

# A REVIEW OF CAUSES AND PREVENTION OF THE ZIKA VIRUS FEVER

**M. Sudhakar Reddy**

Associate professor, Department of Physics,  
School of Sciences, B-II, Jain (Deemed to be University), Bangalore-560027, India  
Email Id: r.sudhakar@jainuniversity.ac.in

## **Abstract**

*Zika virus (ZIKV) also belongs to the same family Flaviviridae of the Chikungunya, West Nile, Japanese encephalitis and the Dengue fever. So it also becomes difficult to detect the ZIKV fever because it is misinterpreted as the dengue virus or chikungunya. Further there is no specific medicine available in the market for this fever so only bedrest and some kind of fever medicines can be taken to treat the person. Precautionary measures must be taken prior to get infected with the infection of the virus like sleeping under the mosquito nettings, destroy all the stagnant water places which are the breeding place for the mosquitoes. For the combination of ZIKV and DENV (Dengue virus) anti-inflammatory medicines must not be taken. So in this paper the techniques for the detection of the ZIKV infections and treatment available till date has been discussed which will be very helpful for the researchers continuing or starting their research in ZIKV.*

**Keywords:** Anti-inflammatory drugs, Breeding place, Chikungunya, DENV, Japanese Encephalitis, ZIKV.

## **I. INTRODUCTION**

Zika virus (ZKV) being an arbovirus belongs to the family of Flaviviridae that also includes the Chikungunya virus, Japanese encephalitis, West Nile, Yellow fever and the Dengue fever [1]. It is spread by the Aedes genus of the mosquitoes. It is positive and a one strand RNA virus with an envelope making it very much similar to the Spondweni virus. Two main lineages have been found so far which are: African and Asian. Before 2015, Zika Virus outbreaks occurred in the areas of the South-East Asian, Africa and the Pacific Islands. ZKV was isolated from the Aedes africanus class mosquitoes after the discovery in 1947 and it was known that the virus can infect the human beings too. The first such case of the infection among the human being due to this virus was

diagnosed in Nigeria in 1953 with the confirmation of 3 such cases of infection. The history of the arisen of the various cases can be seen in Figure 1.

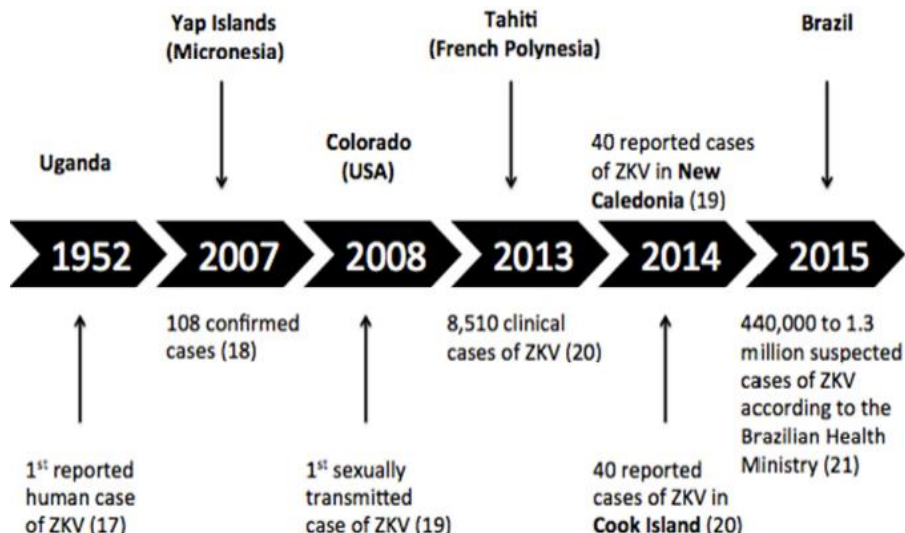


Fig. 1: Timeline for the major outbreaks of the ZIKV infections

### A. Mode of Transmission

Mosquitoes that are carriers of dengue, yellow fever and chikungunya also carries the Zika virus. These mosquitoes *Aedes aegypti* and *Aedes albopictus* infect the human beings through the bite after biting an infected person. These mosquitoes are bite in the daytime and breed in the containers used for the water storage in homes and get their feed both when indoors or outdoors near the dwellings. During their travelling from one place to another the mosquitoes bite the various persons and thus infecting the normal or healthy person after biting an already infected person. Traces of the Zika Virus RNA has been found in the semen, amniotic fluid, blood, breast milk, urine, saliva and the breast milk. Transmission of the virus during pregnancy to the baby, sexual intercourse and blood transfusion. However, till date there is no proof to ensure the transfer of the virus during breast feeding.

### B. Clinical signs and symptoms

The symptoms developed due to this virus are mild in nature and there are 20% chances of the development of the illness in humans means out of the 5 persons only one person will get ill. The symptoms usually appear in 2-12 days after being infected with the virus and the symptoms that appear are fever, joint pain, maculopapular rash, conjunctivitis and these may last up-to a week. Some other symptoms may also appear like headache, pain in the muscles but diarrhea, ulcers in the mucus membrane, abdominal pain, pruritus and the abdominal pain can be seen in rare cases. ZIKV and the microcephaly can be related closely for the newborn babies and in adults the symptoms of Guillain-Barre syndrome can be seen [2]. In a study the cases detected were as shown table 1.

**Table 1: Detection of the ZIKV cases along with neurological defects like GBS and microcephaly [3].**

| Country     | Month/Year | Suspected Disease | Total cases | Confirmed cases of the suspected disease | ZIKV cases | GBS | microcephaly |
|-------------|------------|-------------------|-------------|--|------------|-----|--------------|
| Brazil      | Feb, 2016  | microcephaly      | 1132        | 404(24%)                                 | 17(4%)     |     |              |
| Brazil      | July, 2015 | ZIKV              | 76          | 76                                       |            | 42  |              |
| Venezuela   | Jan, 2016  | GBS               | 255         | 255                                      | 255        |     |              |
| El Salvador | Jan, 2016  | GBS               | 104         | 104                                      | 104        |     |              |

## II. DIAGNOSIS

A non-pregnant woman who has developed symptoms for the virus should undergo for the testing of serum and urine for the ZIKV RNA, ZIKV, dengue virus Ig M and the nucleic acid testing (NAT). Nucleic Acid Testing is useful whenever the samples are collected within two weeks of the developing of the symptoms [4]. After the samples for the NAT has been collected then ZIKV and dengue virus Ig M tests should be conducted. Immunoglobulin M levels can be tested after the 14 days of the appearance of the symptoms while the NAT test should not be conducted after the 2 weeks. Now for a pregnant woman having symptoms of the ZIKV can be advised for the serum and the urine ZIKV Ig M and NAT within the 12 weeks of the symptoms [5]. If the NAT are positive, then it is the case of the acute maternal ZIKV infection even when the Ig M test is negative. Now for the positive result of any of the NAT serum or urine and Zika Ig M comes positive, then it is also the case of acute ZIKV infection. But if both NAT serum and the urine comes negative and the Ig M is positive then plaque reduction neutralization test should be done on the patient. But asymptomatic pregnant lady having an exposure to the Zika virus should be tested for NAT during her prenatal check up with further two tests and during the pregnancy two more non-consecutive tests should be performed. Ig M test is not required to be performed. Now in any of tests for NAT comes positive then no further NAT tests should be performed.

**Table 2: Detection techniques used for the ZIKV**

| Detection of Disease | Technique used to detect the disease    | Number of parameters | One parameter | 2 <sup>nd</sup>    | 3 <sup>rd</sup>  | 4 <sup>th</sup>         |
|----------------------|---|----------------------|---------------|--------------------|------------------|-------------------------|
| ZIKV                 | RT-PCR                                  | 4                    | Virus         | Viral nucleic acid | Immunoglobulin M | Neutralizing antibodies |
| ZIKV                 | Plaque reduction neutralization testing |                      |               |                    |                  | Neutralizing antibodies |

**\*RT-PCR:** Reverse transcriptase polymerase chain reaction

Treatment for the ZIKV infections involves just the symptomatic cares so patients are always advised for the bed rest and to maintain the hydration of the body. Acetaminophen can be taken in case of any pain and fever but aspirin nonsteroidal anti-inflammatory drugs should be avoided before the test of the dengue comes negative because it may lead to the bleeding.

### A. Management and Prevention of Zika virus infection

As there is no specific medicine available for the ZIKV fever so only precautionary measures are adopted like taking fluids, antipyretics, rest and oral analgesics for the fever and the pain relief. Some kinds of non-steroidal anti-inflammatory drugs should be taken only after the relief from the dengue due to the risk for bleeding [6]. Such anti-inflammatory drugs also should not be taken during the pregnancy.

### B. Prevention of mosquito bite

Once a person got infected with the disease then that person is now the active source to spread the disease further. So, such a person should avoid blood transfusion, bite of the mosquito because biting an infected person will also make the mosquito infected and that mosquito will further infect the other persons by biting them. To protect from the mosquito either the long sleeve shirts, trousers should be worn or mosquito repellants should be applied on the body [7]. An infected female mosquito Aedes lays a number of eggs on the stored water so avoid storing the water in containers or some kind surface covering chemicals must be poured over the water in open spaces.

### C. Vaccine development

For the various kinds of flaviviruses medicines are available since 1930's while for the dengue fever it was made available in the mid of 2010.

## D. Travelers

While visiting those countries where ZIKV is in active stage or is spread in tremendous amount, travelers should wear personal protective measures to stay away from the mosquito bites. Protective measures include the repellent, wearing long sleeve shirts and pants. Always sleep under the mosquito nets while sleeping even during the day time. It has also been found that ZIKV can be transmitted through sexual intercourse so, it is recommended for the persons who have travelled to the active ZIKV areas should avoid any sexual activity and from the day of return use of condoms is recommended [8]. Blood donation should also be avoided for at-least 28 days to prevent the spread of the ZIKV. Health care officials should always provide time to time counselling to the females of the reproductive age regarding the pregnancy planning in the ZIKV active areas.

## E. Pregnant women

Pregnant women or women who are planning to get pregnant in near future should think off carefully to travel to the areas of active ZIKV or it is better for them to delay the plan of visiting such areas. But if it is very much urgent to travel then strong measures must be taken like using mosquito repellent, wearing personal protective equipment. For the women who have travelled in such areas should always contact healthcare providers even if there are no symptoms for the virus attack.

## F. Management and prevention of congenital Zika virus infections

As the Aedes mosquitoes spread the virus so some kind of preventive measures must be taken to eliminate the infection. Mosquito repellants should always be used for the day and night because mosquitoes bite during both the times. Pregnant, breastfeeding ladies and even the elder persons should also take care off. Mosquito repellants should be applied over the sunscreen if anyone uses any such kind of lotion to protect from the sun. But 2 month old babies should be prevented from using these repellants. Eyes and mouth should also be protected from the repellent as it may affect the eyes. For the other preventive steps mosquito nettings and long-sleeve shirts and long pants should be worn. Mosquito breeding points or sources should be eliminated which are stagnant water in flowerpots, tires and dust bins. Sleeping outside in open areas should be avoided and also the outdoor activities must be avoided also.

Table 3: Difference between the Zika, Dengue and chikungunya virus fever[9].

| Symptoms           | ZIKV fever             | DENV fever     | Chikungunya            |
|--------------------|------------------------|----------------|------------------------|
| Fever              | Less severe            | More severe    | More severe            |
| Headache           | Less intense           | More intense   | more intense           |
| Malaise            | Less intense           | More           | More                   |
| Hemorrhagic        | Have not been reported | Higher chance  | Have not been reported |
| Shock complication | Have not been reported | Higher chance  | Have not been reported |
| Conjunctivitis     | Frequently present     | Seldom         | Seldom                 |
| Arthralgia         | Mild                   | Moderate       | Severe                 |
| IL-1 $\beta$ level | High                   | Low            | High                   |
| IL-2 level         | High                   | Low            | Low                    |
| MCP-1 Level        | No significant changes | Low            | No significant changes |
| Severe infection   | Lower risks            | Higher risks   | Lower risks            |
| Cytokine storm     | Does not occur         | Usually occurs | Usually occurs         |
| Th2 bias           | Yes                    | No             | Yes                    |
| IFN- $\gamma$      | Normal                 | Increased      | Increased              |
| TNF- $\alpha$      | Normal                 | Increased      | Normal                 |
| Thrombocytopenia   | Rarely occurs          | Usually occurs | Rarely occurs          |
| RANTES             | High                   | Low            | Low                    |
| VEGF               | High                   | Low            | High                   |
| PDGF $^{\alpha}$   | No significant changes | Low            | High                   |
| IL-5               | No significant changes | Low            | No significant changes |
| IL-7               | No significant changes | Low            | High                   |
| IL-12              | No significant changes | low            | high                   |

### III. CONCLUSION

It is difficult to confirm ZIKV infections because of its mild manifestations in clinics. It also has been found that tears can be the route for the transmission of the infection and so ZIKV prevalence can be more than the reported ones[10]. So, elder persons, pregnant ladies, lactating mothers with acute illness should be screened actively. Newborn babies should also be tested on regular basis by the ophthalmologists. Although ZIKV infection is not fatal in nature but the complications related with it are dangerous. Development of the other diseases related with it makes this infection complicated. As there is no specific medicine is available till date so only preventive measures need to be taken to prevent the untoward results. Bed rest, mosquito repellants and use of mosquito nettings while sleeping in open areas. Avoid to take rest near the ponds or where the water is stagnant because such places are always the breeding places of the mosquitoes.

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