Nasal Spray Vaccine That Uses Nanoparticles Fights All Flu Strains — and Potentially COVID, Too

2021-08-11

Not a fan of getting your yearly flu vaccine injection? Scientists have developed a nasal spray vaccine that they say could protect against all strains of the influenza virus. Even more promising: it might even be adapted to fight other pathogens, such as COVID.

The nasal spray offers broad protection, allowing for hope of a front-line defense against potentially lethal forms of the flu virus. Recurring seasonal epidemics and potential pandemics are among the most severe threats to public health, the team from Georgie State University says.

The spray contains a protein called recombinant hemagglutinin (HA) that “lives” on the surface of the influenza viruses. It is essential to the virus’ ability to cause infection.

The flu virus is difficult to fight because it can evolve and “learn” to protect itself against drugs quickly. The new spray could solve this problem. “Our research opens a new path for the development of needle-free and logistically simplified intranasal flu vaccines for cross-protection,” says senior study author Dr. Baozhong Wang, in a statement.

The spray administers nanoparticles through the nose to boost the immune system. Current vaccines don’t work against mismatched flu strains. More effective alternatives are urgently needed. Nasal sprays are a particularly promising strategy.

Respiratory tracts are the portal of virus entry. Nasal sprays prevent infection at the key spot, doctors say. They can also stimulate systemic immune responses throughout the body. Vaccines injected into a muscle don’t induce mucosal immune responses in respiratory tracts. This new potential solution combines HA with the chemical graphene oxide.

“Conventional flu vaccines predominantly induce antibody responses. However, recent research demonstrates that lung resident memory T-cell responses are indispensable for

optimal cross-protection against pulmonary influenza infection," says Wang. "The development of lung resident T-cell responses requires vaccination by a respiratory route or influenza virus infection. Our research opens a new path for the development of needle-free and logistically simplified intranasal flu vaccines for cross-protection."

In tests on mice and human cells cultured in the lab, the vaccine produced antibodies. "In our study, we reported for the first time that two-dimensional graphene oxide nanomaterials had a potent adjuvant effect in boosting the immune responses of intranasal hemagglutinin vaccines," says lead author Dr. Chunhong Dong.

The nanoparticles significantly enhanced immune responses in mucous and throughout the rodents' bodies. The robust reaction also conferred protection against different virus strains.

"This study gives new insights into developing high-performance intranasal vaccine systems with two-dimensional sheet-like nanoparticles. The graphene oxide nanoparticles have extraordinary attributes for drug delivery or vaccine development, such as the ultra-large surface area for high-density antigen loading, and the vaccine showed superior immunoenhancing properties in vitro and in vivo. The nano-platform could be easily adapted for constructing mucosal vaccines for different respiratory pathogens," Dr. Dong said.

Needle-free flu sprays possess superior logistical advantages over a jab, added the researchers. They include easy administration with high acceptance rates and the avoidance of biohazardous waste.

The study is published in Proceedings of the National Academy of Sciences.

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