

## Zika Virus: A Surprising Savage Infection Worldwide

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The outbreak of zika virus belonging to the flavivirus genus was first reported in 1947 in the monkey species in Uganda. Then it was first isolated from the *Aedes* mosquito's species. Recent outbreaks have been reported in India also. The main host of the virus is humans like all other flaviviruses. Although the fatality rate is not so high but the effects are seen majorly on the fetus when pregnant women gets infected. No perfect treatment or vaccine has been developed yet to treat the disease. In India also few cases are now being reported and it shows that the outbreak of the virus is just not limited to Brazil and America but now also to Asian countries as well and gradually worldwide its infection will spread through. This article deals with the development of the zika virus from 1947 to 2018 and the preventive measures in order to prevent future outbreaks have been considered.

**Keywords:** Zika Virus, Flavivirus, Microcephaly, Vaccine, Infection, mosquitoes, *Aedes* species.

With the growing technology the pollution around the world is increasing incredibly. The humans are destroying the natural habitats of animals and construction is going all around the earth whether its developed countries or developing ones, no one is looking at the adverse effects which are coming with the modernization of the world. In the earlier days the diseases were rarely seen and diagnosed. People were living a longer life as compared to present average age. It is said that people are growing with the development of the things around them they are converting their hard working life into ease by innovating things like robots, artificial intelligence, use of transportation like cars etc but all these innovations are also coming with various drawbacks like cardiovascular diseases, hypertension, obesity etc. The diseases are also increasing due to the passage of animals to humans as the animals are migrating to human world because of deforestation, destruction of

their forests, forest fires and various other modes. Though now all the countries are coming up with the scheme of saving the forests and the wildlife because now they are realizing the importance of them but now its too late for it. Various viruses are now being discovered on a regular basis which are being transmitted through insects and other animals which are life threatening and cause a massive destruction. Some of the viruses are nipah virus, ebola virus, zika virus, hiv virus etc.

In this paper, we will discuss about the zika virus as various other viruses have already been studied a lot. Zika virus is a form of virus transferred through mosquitoes to humans. It basically spreads through the bite of infected mosquito named as *Aedes aegypti* and *Aedes albopictus*.

In this article an elaborative discussion on zika virus will be done. The following includes sectional details of the article:

In the first part detailed study about the developments of zika virus till 2018 is discussed.

The second section tells about the emergence of the zika virus in India and the measures taken by the government to prevent the infection.

The third section includes structure of the zika; its epidemiology, causes and symptoms and preventive measures.

In the fourth section the overall discussion about the development of zika virus is provided.

The final section deals with the conclusion of the article.

### **Review of Literature**

Zika virus is a type of flavivirus which was first identified in 1947 from monkey species rhesus macaque located from the same name as the virus known today the Zika Forest<sup>1</sup>. It was later isolated from the mosquito *Aedes africanus* in the Zika forest itself<sup>2</sup>. The genetic makeup of the virus includes a single standard RNA virus present mainly in flaviviridae<sup>3</sup>. The first human infection from the same has been in Nigeria. 3 people were identified holding the infection<sup>4</sup>.

Initially the virus infection spread to very small number of patients but drastic change was seen after 2007. The deadly spread of zika infection was seen in Yap. In this almost 75% of people were found to possess this virus<sup>5</sup>. After this major outbreak the trend of spread of zika virus changed and was rapidly getting transferred<sup>6</sup>. The genome of zika virus holds 10,794 nucleotides which encodes 3420 amino acids. It is made up of two regions which are noncoding that are on the reading frame which encodes poly proteins and seven non structure proteins<sup>7</sup>. When the mosquito infection was identified it was seen that it has similar entry of cells like other flaviviruses. The virus enters through dermatological cells with the help of receptors which further helps them to move towards lymph nodes and blood<sup>8</sup>. The study regarding the pathogenesis of the viral infection was done it showed that fibroblasts and dendrite cells facilitate the entry of the virus<sup>9</sup>. When the virus enters the host it gets multiplied in the endoplasmic reticulum but to its surprise the antigens of the same were identified in the nuclei of the cells<sup>10</sup>. Zika virus major outbreak was noticed in 2015 in Brazil where approximately 1,200,000 people were found to be infected<sup>11</sup>. There were only

2 cases of sexually acquired infection were reported where the infant born with disorder was delivered in Hawaii was present during the pregnancy period in Brazil<sup>12</sup>. The first outbreak of zika in India was observed in May 2017 in two states of the country<sup>13</sup>. Till then there were no cases reported but as the mosquito species were present in India so World Health Organization (WHO) kept India under category 4 in which virus may be present but no cases have been reported but after this now India has been put under category 2<sup>14</sup>. Three cases were reported in Ahmadabad and further one case seen in Chennai, India<sup>15</sup>. The transmission of the virus from the infected mother to the infant is a major issue to deal with as the virus easily passes to the fetus and causes various health disorders related to brain, hearing loss, defects related to eyes, joints problem etc.<sup>16</sup>. It has been noticed that people suffering from zika virus can also develop some other diseases like GBS (Guillain Barre Syndrome) in which the sufferer can develop neurological disorders or even can get paralyzed<sup>17</sup>. On October 2018, India has again reported the case of zika infection which shows three outbreaks in less than 2 years. This outbreak was seen in Jaipur, Rajasthan<sup>18</sup>. The main government initiative was to protect the pregnant women in the affected area so that the transmission cannot get transferred to infants<sup>19</sup>.

### **Zika Virus: Origin in India**

The first case of zika as told earlier was reported in 2017 in Ahmadabad around the month of January. Three people were identified to possess the infection. The second case was seen in the same year in Tamilnadu in the month of July. Only one person had been reported in this outbreak<sup>22</sup>. All these cases have been detected with the help of RT-PCR (Reverse Transcriptase Polymerase Chain Reaction)<sup>21</sup>. The recent outbreak was seen in Jaipur in the month of September, 2018 in which 22 cases were reported as infected and out of 22, seven infected persons were found to be living nearby each other. The patients were kept isolated in the Swami Man Singh Hospital, Jaipur<sup>22</sup>.

### **Prevention and control in India**

Various prevention and control strategies were implemented by the government of India after the recent outbreak of zika infection in Jaipur. The government conducted spraying to control mosquitoes in almost every prone area of Jaipur and thousands of containers have been

treated with temephos which is a chemical used to treat insect infested water. The medical teams have been appointed to have a continuous report for any symptoms of infection in the prone areas. The government also formed national center for disease control in Delhi to regularly monitor the situation and also a serious check is being made on the pregnant women in the prone areas for the transfer of infection to the infants.

### **Zika Virus Structure**

#### **Epidemiology**

Zika virus belongs to the family of flaviviridae of genus flavivirus and was first observed in 1947. The most similar diseases are dengue, yellow fever and west Nile viruses<sup>23</sup>.

Till now the epidemic area of first infection is still unclear but it is said that a man from Philippines had possessed the virus. It is being said that GBS and zika have a close association with each other because usually the symptoms are similar in both infections by increase in neurological disorders<sup>24</sup>.

#### **Structure**

The structure of this virus was first invented through the use of cryo electron microscopy. The structure seemed to be similar to other flaviviruses containing a membrane and capsid which further contains the RNA genome of virus<sup>25</sup>.

One auxiliary contrast between Zika infection and different flaviviruses is a circle of amino acids uncovered on the surface of the molecule<sup>26</sup>. This succession of the E glycoprotein, and a sugar particle appended to it, may be associated with controlling Zika infection tropism and pathogenesis. The capacity of West Nile infection to enter the focal sensory system of mice has been connected to glycosylation at a comparable position, while cell receptors are thought to join to sugars on the dengue infection capsid<sup>27</sup>. K dolma in 2016 described the complete sequence of zika virus genome as shown in the below figures 1 and 2

The following figure shows the genome of the virus:

Infection particles are 40 nm in diameter across, with an external envelope and a thick inward center. The Zika infection RNA is 10,617-nucleotide long. The Zika infection genome encodes for a polyprotein with three auxiliary, pre membrane/film, and envelope (counting the envelope-154

glycosylation theme recently connected with destructiveness), and seven nonstructural proteins, NS1, NS2A, NS2B, NS3, NS4A, NS4B, and NS5 encodes for. Virions situated on the surface of the cell film enter the host cells. The site of mRNA translation is in the cell cytoplasm<sup>28</sup>.

Many advanced image acquisition and image processing techniques are available to clearly visualize the structure and genome of the virus, beside these there are many image enhancement and denoising techniques to clearly observe the relevant and fine information under study<sup>32-37</sup>.

#### **Mode of transmission**

The fundamental transmission course of the Zika infection is by means of mosquitoes of the class Aedes, a similar vector that transmits dengue or chikungunya. After a contaminated mosquito chomp, ailment side effects generally seem following a brooding time of three to twelve days. The infection is transmitted from human to human by the chomps of tainted female mosquitoes, principally Aedes aegypti and Aedes albopictus<sup>29</sup>. A tainted mosquito would then be able to spread the infection to other individuals. Although the main transmission is through mosquitoes but there are three other modes also through which virus can be transmitted to humans. They are as follows:

#### **Symptoms**

Zika virus generally causes very low or no symptoms of illness during its earlier stages in children and adults. The symptoms like headache, pain in the body, fever or rashes can develop if any occurs. But if the virus is transferred during pregnancy from infected mother to fetus then the symptoms are threatening. The most common are miscarriage, birth defects and most importantly microcephaly (30).

#### **Diagnosis**

The diagnosis of zika virus can be done by using two tests as follows:

- Nucleic Acid testing (NAT) is utilized to identify hereditary proof of the Zika infection. The NAT test would be performed simultaneously on both a blood and pee test.
- Immunoglobulin M (IgM) testing is utilized to identify proteins, known as antibodies, that are created by the body in light of the Zika disease. The test is blood-based and normally ready to recognize antibodies inside four days of

the presence of side effects<sup>31</sup>.

**Treatment**

There is no specific treatment for the zika infection. Symptoms for joint pain and aches can be treated using acetaminophen drug<sup>31</sup>.

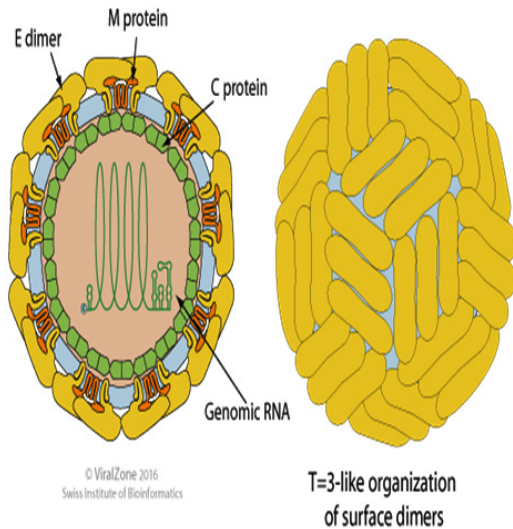
**Prevention**

Presently there is no cure for the zika infection. No vaccine has been developed to prevent the transmission like the nipah virus.

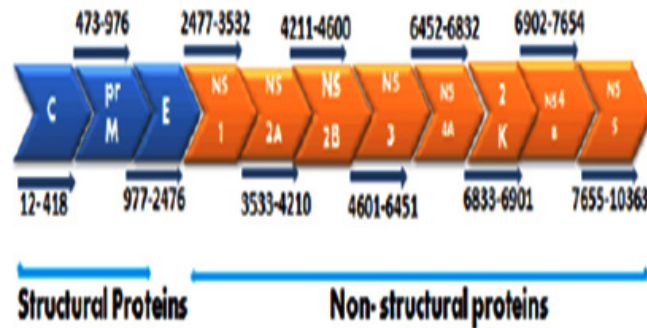
Till now no perfect treatment is present for the nipah virus also like the zika<sup>38</sup>. But mosquito borne infections can be prevented by using insect repellent, wearing clean clothes, not keeping the water standing for long time etc. to prevent the risk of sexual contact one should use condoms if returned from the prone infected region<sup>29</sup>.

**DISCUSSION**

Though from the literature review it is seen that the virus till now has not caused much damage but its outbreak are seen more common now and in future it can result to deadly virus. The pregnant women are seen more prone to the infection and its major effect on fetus is observed. The main long lasting one is microcephaly which can even lead to death of the child. Therefore one should not take this infection lightly as this disease is spreading worldwide now. In the upcoming years the scientists need to study about the virus infection and develop its treatment because till now no treatment has been developed for the infected persons. Further vaccine should also be developed as the pregnant women living in the infected areas can pass the infection to the fetus which leads to transfer of the infections from one age group to other and can also lead to miscarriages. This



**Fig. 1.** Structure of Zika virus(28)



**Fig. 2.** Genome Of Zika Virus (28)

**Table 1.** Modes Of Transmission (29)

S.no	Modes	Zika transmission
1.	Mosquitoes	Infected Aedes species
2.	From mother to baby	Virus can be transferred from infected mother to fetus but not seen during the birth
3.	Blood	Spread through blood transfusion is seen.
4.	Sexual contact	Virus is seen to get transferred through sexual contact also.

has to be developed in order to prevent the above discussed issues in the future. There is a future question that can it be used as a bioweapon also which needs to be studied.

### CONCLUSION

Through this study we can conclude that zika virus is majorly seen in the states of Brazil and United States and Africa but now as the techniques are developing and people are migrating from countries the spread is seen in Asian countries also. In India itself there have been 3 outbreaks reported in less than 2 years. So the infected mosquitoes are present in every part of the region now. Therefore it is advised to take necessary preventive measures from the beginning itself by the national medical committees of every prone country to prevent the devastating effect of the virus outbreak. Further it is recommended to pursue more research regarding the virus as no vaccine has been developed yet prevents it.

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