In Preventing Upper Airway Infections Mucosal COVID-19 Boosters Outperform mRNA Shots

A team of researchers from the United States used non-human primate models to compare the protection conferred by an intramuscular booster dose of the bivalent messenger ribonucleic acid (mRNA) coronavirus disease 2019 (COVID-19) vaccine with that provided by a booster dose of a mucosal bivalent adenoviral vector vaccine delivered through an aerosol device or intranasal route.

Study

In the present study, the researchers used Macaca mulatta or rhesus macaques to investigate the protective immune responses elicited by a mucosal bivalent adenoviral vector vaccine containing stabilized spike protein from the ancestral Wuhan strain and the Omicron BA.5 variant of SARS-CoV-2.

They compared these immune responses against those elicited by an intramuscular booster dose of a bivalent mRNA vaccine encoding the spike proteins of the same two variants.

Although the inflammation and pathology due to severe disease in humans are not completely recapitulated in non-human primate models, studies have shown that the virus readouts and immune responses observed in non-human primate models can be used to predict the clinical outcomes for Omicron infections in humans.

The adenoviral vector vaccine used in the study was the ChAd-SARS-CoV-2-S vaccine, which is currently being administered in the form of nasal drops in India under the name iNCOVACC. Viral vector vaccines using adenovirus, Newcastle disease virus, or parainfluenza virus can elicit immune responses at the site of the infection, making these vaccines an ideal candidate for a mucosal, intranasally administered booster dose.

The rhesus macaques in the study were primed with two intramuscular doses of an mRNA vaccine encoding the spike protein from the ancestral Wuhan strain.

Seven months after they were primed, one group of macaques was administered with the bivalent ChAd-SARS-CoV-2-S vaccine through an aerosol device, and the vaccine was delivered to the lower and upper airways.

A second group was administered the vaccine intranasally in the form of a mist using a clinical sprayer. In contrast, a comparison group was intramuscularly administered a booster dose of the bivalent mRNA vaccine.

The protection conferred by the mucosal adenoviral vector vaccine administered through aerosol and intranasal routes and the intramuscular booster dose of the bivalent mRNA vaccine were compared by challenging the animals with the XBB.1.16 strain of the virus four and a half months after the booster doses were administered.

Findings

The study found that the viral replication in the lungs and the nose of the animals that were administered the mucosal adenoviral vector vaccine against SARS-CoV-2 was minimal for the animals in both the aerosol and intranasal administration groups.

In contrast, the animals that were intramuscularly administered the booster dose of the bivalent mRNA vaccine showed lower levels of viral replication only in the lower airways.

The mucosal vaccine also resulted in durable immunoglobulin (Ig) A and IgG responses in the airways and activated B cells specific for the spike protein in the lungs, which was not observed in the case of the intramuscular bivalent mRNA vaccine booster dose.

The study found that the aerosolized delivery of the mucosal vaccine elicited broad mucosal immunity in multiple respiratory compartments, which could rapidly suppress the replication of SARS-CoV-2.

In comparison, the intranasally administered booster dose of the same vaccine could only boost the IgA titers in the airway, which could prevent the local replication of the virus but could not inhibit viral replication in the lungs as effectively as the aerosolized booster dose or elicit memory B cells specific to the spike protein.

Conclusion

Overall, the findings showed that a booster dose of mucosal adenoviral vector vaccine against SARS-CoV-2, administered as an aerosol, was most effective in controlling viral replication in the lungs and the nose.

The IgA titers in the airways were indicative of the protection in the upper respiratory compartments. In contrast, memory B cell and T cell responses, as well as IgA and IgG titers, correlated with the protection conferred in the lower airways.

Source:

https://www.news-medical.net/news/20240905/Mucosal-COVID-19-boosters-outperform-mRNA-shots-in-preventing-upper-airway-infections.aspx