

Zika Virus

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**Introduction**

The Zika virus is a mosquito-borne illness that commonly occurs in tropical and subtropical climates. It is classified as a single-stranded RNA flavivirus that belongs to the *Flaviviridae* family, which also includes viruses such as West Nile, yellow fever, and Dengue[1]. It also contains an enveloped icosahedral structure. This virus is primarily transmitted through an infected *Aedes* mosquito, but it can also be passed through sexual contact, blood transfusions, or mother-to-fetus infections. Many individuals infected with this virus can be asymptomatic, while others may have mild symptoms such as headache, fever, rash, and joint or muscle pain[2]. In more severe cases, individuals can develop Guillain-Barre Syndrome, acute myelitis, and severe microcephaly.

### **Distribution**

The Zika virus is endemic to certain parts of Africa and Asia. Cases can now be found in North America, South America, and the Pacific Islands [3]. In 1947, the Zika virus was initially discovered from a rhesus monkey living in the Zika forest of Uganda. One year later, it was recovered from an *Aedes africanus* mosquito within the same forest [4]. In 1952, the first human cases were detected in Uganda and the United Republic of Tanzania. The first outbreak outside of Africa was reported in 2007, from the Yap Islands located in the Federal States of Micronesia [1]. In 2013, the second outbreak occurred in French Polynesia. Within a period of 6 months, about 32,000 cases were reported, but there were no severe complications or deaths [5]. As the virus spread rapidly, cases were exported from French Polynesia to New Caledonia, Easter Island, and Cook Island. These cases mainly contributed to the pandemic spread of the virus to the Americas, Brazil, and back to Africa in 2015.

### **Transmission**

The primary source of transmission is through the bite of an infected *Aedes aegypti* or *Aedes albopictus* mosquito [6]. If an adult female mosquito has a blood meal from a person infected with Zika, the blood meal will then infect the mosquito, causing it to carry viral particles within their saliva. When the infected mosquito takes a blood meal from another human, the virus will now be transmitted into the new person's blood [7]. As viral particles enter the body, they carry specific proteins that interact with receptor proteins of human cells, which allows them to enter individual cells. The RNA genome is then released into the cytoplasm of the cell and translated by enzymes to make proteins needed for the production of new viral particles. Once the new viral particles are released from the human cell, they can now infect other cells and continue the infection cycle[6].

Other non-vector modes of transmission include sexual contact with an infected individual, exposure to infected blood, and congenital or perinatal infections [8]. Sexual transmission can occur whether the infected individual is symptomatic or asymptomatic. Zika RNA has been detected in semen, vaginal fluids, urine, and saliva. Men and women can pass Zika through sex within different time frames because the virus tends to stay in semen longer than in other body fluids. In men, Zika RNA has been detected in semen up to 370 days after onset of illness, but the shedding of viral particles is rare after 30 days. In women, Zika can be detected in vaginal secretions up to 180 days [1]. Maternal-to-fetal transmission occurs when an infected pregnant woman passes the virus to her fetus during pregnancy or around the time of birth.

## **Symptoms**

4 out of 5 infected individuals are asymptomatic [2]. Those that are symptomatic show signs of a fever, rash, headache, conjunctivitis, and joint or muscle pain. The incubation period is

estimated to be 3-14 days with mild symptoms that may last up to a week. Complications of the Zika virus infection can trigger Guillain-Barre (GB) syndrome in older children and adults [9] GB syndrome is a rare disorder in which the body's immune system mistakenly attacks the nerves. Symptoms include weakness or tingling of the hands, feet, muscles that control breathing, and facial muscles. The incidence of GB syndrome associated with the Zika virus is estimated to be 2-3 cases per 10,000 Zika virus infections [1].

Complications like microcephaly or Congenital Zika Syndrome can appear in developing fetuses. Microcephaly occurs if the infant's brain was not developed properly. This causes the infant's head to be significantly smaller than normal. Other severe fetal brain defects that derive from Congenital Zika Syndrome includes prominent features of fetal brain disruption sequence, subcortical brain calcifications, lesions or scarring in the back of the eyes, and limitation of body movements. Although these conditions can develop in any trimester, risk is greatest with infections occurring in the first trimester. Newborns have a 5 to 24% risk of congenital Zika syndrome and a 4 to 6% risk of microcephaly. Developing fetuses with microcephaly or other congenital abnormalities is associated with a 14% chance of fetal mortality.

### **Diagnosis and Treatment**

Diagnostic procedures are based on the detection of viral components and the detection of antibodies [3]. Specimens for viral isolation testing include blood, urine, cerebrospinal fluid, and amniotic fluid. The reverse transcription-polymerase chain reaction (RT-PCR) is the preferred testing method for detecting the viral components of Zika during the acute phase of illness [4] Serological assays are used to detect antibodies, but there are major limitations due to the cross-reactivity of antibodies derived from different viruses within the *Flaviviridae* family [3]. If an individual has been exposed to multiple flaviviruses, positive serologic test results

should be confirmed with a flavivirus type-specific serological assay. However, confirmatory assays like plaque-reduction neutralization tests can also result in a cross-reaction.

Treatment for Zika virus infection is aimed at relieving symptoms since no specific antiviral medications or vaccines have been approved for treatment [2]. Individuals with mild symptoms should rest, drink plenty of fluids, or take medications such as acetaminophen to relieve joint pain. It is recommended to avoid taking non-steroidal anti-inflammatory drugs (NSAIDs) until dengue can be ruled out due to the risk of bleeding [9]. Those with Guillain-Barre syndrome should follow the normal therapeutic approach which includes therapeutic plasma exchange or intravenous immunoglobulin treatment [1].

Several precautionary measures are taken to avoid contracting the Zika virus. Individuals can avoid getting bit by an infected mosquito by applying bug repellent to skin or clothes, wearing protective clothing that covers as much skin as possible, and staying in well-screened housing [2]. Reducing the risk of sexual transmission relies on abstinence or protected sexual intercourse and the prevention of congenital Zika syndrome relies on avoiding the infection during pregnancy [2]. The vast number of cases in endemic areas like Africa or South America indicates how important it is to take precautions when traveling.

### **Case Study**

A 34-year-old pregnant woman developed a rash at 19 weeks of gestation [10]. While living in the endemic area of Sincelejo, Columbia, she showed no signs of diabetes or any blood-pressure related disorders. She also had no history of drug or alcohol use during pregnancy. According to her hospital laboratory testing report, no active infection against cytomegalovirus, herpes, Chikungunya, or dengue was detected in her serum. Ultrasounds were given to record the development of the fetus: The 16-week ultrasound showed a head circumference of 11.5 cm and

a fetal weight of 219 grams; at 25 weeks, the fetal weight was 770 grams with a cephalic perimeter of 20.2 cm; at 32 weeks, a third ultrasound showed a cephalic perimeter of 22 cm with an abnormally small cerebellum and an augmented cisterna magna, confirming the microcephaly diagnosis. Once the infant was born at 39 weeks, the head circumference was 27.5 cm. A computerized axial tomography (CAT) scan also confirmed microcephaly. The CAT scan showed intracerebral calcifications, cerebral hypoplasia, and supratentorial hydrocephalus. Zika virus RNA was then detected in the placenta using RT-PCR, but the detection of the umbilical cord and serum of the infant were unsuccessful. IgM antibodies were detected in the serum of the mother. 9 months later, the newborn presented weak muscle tone in his neck, repeated respiratory infection, and neurological impairment.

### **Outbreaks within the United States**

*Aedes albopictus* mosquitoes, which are vectors of the Zika virus, were believed to have entered the U.S. from Asia through imported shipments of used tires [11]. They were first documented near Texas and Jacksonville, Florida in 1986. Due to the year-round population of *Aedes* mosquitos and the high volume of travelers from endemic countries, Florida later became vulnerable to Zika virus outbreaks. In July of 2016, the first outbreak was recorded in Miami-Dade County, Florida. Three additional outbreaks were later identified within the same county. As Florida quickly became the epicenter of Zika activity, a total of 5,168 symptomatic cases were reported in the U.S. that year [12] By 2017, the number of cases dropped to 452. Cases continued to decrease in the following years, leaving only 22 cases. As of October 1, 2020, only 2 cases are reported.

### **Conclusion**

Zika virus is a viral infection found in tropical climates within Africa, the Pacific regions, and the Americas. Forms of transmission include mosquito bites, sexual contact, and mother-to-fetus. This virus only poses a significant threat to infected infants rather than adults due to congenital Zika syndrome. It is estimated that 80% of all cases are asymptomatic [1]. Symptomatic infections are generally mild and may last for 2-7 days [2]. Although there are no treatments or vaccines available, symptoms can be treated with supportive care.

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