Vaccine with virus-like nanoparticles effective treatment for RSV, study finds

3 August 2015

A vaccine containing virus-like nanoparticles, or microscopic, genetically engineered particles, is an effective treatment for respiratory syncytial virus (RSV), according to researchers at Georgia State University.

The findings, published on July 14 in the *International Journal of Nanomedicine*, suggest this vaccine induces long-term protection against RSV and could serve as a novel treatment option for this disease. There is currently no licensed RSV vaccine.

"Recombinant engineered nanoparticle vaccines might be developed to prevent highly contagious respiratory pathogens such as RSV, as reported in this study," said Dr. Sang-Moo Kang, a professor in the Institute for Biomedical Sciences at Georgia State.

Respiratory syncytial virus (RSV) is a respiratory virus that infects the lungs and breathing passages. RSV can cause serious problems in infants and older adults and is the leading cause of bronchiolitis, inflammation of the small airways in the lungs, and pneumonia in children younger than 1 year old in the United States. RSV is recognized as a significant cause of respiratory illness in older adults, according to the Centers for Disease Control and Prevention.

In the study, mice were vaccinated with either 1) FG VLPs or virus-like nanoparticles expressing RSV fusion (F) and attachment glycoproteins (G) or 2) FI-RSV or formalin-inactivated RSV, which failed clinical vaccine trials in the 1960s because it caused severe vaccine-enhanced respiratory disease. The mice were infected with live RSV pathogen one year later after vaccination.

Mice vaccinated with FG VLPs showed no obvious sign of severe pulmonary disease in tissue examinations upon RSV infection and significantly lower levels of eosinophils, T-cell infiltration and inflammatory cytokines, but higher levels of antibodies and interferon-? antiviral cytokine, which are correlated with protection against RSV disease.

Some mice were treated with clodronate liposomes, which induce cell death and deplete tissue macrophages, so the researchers could understand the role of alveolar macrophages (AMs) in inducing long-term protection. AMs, the first defense line of innate immune cells in the respiratory tract, can eliminate foreign antigens and regulate inflammatory responses, but their role in RSV protection and disease has been unknown.

Recombinant RSV FG VLP vaccine immune mice treated with clodronate liposomes showed increases in inflammatory cytokines, chemokines and eosinophils. In contrast, FI-RSV immune mice with clodronate liposome treatment demonstrated increases in eosinophils, plasmacytoid dendritic cells, interleukin-4 T-cell infiltration, proinflammatory cytokines, chemokines and mucus production upon RSV infection. FI-RSV immune mice showed severe pulmonary disease in tissue examinations.

The study suggests that recombinant RSV FG virus-like nanoparticle vaccination induces long-term protection against RSV without causing vaccine-enhanced RSV disease by appropriately controlling granulocytes, cytokines and T-cells.

It also proposes that alveolar macrophages play an important role in RSV protection and innate and adaptive immunity by controlling eosinophils, mucus production, inflammatory cytokines and T-cell infiltration.

More information: *International Journal of Nanomedicine*, Published Date July 2015 Volume 2015:10 Pages 4491—4505 DOI: 10.2147/IJN.S83493

Provided by Georgia State University

APA citation: Vaccine with virus-like nanoparticles effective treatment for RSV, study finds (2015, August 3) retrieved 11 October 2022 from https://medicalxpress.com/news/2015-08-vaccine-virus-like-nanoparticles-effective-treatment.html

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