

VAC_08 - Evaluation of the immune response and protection induced by a DNA-based vaccine against SARS-CoV-2

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Introduction: The disease called COVID-19 emerged in China in December 2019 and was recognized by the World Health Organization (WHO) as a pandemic in March 2020. Given the high number of cases and deaths worldwide, the emergence of new variants may require specific vaccines for each country/region. Therefore, countries with technology parks could become self-sufficient to produce its own vaccines.

Objective: The present study aimed to develop a Brazilian DNA-based vaccine for COVID-19 using recombinant plasmids carrying the gene sequence of the Spike protein from SARS-CoV-2.

Methodology: Spike gene sequence was cloned into the pCTV (expression plasmid), transformed into DH5 α bacteria and purified using Plasmid Giga Kit (Qiagen). Mice were immunized with two intramuscular doses (21 days apart) containing 100 μ g of DNA. The specific humoral response was evaluated by total IgG, IgG subclasses (IgG1 and IgG2c) and neutralizing antibody titers in plasma samples. Splenocytes were stimulated with Wuhan strain recombinant protein (RBD domain) for detection of IFN- γ . For protection evaluation, hACE-transgenic mice were immunized and challenged with SARS-CoV-2.

Results: High levels of total IgG and IgG2c were detected in immunized animals using different plasma dilutions (1:25 until 1:25,000; ($p \leq 0.0001$)). Regarding cellular immune response, animals immunized with pCTV Spike showed high IFN- γ secretion in response to specific stimulation with RBD ($p < 0.05$) compared to control groups. Immunized animals showed high percentage of neutralization (nAb). All immunized animals survived after challenge with SARS-CoV-2 and no viral load was detected in the lung tissue after 5 days of the challenge (measured by PFU) ($p < 0.001$). The histopathological analyses reveal the presence of edema, vascular congestion, hemorrhage and intense inflammatory infiltrate in the lungs of non-immunized animals.

Conclusion: These findings suggest that the pCTV Spike could be an interesting vaccine against SARS-CoV-2, since it induces a strong immune response and protect all challenged animals. The next step is to evaluate the protection rate induced by DNA containing the Spike gene sequence in immunized hACE-transgenic mice and challenged with SARS-CoV-2 variants.

Keywords: Covid-19; SARS-CoV-2; Vaccine