A Comprehensive Review on Human Virus

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Abstract:

Zika virus is a mosquitoborne flavivirus that is the focus of an ongoing pandemic and public health emergency. In this review, we discuss different basic and clinical aspects of Zika virus infection including virology, epidemiology and pathogenesis of disease. Nipah virus (NiV) is a paramyxovirus responsible for a high mortality rate zoonosis. As a result, it has been included in the list of Blueprint priority pathogens. Bats are the main reservoirs of the virus, and different clinical courses have been described in humans.Ebola Virus Disease (EVD), also known as Ebola Hemorrhagic Fever (EHF), initially emerged over 40 years ago in the Democratic Republic of Congo. Endemic to Africa.In this review basically focused on the structure,clinical features, epidemiology and prevention. Dengue is an acute viral illness caused by RNA virus of the family Flaviviridae and spread by Aedes mosquitoes. Presenting features may range from asymptomatic fever to dreaded complications such as hemorrhagic fever and shock. Chikungunya virus (CHIKV), a reemerging arbovirus, causes a crippling musculoskeletal inflammatory disease in humans characterized by fever, polyarthralgia, myalgia, rash, and headache.This article provide a detailed overview on structure,clinical feature,epidemiology and dengue prevention and management of the respective virus.

Keywords: Nipah virus,Zika virus,Ebola virus,Dengue virus ,Chikungunya virus

INTRODUCTION

1.Zika virus[1]

Zika virus is a mosquito-borne virus first identified in Uganda in 1947 in a Rhesus macaque monkey followed by evidence of infection and disease in humans in other African countries in the 1950s.From the 1960s to 1980s, sporadic human infections were detected across Africa and Asia. However, since 2007 outbreaks of Zika virus disease have been recorded in Africa, the Americas, Asia and the Pacific.In outbreaks over the last decade Zika virus infection was found to be associated with increased incidence of Guillain-Barré syndrome. When Zika virus emerged in the Americas, with a large epidemic in Brazil in 2015, an association between Zika virus infection and microcephaly (smaller than normal head size) was first described; there were similar findings in French Polynesia upon retrospective review. From February to November 2016, WHO declared a Public Health Emergency of International Concern (PHEIC) regarding microcephaly, other neurological disorders and Zika virus, and the causal link between Zika virus and congenital malformations was soon confirmed *(1,2)*. Outbreaks of Zika virus disease were identified throughout most of the Americas and in other regions with

established *Aedes aegypti* mosquitos. Infections were detected in travellers from active transmission areas and sexual transmission was confirmed as an alternate route of Zika virus infection.

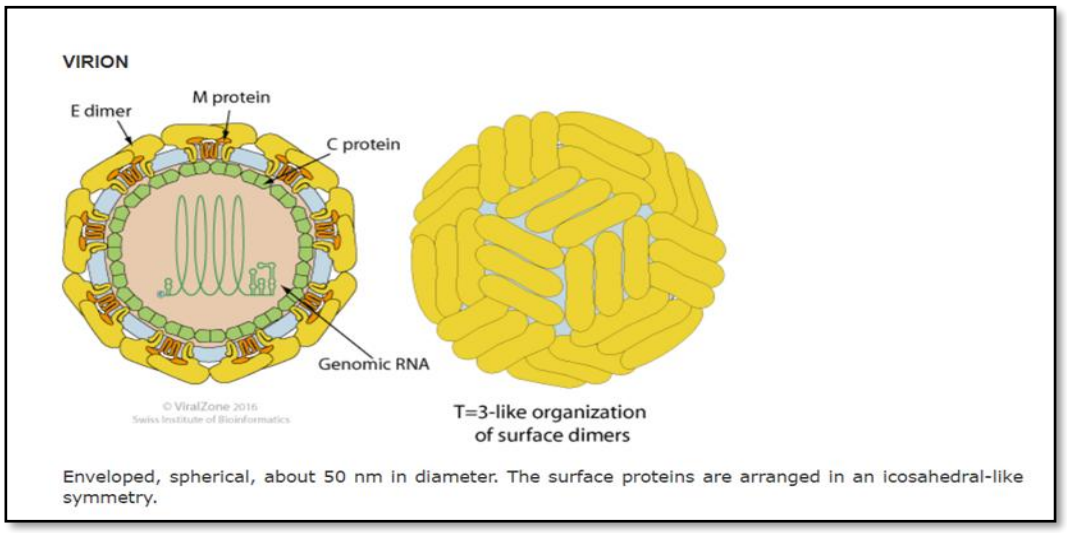

Figure-1: Zika virus

Clinical Features [2]

- Fever.
- Headache.
- Joint pain.
- Redness in the whites of your eyes (pink eye/conjunctivitis).
- Rash that's a mix of raised and flat red areas of skin (maculopapular), which can be itchy.

Epidemiology[2]

- **Mosquitoes.** The most common way to get Zika is through the bite of *Ae. aegypti* and *Ae. albopictus* mosquitoes. You can find these mosquitoes in many parts of the world, including the U.S. They spread Zika when they bite someone who's infected and then bite someone else.
- **Pregnant woman to fetus.** If you're pregnant and have a Zika infection, it can pass through the placenta to the fetus. Zika can cause your child to be born with congenital (present at birth) conditions like microcephaly.
- **Sexual contact.** Zika virus can stay in body fluids, like semen, for weeks to months after an infection, even if you never had symptoms or your symptoms have gone away. It can spread to other people through oral, anal or vaginal sex.
- **Blood transfusion.** Health officials have reported Zika transmission through blood transfusions in Brazil and France in the past. There's never been a reported case of Zika spreading through blood transfusions in the U.S.

Prevention and Management[3]

- **Protect yourself from mosquitoes.** If you're traveling to an area with a risk of Zika or a current Zika outbreak, cover exposed skin with clothing and wear EPA-registered insect repellant. Sleep indoors in a room with screens in the windows or under a mosquito bed net. Avoid getting mosquito bites for at least three weeks after you return from travel.

- **Use condoms or abstain from sex.** If you've traveled to an area with a risk of Zika or a current outbreak, use a condom or avoid (abstain from) oral, anal and vaginal sex for three months after returning, even if you don't have symptoms.

- **Avoid traveling to areas with Zika if you're pregnant.** If you travel to an area with a risk of Zika, let your pregnancy care provider know and keep an eye out for symptoms of Zika.

2.Nipah virus[4]

Nipah virus (NiV), an RNA virus classified in the Paramyxoviridae family and Henipavirus genus alongside the Hendra virus (HeV) and Cedar virus, finds its natural reservoir in bats. Although Cedar virus exhibits no pathogenicity in animals, NiV and HeV are notorious for causing severe, potentially fatal neurological and/or respiratory diseases. Recognizing its outbreak potential, the World Health Organization (WHO) has listed NiV among the pathogens demanding urgent research and development activities. First emerging in Malaysia in 1998, NiV has since triggered multiple outbreaks in South and Southeast Asia, posing a significant threat due to its high pathogenicity across various mammalian species.

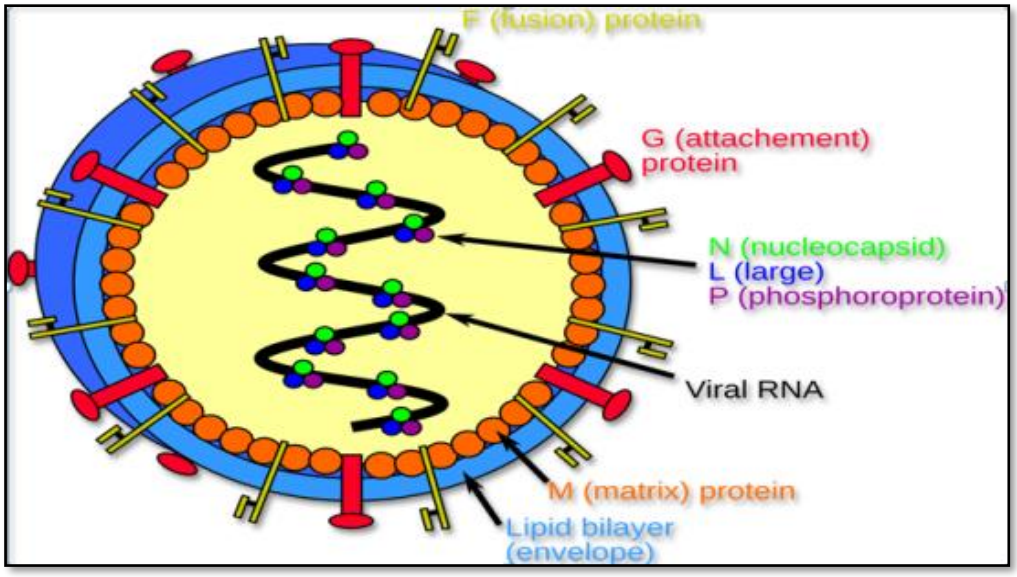

Figure-2: Nipah virus

Clinical Features [5]

- Fever: The fever is often accompanied by headaches and body aches.
- Respiratory symptoms: Nipah virus infection can cause respiratory symptoms, including cough, sore throat, and difficulty breathing
- Encephalitis: Nipah virus is known to cause severe encephalitis.
- Muscle pain: Patients infected with Nipah virus may experience muscle pain or myalgia, which can be generalized or localized.
- Gastrointestinal symptoms: Nausea, vomiting, and abdominal pain are common gastrointestinal symptoms associated with Nipah virus infection. Diarrhea may also occur.
- Hematological abnormalities: Nipah virus infection may be associated with hematological abnormalities, including lymphocytopenia (reduced lymphocyte count) and thrombocytopenia (reduced platelet count).
- Nipah virus infection can vary in severity, ranging from mild respiratory illness to severe encephalitis, with a high case fatality rate.

Epidemiology[5]

- Natural transmission of NiV occurs via inhalation or ingestion of infected material .
- In previous human outbreaks, direct contact with secretions or excretions from NiV-infected animals has also been recognized as the leading cause of infection

Prevention and Management[6]

- Early Detection: Establishing a robust surveillance system is crucial to detecting Nipah virus cases early.

- Infection Prevention and Control:This includes isolation of suspected or confirmed cases, use of personal protective equipment (PPE), hand hygiene, and disinfection of contaminated surfaces.
- Contact Tracing:. Contact tracing helps identify potential secondary cases and allows for early intervention and monitoring of exposed individuals.
- Case Management: Providing symptomatic and supportive care, including respiratory and organ support, is the mainstay of treatment.

- Public Awareness and Education: This includes educating the public about avoiding direct contact with infected bats, refraining from consuming raw date palm sap contaminated by bat saliva or urine, and practicing good hygiene measures.
- Animal Surveillance and Control: Surveillance and control measures targeting these animal populations, including culling infected or at-risk animals, can help prevent spillover events.

3.Ebola virus[7]

Ebola virus disease (EVD), formerly known as Ebola haemorrhagic fever, is a severe, often fatal illness affecting humans and other primates.The virus is transmitted to people from wild animals (such as fruit bats, porcupines and non-human primates) and then spreads in the human population through direct contact with the blood, secretions, organs or other bodily fluids of infected people, and with surfaces and materials (e.g. bedding, clothing) contaminated with these fluids.The average EVD case fatality rate is around 50%. Case fatality rates have varied from 25% to 90% in past outbreaks.The first EVD outbreaks occurred in remote villages in Central Africa, near tropical rainforests. The 2014–2016 outbreak in West Africa was the largest and most complex Ebola outbreak since the virus was first discovered in 1976. There were more cases and deaths in this outbreak than all others combined. It also spread between countries, starting in Guinea then moving across land borders to Sierra Leone and Liberia.It is thought that fruit bats of the Pteropodidae family are natural Ebola virus hosts.

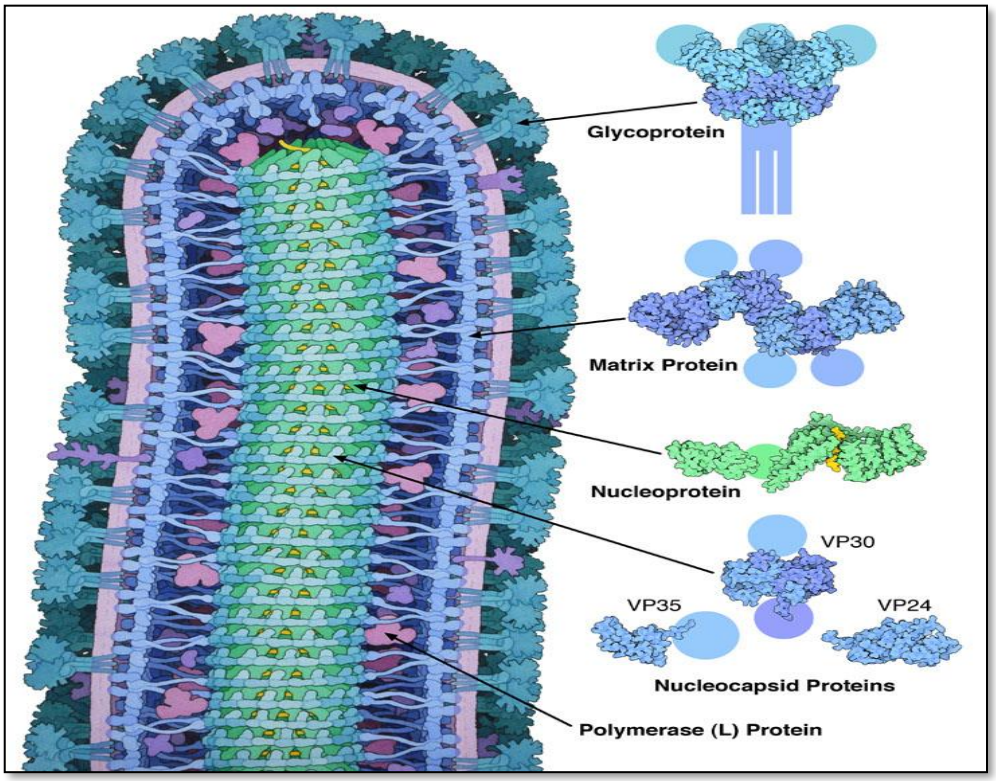

Figure-3: Ebola virus

Clinical Features [8]

Fever, fatigue, muscle, pain, headache, and sore throat. This is followed by vomiting, diarrhea, rash, symptoms of impaired kidney and liver function, and in some cases internal and external bleeding (e.g. oozing from the gums, blood in the stools). Laboratory findings include low white blood cell and platelet counts and elevated liver enzymes.

Epidemiology[8]

- It is thought that fruit bats of the Pteropodidae family are natural Ebola virus hosts.
- Ebola is introduced into the human population through close contact with the blood, secretions, organs or other bodily fluids of infected animals such as chimpanzees, gorillas, fruit bats, monkeys, forest antelope and porcupines found ill or dead or in the rainforest.
- Once infection occurs in humans, there are several ways Ebola can spread to others, including through direct contact (through broken skin, mucous membranes - eyes, nose, mouth, etc.) with: blood or body fluids (including but not limited to urine, saliva, sweat, feces, vomit, breastmilk, semen) of a person who is sick with Ebola objects contaminated with the virus (e.g., needles, syringes).
- Risk is highest during the late stages of the illness when the patient is vomiting, having diarrhea, or hemorrhaging, and at death if unprotected contact with the corpse occurs.
- Post-mortem infection has been linked to the preparation of the body for burial and during burial rituals or funeral services. Ebola is not spread through the air.

Prevention and Management[9]

- There is no proven treatment for Ebola but simple interventions early on can significantly improve chances of survival. This includes rehydration with fluids and body salts (given orally or intravenously), and treatment of specific symptoms such as low blood pressure, vomiting, diarrhea and infections.
- A range of potential treatments including blood products, immune therapies and drug therapies are currently being evaluated.
- Hand hygiene is the most effective way to prevent the spread of the Ebola virus.
- An experimental Ebola vaccine known as rVSV-ZEBOV proved highly protective against the deadly virus in a major trial in Guinea in 2015. It is being used in response to the current outbreak in the Democratic Republic of the Congo using a ring vaccination protocol.
- During an outbreak, health partners apply a package of interventions including case management, surveillance, contact tracing, laboratory testing, safe burials and community engagement.
- Working with communities to reduce risk factors for Ebola transmission is critical to controlling outbreaks.

4.Dengue virus[10]

Dengue (pronounced DENgee) fever is a painful, debilitating mosquito-borne disease caused by any one of four closely related dengue viruses. These viruses are related to the viruses that cause West Nile infection and yellow fever.An estimated 400 million dengue infections occur worldwide each year, with about 96 million resulting in illness. Most cases occur in tropical areas of the world, with the greatest risk occurring in:

- The Indian subcontinent
- Southeast Asia
- Southern China
- Taiwan
- The Pacific Islands
- The Caribbean (except Cuba and the Cayman Islands)
- Mexico
- Africa
- Central and South America (except Chile, Paraguay, and Argentina)

The structure of the dengue virus is roughly spherical, with a diameter of approximately 50 nm (1 nm is one millionth of 1 mm) (Figure 3). The core of the virus is the nucleocapsid, a structure that is made of the viral genome along with C proteins. The nucleocapsid is surrounded by a membrane called the viral envelope, a lipid bilayer that is taken from the host. Embedded in the viral envelope are 180 copies of the E and M proteins that span through the lipid bilayer. These proteins form a protective outer layer that controls the entry of the virus into human cells.

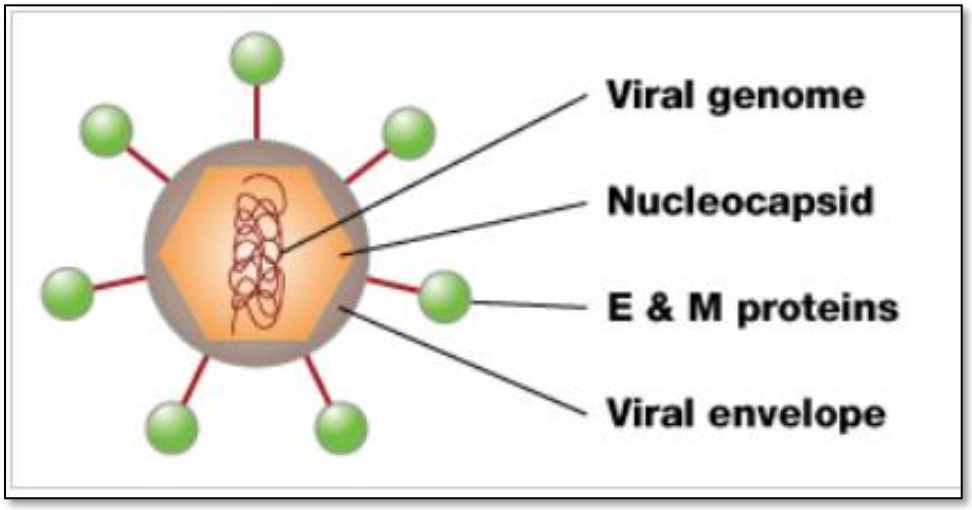

Figure-4: Dengue virus

Clinical Features[11]

Symptoms, which usually begin four to six days after infection and last for up to 10 days, may include

- Sudden, high fever

- Severe headaches
- Pain behind the eyes
- Severe joint and muscle pain
- Fatigue
- Nausea
- Vomiting
- Skin rash, which appears two to five days after the onset of fever
- Mild bleeding (such a nose bleed, bleeding gums, or easy bruising)

Epidemiology[11]

For transmission to occur, the mosquito must feed on a person during a 5-day period when large amounts of virus are circulating in the person's blood; this period usually begins before the person develops illness symptoms. Some people will not have significant symptoms but can still infect mosquitoes. Once the virus enters the mosquito, the virus will then require an additional 8–12 days incubation before it can then be transmitted by mosquito bite to another human. The mosquito remains infected for the remainder of its life, which might be days or a few weeks. In rare cases dengue can be transmitted in organ transplants or blood transfusions from infected donors, and there is evidence of transmission from an infected pregnant mother to her fetus. But in the vast majority of infections, a mosquito bite is responsible.

Prevention and Management[12]

The best way to prevent the disease is to prevent bites by infected mosquitoes, particularly if you are living in or traveling to a tropical area. This involves protecting yourself and making efforts to keep the mosquito population down. In 2019, the FDA approved a vaccine called Dengvaxia to help prevent the disease from occurring in adolescents aged 9 to 16 who have already been infected by dengue. But, there currently is no vaccine to prevent the general population from contracting it.

5.Chikungunya Virus[13,14]

Chikungunya (CHIKV) is a virus that spreads to people through mosquito bites — specifically, through the *Aedes aegypti* mosquito and *Aedes albopictus* mosquito. Chikungunya infection happens when a mosquito with the virus bites a person. The virus doesn't spread from person to person through bodily contact or saliva, although blood transmission may be possible.

CHIKV is a single-strand RNA virus composed of 11,600 nucleotides coding four nonstructural proteins (nsP1-nsP4) and three structural proteins. The structural proteins are the capsid and two envelope glycoproteins: E1 and E2, which form heterodimeric spikes on the viron surface (Figure 1). E2 binds to cellular receptors in order to enter the host cell through receptor-mediated endocytosis. E1 contains a fusion peptide which, when exposed to the acidity of the endosome in

eukaryotic cells, dissociates from E2 and initiates membrane fusion that allows the release of nucleocapsids into the host cytoplasm, promoting infection. Subsequently, the nucleocapsid disassembles in the cytoplasm, releasing the viral genomic RNA. The mature virion contains 240 heterodimeric spikes of E2/E1, which after release, bud on the surface of the infected cell, where they are released by exocytosis to infect other cells. Figure 2 indicates the CHIKV replication cycle in vertebrate cells.

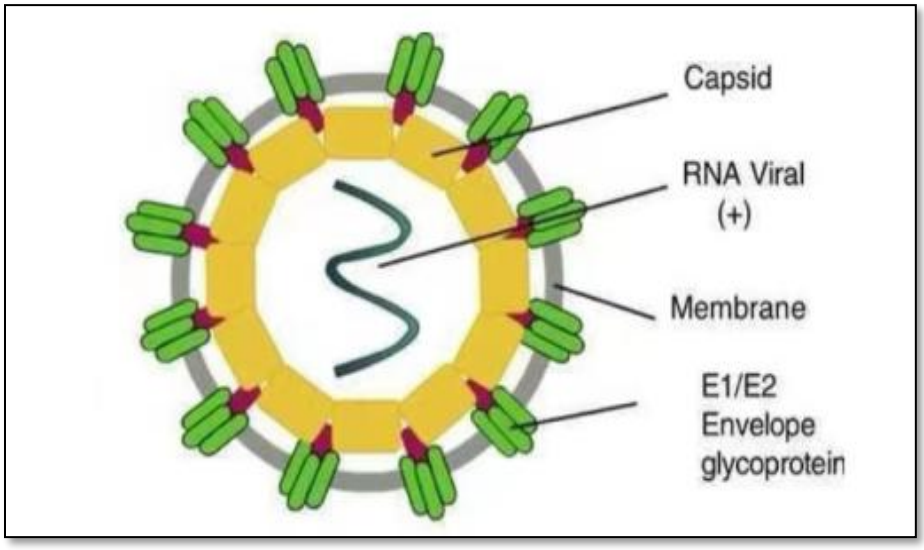

Figure-4: Chikungunya Virus

Clinical Features

Most people infected with chikungunya virus will develop some symptoms.Symptoms usually begin 3–7 days after being bitten by an infected mosquito.

- The most common symptoms are fever and joint pain.
- Other symptoms may include headache, muscle pain, joint swelling, or rash.
- Chikungunya disease does not often result in death, but the symptoms can be severe and disabling.
- Most patients feel better within a week. In some people, the joint pain may persist for months.
- People at risk for more severe disease include newborns infected around the time of birth, older adults (≥65 years), and people with medical conditions such as high blood pressure, diabetes, or heart disease.
- Once a person has been infected, he or she is likely to be protected from future infections.

Epidemiology

Transmission of CHIKV occurs mainly through the bite of an infected Aedes (subgenus Stegomyia) species of mosquito. However, maternal-fetal transmission can occur intrapartum, which results in high rates of infant morbidity. Historically,

CHIKV has been endemic in tropical and subtropical regions of sub-Saharan Africa and Southeast Asia, where two distinct CHIKV transmission cycles exist. CHIKV is maintained in a rural enzootic transmission cycle, which occurs between various forest or savannah Aedes (Stegomyia) mosquitoes and animal reservoirs, with nonhuman primates being the presumed major reservoir host. Occasional introduction of the virus into urban areas is thought to cause periodic outbreaks of CHIKV disease. Urban transmission is mediated primarily by Aedes aegypti or Aedes albopictus mosquitoes and occurs in a human-mosquito-human transmission cycle. While enzootic sylvan transmission of CHIKV has been well established in Africa, outbreaks in Asia have been mainly attributed to urban human-mosquito-human transmission, although there is limited evidence for enzootic transmission . Little is known about the factors contributing to the natural maintenance of CHIKV but understanding catalysts that promote CHIKV maintenance and spillover dynamics is essential to combatting emergence and spread of the virus.

Prevention and Management

There is no vaccine to prevent or medicine to treat chikungunya virus.So only symptomatic treatment done by

- Get plenty of rest.
- Drink fluids to prevent dehydration.
- Take medicine such as acetaminophen (Tylenol®) or paracetamol to reduce fever and pain.
- Do not take aspirin and other non-steroidal anti-inflammatory drugs (NSAIDS until dengue can be ruled out to reduce the risk of bleeding).
- If you are taking medicine for another medical condition, talk to your healthcare provider before taking additional medication.

CONCLUSION

This concluding chapter explains that as viruses like Zika virus, Nipah virus, Ebola virus, Dengue virus and Chikungunya virus. The history of viruses and people is an account of the world and the events that shape it. In the end, the splendor of human history is not in wars won, dynasties formed, or financial empires built but in improvement of the human condition. The obliteration of diseases that impinge on people's health is a regal yardstick of civilization's success, and those who accomplish that task will be among the true navigators of a brave new world.

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