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Observational Study

Efficacy and safety profile of 2-dose SARS-CoV-2 vaccine in cancer patients: A observational study in China

Cai SW *et al.* SARS-CoV-2 vaccine in cancer patients

Abstract

BACKGROUND

The new coronavirus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has produced a globally pandemic of severe coronavirus disease 2019 (COVID-19), resulting in modifications to public health policies on a universal scale. The SARS-CoV-2 vaccine has evolved as the most effective and secure way for protecting healthy individuals against COVID-19. Patients with cancer were excluded from clinical trials due to their increased COVID-19 risk and current immunosuppressing therapy. Insufficient safety and effectiveness evidence exist for the SARS-CoV-2 vaccination in cancer patients.

AIM

To assess the efficacy and safety of the 2-dose SARS-CoV-2 vaccine in cancer patients.

METHODS

A multicenter observational study was performed at 10 Chinese hospitals between January 1, 2021, and December 31, 2021. Each participant in the research received two doses of the Chinese vaccination. A total of 215 healthy people were screened and 132 eligible patients with cancer were recruited. In order to verify the safety of the second dose of the vaccine, a side - effect report was compiled. Two weeks following the second vaccination dose, subjects underwent an analogous questionnaire. Utilizing a magnetic particle-based chemiluminescence immunoassay, serum levels of anti-SARS-CoV-2 immunoglobulin G (IgG) antibodies were measured to determine the treatment's effectiveness. IgG levels ≥ 10 AU/mL are considered seropositive.

RESULTS

All 347 eligible patients were finished follow-up and anti-SARS-CoV-2 IgG antibodies were detected. Local pain at the injection location was the highest common side effect mentioned by all responders, with an increased incidence in cancer patients than the

healthy people after the second dose vaccine (17.2% vs 9.1%; $P = 0.035$). No significant difference in headache, urticaria, and other adverse reactions between patients with cancer and healthy people. In the group of cancer patients, the seropositivity incidence was 83.3%, while it was 96.3% in the group of healthy people. In the group of cancer patients, the seropositivity incidence and antibody levels were significantly lesser ($P < 0.001$). This analysis showed a relatively poorer response rate in the active immunosuppressive treatment and older age cancer patients.

CONCLUSION

It was efficacy and safety to accept a two-dose Chinese vaccine in cancer patients. While it needs to focus on the efficacy of elderly cancer patients who present active immunosuppressive treatment.

Key Words: SARS-CoV-2; Vaccine; Cancer; COVID-19; Immunotherapy

Cai SW, Chen JY, Wan R, Pan DJ, Yang WL, Zhou RG. Efficacy and safety profile of 2-dose SARS-CoV-2 vaccine in cancer patients: A observational study in China. *World J Clin Cases* 2022; In press

Core Tip: Newer strains of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) made the ongoing global coronavirus disease 2019 pandemic critical. Patients with cancer form a high-risk group, as those with active cancer or those treated with immunosuppressive therapies are more likely to be infected by SARS-CoV-2. Our study indicated the efficacy and safety of two doses of the SARS-CoV-2 vaccine in cancer subjects.

INTRODUCTION

The new coronavirus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has produced a globally pandemic of severe coronavirus disease 2019 (COVID-19),

resulting in modifications to public health policies, causing many patient deaths worldwide^[1]. 47583 cases of COVID-19 were diagnosed, and 13436 patients were dead until April 2, 2022, in China. The SARS-CoV-2 vaccine was considered to be the preventive way of accomplishing sufficient herd immunity against SARS-CoV-2 disease to eventually stop the COVID-19 pandemic. More than 3.2 billion doses of the SARS-CoV-2 vaccine were administered until April 2, 2022, in China, almost 1.28015 billion Chinese accepted the SARS-CoV-2 vaccine.

Patients with cancer have been recognized as a highly vulnerable group, and it has important significance to clarify the risk and efficacy of vaccination as patients with active cancer or those treated with immunosuppressing therapies are more likely to get SARS-CoV-2 and develop severe illness if infected with COVID-19^[2,3]. Even though, higher mortality in cancer patients than in healthy people^[4]. However, it is unknown whether COVID-19 vaccinations are effective and safe for cancer patients as almost all vaccine-evaluated clinical trials excluded cancer patients^[5]. Current recommendations suggest cancer patients to obtain SARS-CoV-2 vaccinations against COVID-19, despite the absence of solid data on the effectiveness and safety of these vaccines in cancer patients^[6].

Therefore, we aimed to clarify and compare the efficacy and safety of SARS-CoV-2 vaccines between cancer patients and non-cancer individuals. It would improve clinical care and protect these vulnerable patient populations, and it also helps the government to formulate corresponding policies.

MATERIALS AND METHODS

Study design and patients

This research is a multicenter observational study performed at 10 Chinese hospitals from January 1, 2021 to December 31, 2021. We screened 215 healthy people and 132 eligible patients with cancer were recruited. All healthy people and cancer patients accept double-dose SARS-CoV-2 vaccination. China has released SARS-CoV-2 inactivated vaccines from the Beijing Institute of Biological Products, Wuhan Institute of

Biological Products, and Sinovac. Two weeks after the second vaccination dose, an identical survey was completed online or by telephone to report side effects. Using a magnetic particle-based chemiluminescence immunoassay, serum values of anti-SARS-CoV-2 immunoglobulin G (IgG) antibodies were measured to determine the treatment's efficacy. The research protocols were designed and conducted to measure the potential of the safety and efficacy in cancer patients after double-dose SARS-CoV-2 vaccines. It was registered with the registration number CWXH-IPR-2012003 (date: December 20, 2020) with protocol approval from the Clinical Research Ethics Committees of Anhui Medical University Affiliated with Wuxi Clinical College (Approval number: YXLL-2020-003).

347 subjects were enrolled in total. In furthermore, the trial was described for participants, their family members, or legal counsel. The patients' competency was then evaluated based on their appropriate alignment to time, location, and personality, as well as their comprehension of the presentation. All potential participants provided their written permission.

Assessments

Approximately two weeks after the second vaccination dose, an analogous telephone or online questionnaire was performed. Vaccine recipients were asked if they had experienced any similar signs like: Fatigue, localized soreness, or injection point edema. Additionally, they were allowed to report symptoms not listed in the survey. We also record the baseline characteristics of the study population including treatment delivery, data collection, or outcome assessment. Additionally, Five milliliters of peripheral venous blood were collected from subjects and centrifuged at 2500 rpm for 10 min, then stored at -80 °C. SARS-CoV-2 specific IgG antibodies were evaluated by the magnetic particle chemiluminescence method. iFlash 3000 (YHLO, China) and IgG antibody detection Kit (YHLO, China) was used to quantify IgG antibody levels following the manufacturer's instructions. An IgG level ≥ 10 AU/mL is accepted as seropositive.

Statistical analysis

The differences in continuous variables between the two groups were tested by a student's *t*-test or Mann-Whitney *U* test, expressed as mean \pm SD. Categorical variables are represented as *n* (%), and were compared by the chi-squared test or Fisher's exact test and continuous data by the Wilcoxon rank-sum test. In calculating the mean difference or risk ratios with 95% confidence intervals, *P*-values of 0.05 were judged as statistical significance. Statistical analyses were performed by SPSS Statistics (v. 20, IBM, Chicago, IL). No interim analysis was included in the assessments. Data overseeing was performed by the 904th Hospital of PLA.

RESULTS

Baseline patient characteristics: Overall population

347 patients were subjected to assessment between January 1, 2021, and December 31, 2021. Among them, 215 healthy people were screened and 132 eligible patients with cancer were recruited. All 347 eligible subjects finished follow-up and anti-SARS-CoV-2 IgG antibodies were detected. Table 1 depicts the demographics and features of study subjects.

Adverse effects and safety evaluation

Two doses of the SARS-CoV-2 vaccine were administered to cancer patients to evaluate their safety. All adverse effects were recorded for the second dose. According to the cancer patient group, total side effects occurred in 28.8% of those who received the second dose of the vaccination, and 34.4% in healthy adults. The incidence of side effects reported after the second dose had no significant difference between the two groups (*P* = 0.215). The highest frequent adverse events were tired (15.9%), headache (12.9%), and local pain (9.1%) in the cancer patients, while the first three common adverse were local pain (17.2%), headache (12.1%), and fever (10.7%) in the healthy people. The rate of local pain was higher significantly in the healthy people than the cancer patients (*P* = 0.035, Table 2), and the incidence of tiredness was increased

significantly in the cancer patients than the healthy people ($P = 0.045$, Table 2). Another adverse incidence⁴ showed no significant difference between the two groups ($P > 0.05$, Table 2).

Efficacy evaluation

The identification of SARS-CoV-2 specific IgG antibodies two weeks after the administration of the second dosage was used to determine whether or not two doses of the SARS-CoV-2 vaccination were effective in preventing infection with the virus. Cancer patients had a seropositivity rate of 83.3% and a median antibody level of 25.8 AU/mL. Seropositivity rates were 96.3% and median antibody levels were 31.6 AU/mL in healthy individuals. Cancer patients had a significantly lower seropositivity rate and antibody levels than the non-cancer subjects when compared with the non-cancer group ($P < 0.001$, Table 3). We also found no significant variation in the antibody values between the different vaccines in cancer patients and healthy people ($P > 0.05$, Table 3). Additionally, the immune response may be reduced as the particularity of chemotherapy and immunotherapy. As a result of active chemotherapy, 66.7% of patients were seropositive, immunotherapy: 74.1%, targeted therapies: 83.3%, and 94.1% in non-therapies. The efficacy of chemotherapy, immunotherapy, and targeted therapies decreased significantly for non-therapies (Table 3, $P > 0.05$).

DISCUSSION

In this multicenter study, Cancer patients were studied to determine the short-term side events and effectiveness of the SARS-CoV-2 vaccine; current cancer treatments may have an effect on these outcomes. After receiving the second dose, there was not a statistically significant variation in the incidence of adverse responses between the groups, according to the present findings, as compared to healthy people, the cancer patients had a lower rate of local pain and a higher rate of tiredness than the healthy individuals. Another adverse incidence was compared between the two groups, however there were no significant variations found between them. We also found an

83.3% seropositivity rate in the cancer patient and a 96.3% seropositivity rate in healthy people. Antibody levels and seropositivity rates were significantly lower among cancer patients than among non-cancer healthy subjects. Hence, our study indicated it was efficacy and safety after two dosages of SARS-CoV-2 vaccine administration in cancer subjects.

Because of the large number of people vaccinated SARS-CoV-2 vaccine, more and more studies focus on the rate of vaccine-related adverse effects^[7,8]. A latest systematic review that comprised eleven medical testing found that practically all adverse responses after COVID-19 vaccine administration were mild to moderate, and that few severe reactions were not connected to the test vaccination^[7]. While was no clear efficacy and safety evaluation for cancer patients after SARS-CoV-2 vaccine administration in China, a high vaccine hesitancy was exhibited in the cancer patients. A European and Hong Kong survey also indicated that most cancer patients were unwilling to be vaccinated or hesitated^[9,10]. The present study demonstrated that, patients suffering from cancer were not at risk when given the SARS-CoV-2 vaccine, and show no increase in the rate of vaccine-related adverse effects. The results were similar to the previous studies in different countries and different SARS-CoV-2 vaccine administrations^[1]. Shulman *et al*^[2] also reported that patients with cancer were compared with those without cancer, few differences in reported adverse events were noted, and active cancer treatment had little impact on adverse event profiles.

The most common symptom reported by healthy people was local pain at the injection site, which decreased significantly among cancer patients. It could be that cancer patients have a higher tolerance for pain after long-term treatment by intravenous injection. Additionally, tiredness is the most common complaint of cancer patients, it was higher significantly than the healthy people. Maybe, patients with cancer suffer from fatigue due to advanced age and weakened bodies than those in the general population. Hence, cancer patients need more rest after SARS-CoV-2 vaccine injection.

For efficacy evaluation, the seropositivity rate was as low as 83.3% in cancer patients, it was significantly decreased than healthy people in this study. Further antibody detection, patients with cancer have lower IgG antibody levels than individuals without cancer. Ariamanesh *et al*^[11] reported that the seropositivity rate also decreased in patients with malignancies. Similar results also were demonstrated in a turkey study^[1]. In the recent study, Goshen-Lago *et al*^[12] reported that ³ the SARS-CoV-2 BNT162b2 vaccine appeared to be safe and achieve satisfactory serologic status in patients with cancer.

Meanwhile, immune reactions to the SARS-CoV-2 vaccination can vary depending on the stage of cancer therapy the patient is currently receiving. In the present study, the lowest seropositivity rate was 66.7% after active chemotherapy treatment. Cancer patients who are receiving vigorous chemotherapy and immunotherapy may have a reduced cellular immune reaction, which could be the cause of this immunity suppression. Hence, whether the need to change the additional doses or strengthen vaccine injection. It also needs to be explored in future studies and health officers' focus.

In addition, there were a few shortcomings with this research and compare with previous studies. To start, the sample size was low, therefore further research with higher sample sizes is required to investigate the efficacy and safety of the SARS-CoV-2 vaccine in cancer patients. Secondly, we evaluated the efficacy of participants just by detecting the IgG antibody levels, IgM antibody levels may be assessed in the future study. Thirdly, the current investigation only covers the short-term side effects and efficacy of the SARS-CoV-2 vaccine in patients with cancer. To evaluate the effect of vaccines and antibody levels on the prevention of disease, a long-term investigation is required.

CONCLUSION

According to the presented findings, the 2-dose SARS-CoV-2 vaccine in cancer patients was efficacy and safety. The most prevalent side effects seen by cancer patients were fatigue, headaches, and localized pain. Cancer patients' seropositivity rates and IgG

antibody levels were lower than those of healthy individuals. Active chemotherapy and immunotherapy maybe affect the effectiveness of the vaccine. Also, following up for a longer period was unclear in terms of its effects. Therefore, further and larger populations of cancer patients undergoing the 2-dose SARS-CoV2 vaccine should be investigated.

ARTICLE HIGHLIGHTS

Research background

The ¹ severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) vaccine has evolved as the most effective and secure way for protecting healthy individuals against coronavirus disease 2019 (COVID-19). Patients with cancer have been recognized as a highly vulnerable group, and it has important significance to clarify the risk and efficacy of vaccination. we aimed to clarify and compare the efficacy and safety of SARS-CoV-2 vaccines between cancer patients and non-cancer individuals.

Research motivation

The new coronavirus ¹ SARS-CoV-2 has produced a globally pandemic of severe COVID-19, SARS-CoV-2 vaccine was considered to be the preventive way of accomplishing sufficient herd immunity against SARS-CoV-2 disease to eventually stop the COVID-19 pandemic. Current recommendations suggest cancer patients to obtain SARS-CoV-2 vaccinations against COVID-19, while insufficient safety and effectiveness evidence exist for the SARS-CoV-2 vaccination in cancer patients.

Research objectives

⁵ The present observational study was conducted to assess the efficacy and safety of the 2-dose SARS-COV2 vaccine in cancer patients.

Research methods

A multi-center observational study enrolled 132 eligible patients with cancer were recruited. Two weeks following the second vaccination dose, subjects underwent an analogous questionnaire. Utilizing a magnetic particle-based chemiluminescence immunoassay, serum levels of anti-SARS-CoV-2 immunoglobulin G (IgG) antibodies were measured to determine the treatment's effectiveness. IgG levels ≥ 10 AU/mL are considered seropositive.

Research results

Local pain at the injection location was the highest common side effect, higher in cancer patients than the healthy people (17.2% *vs* 9.1%; $P = 0.035$). No significant difference in headache, urticaria, and other adverse reactions between patients with cancer and healthy people. The seropositivity incidence and antibody levels were significantly lesser ($P < 0.001$). This analysis showed a relatively poorer response rate in the active immunosuppressive treatment and older age cancer patients.

Research conclusions

It was efficacy and safety to accept a two-dose Chinese vaccine in cancer patients. While it needs to focus on the efficacy of elderly cancer patients who present active immunosuppressive treatment.

Research perspectives

Further and larger populations of cancer patients undergoing the 2-dose SARS-CoV-2 vaccine should be investigated. Longer follow-up was needed to clarify the efficacy and safety profile of 2-dose SARS-CoV-2 vaccine in cancer patients.

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