, two doses of the vaccination are required. After complete immunization, immunity may begin to diminish. A third dose booster is frequently used. Those with underlying illnesses such B cell malignancy will need further immunization. The demand for enhanced immunity among individuals with underlying disorders, on the other hand, remains a source of concern. It is proposed that a fourth immunization dose be created. In the case of the introduction of a new strain, as well as the likely loss of public immunity following routine mass vaccination, some scientists are recommending a fifth dosage vaccine. Because the efficacy of the third vaccine is unclear, any investigation into its efficacy is fascinating. A current outbreak of sickness is also being caused by the new COVID-19 strain among persons who have been properly vaccinated. The authors of this study use a clinical model to predict how persons with B cell malignancies would respond to the fourth dose of COVID-19 immunization. During this investigation, the fourth dose enhancing COVID-19 vaccine regimen was found to play a role in infection immunogenicity. If a fourth dosage is anticipated, a variety of mRNA COVID-19 vaccination alternatives should be considered.

Keywords

COVID-19, Dose, Fourth, Vaccine, B cell malignancy

Introduction

COVID-19 is still a worldwide issue for which there is no effective treatment [1]. Vaccination is the greatest option for disaster management [2]. COVID-19 vaccination is now universally regarded as an effective primary approach of COVID-19 prevention. Traditionally, two vaccine doses are required for full vaccination. After complete vaccination, immunity levels may drop, necessitating the use of self-protective behavior. When there is a novel developing variant and a probable decline in antibody following standard immunization, several experts recommend using an additional booster dose of COVID-19 vaccine [3-4].

After complete vaccination, antibody levels may diminish, necessitating the use of self-protective behavior. Determining the efficacy of the COVID-19 vaccine in specific groups of vaccine recipients with underlying disease is a big clinical problem. Immuno compromised patients and those suffering from autoimmune diseases (such as systemic lupus erythematosus and ulcerative colitis) have a poor immune response to routine immunization [1]. Immunocompromised patients are the main group of people who are very resistant to vaccines [1]. It has been suggested that a booster vaccination be given. Many people are still concerned about the third dose of COVID-19 vaccine, which is used as a booster dose. The COVID-19 vaccine has already received its third dose, and the fourth dose is on its way.

It's common to take a third dose booster. Those with underlying conditions, such as B cell malignancy, will require further vaccinations. On the other hand, the need for improved immunity among people with underlying illnesses continues to be a source of concern. It has been suggested that a fourth vaccination dose be developed. Some scientists are advocating a fifth dosage vaccine in the event of the arrival of a new strain, as well as the likely loss of public immunity following routine mass immunization. Because the third vaccine's efficacy is unknown, any inquiry into it is exciting. The novel COVID-19 strain is also causing a current outbreak of illness among those who have been appropriately vaccinated. To forecast how people will react to the medicine, the authors of this study used a clinical model. The researchers used a clinical model to predict how persons with B cell malignancy concerns will react to the fourth dose of the COVID-19 vaccine.

Materials and Methods

The researchers used a clinical model to anticipate how people with B cell malignancy will react to the fourth dosage of COVID-19 vaccination. The current research is focused on clinical mathematical modeling. ==According to an in vitro and in vivo study, the technique is a standard in silico mathematical modeling technique with no impact from environmental complicating elements. "Primary data" [5] refers to basic information on the protective efficacy rates of various vaccination types. Various vaccines have different immunogenicity mechanisms, according to a basic assumption. Vaccines made with various biotechnologies contain a variety of essential components, resulting in a variety of immune protection inductions. The most effective immunity level or protective efficacy will be obtained once routine immunization is completed. The extra fourth dose will be employed to increase the efficacy of the immune system.

Using a mathematical modeling technique, the conventional strategy for estimating the efficacy of a booster dose of a vaccination is utilized [6]. The methodology is a new way of measuring vaccine efficacy in silico, and it didn't require the use of a human subject for research on a new vaccine that hasn't been shown safe [6]. In vitro and in vivo experiments have shown that the unique technique may generate a good prediction result with minimal impact from environmental confounding factors when employing an in silico mathematical modeling technique [6].

This study employed the same modeling strategy as a previous study that looked at the influence of a COVID-19 vaccine booster dose. The protective efficacy after the third dose is likely to be regarded background protective efficacy for modeling purposes. If given as a booster dose, the increased protection from the fifth dose can increase boostering activity and raise the protective efficacy rate, but it will not exceed the baseline protective efficacy rate. However, the ultimate protection efficacy will not exceed the background protective efficacy of the boostering vaccine, which is required in present models. As a result, the efficacy of the third dose will be the same as the background protective efficacy of the second dose. Under the previously stated primary condition, the ultimate projected protective efficacy rate after the fourth dose will be calculated as "background protective effect after the third dose + extra protection from the fourth dose."

Using basic data from a developing Asian region with a problem of highly endemic uncontrollable infection, this model simulates and predicts the role of COVID-19's fifth dose. Background COVID-19 vaccination varies in this scenario, with some people receiving two doses of COVID-19 vaccine plus two booster doses of COVID-19 vaccine. In this situation, the most common COVID-19 immunization regimen is inactivated-inactivated-mRNA viral vector for the first, second, and third doses (https://www.prachachat.net/marketing/news-837033).The current modeling analysis is based on the most recent publicly available data on the efficacy of COVID-19 vaccination at the third dosage. The fundamental information is taken from an actual Southeast Asian government report (https://www.prachachat.net/marketing/news-837033). Data from a previous report on vaccine efficacy in cases of B cell malignancy is also utilized to alter the vaccine's reported efficacy [7]. According to that study, immunogenicity is 60% of normal in instances with underlying B cell malignancy [7].

Results

According to clinical modeling, different third dose regimens result in varied protection rates, which can result in different projected protection efficacy for different background third dose regimens. Considering expected protective efficacy rate after the fourth dose, the mRNA vaccine gives the highest efficacy (8 %) following by viral vector vaccine (3 %) and inactivated vaccine. The inactivated vaccine induces no additional protective efficacy (0 %).

Discussion

After receiving the COVID-19 vaccine, protection starts to wane, posing a danger of re-infection. After receiving both doses of the vaccination, COVID-19 infection is still a possibility, thus prevention is essential. Furthermore, protection in some specific groups, such as dialysis patients, is not good after two immunization doses. As a result, booster immunization doses have been proposed and are currently being used in a number of situations. Only a few studies have been undertaken on the efficacy of the additional booster vaccination dosage, and they are mostly limited to groups with immunological deficiencies. Many experts now believe that a booster vaccine dose can assist enhance immune response, but that it isn't always required [8 - 9].

The third and last dose COVID-19 immunization is widely used to boost immunity in immune compromised individuals and to battle the COVID-19 variation that is on the rise [3-4]. Due to the disease control failure in some areas, such as Indochina, a fourth dose of vaccine was formerly used. After the fourth dose, the vaccine's effectiveness is still in question. In routine present practice, the boostering is usually indicated in cases with underlying illness B cell malignancies are disorders that interrupt the normal production of B cells and lead them to become malignant. B cell malignancy patients are more prone to have a severe infection. For this group of patients, primary COVID-19 prevention through immunization, as recommended by the Centers for Disease Control and Prevention should be prioritized. B cell malignancy is one of the most common tumors in our context, and a booster dose of COVID-19 vaccination should be given to the patients with B cell malignancy.

It can reveal that for subjects with underlying B cell malignancy, the fourth COVID-19 vaccination dosage can still give extra immunoprotection. The observed result could be explained by the fact that the background third dose COVID-19 immunization is not based on the standard mRNA COVID-19 vaccination schedule in this situation, leaving an immunological gap that the additional fourth dose could fill **Table 1.**

The third dose vaccine		**Protective efficacy rate (%)**	
		Background protective effect after the third dose** (%)	Expected protective efficacy rate after the fourth dose (%)
Type	Specific boostering* activity (%)		
Inactivated	16.2	86	86
Viral vector	22.2	86	89
mRNA	14.4	86	94

Table 1: Expected immune protection after the fifth dose of COVID-19 vaccine for cases with underlying B cell malignancy.

*When a vaccine is given as a second dose, specific boostering activity refers to the ability to augment the protective efficacy rate of the first dose.

** The reported immunoprotection rate following complete four dose vaccination of the vaccine is referred to as the background protective effect after the third dosage, and the data is based on publicly accessible data in a developing country (https://www.prachachat.net/marketing/news-837033).

Based on the present research, it can imply that the fourth dose of COVID-19 vaccine is useful to promote immunogenicity among the patients with underlying B cell malignancy. The mRNA COVID-19 vaccine can induce the most additional protective efficacy if it is used as the fourth dose COVID-19 vaccine, whereas the inactivated COVID-19 has no role for using as the boostering COVID-19 vaccine due to no additional protective efficacy.

Conclusion

The fourth dose of the COVID-19 vaccine regimen was discovered to play a role in infection immunogenicity in B cell malignancy cases in this study. A range of mRNA COVID-19 immunization options should be examined if a fourth dosage is expected.

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