New test extends window for accurate detection of Zika

March 6 2018

Credit: American Society for Microbiology

Diagnosis of Zika infection is complex. Molecular tests for exposure are only reliable in the first two to three weeks after infection while the virus is circulating in the bloodstream. Antibody tests are confounded by

cross-reactivity of antibodies to Zika with dengue, yellow fever, and Japanese encephalitis viruses following infection or vaccination. A new blood test called ZIKV-NS2B-concat ELISA is faster, less expensive, and extends the window of accurate detection from weeks to months after the onset of infection, giving clinicians a powerful new tool to screen for Zika throughout pregnancy.

The new Zika test is detailed in the scientific journal mBio and was developed by scientists at the Center for Infection and Immunity (CII) at Columbia University's Mailman School of Public Health and their colleagues at the University of California, Berkeley; Ministry of Health of Nicaragua; Walter Reed Army Institute of Research; Erasmus University Medical Centre; New York City Department of Health and Mental Hygiene; New York State Department of Health; and Roche Diagnostics.

To develop and evaluate the test, the researchers analyzed blood samples collected from children in the Nicaraguan Pediatric Dengue Cohort Study, all of whom had previously tested positive for Zika virus. Using a microarray, they identified a unique peptide sequence—a short section of amino acids—that binds with antibodies to Zika virus but not with antibodies to similar viruses like dengue, yellow fever, and Japanese encephalitis. Next, the researchers customized a low-cost testing technology called enzyme-linked immunosorbent assay (ELISA) to work with the sequence—improving on current versions of the ELISA test which use larger sections proteins that bind to the virus. (The researchers recently used the same method to build the first multiplex test for tick-borne diseases.)

ZIKV-NS2B-concat ELISA is both highly specific and sensitive, with rates of false positives and false negatives of less than 5 percent in the two to three weeks after acute illness, even without symptoms. The new test quickly detects up to 200 samples in four hours and the researchers

anticipate its cost will be similar to other ELISA tests used in clinical settings.

"Many people infected by Zika have only mild illness, or are unable to see a clinician in the early, acute phase of infection," says lead author Nischay Mishra, Ph.D., an associate research scientist at the Center for Infection and Immunity. "Our new test greatly extends the window during which an individual can be assessed with accuracy."

Infection with Zika virus during pregnancy raises risk for neurodevelopmental problems in the offspring, including fetal microcephaly in at least one in ten pregnancies. In adults, Zika can trigger Guillain-Barré syndrome, which causes the immune system to attack the nerves. Since the emergence of Zika virus in the Americas in 2015, 583,144 cases have been reported to World Health Organization, with costs estimated as high as $18 billion between 2015 and 2017. However, long-term costs will likely be much higher given the additional, as-yet-unknown complications from congenital infections.

"An affordable and accurate test for Zika virus is critical for public health," says senior author W. Ian Lipkin, MD, director of CII and John Snow Professor of Epidemiology at Columbia's Mailman School of Public Health. "Even absent symptoms of illness or evidence of birth defects, Zika may inflict long-term harm on the person infected or their offspring."

Provided by American Society for Microbiology