

Zika virus – Outbreaks and epidemiology: A Review Article

Shagun Tyagi

Department of Biotechnology, Mahatma Jyoti Rao Phoole University, Jaipur, India

Abstract

At present, one of greatest concerns of medical personnel is Zika virus (ZIKV). An outbreak of illness characterized by rash, arthralgia, and conjunctivitis was reported on Yap Island in the Federated States of Micronesia. Serum samples from patients in the acute phase of illness contained RNA of Zika virus (ZIKV), a flavivirus in the same family as yellow fever, dengue, West Nile, and Japanese encephalitis viruses. These findings show that ZIKV has spread outside its usual geographic range.

Sixty years earlier, on April 18, 1947, fever developed in a rhesus monkey in the Zika Forest of Uganda. In early 1948, ZIKV was also isolated from *Aedes africanus* mosquitoes trapped in the same forest. Serologic studies indicated that humans could also be infected. Transmission of ZIKV by artificially fed *Ae. aegypti* mosquitoes to mice and a monkey in a laboratory was reported in 1956.

Keywords: Zika virus (ZIKV), epidemiology

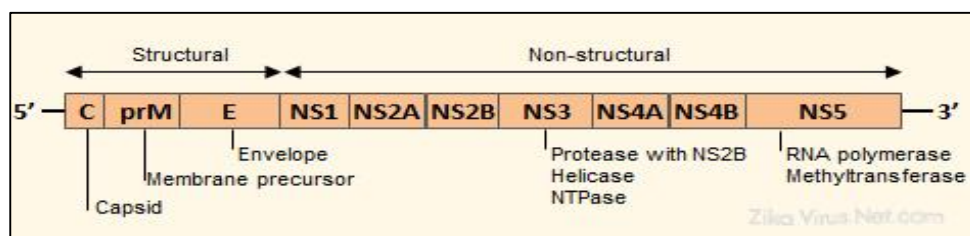
Introduction

In 1947, a study of yellow fever yielded the first isolation of a new virus, from the blood of a sentinel rhesus macaque that had been placed in the Zika Forest of Uganda. Its name comes from the Zika Forest of Uganda, where the virus was first isolated. Zika virus is also known as ZIKV. ZIKV is an arthropod-borne virus (arbovirus) in the genus *Flavivirus* and the family *Flaviviridae*. ZIKV was first isolated from a nonhuman primate in 1947 and from mosquitoes in 1948 in Africa, and ZIKV infections in humans were sporadic for half a century before emerging in the Pacific and the Americas. ZIKV is usually transmitted by the bite of infected mosquitoes. It is spread by daytime-active *Aedes* mosquitoes, such as *A. aegypti* and *A. albopictus*. The infection, known as Zika fever or Zika virus disease, often causes no or only mild symptoms, similar to a very mild form of dengue fever. Zika can also spread from a pregnant woman to her fetus. This can result in microcephaly, severe brain

malformations, and other birth defects. Zika infections in adults may rarely result in Guillain–Barre syndrome (1).

Genome structure of Zika virus

Along with other viruses in the *Flaviviridae* family, Zika virus is enveloped and icosahedral with a non-segmented, single-stranded, positive sense RNA genome. It is most closely related to the *Spondweni virus* and is one of the two viruses in the Spondweni virus clade. Virus particles are 40 nm in diameter, with an outer envelope and a dense inner core. The Zika virus RNA is 10,617-nucleotide long. The Zika virus genome encodes for a polyprotein with three structural proteins, capsid, premembrane/membrane, and envelope and seven nonstructural proteins, NS1, NS2A, NS2B, NS3, NS4A, NS4B, and NS5. NS3, NS4A, NS4B, and NS5 encode for Virions located on the surface of the cell membrane enter the host cells [4].



Transmission of ZIKA virus

- **Through mosquito bites:** Zika virus is transmitted to people primarily through the bite of an infected *Aedes* species mosquito (*Ae. aegypti* and *Ae. albopictus*). These are the same mosquitoes that spread dengue and chikungunya viruses [5].
- **From mother to child:** A pregnant woman can pass Zika virus to her fetus [3].
- **Through sexual contact:** In known cases of sexual transmission, the men developed Zika virus symptoms.

- **Through blood transfusion:** There have been multiple reports of blood transfusion transmission cases in Brazil.

Pathogenesis

The detailed pathogenesis is still unknown. Emerging evidence suggests that ZIKV after being injected through the skin, gains access initially to immature dendritic cells, dermal fibroblast, and epidermal keratinocytes. Adhesion factors such as DC-SIGN, AXL, Tyro3, and TIM-1 help entry in these cells. With the help of envelope protein (E-protein), the

virion attaches to the targeted cells. Then by the process of endocytosis with assistance from clathrin-coated pits, the virion enters the cytoplasm of the cells. Replication occurs primarily in the cellular cytoplasm though ZIKV RNA has been isolated from the nucleus. Then the cells undergo apoptosis and autophagy causing the release of virus particles [2].

Clinical features

The incubation period of ZIKV infection is not known precisely. Most of the cases occur 3-12 days after mosquito bites. A majority of ZIKV infections are asymptomatic. Mild fever, skin rashes, conjunctivitis (nonpurulent), muscle pain and joint pain (small joints of hands and feet), back pain, malaise, or a headache lasting for 2-7 days are seen only in 20% of infected individuals. Other possible manifestations include anorexia, retro-orbital pain, edema, diarrhea, constipation, abdominal pain, dizziness, and pruritus.

Diagnosis

Diagnostic tests for ZIKV infection include PCR tests on acute-phase serum samples, which detect viral RNA, and other tests to detect specific antibody against ZIKV in serum. An ELISA has been developed at the Arboviral Diagnostic and Reference Laboratory of the Centers for Disease Control and Prevention to detect immunoglobulin (Ig) M to ZIKV.

Prevention and Treatment

Though there are several unknown facts about the pathogenesis, transmission, complications, and treatment of ZIKV, physicians should guide patients regarding prevention of the disease as much as possible. Particular care should be taken of pregnant women. The disease is asymptomatic in a majority of the cases. Affected patients should be kept under close observation. They should be counseled about the risk of blood donations. Mosquito control measures should also be implemented stringently. Proper preventive methods will break the chain of transmission. Countries where other *Aedes* mosquito-borne diseases are endemic should be extremely cautious and have a thorough surveillance. In 2016, the vaccine of Zika is expected to arrive. If the current guidelines are followed properly, this infection can be combated successfully.

References

1. Goldsmith, Cynthia Zika Virus. Centers for Disease Control and Prevention, 2005.
2. Symptoms, Diagnosis, & Treatment. Zika virus. Atlanta: Centers for Disease Control and Prevention.
3. Petersen Emily E, Staples J Erin, Meaney-Delman Dana. Interim Guidelines for Pregnant Women During a Zika Virus Outbreak-United States, 2016. MMWR. Morbidity and Mortality Weekly Report 2016; 65(2):30-33.
4. Goodsell DS, Zika Virus. RCSB Protein Data Bank. Research Collaboratory for Structural Bioinformatics (RCSB). doi:10.2210/rcsb pdb/mom_2016_5
5. Dengue and the *Aedes aegypti* mosquito (PDF). Dengue Branch. Centers for Disease Control and Prevention.