Mixing of Sputnik V and AstraZeneca COVID-19 Vaccines

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Abstract

Background and aim: The coronavirus disease 2019 (COVID-19) vaccine helps to develop immunity to SARS-CoV-2, the virus that causes COVID-19, in most cases preventing the disease. Although various brands of vaccines work in different modes, all COVID-19 vaccines prompt an immune reaction to make the body remembers how to protect from the virus in the future. The present study aims to evaluate the safety and the immune response for mixing of Sputnik V and AstraZeneca COVID-19 vaccines on mice.

Materials and methods: Our experimental study was performed on mice weighing on average of 20 g, selected by random allocation. The mice were divided into four groups of 12. Group one received a single dose of 0.5 ml Sputnik V COVID-19 vaccine, group two received two doses of 0.5 ml AstraZeneca COVID-19 vaccine, group three received two doses of 0.5 ml Sputnik V together with 0.5 ml AstraZeneca COVID-19 vaccine and group four received two doses of 0.5 ml of 0.9 % NaCl.

Results: Our study shows that mixing of Sputnik V and AstraZeneca COVID-19 vaccines is safe and induces good immunity for mice.

Conclusion: Mixing of Sputnik V and AstraZeneca COVID-19 vaccines creates no problems and provides good immunity to mice and may be an interesting technique to help to overcome shortcomings of one or the other vaccine. Further toxicity studies are required to assess potential hazards for humans to evaluate the histopathological characteristics.

Keywords: Sputnik V COVID-19 vaccine; AstraZeneca COVID-19 vaccine; Mice; Coronavirus disease (COVID-19)

Introduction

Coronavirus Disease 2019 (COVID-19) pandemic causes the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). The plague has affected almost every side of human life and will persist to do so until most of the population is vaccinated. SARS-CoV-2 infection starts with the attachment of the trimeric “spike” glycoprotein to the virion surface binding to angiotensin-converting enzyme 2, allowing viral entrance and starting of viral replication [1,2]. Several vaccine platforms were developed to generate a rapid emergency response. The main types of COVID-19 vaccines currently available are: messenger RNA (mRNA) vaccine (Pfizer-BioNTech) [3], vector vaccine (AstraZeneca and the University of Oxford, Sputnik V) [4], Protein subunit vaccine (Novavax) and inactivated virus (Sinovac Biotech) [5]. Most authorized vaccines need two doses administered at three or even months separation time. Several European countries and Canada are now recommending a different vaccine as the second dose for some patients and they found such approach could be beneficial. In addition, in three current studies, researchers have found that following one dose of the vaccine made by AstraZeneca with a dose of the Pfizer-BioNTech vaccine produces strong immune responses, as measured by blood tests [6]. Two of the studies even recommend mixed vaccine application which was at least as protective as two doses of the Pfizer-BioNTech product [6]. Due to short supplies of Sputnik V COVID-19 vaccine component II to Libya the study was required to investigate the possibility of having a different vaccine for the second dose.

Materials and Methods

Experimental animals

Swiss Albino male mice (18 g ± 3 g) were used for experiments. In order to reduce the contact caused by environmental alterations and handling during behavioral studies, mice were acclimatized to the Laboratory Animal Holding Center and laboratory surroundings for three days and at least one hour before the experiments, respectively.
Mice were kept under standard conditions with food (low protein diet) and water available ad libitum. The animals were housed six per cage in a light-controlled room (12 h light/dark cycle, light on:07:00 h) at 27°C and 65% relative humidity. All experiments were carried out between 11:30 h and 14:00 h. Each test group consisted of 12 mice, and each mouse was used only once. All animal experiments were conducted according to guidelines set by the Institutional Animal Ethics Committee of University of Tripoli.

**Clinical and necropsy observations**

This study represents one arm of the safety evaluation program for the two vaccines and was designed to assess local tolerance to acute toxicity. The aim was to evaluate these parameters following the administration of the proposed human vaccine dose. The mice were divided into four groups of 12. Group one received single dose of 0.5 ml Sputnik V COVID-19 vaccine, Group two received two doses of 0.5 ml AstraZeneca COVID-19 vaccine and the second dose was given after 21 days, group three received three doses of 0.5 ml (human dose) Sputnik V and 0.5 ml (human dose) AstraZeneca COVID-19 vaccines after 21 days and group four (control) received two doses of 0.5 ml of 0.9% NaCl. Mice were examined every day for 40 days. Any signs of ill health were recorded daily. Blood samples for IgM and IgG were taken from animals in day 14 and day 35 after first dosing. At necropsy a full macroscopic examination was performed on each animal. Organs macroscopically examined were spleen, lungs, liver, kidney, heart, brain, testes, and ovaries.

**Statistical analysis**

The difference among various treated groups and the control group were analyzed using one-way ANOVA followed using unpaired Student’s t test. The results were expressed as the mean ± SEM of the number of experiments done, with p<0.05 indicating a significant difference between groups. All p values reported are for a one-tailed test. The significance level was chosen at α = 0.05.

**Results and Discussion**

None of the mice used in the study showed any sign of abnormality or ill health throughout the 42 days post-immunization observation for the four groups. At the necropsies no macroscopic treatment related changes were observed. Antibody binding the SARS-CoV-2 spike protein were induced by vaccination, and, as expected, the temporal induction of anti-spike IgM was faster than that of IgG.

The potential vaccine combinations of Sputnik V and AstraZeneca COVID-19 vaccines have been tested on mice. This primary result of mixing vaccines proves safety and effectiveness and could speed the effort to protect people. This is consistent with the suggestions by Cristóbal Belda-Iniesta, a clinical research specialist at the Carlos III Health Institute. Governments could immediately distribute new vaccines after 21 days and group four (control) received two doses of 0.5 ml AstraZeneca COVID-19 vaccine and the second dose was given after 21 days, group three received two doses of 0.5 ml Sputnik V COVID-19 vaccine and 0.5 ml (human dose) AstraZeneca COVID-19 vaccine after 21 days and group four (control) received two doses of 0.5 ml of 0.9% NaCl. Mice were examined every day for 40 days. Any signs of ill health were recorded daily. Blood samples for IgM and IgG were taken from animals in day 14 and day 35 after first dosing. At necropsy a full macroscopic examination was performed on each animal. Organs macroscopically examined were spleen, lungs, liver, kidney, heart, brain, testes, and ovaries.

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