Novel vaccine strategy produces rapid and long-term protection against Chikungunya virus

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The Chikungunya virus (CHIKV) is transmitted through mosquitoes and causes fever and joint pain that can sometimes become severe and disabling. Outbreaks of the virus have already occurred in Africa, Asia, and Europe, and in late 2013, the virus was first seen in the Americas with the number of cases dramatically increased. No vaccine to prevent or treat this virus currently exists.

Now, new research from The Wistar Institute has demonstrated how a novel vaccine strategy that boosts the immune system by rapidly producing antibodies against CHIKV, combined with a traditional DNA-based vaccine approach, can provide both short term and long term protection against the virus. Study results are published in the *Journal of Infectious Diseases*.

"Antigen-based vaccination strategies require a lag time that leaves patients susceptible to infection and disease," said David B. Weiner, Ph.D., executive vice-president of The Wistar Institute, director of Wistar's Vaccine Center, W.W. Smith Endowed Chair in Cancer Research, and senior author of the study. "This novel strategy for generating rapid immune protection has the ability to fill this gap in the way vaccines are developed for CHIKV and other emerging and dangerous diseases."

Weiner and colleagues have developed a non-viral, vector-based

monoclonal antibody delivery method that they believe has advantages for rapid antibody generation. Normally, monoclonal antibodies are manufactured outside of the body and therefore take time to develop and are very costly. Through genetic enhancement and improved formulations as well as a unique delivery system involving electroporation - a technology where electrical fields are created to make cells more permeable - the vaccine can be delivered directly into cells in a living animal where the monoclonal antibodies designed to fight the disease are directly manufactured and delivered into the blood stream providing rapid immunity.

In this study, when mice infected with CHIKV were given one intramuscular injection of the monoclonal antibody-producing CHIKV vaccine, antibodies against the virus were generated in vivo within 24 hours of administration. The injection neutralized isolated pockets of the virus and protected the mice from viral challenge. Since the virus usually manifests itself within 3-to-7 days of transmission, a rapid response is important for reducing the burden of the disease. When combined with a DNA-based vaccine for CHIKV, the researchers observed both rapid and long-lived protection against the virus.

"The vaccination regimen we tested in this study provided stable, persistent responses against a virus with rapidly increasing global incidence," said Karrupiah Muthumani, Ph.D., assistant professor in the Wistar Institute Vaccine Center and first author of the study. "This new approach will likely have importance for a variety of infectious and non-infectious diseases."

More information: Karuppiah Muthumani et al. Rapid and long-term immunity elicited by DNA encoded antibody prophylaxis and DNA vaccination against Chikungunya virus, *Journal of Infectious Diseases* (2016). DOI: 10.1093/infdis/jiw111