A SARS-CoV-2 Spike Ferritin Nanoparticle Vaccine Protects against Heterologous Challenge with SARS-CoV-2 Variants of Concern in Syrian Golden Hamsters

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Abstract

Summary

SARS-CoV-2 vaccines have been safe and effective in reducing Covid-19 mortality and morbidity. However, emergence of SARS-CoV-2 variants of concern (VOC) and their escape from vaccine-elicited immunity underscores the need for next-generation vaccines that confer broader protection. Additionally, current vaccines have had minimal impact on virus transmission, which is of particular relevance to densely quartered military populations. Here, we demonstrate efficacy of a novel SARS-CoV-2 Spike ferritin nanoparticle (SpFN) vaccine against SARS-CoV-2 VOC in a Syrian golden hamster (SGH) model.

Methods-Results

SpFN was administered as a single or two-dose (0 and 4 week) regimen, at a high (10 μg) or low (0.2 μg) immunogen dose. A two-dose PBS control arm was also included. Animals were challenged intranasally, 11 weeks after initial immunization, with either Alpha (n = 5) or Beta (n = 6). Strong binding and neutralizing antibody (Nab) responses against Alpha and Beta developed two weeks after the final immunization. Neutralization activity was also detected after the second dose against SARS-CoV-1 pseudovirus. Following challenge, weight loss was reduced by ~10% in vaccinated animals compared to controls. Lung viral load was undetectable in vaccinated SGH following two doses, compared to >1 x 10^6 TCID50/g in controls, and pathology indicated limited viral replication and disease in the two-dose (10 μg) vaccinated SGH after Alpha and Beta challenge compared to controls. Subsequent studies have been designed to evaluate a bivalent formulation of the vaccine (SARS-CoV-2 (Wuhan-1) and SARS-CoV-1 (Urbani) SpFN). In this study, animals were challenged with either SARS-CoV-2 Omicron or SARS-CoV-1 Urbani, with immunogenicity, virologic and pathologic protective efficacy as primary endpoints. Results from the bivalent vaccination experiment are under analysis.

Conclusion

The reduction in viral burden and lung pathology in vaccinated animals is likely predicated on potent binding and NAb responses; measures shown to be reliable correlates of protection for some SARS-CoV-2 vaccine platforms. These data demonstrate SpFN-ALFQ is potently immunogenic and efficacious in protecting against SARS-CoV-2 VOCs in a pathogenic hamster model, supporting further development as a next-generation Covid-19 vaccine.