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A REVIEW ON ZIKA VIRUS

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ABSTRACT

This review article provides an overview of the virus, its diagnosis, clinical characteristics, and management. Because of the ongoing current outbreak in southern America, which began in December 2015, the Zika virus has been in the news for quite some time. The World Health Organisation designated it a public health emergency in February 2016 due to its relationship with congenital abnormalities, including microcephaly in infants born to infected women. The virus spreads rapidly across the United States of America, and then to Asia, has prompted severe worldwide worries. Its expansion to neighbouring nations poses a severe threat to the Indian populace.

KEYWORDS: Zika virus, Aedes mosquito, Flaviviridae, Microcephaly and Neurological infections.

INTRODUCTION

Zika[3] virus is a mosquito-borne flavivirus that was first identified in Uganda in 1947 in rhesus monkeys.[1] The first human Zika virus was identified in Nigeria in 1954. Zika virus is transmitted primarily by aedes mosquitoes, which bite mostly during the day. These are the same mosquitoes that spread dengue, chikungunya and yellow fever. Zika virus infection during pregnancy can cause infants to be born with microcephaly and other congenital malformations as well as preterm birth and miscarriage. Microcephaly is a neurodevelopment

disorder which is spread from pregnant women to her unborn baby, where an infant's head does not develop normally and remains abnormally small when compared to the others. A number of emerging and re-emerging infections have taken a heavy toll on the public health around the globe. Some of these infections that have been in the news recently include the swine influenza, severe acute respiratory syndrome, middle east respiratory syndrome, Ebola virus disease, and the Zika virus infection.[2]

Zika virus (ZIKV) (strain MR 766) was first isolated from the serum sample of a Rhesus monkey during a research on yellow fever virus (YFV) in the Zika forest, Uganda 1947. In 1948, the virus was isolated from a pool of Aedes Africanus (Stegomya) mosquitoes in the same forest. The first cases of human infection were reported in 1950 in Africa and later in Asia and remained restricted to these regions until 2007. Since then, ZIKV has spread geographically, with reports of infection in the North Pacific, French Polynesia, and South Pacific. The first records in the Americas date from 2015, when ZIKV spread across the Pacific Ocean to invade Brazil, Suriname, and Columbia. Since 2015, 84 countries reported the new introduction or re-introduction of ZIKV, and, although prevention and measures are being taken, the risk of infection is still a reality, mainly in regions with a large mosquito vector presence.[3]

ZIKV is mainly transmitted by the bite of female mosquitoes of the Aedes aegypti and Aedes albopictus species. The latter is prevalent in Southeast Asia and, because of its ability to adapt to different environments; it has been found in the Americas, Pacific Islands, Australia, and Africa. A. albopictus[6] is a potential vector for more than 20 arboviruses, including important members of the Flaviviridae and Togaviridae families such as Dengue (DENV) and Chikungunya (CHIKV), respectively. Both species can co-exist in the same regions. Although previous researches demonstrated the superiority of A. albopictus, this specie is considered the second main vector of DENV and CHIKV. Indeed, the transmission by other species of the Aedes genus, including Aedes africanus, Aedes luteocephalus, Aedes vitattus, Aedes furcifer, Aedes hensilii, and Aedes apicoargenteus, should be considered. The successful virus transmission by these species is related to their high capacity of proliferation in tropical and subtropical regions. Even though wild primates are the main non-human reservoirs, anti-ZIKV antibodies have been also identified in rodents and domestic animals. Additionally, others transmission routes have been confirmed[7], such as blood transfusion, sexual, perinatal, and Trans placental transmissions.[4]

ZIKV belongs to the Flaviviridae family and the genus Flavivirus, being phylogenetically related to the dengue virus (DENV), West Nile virus (WNV), and yellow fever virus (YFV). Recently, the structural similarity among the virions of ZIKV and other Flavivirus was demonstrated by cryoelectron microscopy (cryo-EM). The viral nucleo capsid of Flavivirus is surrounded by a bilayer lipid membrane with a 25 to 30 nm diameter derived from the host cells, in which viral glycoproteins are inserted.[5,6]

History and Epidemiology of Zika Virus[8,10,12]

Before the first large outbreak of Zika virus infection on yap island, federated states of Micronesia, only sporadic cases and serological evidence of Zika virus were reported in western and central Africa and ported in western and Central Africa and south-east Asia, but in 2007 Zika virus emerged as an important human pathogen. An increased incidence of cases of the guillain- barre syndrome was reported after a larger epidemic of Zika virus infection in French Polynesia in 2013. In 2014, autochthonous transmission of Zika virus infection occurred in eastern island from February.

In early 2015, several cases presenting a "dengue like syndrome" investigated in Brazil[9] (a non -dengue virus and non -chikungunya virus infection) and Zika virus was detected by reverse transcription polymerase chain reaction assay and confirmed by DNA sequencing. The Brazil Zika virus strain shares a common ancestor with the Zika virus strain that circulated in French Polynesia. On July 2015, in the state of Bahia, brazil, an increase in the number of Guillain -barre syndrome cases in which half of them had reported symptoms consistent with Zika virus infection. In January 2016, an unusually significant increase of GBS was reported in Salvador. An emergency committee was convened by the director -general of WHO, under the international health regulations on 1 February 2016, and finally announced "the recent cluster of microcephaly and other neurologic disorders reported in brazil to be a PHEIC.

Studies reported that ZIKV has three main lineages, two from Africa and one from Asia. The African lineage split in East and West African clusters. Asian lineage presents expanded geographical distribution, since it emerged in the Pacific Ocean and South America. The 2015–16 epidemic occurred in the America was due to strain of the Asian lineage generally known as the American strain. However, some consider the American outbreak strain as its own lineage. Epidemiology studies revealed distribution of ZIKV in half of the North African continent, Vietnam, Malaysia, Indonesia, Philippines, India, Thailand and Pakistan. The first

human case was detected in Uganda in 1952 during a study indicating the presence of neutralizing antibodies to ZIKV in sera. Only few cases of infection in human were reported before 2007 when outbreak of ZIKV infection in humans occurred in Yap, Federated States of Micronesia, in the Pacific region. In French Polynesia the largest epidemic of ZIKV occurred during 2013 to 2014 and extended to New Caledonia, Cook Islands, Vanuatu, Easter Island, Solomon Islands and other Pacific Islands. ZIKV transmission is known in 55 countries and territories. However, only in 2015 to 2016, indigenous transmission has been reported for 41 of them.

SYMPTOMS OF ZIKA VIRUS

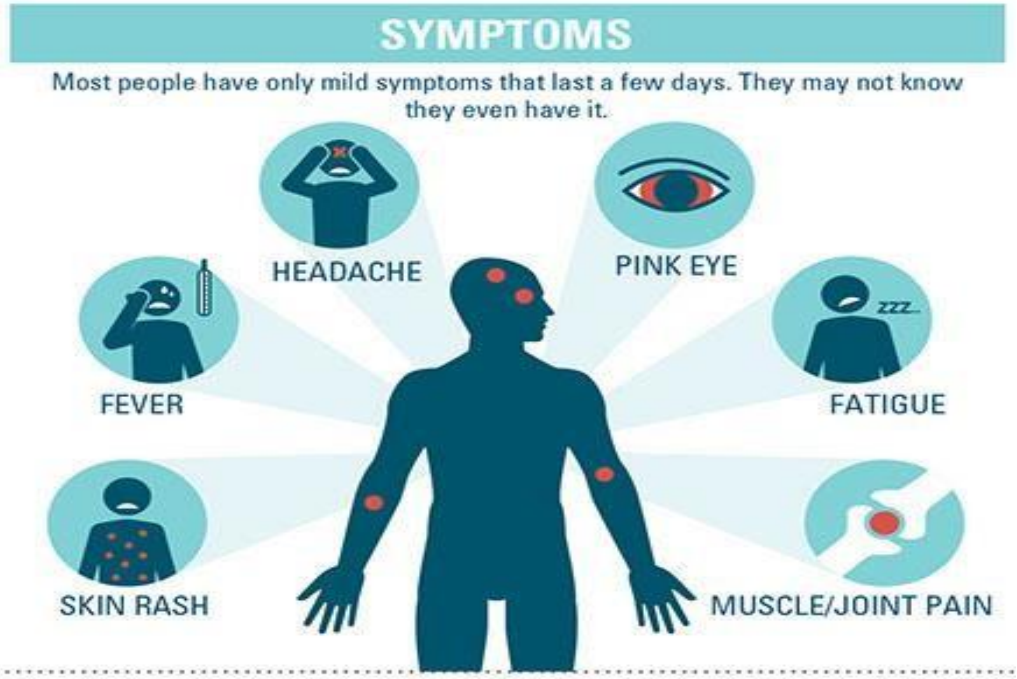

Fig 1: Common symptoms of Zika virus.

RISK FACTORS OF ZIKA VIRUS

The factors that increase the risk of Zika virus disease include:

- ✓ Mosquito bites in endemic areas.
- ✓ The most potent risk factors related to contracting Zika virus are travelling to endemic areas, such Asia and Africa [reported prior to 2007], the Federated States of Micronesia [all cases were reported in 2015.
- ✓ Unprotected sex.
- ✓ Traveling to the areas where there are Zika outbreaks.
- ✓ Staying in Zika-infected areas.

- ✓ Blood transfusion from an asymptomatic donor in an endemic area.
- ✓ Accidental laboratory exposure [needles/sharps injury].
- ✓ Perinatal exposure.

INCUBATION PERIOD OF ZIKA VIRUS[13]

The incubation period [the time from exposure to symptoms] for Zika virus disease is not known, but is likely to be a few days to a week. The illness is usually mild with symptoms lasting for several days to a week.Zika virus usually remains in the blood of an infected person for a few days but it can be found longer in some people. In acute: 3 to 10 days after onset of symptoms. Convalescent: 2-3 weeks after acute sample. Incubation period for Zika virus: 3 to 14 days but may extend to a few weeks.Zika virus remains in semen and urine longer than in blood. Some infected pregnant women can have evidence of Zika virus in their blood longer than expected.

VECTOR-BORNE TRANSMISSION[14]

Like most of the flaviviruses, the main route of transmission for ZIKV is through the bite of an infected mosquito. But other modes of transmission have been reported, such as infected blood transfusion, sexual transmission, and maternal-fetal transmission. Two distinct life cycles have been reported for ZIKV: enzootic or sylvatic cycle and epidemic or urban cycle.

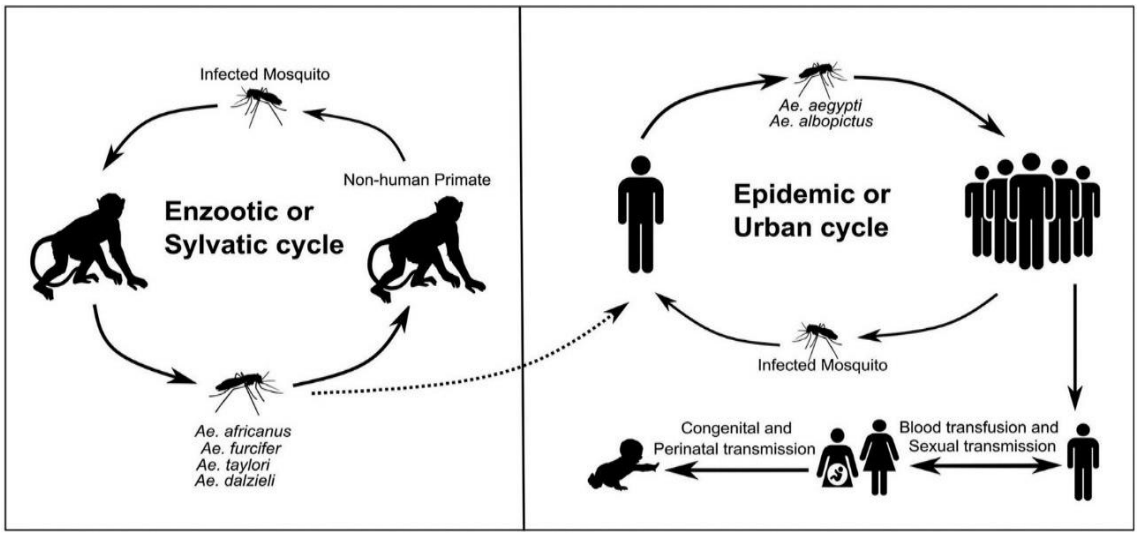

Fig 2: Transmission cycle of Zika virus.

Transmission Cycle of Zika Virus

ZIKV is maintained in nature through the enzootic or sylvatic cycle occurring between *Aedes* mosquitoes and non-human primates including apes and monkeys. The sylvatic cycle is

thought to be the reason behind the maintenance of the ZIKV lineage in Africa whereas; sylvatic transmission has not been proved in Asia. The major forest- dwelling *Aedes* mosquitoes are *A. africanus*, *A. furcifer*, *A. taylori*, and *A. luteocephalus*, which act as enzootic vectors in Africa. Humans are the incidental host in such a transmission cycle and further carry the virus to the epidemic or urban cycle in which human–mosquito–human transmission of ZIKV is observed. In the urban cycle, humans are the main host and serve as amplifier and carrier of infection to uninfected mosquitoes. *Aedes aegypti* and *A. albopictus* are the principal species involved in such transmissions and have been noted in the majority of ZIKV outbreaks. *Aedes aegypti* is mostly confined to tropical and subtropical regions, but *A. albopictus* is found in temperate areas along with tropical and subtropical regions, increasing the outreach of ZIKV. The other *Aedes* species reported to act as vectors in epidemic cycles were *A. hensilli* and *A. polynesiensis* during outbreaks of Yap Island and French Polynesia, respectively.

NON-VECTOR-BORNE TRANSMISSION

The majority of ZIKV transmissions are vector-borne, but it can also spread through non-vector-borne modes, including sexual transmission, materno-fetal transmission, and blood transfusion. Sexual transmission is reported in different cases especially in travelers returning from ZIKV endemic areas. ZIKV is the first arbovirus to be detected in the semen, and high viral loads have been reported from semen samples of infected individuals, indicating potential for sexual transmission. The viral RNA has also been detected in saliva and urine samples of infected individuals. Sexual transmission may enable limited subcritical transmission in areas without *Aedes* spp. In most of the cases, sexual transmission has been observed from infected males to their sex partners, but female-to-male transmission is also reported in some instances. Blood transfusion is another potential novel route for ZIKV transmission and was suspected during the French Polynesian outbreak in 2013–2014. The viral RNA was detected among 2.8% asymptomatic blood donors in the region during ZIKV outbreak. In 2016, confirmed cases of viral transmission by blood transfusion were reported from Brazil.

MOTHER TO CHILD TRANSMISSION[12]

A mother already infected with Zika virus near the time of delivery can pass on the virus to her newborn baby around the time of birth. It is possible that Zika virus could be passed from mother to foetus during pregnancy. To date, there are no reports of infants getting Zika virus

through breastfeeding. Because of the benefits of breastfeeding, mothers are encouraged to breastfeeding even in areas where Zika virus is focused.

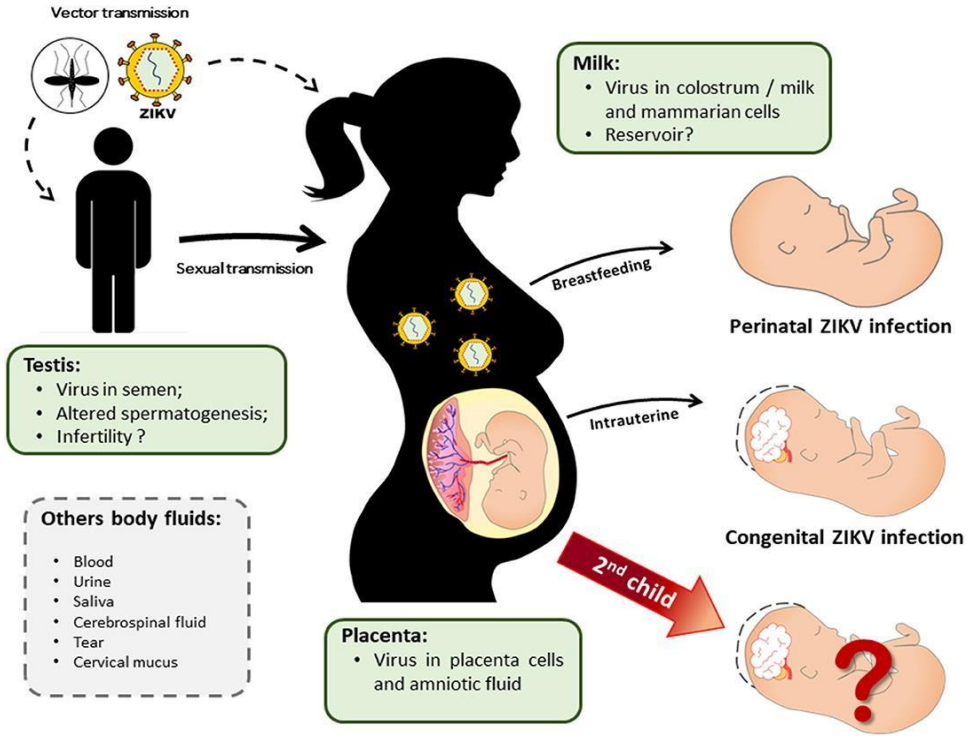

Fig. 3: Zika virus vertical transmission from mother to child.

Effect of Zika Virus Mainly on Fetus through Pregnant Women

It is possible that Zika virus could be passed from mother to fetus during pregnancy. Zika virus can also cross the placenta, affecting an unborn foetus. Hence, this Zika virus infection during pregnancy can cause foetal abnormalities and other congenital malformations and also infants to be born with microcephaly and guillian barre syndrome as well as pre term birth and miscarriage. Microcephaly is a neuro development disorder which is spread from pregnant women to her unborn baby, where an infants head does not develop normally and remains abnormally small when compared to the heads of others same age and sex. Therefore, these type of infected microcephaly babies brain may not have developed properly and develop a problems like abnormal growth, developmental delays, loss of hearing ,eye problems like conjunctivitis etc., can be effected from Zika virus infected pregnant women to fetus.

COMPLICATIONS OF ZIKA VIRUS[7]

World Health Organization (WHO) has declared the spread of the Zika virus as a public health emergency due to the complications that arise from this virus.

The severe dehydration Guillain-Barre syndrome (a condition where your immune system attacks your nerves, leading to muscle weakness and even paralysis)

- Congenital malformations, especially microcephaly
- Miscarriage and stillbirth in pregnant women
- Premature birth
- Eye problems in infants with Zika-related microcephaly, such as defects in the retina or the optic nerve, which could lead to blindness later in life
- Hearing impairment.
- Acute Disseminated Encephalomyelitis (ADEM), which is inflammation in the brain and spinal cord that damages the myelin or the protective covering of nerve fibers, gradually leading to visual loss, and weakness to the point of paralysis.

DIAGNOSIS OF ZIKA VIRUS[14]

- It is often recommended to get a diagnosis for the Zika virus within a week after observing symptoms or if you have recently traveled to Zika-affected areas.
- The Zika infection is diagnosed through the following methods:
- Evaluating medical history, if there is a travel history to high-risk countries having an active Zika virus outbreak. Physical examination to look for signs and symptoms.
- Blood and urine tests and other laboratory tests to detect Zika infection.

Ultrasound (USG test)

- Ultrasounds (every 3 to 4 weeks) are recommended for pregnant Zika-infected mothers. The USG test can identify several fetal brain disorders, including microcephaly and intracranial calcifications in the fetus.

Treatment of Zika Virus

- The Zika virus disease has no specific medication or vaccination usually; therapy aims to reduce Zika symptoms. Most people generally recover on their own with the help of adequate rest and supportive treatment.
- The Zika virus treatment method includes following:
- ✓ Drink enough fluids such as water, fruit juices, buttermilk, and coconut water to avoid dehydration.
- ✓ Take enough rest because the infection can cause exhaustion and fever.
- ✓ As directed by the physician, use paracetamol in case of pain or fever.
- ✓ Pregnant women staying in highly affected Zika virus areas should take precautions to

avoid mosquito bites by using mosquito repellants, use bed nets, etc.,

PREVENTION OF SEXUAL TRANSMISSION

Zika virus can be sexually transmitted from a person who has Zika to his or her sex partners, even if asymptomatic. WHO recommends that sexually active men or women to be counselled and offered a full range of contraceptive methods includes following: oral contraceptive pills, implants, injectables, patches, vaginal rings, intra uterine devices, condoms, male and female sterilization, lactational amenorrhea methods, withdrawal and fertility awareness-based methods. For regions with active transmission of Zika virus, all people with Zika virus infection and their sexual partners [particularly pregnant women] should receive information about the risks of sexual transmission of Zika virus. Women who have had unprotected sex and do not wish to become pregnant due to concerns about Zika virus infection should have ready access to emergency contraceptive services and counselling. Pregnant women should practice safer sex [including correct and consistent use of condoms] or abstain from sexual activity for at least entire duration of pregnancy.

CONCLUSION

Zika infection has emerged as a substantial concern to public health, and the virus epidemiological similarities to chikungunya and dengue make it a viable contender for becoming a worldwide health issue. The latest Indian outbreak and the explosive outbreak in Brazil have previously revealed ZIKV's propensity for fast population spread. Along with traditional vector control efforts, public health authorities should implement effective policies to avoid non-vector-borne transmissions. Extensive animal model research is required to fully understand the pathophysiology and relationship of ZIKV with neurological and immunological complications. It is difficult to foresee the next ZIKV pandemic, but with efficient monitoring studies, accurate and speedy diagnosis, and the development of targeted antivirals and vaccines, we can better manage and control this new pathogen.

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