ZIKA VIRUS UPDATE AND BIOLOGICAL CONTROL OF AEDES SPECIES MOSQUITO (*A. AEGYPTI AND A. ALBOPICTUS*)

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Abstract

This paper provides an update on the Zika virus and as the MEJFM is going to press, the WHO advises that there is now an increasing accumulation of evidence of an association between the Zika virus and microcephaly. It may take a further 4-6 months to prove.

The paper also covers recently announced Australian research and successful 5 country trials on the biological control of the carrier mosquito, the Aedes aegypti mosquito.

Keywords: **Zika virus, Dengue fever, chikungunya virus, biological control, Wolbachia**

Introduction

As the ME-JN is going to press, the WHO advises that there is now an increasing accumulation of evidence of an association between the Zika virus and microcephaly. It may take a further 4-6 months to prove.

WHO will convene an advisory group on mosquito control in 3-4 weeks (end of March 2016).

The WHO declared the outbreak an international health emergency on February 1, 2016 citing a 'strongly suspected' relationship between the Zika virus, which is carried by mosquitoes, and infection in pregnancy and microcephaly.

The disease has been linked to severe birth defects in Brazil and has spread to nearly 30 countries and territories.

But also as we are going to press, Australian researchers at the University of Melbourne, Australia who have been working on a biological control approach to Dengue fever have announced on the 19th February, 2016 good results of biological control of the carriers, the Aedes aegypti mosquito. The same mosquito is responsible for carrying the Zika virus and the chikungunya virus as well as Dengue fever.

The biological control involves releasing populations of mosquitoes that have been infected with a commonly occurring species of bacteria, called Wolbachia.

The bacteria effectively inoculate the mosquitoes against the dengue virus. The treated populations then out-compete their dengue-carrying rivals, greatly reducing their numbers. Small-scale trials of the strategy started in 2011, and have so far been carried out in Queensland (Australia), Vietnam, Indonesia and Brazil.

The largest trial so far started in 2014, with the release of Wolbachia-infected mosquitoes throughout Townsville, northern Australia.

The viruses that cause dengue and Zika are very closely related. Both are members of the Flavivirus family, which also includes the yellow fever and West Nile viruses. Both are transmitted by the same species of mosquito, known as Aedes aegypti.

"We have done the experimental work and it's currently winding its way through pre-publication," said researchers.

"It shows that Wolbachia blocks Zika in an almost identical way, so where we've put it out to block dengue the mosquito populations are also resistant to Zika."

With the possibility, even if it's a small possibility, that dengue viruses might evolve resistance against wolbachia an 'insurance policy' has also been created by Australian scientists working on the problem so that "we could have a solution to cover the possibility that Dengue viruses would evolve resistance to wolbachia.

This second wolbachia mosquito combination will effectively prevent the possibility of Dengue viruses escaping the blocking effect of wolbachia".

It will take time to verify and inoculate all mosquito populations, so in the meantime I will follow with an overview of Zika, its mode of transmission, treatment approaches and a list of currently infected areas.

In one of the first studies published related to the recent Zika outbreak, researchers in Brazil documented the eye abnormalities in babies with a traditionally rare condition called microcephaly. Babies with the condition are born with abnormally small brains, which can be connected with other complications. It's not unusual for vision problems to be associated with microcephaly.

They found that in one-third of babies with microcephaly - after a presumed Zika infection before they were born - there was an additional eye abnormality that could threaten their vision.

Ten of the 29 babies observed had irregularities in one or both eyes, and about 80% of the mothers reported Zika-like symptoms during their pregnancy.

For the most part, only about one in five people with Zika ever shows symptoms, which most commonly include fever, rash, joint pain, and red eyes, though there have been cases of a temporary neurological disorder Guillain-Barre Syndrome associated with Zika.

It's Zika's connection to microcephaly that's particularly concerning. This connection has raised concerns about pregnant women contracting the virus.

The best way to prevent infection is to avoid being bitten by the mosquitoes that transmit the disease, by either avoiding travel to areas where the virus is being transmitted, or wearing long clothes and using mosquito repellent.

Regions/Countries were Zika has been found

AMERICAS

- Barbados
- Bolivia
- Brazil
- Colombia
- Commonwealth of Puerto Rico, US territory
- Costa Rica
- Curacao
- Dominican Republic
- Ecuador
- El Salvador
- French Guiana
- Guadeloupe
- Guatemala
- Guyana
- Haiti
- Honduras
- Jamaica
- Martinique
- Mexico
- Nicaragua
- Panama
- Paraguay
- Saint Martin
- Suriname
- U.S. Virgin Islands
- Venezuela

OCEANIA/PACIFIC ISLANDS

- American Samoa
- Samoa
- Tonga

AFRICA

- Cape Verde

Currently there has been no evidence of Zika infected mosquitos in the Middle East.

Medical Aspects for Healthcare Providers

It is not yet known if a woman who is not pregnant and is bitten by a mosquito and infected with Zika virus, will have a risk with future pregnancies.

When a woman is infected with Zika virus while she is pregnant the virus usually remains in the blood of an infected person for only a few days to a week. The virus will not cause infections in an infant that is conceived after the virus is cleared from the blood. There is currently no evidence that Zika virus infection poses a risk of birth defects in future pregnancies. A women contemplating pregnancy, and who has recently recovered from Zika virus infection, should consult her healthcare provider after recovering.

For those babies infected with Zika Babies with microcephaly can have a range of other problems, depending on how severe their microcephaly is. Microcephaly has been linked with the following problems:

- Seizures
- Developmental delay, such as problems with speech or other developmental milestones (like sitting, standing, and walking)
- Intellectual disability (decreased ability to learn and function in daily life)
- Problems with movement and balance
- Feeding problems, such as difficulty swallowing
- Hearing loss
- Vision problems

These problems can range from mild to severe and are often lifelong. In some cases, these problems can be life-threatening. Because it is difficult to predict at birth what problems a baby will have from microcephaly, babies with microcephaly often need close follow-up through regular check-ups with a healthcare provider to monitor their growth and development.

To date, there are no reports of infants getting Zika virus through breastfeeding. Because of the benefits of breastfeeding, mothers are encouraged to breastfeed even in areas where Zika virus is found.

Spread of the virus through blood transfusion and sexual contact have been reported.

Symptoms

- About 1 in 5 people infected with Zika virus become ill (i.e., develop Zika).
- The most common symptoms of Zika are fever, rash, joint pain, or conjunctivitis (red eyes). Other common symptoms include muscle pain and headache. The incubation period (the time from exposure to symptoms) for Zika virus disease is not known, but is likely to be a few days to a week.
- The illness is usually mild with symptoms lasting for several days to a week.
- People usually don't get sick enough to go to the hospital, and they very rarely die of Zika.
- Zika virus usually remains in the blood of an infected person for about a week but it can be found longer in some people.

Diagnosis & Reporting

Based on the typical clinical features, the differential diagnosis for Zika virus infection is broad. In addition to dengue, other considerations include leptospirosis, malaria, rickettsia, group A streptococcus, rubella, measles, and parvovirus, enterovirus, adenovirus, and alphavirus infections (e.g., Chikungunya, Mayaro, Ross River, Barmah Forest, O'nyong-nyong, and Sindbis viruses).

Preliminary diagnosis is based on the patient's clinical features, places and dates of travel, and activities. Laboratory diagnosis is generally accomplished by testing serum or plasma to detect virus, viral nucleic acid, or virus-specific immunoglobulin M and neutralizing antibodies.

In 2016, Zika virus disease became a nationally notifiable condition. Healthcare providers are encouraged to report suspected cases to their state or local health departments to facilitate diagnosis and mitigate the risk of local transmission. State health departments are encouraged to report laboratory-confirmed cases to CDC through ArboNET, the national surveillance system for arboviral disease.

There are no commercially available diagnostic tests for Zika virus disease.

During the first week after onset of symptoms, Zika virus disease can often be diagnosed by performing reverse transcriptase-polymerase chain reaction (RT-PCR) on serum. Virus-specific IgM and neutralizing antibodies typically develop toward the end of the first week of illness; cross-reaction with related flaviviruses (e.g., dengue and yellow fever viruses) is common and may be difficult to discern. Plaque-reduction neutralization testing can be performed to measure virus-specific neutralizing antibodies and discriminate between cross-reacting antibodies in primary flavivirus infections.

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