

Overview of Zika Virus

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ABSTRACT:

The positive-stranded RNA virus known as Zika virus (ZIKV), which is spread by mosquitoes and belongs to the Flaviviridae family (genus Flavivirus), is currently generating an unprecedented widespread outbreak in the Americas. Historically, between the late 2000s and the early 2010s, ZIKV invaded the Caribbean and moved eastward from tropical Africa and Asia to the Pacific Islands. And arrived in North America in 2016, travelling via Central and South America in 2015. ZIKV infection has been connected to an increasing number of severe neurological disorders, such as microcephaly and Guillain-Barré syndrome, even though it typically only results in a mild, self-limiting sickness or no symptoms at all. ZIKV is a major concern to public health worldwide due to the virus's ongoing geographic spread and that of its mosquito vectors. But there aren't any antiviral medications or vaccinations available. The main way that the Zika virus spreads is through mosquito bites. However, there has been evidence of non-vector transmission in recent years, including mother-to-fetus transmission (Vertical transmission), blood transfusions, and the spread of infected urine. There isn't yet an antiviral medication available to treat Zika virus infection. The research of vaccinations to stave off Zika virus infection is still ongoing. This article includes an overview of the disease's history, mechanisms of transmission, clinical manifestations, creation of a vaccine, and advancements in antiviral medications. The zika virus was identified in 1947 in Uganda as a flavivirus spread by mosquitoes. The virus first surfaced in the Americas and the Pacific, where it propagated and caused widespread outbreaks of human illness. Although the exact causes of the virus's emergence are unknown, they most likely entail its transfer into untested habitats marked by the presence of high concentrations of susceptible human hosts and capable *Aedes* spp. mosquitoes in urban settings. The sexual and transplacental transmission of the Zika virus, together with the neurological morbidities it causes (such as Guillain-Barr syndrome and foetal microcephaly), are its distinctive hallmarks. The identification of viral nucleic acids in biological materials is necessary for diagnosis; however, due to the wide cross-reactivity of antibodies amongst flaviviruses, identifying a particular antibody reaction may not be definitive. Although the Zika virus has been isolated in humans from Africa and Asia on occasion, the sickness has not yet shown any signs of serious clinical consequences. not previously recorded before the current pandemic in the Americas.

KEYWORDS: Zika virus, Flavivirus, Arbovirus, Mosquito-borne pathogen, Zika outbreak, Zika pandemic, Microcephaly, Guillain-Barré syndrome

INTRODUCTION

Many mosquito species, most notably the less anthropophilic *Aedes albopictus* and the daytime-active *Aedes aegypti*, bite humans to spread Zika virus. The latter is widespread in portions of southern Europe as well as in the USA as far north as southern Minnesota and Maine. It loves sylvatic habitats. Numerous kinds of mosquitoes have already been documented, from which Zika virus strains were recovered. A new virus carried by arthropods is called the Zika virus. It is a member of the family Flaviviridae and genus Flavivirus. Zikavirion is a positive-sense RNA molecule with an icosahedral shape and a diameter of 40–50 nm[1]. When a mosquito bites you, the Zika virus can spread blood transfusion, from pregnant women to their foetus, sexual interaction, and *Aegypti* and *Albopictus*][2–5]. Individuals infected with ZIKV typically show no symptoms at all or very minor ones, negating the need for hospitalisation. The symptoms of a ZIKV infection include fever, headache, rash, red eyes, and aches in the joints and muscles. ZIKV infection can impact young infants who contract the virus after birth and is linked to a number of congenital abnormalities. Zika virus infections have been reported in humans in Africa and Asia since 1947; yet, the disease has not yet been shown to have any serious clinical consequences. not been recorded before the present American outbreak. Given that the virus has been identified for six decades, it is maybe not surprising that the Zika virus was just recently identified as a potential cause of disease epidemics. Since the virus's first outbreak in Micronesia in 2007, a great deal of work has been done to understand its epidemiology; nevertheless, the older data on the virus has not received as much attention. Many mosquito species, most notably the less anthropophilic *Aedes albopictus* and the daytime-active *Aedes aegypti*, bite humans to spread Zika virus. The latter is more inclined to sylvatic habitats, as well as in portions of southern Europe and the USA's northernmost states, including southern Minnesota and Maine. Therefore, the purpose of this systematic review is to compile and assess all study data regarding nonarthropodborne modes of ZIKV transmission in order to establish a foundation of evidence for the critical evaluation of the current state of knowledge that underpins preventative initiatives and health care guidelines. The most recent research on transmission, clinical presentation, diagnosis, treatment, and prevention of ZIKV is described in this review, which also examines the effects of the virus's outbreak and points out knowledge gaps.

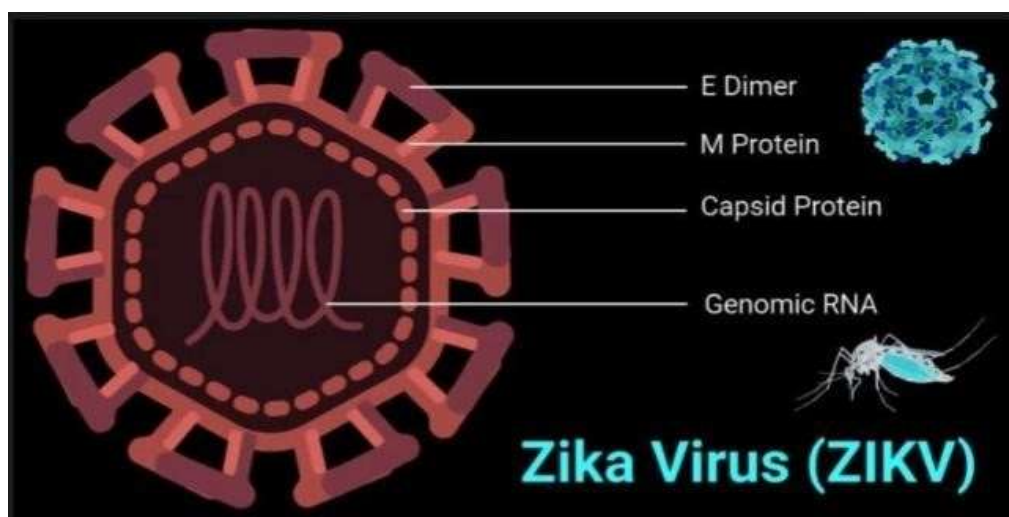


Fig.1 ZIKA VIRUS.

HISTORY AND EPIDEMIOLOGY OF ZIKV:

ZIKV may belong to the Flaviviridae family and spread via the Aedes genus. Arboviruses, dandy fever viruses, and Japanese encephalitis viruses are other members of this family (Hamel, R., Dejarnac, O., Wichit, S., Ekcharyawat, P., Neyret, A., Luplertlop, N.,... & Missé, D. 2015). Additionally, ZIKV antibodies were found in animal species, especially non-human ones. primates (A. W. McCrae, B. G. Kirya, 1982). Along with arboreal mosquitoes such as Aedes Africanis or mosquitoes with an oversized tropical and semitropic range such as Aedes aegypti, ZIKV was also isolated from several dipterans in Africa and Asia (Marchette, N. J., Garcia, R., & Rudnick, A. 1969). Several times (Grard, G., Caron, M., Mombo, I.

M., Nkoghe, D., Mboui Ondo, S., Jiolle, D.,... & Leroy, E. M. 2014). as well as Aedes albopictus. Epidemiology investigates the open distribution of The most significant Zika virus epidemic was in 2013 and 2014, affecting the

Cook Islands, Vanuatu, Easter Island, King Islands, New Caledonia, and other Pacific Islands. In fifty-five nations and territories, ZIKV transmission is understood. Nevertheless, autochthonic transmission is only documented for 41 of them in 2015–2016, with indirect confirmation pertaining to virus was circulated in six countries, five of those countries reported an end to outbreaks, and three of those countries experienced local infection (Fu, K. W., Liang, H., Saroha, N., Tse, Z. T. H., Ip, P., & Fung, I. C. H. 2016).

MOLECULAR BIOLOGY AND VIROLOGY OF ZIKV:-

In addition to Hepacivirus (one species that is the hepatitis C virus), Pestivirus (four species), Pegivirus (two species), and animal virus (53 species), the Flaviviridae family has four genera that are clinically necessary. The majority of clinically significant pathogens, aside from the hepatitis C virus, are members of the animal virus genus. The most important signs and symptoms. Poon, R. W. S., Wong, S. S. Y., Fever, rashes, rebirth, visceral involvement, and hemorrhagic fever are among the symptoms caused by flaviviruses (T Adams, M. J., Lefkowitz, E. J., King, A. M., Harrach, B., Harrison, R. L., Knowles, N. J.,... & Davison, A. J. 2017). ZIKV ordination is ten,794 kb long and consists of a positive sense fibre ribonucleic acid molecule with two noncoding regions (NCR) of thirty-nine and fifty-nine kb, as well as the super molecule is split into seven and seven (NS1-NS2ANS2BNS3-NS4A-NS4B-NS5), capsid (C), envelope (E), precursor of membrane (prM), and seven (Fig. 2). Kuno, G., Chang, G. J. J., Tsuchiya, K. R., Karabatsos, N., & Cropp, C. B. 1998). E protein is the main super molecule on the particle surface. This supermolecule is involved in mediating binding, membrane fusion, and several other aspects of the viral cycle. The biggest super molecule of an infectious agent with RNA-dependent ribonucleic acid synthesis in its Cterminal The NS5 super molecular activity known as acid enzyme (RdRP) is attributed to its N-terminus, which is responsible for its process due to alkyl enzyme activity. In the thirty-nine NCR of the ZikV ordination, there are 428 nucleotides and twenty seven folding patterns.

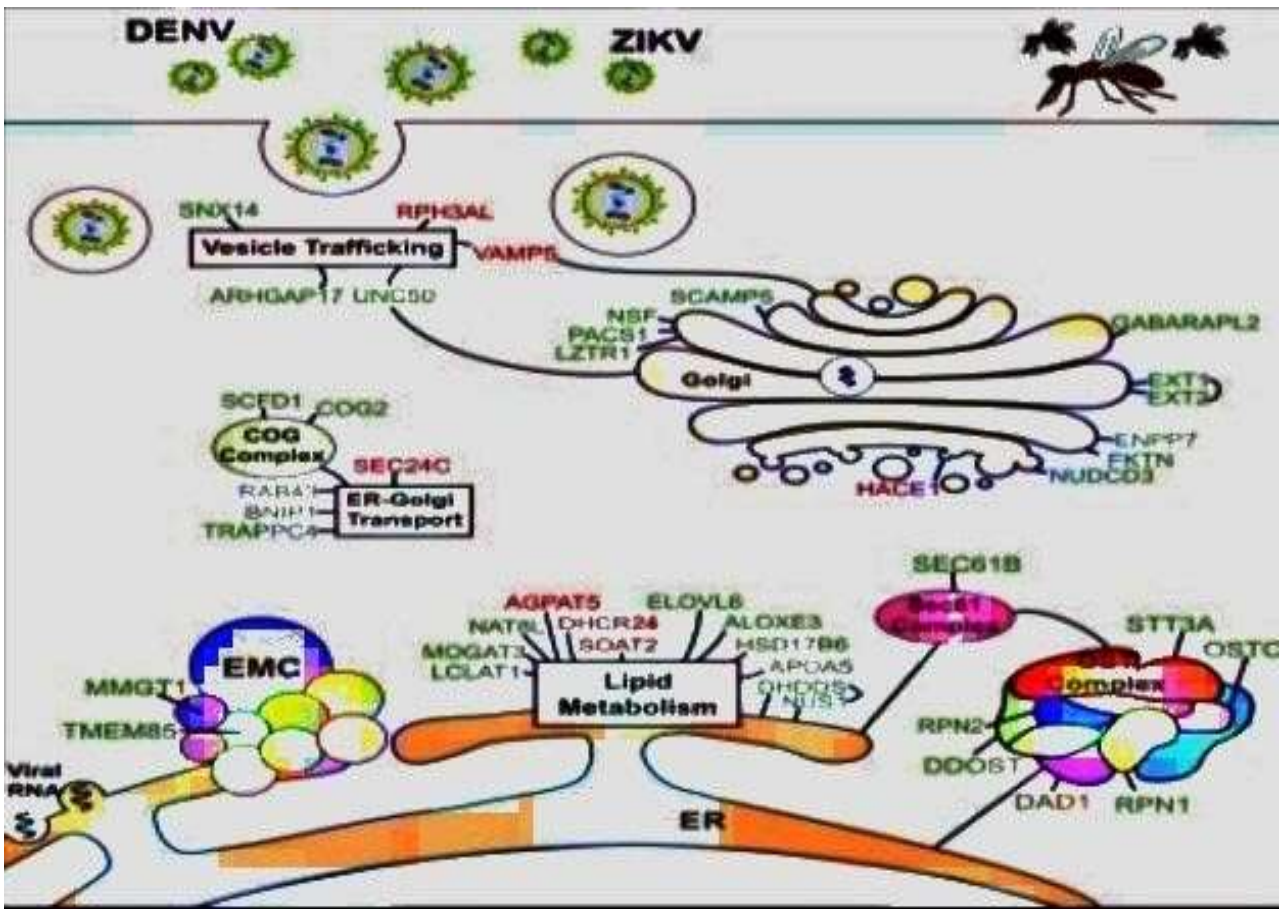


Fig.2 Molecular biology and virology of ZIKV.

MODE OF TRANSMISSION OF ZIKV

It was once thought that the only way the Zika virus could spread was through the bite of an infected mosquito. However, there has been evidence of additional ways of transmission in recent years, including blood, mother-to-fetus (vertical) transfer, and sexual transfusion and the spread of contagious urine infections. Therefore, in order to effectively manage the Zika virus infection, control measures for both vector and non-vector transmission need to be established. Effective treatment, vaccination, and diagnostic approaches must also be developed.

1. TRANSMISSION THROUGH MOSQUITO BITE

When a healthy person is bitten by an infected mosquito, the Zika virus is spread. The Zika virus is mostly spread by *Aedes aegyptii* and *Aedes albopictus* [3]. This mosquito is known to spread various flaviviruses and is mostly active during the day. Anopheles, the other kind of mosquito, The virus can also be spread via earwig, *Mansonia*, and *Culex* [43]. For mosquitoes, the incubation period lasts roughly ten days.

2. SEXUAL TRANSMISSION

The Zika virus can be spread through sexual contact, and Foy et al. reported the virus's first sexual transmission in 2011. Sexual contact between infected individuals and other partners can spread the Zika virus, even if the infected individuals only show minor symptoms or are symptomless. Males to females, males to males, and females to males can all contract the Zika virus. Nonetheless, the majority of cases involving transmission from symptomatic males to females have been identified.

3. VERTICAL TRANSMISSION

The Zika virus can infect a foetus either during pregnancy or after delivery in pregnant women.5. Microcephaly, Guillian-Barre syndrome, and congenital Zika syndrome are among the foetal brain abnormalities that have been linked to ZIKV sickness, according to a number of research .The virus may have been transferred from mothers to foetuses as evidenced by findings in baby serum, foetal brain, and amniotic fluid . Although the Zika virus has also been found in breast milk, breastfeeding is still advised by the WHO because it is not known to spread to infants .

4. BLOOD TRANSFUSION

Health authorities in Brazil verified two incidences of Zika virus transmission in blood donors in 2016 [4]. Since the majority of Zika infections are asymptomatic, the potential for bloodborne transmission of the virus has confounded efforts to prevent its spread. A look back a study conducted in French Polynesia between 2013 and

2014 on blood donor samples found 2.8% of asymptomatic, healthy donors to have the Zika virus [54]. The development of solutions for the efficient management of Zika virus disease has become a challenge due to the virus's multiple mechanisms of transmission.

CLINICAL MANIFESTATION OF ZIKV INFECTION :-

The incubation period in each of the aforementioned instances was no more than 12 days [12–14], which is consistent with other reports of ZIKV infections, which ranged from 3 to 12 days . Notably, 80% of patients with the condition are asymptomatic. As previously mentioned, symptomatic cases are defined by a selflimiting, brief febrile illness lasting three to nine days without serious consequences . Most commonly seen symptoms include a mild fever, arthralgia (small joints of the hands and feet), headaches, muscle aches, retro-orbital pain, abdominal pain, prostration, edoema.

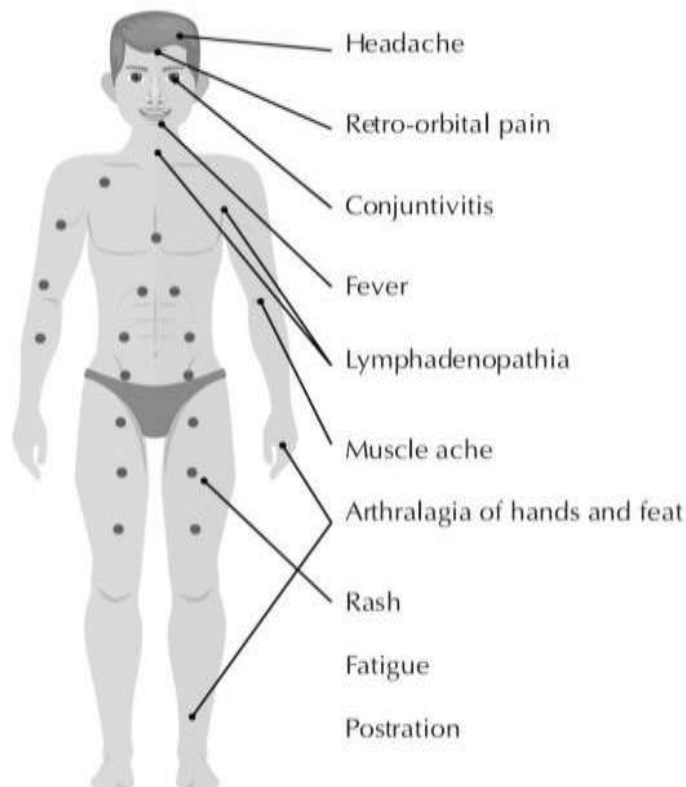


Fig. 3.Symptoms of ZIKV infection.

lymphadenopathy, and a maculopapular rash that can start on the face and spread throughout the body. Other signs and symptoms include gastrointestinal symptoms, primarily vomiting, prostatitis, and hematospermia.

Case reports serve as the basis for current knowledge regarding the potential for sexual transmission of ZIKV [26–28]. This was likely a case of ZIKV being sexually transmitted from a husband to a wife after a few days of sexual intercourse.

development of symptoms specific to men. The theory that ZIKV can be spread through sexual contact is supported by high amounts of ZIKV-RNA detected in semen and reproducible ZIKV found in this body fluid at least two weeks after recovery. Even in cases where the individual does not exhibit symptoms at the time, ZIKV can be transmitted through intercourse (vaginal, anal, oral, and sharing of sex toys). The fact that the virus is present in 3% of asymptomatic individuals suggests that there is a potential chance of transmission by transfusion.

PATHOPHYSIOLOGY OF ZIKV

A rat foetus was infected with a ZIKV sample from a patient in Paraíba, northeastern Brazil, who had an acute febrile infection. This infection resulted in restricted intrauterine growth and signs of microcephaly due to infection of cortical progenitor cells, which increased brain cell death. The same authors found that ZIKV reduces brain proliferative zones, interferes with the formation of different cortical layers from the induction of cellular apoptosis and autophagy, and compromises the neurodevelopment of the foetus using human brain organoids—self-assembled, three-dimensional aggregates from pluripotent stem cells with cell types and cytoarchitecture that resemble the embryonic human brain. Additional research employing neurospheres and

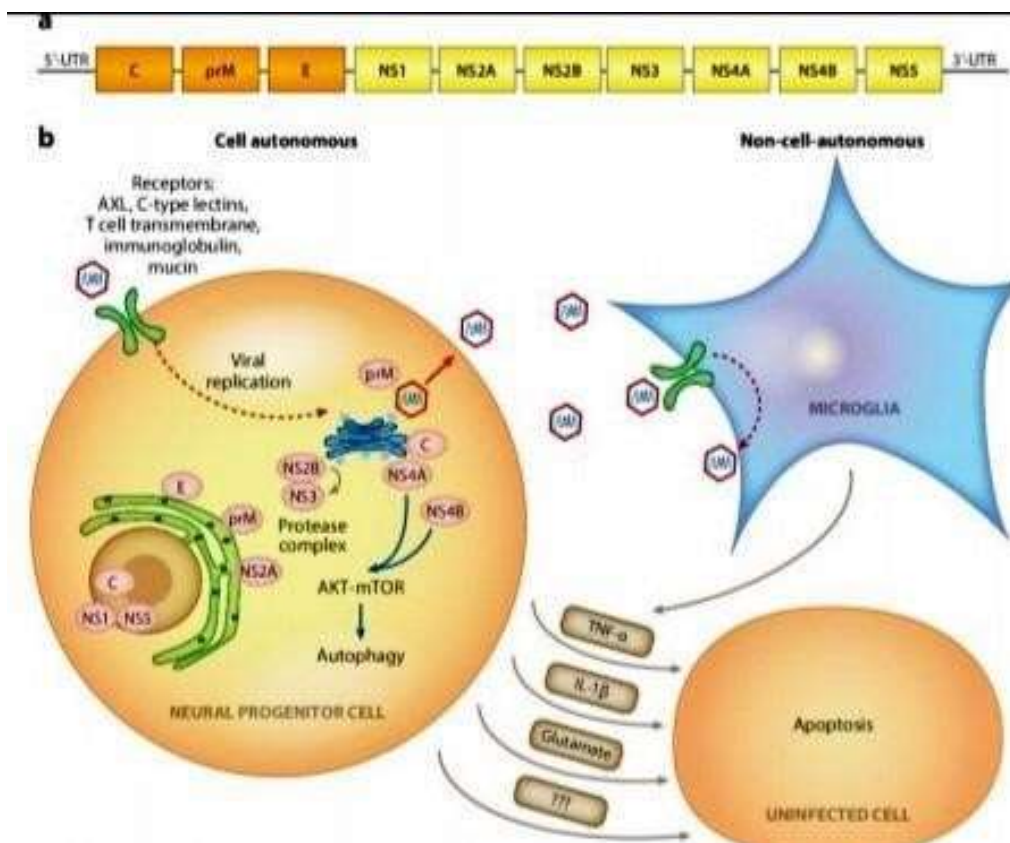


Fig.4 Schematic diagram representing the transmission of zika virus.

brain organoids has also shown that ZIKV can cause brain cell death and, as a result, a decrease in the amount of brain tissue.

ZIKV illness was initially misdiagnosed as broken bone fever infection. For ZIKV laboratory diagnosis testing, virus isolation and serologic methods are used (Fagbami, A. H. 1979). While convalescent and acute sampling and cross-reactions among Flaviviruses are the limitations for serologic analysis, virus isolation takes many days (i.e., 1-2 weeks) methods. ZIKV can also be isolated via cell culture, although this requires specialised labs to observe (Faye, O., Faye, O., Diallo, D., Diallo, M., & Weidmann, M. 2013). ZIKV infections are confirmed by reverse transcription polymerase chain reaction (RT-PCR), while immunological serum globulin against ZIKV is found by enzyme-linked immunosorbent serologic assay. To detect ZIKV in blood serum or other samples, RTPCR is a sensitive, specific, and time-saving method.

NEUROLOGICAL COMPLICATIONS OF ZIKV

Even if it's self-limiting, Guillain-Barré syndrome and cases of various medical symptoms appear in Brazil and French Oceania during ZIKV epidemics. In 2014, Ios, S., Gauthier, V., Goffart, I. L., Cardoso, T., & Herida, M. According to a Brazilian Ministry of Health assessment, there may be a correlation between vertebrate malformations and ZIKV infection in pregnancy, as there has been an approximate twenty-fold increase in the number of cases of abnormal condition cases among newborns. In the second or early trimester, ultrasound can detect ZIKV infection in craniums (Kazmi, S. S., Ali, W., Bibi, N., & Nouroz, F. (2020).

Preterm birth, stillbirth, and foetal loss are among the pregnancy issues caused by Zika infection. Additionally, especially in adults and older children, Zika virus infection can cause neuropathy, myelitis, and Guillain-Barré syndrome.

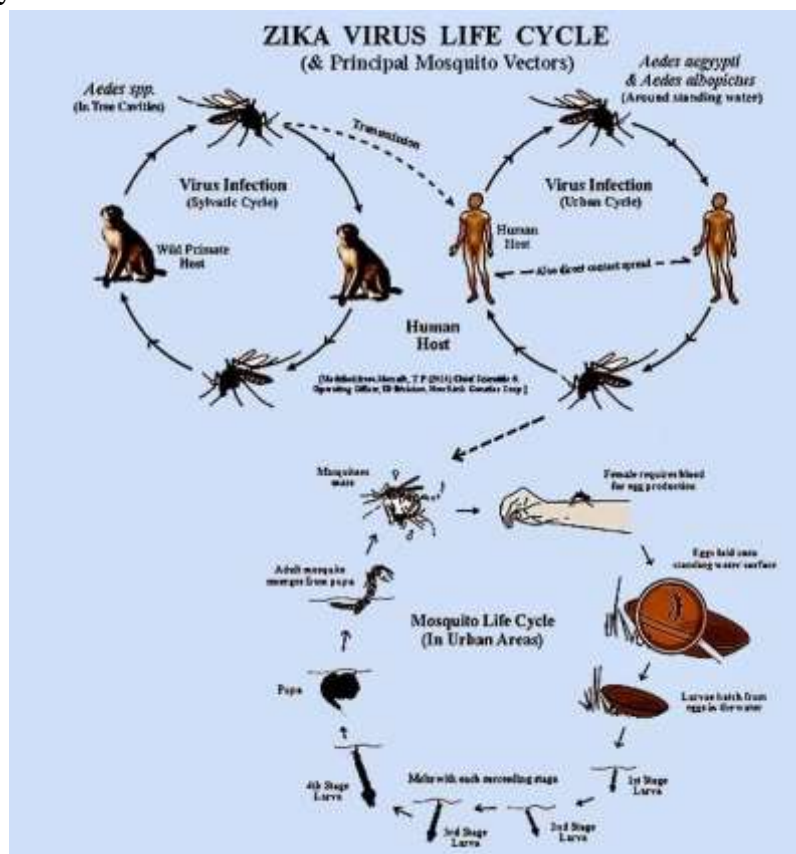


Fig.5 Life cycle of zika virus.

DIAGNOSIS OF ZIKV :-

Diagnostic testing for the Zika virus can be performed in a laboratory setting.

1. Polymerase Chain Reaction (PCR): Dhurba (2016) states that PCR is most helpful in the first three to five days following the beginning of symptoms.
2. Serological test: Only after five days may IgM to the Zika virus be detected using an enzyme-linked immunosorbent assay (ELISA) (Dhurba, 2016).
3. Viral RNA can be found using the nucleic acid amplification test (NAAT) (Dhurba, 2016).
4. Plaque reduction neutralisation assay: Compared to immunological assay, this assay typically has better specificity; nonetheless, it is still possible for crossreactive results to result in subsequent flavivirus infections (Dhurba, 2016).

PREVENTION AND CONTROL OF ZIKV

Mosquitoes and the areas where they reproduce pose the greatest risk of contracting ZIKV. Reducing their interactions with humans is necessary to manage and stop their spread. This can be achieved by covering openings and entrances, utilising mosquito netting, and applying insect repellents. sprays that kill insects. Additionally, this calls for the development of selective investigative instruments, animal models to identify emerging foetal damage due to viral septicity (.Tesh, R. B., Azar, S. R., Muruato, A. E., Hanley, K. A., Auguste, A. J., & Weaver,

S. C. 2016, McGrath, E. L., Rossi, S. L., Gao, J., Widen, S. G., Grant, A. C., Dunn, T. J., & Wu, P. 2017), effective drugs and vaccines to protect Innovative vector control devices and tactics, efficient drugs, and vaccinations to protect people against ZIKV infection.

Since there is currently no vaccine against the Zika virus, the main goals of preventative and control efforts are to minimise mosquito bites, lower the rate of sexual transmission, and manage the mosquito vector. Potentially successful preventative strategies aimed at lowering infections among Pregnant women should take precautions such as utilising insect repellent, bed nets, window screens, air conditioning, permethrin treatment for clothing, avoiding unprotected sexual contact with partners who are at risk of contracting the virus, and avoiding unnecessary travel to areas where the virus is still spreading.

Given that it is one among the vectors for

ZIKV and that vector control strategies involving the application of pesticide agents are challenging because of (i) financial limitations, (ii) logistical challenges, Eliminating larval breeding sites is essential to controlling this vector because it prevents the spread of resistance in the vector population and/or (iii) tight laws governing the use of pesticide agents. Additionally, people should be encouraged to take personal precautions, such as using insect repellents and installing window and door screens to keep insects outside.

An integrated strategy, which includes removing mosquito breeding grounds and using larvicides, is another efficient method of controlling the vector.

pesticides in addition. These methods are severely limited, nevertheless, in part because to the existence of hidden breeding locations in metropolitan areas²⁵.

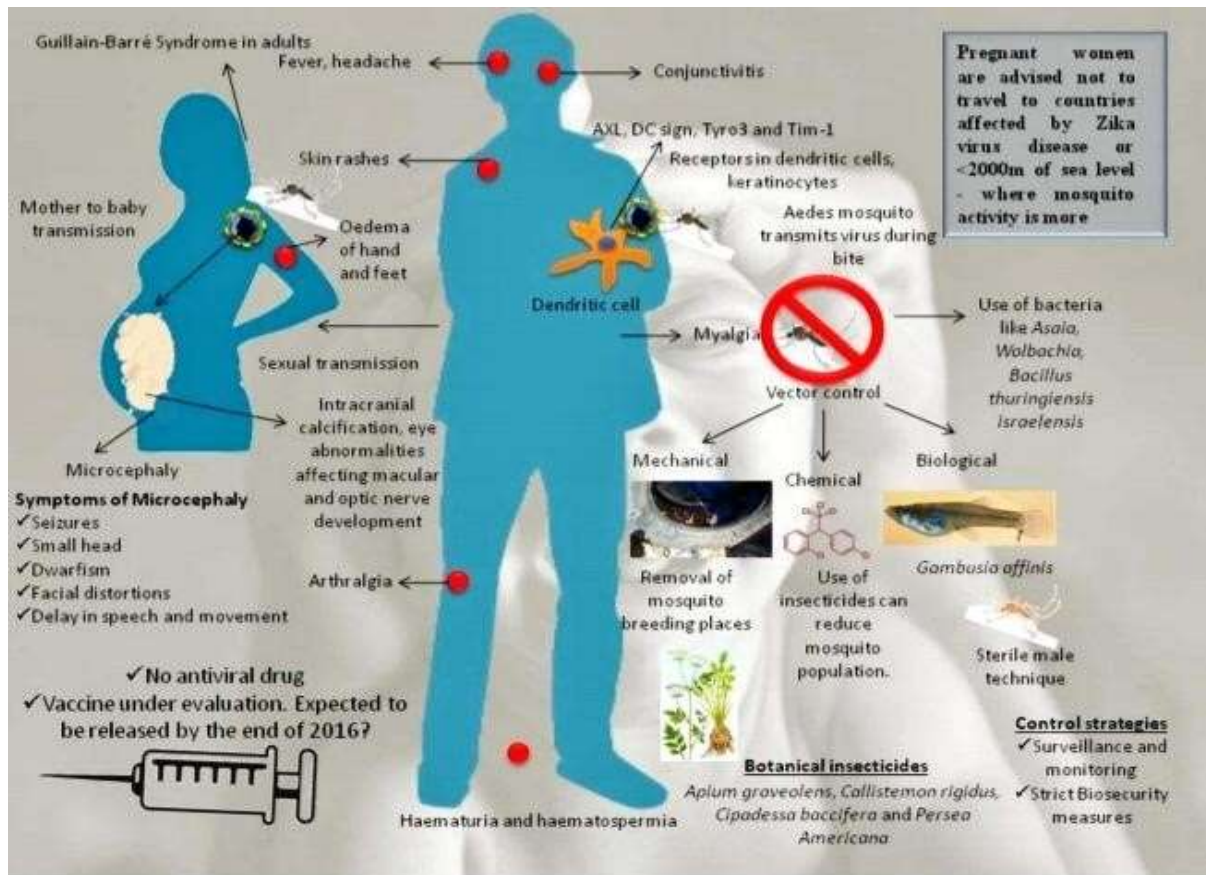


Fig.6 Overview of prevention and control of ZIKV.

TREATMENT OF ZIKV

Like other mosquito-borne flaviviruses, the focus of treatment for a simple Zika virus infection is on the symptoms. Effective Zika vaccinations are desperately needed, as the virus is causally linked to congenital abnormalities, microcephaly, and other birth defects in infants and GBS in adults. Research22 examined the possibility of avoiding the risk of antibody-dependent increase of Zika virus infection by studying the vaccine immunogen, Zika virus NS1. The researchers present a novel DNA vaccine that encodes the secreted Zika virus NS1, which can quickly protect against systemic Zika virus infection. This has led to the identification of novel NS1 T cell epitopes in vivo and highlights the vital role that NS1-specific T cell response plays in protecting against Zika.

People infected with ZIKV must be forced to drink enough water, get plenty of rest, and use liquid treatments to relieve discomfort and fever. They must seek out substance and therapeutic thought if the symptoms aggravate them (see "Fig. 6"). As of right now, there are no particular drugs or materials that can be used to treat or prevent ZIKV infections; the only treatments that are available are those for symptomatic relief, such as paracetamol, which can reduce fever and pain associated with the virus. Nonsteroidal anti-inflammatory drugs, or NSAIDs, must be strictly prohibited. If someone is already taking additional medication for a medical problem, they must obtain a doctor's advice before taking any further medication. In cases of ZIKV infection, therapy is a worthwhile course of action because it has been demonstrated to an inflaming virus found in Japan that is occasionally put in a genus similar to the Zika virus.

Belladonna treatment successfully decreased the Japanese inflammatory infection's severity.

The species *Atropa belladonna* was identified by B.

Bandyopadhyay, S. Das, M. Sengupta, C. Saha, K. C. Das, D. Sarkar, & C. Nayak in 2010. This plant is a member of the potato family (Rowson, J. M. 1950). As a significant source of alkaloids, which are the primary chemical compound and material that make up pharmacological bioactive substances, it has shown effectiveness in treating a variety of medical ailments and has great commercial value (Rajput, H. 2013). Western Asia and Europe are *Belladonna's* native regions. The majority of the compounds in *Atropa belladonna* are found in the mature fruit and the young leaves. It has been used historically to treat a variety of human

Conclusion

Zika infection has become a serious concern to public health due to spreading worldwide epidemics, and epidemiological similarities between ZIKV and chikungunya and Dengue presents a plausible contender for emergence as a worldwide health issue. The explosive outbreak in Brazil and the most recent outbreak in India have already demonstrated how quickly ZIKV may spread over a population. In addition to traditional vector control efforts, public health authorities should establish efficient policies to avoid non-vectorborne transmissions.

ZIKV was first identified in 1947 in Uganda and is mainly spread via the bite of an infected *Aedes* species mosquito (such as *A. aegypti* or *A. albopictus*), while non-vector transmission is also a possible mode of transmission. modes, such as blood transfusion, sexual transmission, and vertical transmission. After being discovered, ZIKV was restricted to Africa and Asia for more than 50 years before making a comeback in the Pacific Islands in the late 2000s and early 2010s.

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