Three Chimeric Zika Vaccine Prototypes Developed on the Genetic Background of the Clinically Proven Live-Attenuated Japanese Encephalitis Vaccine SA14-14-2

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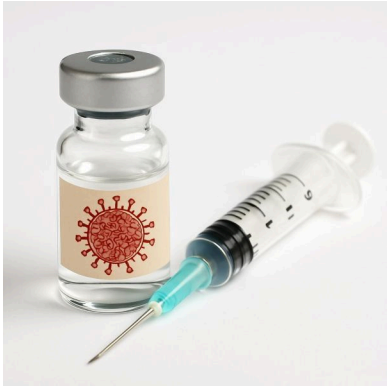

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Biotech & Life Science

Abstract

This live-attenuated vaccine utilizes a genetically engineered Japanese encephalitis virus (JEV) as its backbone to enhance safety and immunogenicity. It is designed as a preventative strategy against Zika virus —a mosquito-borne flavivirus that poses significant neurological risks to pregnant women and their children in tropical and subtropical regions worldwide. This innovative JEV-based vaccine platform also holds promise for adaptation to other clinically relevant flaviviruses, including mosquito-borne flaviviruses such as West Nile virus, dengue virus, and yellow fever virus, as well as tick-borne flaviviruses such as tick-borne encephalitis virus, Powassan virus, Louping-ill virus, and Kyasanur Forest disease virus.

Problem

Zika is a dangerous mosquito-borne orthoflavivirus with no vaccine currently on the market.

Solution

Researchers used the live-attenuated JEV vaccine SA14-14-2 as the genetic backbone to create three chimeric Zika virus vaccine prototypes.

Value Proposition

This technology may be the first Zika vaccine on the market and maximizes safety and dosing efficiency because of its JEV vaccine genetic backbone. It may prove useful for similar orthoflaviviruses like dengue and yellow fever.

Benefit

Zika virus (ZIKV) is a mosquito-borne orthoflavivirus that poses a significant threat to populations in tropical countries of Asia and Africa, and other areas world-wide. Phylogenetically, ZIKV is closely related to other globally significant pathogenic orthoflaviviruses, such as Japanese encephalitis virus (JEV),West Nile virus (WNV), dengue virus (DENV), and yellow fever virus (YFV). There are no vaccines for ZIKV currently on the market. Demand for a vaccine continues to grow as infection rates rise and the effects of the virus are better understood. Originally only

mild effects were seen, but recent outbreaks have been linked to severe neurological syndromes, namely Guilian Barre syndrome (resulting in immune-mediated impairment of peripheral nerves) and congenital Zika syndrome in newborns (resulting in microcephaly, brain abnormalities, and other developmental issues).

Researchers compared three recombinant chimeric Zika viruses developed as candidate vaccine prototypes, in which the two neutralizing antibody-inducing prM and E genes from each of three genetically distinct ZIKV strains were used to replace the corresponding genes of the clinically proven live-attenuated Japanese encephalitisvirus vaccine SA14-14-2.

This technology offers a promising vaccine prototype with the potential to become a safe and effective vaccine that can induce protective immunity against ZIKV through neutralizing antibodies. The live-attenuated Japanese encephalitis vaccine SA14-14-2 creates a unique template, maximizing vaccine safety, ensuring protective efficacy, and capitalizing on the advantage of single-dose immunization. This strategy offers several advantages, including strong and long-lasting immunity, a comprehensive immune response, no need for adjuvants, and a requirement for few doses.

Market Application

This technology could be applied in the Zika virus therapeutics market, as well as related markets for dengue virus and yellow fever therapeutics.

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Publications

- Song, B.-H.; Frank, J.C.; Yun, S.-I.; Julander, J.G.; Mason, J.B.; Polejaeva, I.A.; Davies, C.J.; White, K.L.; Dai, X.; Lee, Y.-M. Comparison of Three Chimeric Zika Vaccine Prototypes Developed on the Genetic Background of the Clinically Proven Live-Attenuated Japanese Encephalitis Vaccine SA14-14-2. Int. J. Mol. Sci. December 29, 2024, 26, 195.