Attenuated Vaccines for Human Respiratory Viruses (hMVP, hRSV, hPIV3)

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Technology description

The Need

Paramyxoviruses are the leading causative agents of acute viral respiratory tract infections. Among the paramyxoviruses, human metapneumovirus (hMPV), human respiratory syncytial virus (hRSV), and human parainfluenza virus type 3 (hPIV3) account for more than 70% of acute viral respiratory diseases. All three viruses cause similar clinical signs and symptoms, ranging from mild respiratory problems to severe coughs, bronchiolitis, and pneumonia. They affect individuals of all ages, but especially infants, children, the elderly, and immunocompromised individuals. In the United States, 60% of infants are infected during their first RSV season, and nearly all children will have been infected with the virus by age 2-3. Epidemiological studies suggest that 5% to 15% of all respiratory tract infections in infants and young children are caused by hMPV, a proportion second only to that of RSV. PIV3 is the third most common, and all three are globally prevalent. Despite the enormous economic losses and emotional burdens these viruses cause, vaccines and anti-viral drugs are currently not available. For decades, approaches to generate vaccines employing viral proteins or inactivated vaccines have failed either due to a lack of immunogenicity or the potential for causing enhanced pulmonary disease upon natural infection with the same virus. The increasing clinical significance of hRSV, hMPV, and PIV3 infections suggest that there is an urgent need for a safe and effective vaccine against these viruses. An effective vaccine would not only prevent acute respiratory tract infection caused by these viruses, but also block transmission routes, thus improving human and public health.

The Technology

Researchers at The Ohio State University, led by Dr. Jianrong Li, developed methyltransferase (MTase)-defective recombinant viruses as live vaccine candidates for hMPV, RSV, and hPIV3. During viral RNA synthesis, modifications such as methylation, capping, and polyadenylation are essential for gene expression and replication. Methylation directly impacts translation of essential viral proteins that ultimately affect viral replications and assembly. Viruses lacking MTase activity are likely to be attenuated, thus affecting immunogenicity. This technology has currently been attenuated in cell cultures and mice while maintaining excellent immunogenicity.

A live attenuated vaccine that targets viral genome replication, virus assembly, and budding.

Application area

Acute viral respiratory disease therapeutics

Advantages

Live attenuated vaccine
Targets viral genome replication, virus assembly, and budding
Elicits high levels of neutralizing antibodies and cellular immune response
Protects from challenge of virulent viruses

Institution

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