

Emergence of Zika Virus Infection

Abstract

Zika, a flavivirus transmitted mainly by mosquitoes in the genus *Aedes*, was discovered in 1947 in Uganda. From the 1960s to 1980s, human infections were found across Africa and Asia, typically accompanied by mild illness. The first reported large outbreak occurred in 2007 on Yap Island, Federated States of Micronesia. The second and largest ZIKV outbreak occurred in French Polynesia in 2013/2014. The symptoms of Zika virus infection may last up to one week and include a maculopapular rash, fever, joint and muscle pain, and conjunctivitis. Previous outbreaks in the Pacific Islands and the current outbreak have revealed a potential association with neurologic illnesses such as Guillain-Barré syndrome. The diagnosis of Zika virus infection is based on results of serum polymerase chain reaction or serologic testing. Acetaminophen can be used to relieve the fever and pain associated with infection.

Keywords: Zika virus; *Aedes aegypti*; Arbovirus; PCR

Review Article

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Abbreviations: DENV: Dengue Virus; WNV: West Nile Virus; Ig: Immunoglobulin

Introduction

Zika virus is an arbovirus in the family Flaviviridae, genus Flavivirus related to dengue virus (DENV), yellow fever, West Nile virus (WNV) and Japanese encephalitis viruses. ZIKV was isolated for the first time in 1947 from a rhesus monkey in the Zika forest of Uganda [1]. The virus caused only sporadic infection and human cases were reported from the 1960s in Asia and Africa, typically accompanied by mild illness. The first reported large outbreak occurred in 2007 on Yap Island, Federated States of Micronesia [2]. The second largest ZIKV outbreak appeared in 2013/2014 in French Polynesia [3], and the number of consultations for Zika fever was estimated at 28,000 (11% of the population) [4]. Subsequently, ZIKV has spread across the South Pacific, and autochthonous cases have been reported in New Caledonia, Easter Island, and the Cook Islands, ZIKV was actively circulating in the South Pacific in 2015 [4,5].

The infection by ZIKV is asymptomatic or accompanied by minor symptoms in most people. Symptoms of Zika virus infection include a maculopapular rash, fever, joint and muscle pain, and conjunctivitis and these symptoms may last up to one week [6,7]. Previous Pacific Islands outbreaks and the current outbreak in 2013/2014 have revealed a neurologic illness such as Guillain-Barre syndrome that has been linked in some cases to ZIKV infection [6,7]. In Nigeria ZIKV was isolated from humans in 1968 and during 1971-1975, a study was conducted in which 40% of the persons tested had neutralizing antibodies to ZIKV [8]. ZIKV infection was reported from other African countries such as Uganda, Tanzania, Egypt, Central African Republic, Sierra Leone [9] and Gabon, and in parts of Asia including India, Malaysia, the Philippines, Thailand, Vietnam, and Indonesia [10]. In additional investigations, the virus was isolated from *Ae. Aegypti* mosquitoes in Malaysia [11]. ZIKV is now emerging in South America (2015) [12].

Transmission of Zika virus

ZIKV is transmitted through the bites of infected female mosquitoes. The virus has been isolated from different species of *Aedes* mosquitoes such as *Ae. africanus*, *Ae. apicoargenteus*, *Ae. luteocephalus*, *Ae. aegypti*, *Ae. vittatus*, and *Ae. furcifer*. ZIKV adapted to an enzootic cycle involving arboreal mosquitoes in Africa to a new urban cycle including urban mosquitoes as vectors and humans as reservoirs [13]. In 2007 there was a ZIKV disease outbreak by *Ae. hensilli* in Yap Island, but investigators were unable to detect ZIKV in any mosquitoes on the island during the outbreak [14]. There are some other routes of transmission of ZIKV such as perinatal infection [15] laboratory contamination [16], sexual transmission [17] and blood transfusion [18].

Diagnosis of Zika virus infection

PCR is used as a diagnostic test for the identification of ZIKV infection on acute-phase serum samples. While PCR detects viral RNA; there are other tests which detect specific antibodies against ZIKV in serum samples. Arboviral Diagnostic and Reference Laboratory of the Centers for Disease Control and Prevention (Atlanta, GA, USA) developed an ELISA test to detect immunoglobulin (Ig) M to ZIKV [19].

PCR tests can be done on samples that are obtained less than 10 days after illness onset. In Yap Island, viral RNA was detected from one patient on day 11 [19]. Cell culture can be used for the isolation of ZIKV [17] but the protocol is reserved to specialized laboratories. The diagnosis of Zika virus infection relies routinely on the detection of ZIKV RNA by molecular methods. Detection of ZIKV RNA is possible on blood and saliva samples that are collected at the acute phase of the disease [20,21]. When it is difficult to collect blood samples, saliva samples are used for the identification of ZIKV [21]. Urine samples are also used for detection of ZIKV RNA after the first week following symptoms onset [22].

Prevention and control of ZIKV infection

Prevention measures for Zika fever are the same as for other arboviruses: mosquito bite prevention and vector control. Mosquitoes that spread Zika virus bite mostly during the daytime. No vaccine exists to prevent Zika virus infection. Zika can be passed through sex from a person who has Zika to his or her sex partners. Condoms (and other barriers to protect against infection) can reduce the chance of getting Zika from sex. Acetaminophen can be used to relieve the fever and pain associated with infection.

Conclusion

Human Zika virus infection appears to have changed in character while expanding its geographical range. The change is from an endemic, mosquito-borne infection causing mild illness across equatorial Africa and Asia, to an infection causing since 2007, larger outbreaks, and from 2013 onwards, outbreaks linked with neurological disorders including Guillain-Barre syndrome. The ZIKV natural transmission cycle involves mosquitoes, especially *Aedes spp.*, but perinatal infection and transfusion-transmission have also been demonstrated. Moreover, ZIKV transmission by sexual intercourse has been suggested. In most cases ZIKV is responsible for a mild disease but severe neurological complications have been reported. Prevention measures for Zika fever are the same as for other arboviruses: mosquito bite prevention and vector control. The occurrence of current and future ZIKV outbreaks must be lowered by some actions such as improving integrated disease surveillance and response, while strengthening the prevention and control programmes for arboviruses.

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