Zika Virus Disease: A Review

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ABSTRACT
Zika virus disease is the focus of an ongoing pandemic and public health emergency. Zika virus disease is a mosquito borne flavivirus that is caused by Zika virus. Aedes species of mosquitoes such as Aedes aegypti and Aedes albopictus, are considered as the main vectors. The incubation period of Zika virus is 3-14 days. The disease was previously limited to sporadic cases in Africa and Asia, the emergence of Zika virus in Brazil in 2015 heralded rapid spread throughout the Americas. Although most Zika virus infections are characterized by subclinical or mild influenza-like illness, severe manifestations have been described, including fever, headache, muscle pain, joint pain, maculopapular rashes, conjunctivitis, Guillain-Barre syndrome in adults and microcephaly in babies born to infected mothers. Neither an effective treatment nor a vaccine is available for Zika virus; therefore, the Public Health response primarily focused on preventing infection, particularly in pregnant women.

INTRODUCTION
Zika virus disease is an acute infectious disease caused by the Zika virus (ZIKV), belonging to family Flaviviridae, genus Flavivirus, which are also the aetiological factors of dengue, yellow fever, Japanese encephalitis, and West Nile fever. Zika virus is a positive-sense single-stranded RNA virus. Zika virus is transmitted by day-time active female Aedes mosquitoes (mainly Aedes aegypti and Aedes albopictus), vectors of dengue, chikungunya, yellow fever, Japanese encephalitis, and West Nile fever (Sikka et al., 2016). The true extent of Zika virus vectors is still unknown. The distribution of Aedes mosquitoes is now the most extensive ever recorded due to global trade and travel. It is reported in Sub-Saharan Africa, South and South-East Asia, North Australia, Oceania, South and Central America, southern states of the United States, and also in southern Europe (A. aegypti in Georgia, southern Russia, Madeira; A. albopictus in Italy, France, Spain, Greece, Croatia, Montenegro, Albania, Bulgaria, southern Russia) (Kraemer et al., 2015). Zika virus is not endemic in Poland because Aedes mosquitoes transmitting the virus are not present in the territory of Poland; however, there is a potential risk of importing the disease from Zika endemic areas, e.g. South and Central America because of a growing popularity of transcontinental travel among Polish people (Korzeniewski et al., 2016). The incubation period of Zika virus is 3-14 days (Krow-Luca et al., 2017).

Zika virus is named after the Ugandan forest where it was first isolated from a rhesus monkey in 1947. The first human cases were detected in 1952 in Uganda and Tanzania (Plourde and Bloch, 20116).

Zika virus is primarily spread by the female Aedes aegypti mosquito, which is active mostly in the daytime (Abushouk et al., 2016; Ayres, 2016). The mosquitoes must feed on blood in order to lay eggs (Abushouk et al., 2016) see Figure 1. The virus has also been isolated from a number of arboreal mosquito species in the Aedes genus, such as A. africanus, A. apicoargenteus, A. furcifer, A. hensilli, A. luteocephalus and A. vitatus, with an extrinsic incubation period in mosquitoes of about 3-14 days (Krow-Luca et al., 2017).

2. MODE OF TRANSMISSION
There are four ways by which Zika virus can be transmitted namely; Transmission through the bite of an infected Aedes species of mosquitoes such as Aedes aegypti and Aedes albopictus (San-Juan, 2012); Vertical transmission (that is, through the mother to the child) (Gatherer and Kohl, 2015); Transmission through sexual contact (Oster et al., 2016); Transmission through blood transfusion (Musso et al., 2014).

The main transmission route of the Zika virus is via mosquitoes of the genus, Aedes, the same vector that
transmits dengue or Chikungunya virus. The virus is transmitted from human to human, by the bites of infected female mosquitoes such as Aedes aegypti and Aedes albopictus (San-Juan, 2012). During the first week of infection, Zika virus can be found in the blood and passed from an infected person to another mosquito through mosquito bites. An infected mosquito can then spread the virus to other people. Infected humans are the main carriers and multipliers of the virus and serving as a source of the virus for uninfected mosquitoes. The virus circulates in the blood of infected human for several days at approximately the same time that they have Zika fever. Aedes mosquitoes may acquire the virus when they feed on an individual during this period (San-Juan, 2012).

A mother already infected with Zika virus near the time of delivery can pass on the virus to her newborn around the time of birth, but this is rare. It is possible that Zika virus could be passed from mother to the fetus during pregnancy (Gatherer and Kohl, 2015). In 2015, Zika virus RNA was detected in the amniotic fluid of two pregnant women where the fetuses have microcephaly, indicating that the virus had crossed the placenta and could have caused a mother to child infection (Schuler-Faccini et al., 2016). As at February 2016, the link between the Zika virus and microcephaly was strongly suspected, but not yet scientifically proven according to WHO (Oliveira et al., 2016).

As of February, 2016, three reported cases indicate that Zika virus could possibly be sexually transmitted. There was a report of a US biologist who had been bitten many times while studying mosquitoes in Senegal. Six days after returning home in August 2008, he fell ill with symptoms of Zika virus but before having unprotected intercourse with his wife who had not been outside the US since 2008. She subsequently developed symptoms of Zika virus, and Zika antibodies in both the biologist and the wife’s blood confirmed the diagnosis (Foy et al., 2011; Oster et al., 2016). In the second case in early February 2016, the Dalles Country Health and Human Service Department reported that a person contracted Zika fever after sexual contact with an ill person who had recently returned from a high risk country. This case is still under investigation (Oster et al., 2016).

A potential risk is suspected based on a study conducted between November, 2013 and February, 2014 during the Zika virus outbreak in French Polynesia in which blood donors tested positive for Zika virus RNA and were asymptomatic at the time of blood donation. Eleven of these positive donors reported symptoms of Zika fever after their donation, and only three of thirty-four samples grew in culture (Musso et al., 2014). Since January, 2014, nucleic acid testing of blood donors was implemented in French Polynesia to prevent unintended transfusion (Musso et al., 2014).

3. EPIDEMIOLOGY

Zika virus was first isolated from a rhesus monkey in the Zika forest in Uganda in 1947 (Plourde and Bloch, 20116). In 1948, Zika virus was isolated from Aedes mosquito, which was considered to be a vector for Zika transmission (Altman, 2007). Over the next decades, the Zika virus was isolated from other mosquitoes of the Aedes genus: A. aegypti, A. apicourseutens, A. luteocephalus, A. vitians, A. furcifer, A. albopictus (Duffy et al., 2009). Until 2007, only 14 cases of the disease were confirmed worldwide (Duffy et al., 2009). The first outbreak of the Zika fever occurred in Micronesia (Yap Island) in 2007. During the outbreak, blood samples were collected from 557 residents of Yap Island; 414 (74%) of the tested individuals had IgM antibody against Zika virus and 156 (38%) of the infected, with a mean age of 36 (61% women; usually the elderly), reported symptoms of the illness during the outbreak period (Duffy et al., 2009). Researchers estimated that 5,005 of the 6,892 Yap residents, who were 3 years of age or older, became infected with Zika virus in 2007 (Duffy et al., 2009). These were the first cases of the disease recorded outside Africa or Asia (Hayes, 2009).

Between 2013 and 2015, further outbreaks occurred in some Pacific islands: in French Polynesia, New Caledonia, Cook Islands, Easter Island, and Solomon Islands. In December, 2013 Zika virus was suspected to be responsible for an estimated 19,000 cases of dengue-like syndrome in French Polynesia (Cao-Lormeau et al., 2014). In 2015, Zika fever spread to Brazil and more than 20 other countries in South and Central America. Until February 2016, an estimated 1.6 million autochthonous cases of Zika have been reported globally, mainly in South and Central America (including approximately 1.5 million cases in Brazil alone, over 30,000 cases in Columbia, more than 4,600 cases in Venezuela), less commonly in Africa (over 7,000 in Cape Verde) and on the islands of Oceania (Tonga, American Samoa, Samoa) (Garcia et al., 2016).

On 1st February, 2016, the WHO declared the Zika virus outbreak to be a Public Health Emergency of International Concern. The WHO declaration may potentially reduce the number of visitors to the Rio Olympic Games in 2016 (Iloos et al., 2014). As of 17th February, 2016, the Centers for Disease Control and Prevention (CDC) reported 82-travel associated Zika fever cases in the United States, with no locally acquired vector-borne infections (CDC, 2016). Single cases of imported Zika infections have also been recorded in Europe (Venturi et al., 2014; Zamarchi et al., 2015), China (Rajagopalan and Clare, 2016), and Australia (Barker, 2016). A continuing expansion of the infection vector to all parts of the world may result in the occurrence of new Zika virus outbreaks, especially in densely populated urban areas (Oster et al., 2016).
Figure 1: Zika virus transmission/life cycle. Source: CDC (2016).

Figure 2: Microcephaly attributed to Zika virus disease. Source: CDC (2016).
4. CLINICAL MANIFESTATIONS

About 75-80% of patients are asymptomatic, only 20-25% of patients infected with Zika virus develop symptoms (Staples et al., 2016; Dasgupta et al., 2016). The most common signs and symptoms of Zika virus disease are: fever, maculopapular rash, headache, muscle pain, joint pain, conjunctivitis, Guillain bare syndrome in adults, microcephaly in babies, see figure 2 (Foy et al., 2011; Heang et al., 2012).

5. DIAGNOSIS

Zika virus disease can be diagnosed by carrying out the following tests in the laboratory;

(a) Polymerase Chain Reaction (PCR): It is more useful in the first 3-5 days after the onset of symptoms (Dhurba, 2016).

(b) Serological test: An enzyme linked immunosorbent assay (ELISA) has been developed to detect IgM to Zika virus only after 5 days (Dhurba, 2016).

(c) Nucleic acid amplification test (NAAT): It is used to detect viral RNA (Dhurba, 2016).

(d) Plaque reduction neutralization assay: This assay generally has improved specificity over immune assay, but may still yield cross-reactive result in secondary flavivirus infections (Dhurba, 2016).

6. MANAGEMENT AND PREVENTION

Avoidance of mosquito bite is an important element to disease control, since the main transmission route of the Zika virus is via mosquito bite. The US Centers for Disease Control and Prevention (CDC) recommends the following preventive measure; keeping the environment clean, avoiding mosquito bites, wear long-sleeved shirts and long pants to cover exposed skin, stay and sleep in screened-in or air-conditioned rooms and door screens to keep mosquitoes outside, travel restrictions to endemic areas, if you have Zika virus disease, protect others from getting sick by avoiding mosquito bites during the first week of illness, taking measures to have safe sex (Dhurba, 2016). There is currently no specific treatment for Zika virus. Care is supportive with treatment of pain, fever and itching (Sikka et al., 2016). Zika virus may be sensitive to interferon treatment, which is commonly used against other viral infections. However, these results have not been tested in animals or humans (Hamel et al., 2015).

7. CONCLUSION

Zika virus disease has been declared a Public Health emergency. Zika virus has the propensity to infect large numbers of persons with severe consequences in some cases. The epidemic has serious medical, ethical, and economic drawbacks, particularly in countries where the resources for early diagnosis are lacking and potential intervention measures (e.g., contraception or termination of pregnancy) are discouraged or illegal (Plourde and Bloch, 2016). Continued vigilance and public enlightenment are the key towards improving our understanding, management and prevention of this emerging pathogen.

REFERENCES


