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Muhammad Muzammal
Gomal Centre of Biochemistry and
Biotechnology, Gomal University, Dera
Ismail Khan, KPK, Pakistan

Safeena Sadiq
Department of Environmental Sciences and
Engineering, Donghua University,
Shanghai, China

Muhammad Zeeshan Ali
Gomal Centre of Biochemistry and
Biotechnology, Gomal University, Dera
Ismail Khan, KPK, Pakistan

Safeer Ahmad
Gomal Centre of Biochemistry and
Biotechnology, Gomal University, Dera
Ismail Khan, KPK, Pakistan

Inayat Ullah
Gomal Centre of Biochemistry and
Biotechnology, Gomal University, Dera
Ismail Khan, KPK, Pakistan

Saima Mashal
Gomal Centre of Biochemistry and
Biotechnology, Gomal University, Dera
Ismail Khan, KPK, Pakistan

Sana Saleem Jan
Gomal Centre of Biochemistry and
Biotechnology, Gomal University, Dera
Ismail Khan, KPK, Pakistan

Rizwan
Gomal Centre of Biochemistry and
Biotechnology, Gomal University, Dera
Ismail Khan, KPK, Pakistan

Sohail Ahmad
Gomal Centre of Biochemistry and
Biotechnology, Gomal University, Dera
Ismail Khan, KPK, Pakistan

Saqib Ali Rustam
Faculty of Veterinary and Animal Sciences,
Gomal University, Dera Ismail Khan, KPK,
Pakistan

Shawana Huma
Gomal Centre of Biochemistry and
Biotechnology, Gomal University, Dera
Ismail Khan, KPK, Pakistan

Muhammad Hanif
Gomal Centre of Biochemistry and
Biotechnology, Gomal University, Dera
Ismail Khan, KPK, Pakistan

Inam Ullah
Department of Biological Sciences,
International Islamic University,
Islamabad, Pakistan

Syeda Tehzeeb Zahara
Department of Zoology, Government
College University, Lahore, Pakistan

Corresponding Author:
Muhammad Muzammal
Gomal Centre of Biochemistry and
Biotechnology, Gomal University, Dera
Ismail Khan, KPK, Pakistan

Chikungunya virus: An emerging Arbovirus

Muhammad Muzammal, Safeena Sadiq, Muhammad Zeeshan Ali, Safeer Ahmad, Inayat Ullah, Saima Mashal, Sana Saleem Jan, Rizwan, Sohail Ahmad, Saqib Ali Rustam, Shawana Huma, Muhammad Hanif, Inam Ullah and Syeda Tehzeeb Zahara

Abstract

Chikungunya virus (CHIKV) is an “alpha virus” and female mosquitoes of *Aedes* species is blamable for the virus transmission, particularly by “*Aedes aegyptius*” and “*Aedes albopictus*”. Major sign of Chikungunya virus are temperature (severe) & body pain. Other features include headache, joint and muscle swelling, skin rashes. Although Chikungunya virus is not deadly but its features can be severe and cause serious damage. Just like other mosquitos borne diseases, important prevention for Chikungunya is to prevent from mosquito bite. It is essential to contrivance different protocols of affected individual care, in which main care procedures plays the important role.

Keywords: Chikungunya virus, mosquitos, patient, headache, swelling

1. Introduction

Chikungunya virus is the member of “Togaviridae” family and abbreviated as ‘CHIKV’ belongs and its genus is genus Alpha virus. CHIKV is an alpha virus. It is only spread by female mosquitoes of “*Aedes* species “bite, particularly by “*Aedes aegyptius*” & “*Aedes albopictus*” [1]. Chikungunya virus (Based on E1 gene Sequence) is categorized into three ancestries 1) “Asian”, 2) “East/Central/ South African” (ECSA), and 3) “West African” [1]. Chikungunya virus is widespread Africa and South-East Asia. In African countries, Chikungunya virus has been found to mingle in a “sylvatic cycle” among forest-dwelling *Aedes spp.* (mosquitoes, squirrels, birds, wild primates, and rodents) [2]. Therefore, human outbreaks occur only, when the virus outflows from the forest cycle to an epizootic savannah or woodland cycle [2]. While, in Asia, Chikungunya virus moves between mosquitoes and naive human hosts in an “urban cycle” [2]. CHIKV is RNA (+ strand) virus and icosahedral shape. It contains 11.8 kb RNA and its size (diameter) is about 70nm [3,4]. On its envelop, it has about 240 ‘heterodimers of trans membrane glycoprotein’ (E1 and E2). On its surface, it also possesses 80 trimetric spikes. It also contains small peptides i.e. E3 and 6K in its structure. Among these peptide, function of 6K glycoprotein is the assembly of virus after replication. While the function of E3 peptide is the formation of spikes with the help of E2 peptide [5]. Replication of virus not like other mammalian cells but it is similar to other viral cells i.e. need host machine to replicate in the host cells. It takes about 10-16 hours for the virus to replicate in the host cell after infection and in mammals the virus replicates at 37° C in less than 8-10 hours after infection [6].

2. Isolation of Chikungunya virus

Isolation and History of Chikungunya virus is in table 1

3. Sign and Symptoms of Chikungunya virus.

Major sign and symptoms includes fever (severe) and joint/muscle pain. Other features include headache, joint and muscle swelling, skin rashes. Although Chikungunya virus is not deadly but its symptoms can be severe, cause serious damage, long lasting but rarely fatal. Infants, who are diseased around birth time, adults (≥65) and patients with high blood pressure, diabetes or other chronic disease are more disposed or at higher threat for highly severe disorder. It has been documented that that if an individual is diseased once, one will probable to be immune for this disorder in future [9].

Main differential phenotypes of Chikungunya virus and related mosquitos borne disorders are in table 2.

Table 1: History of Chikungunya virus

Year	Countries	Approximate Cases	Reference
1953	Tanzania	N/A	7
1958-1973	Bangkok, Thailand And other Asian countries	N/A	8
2004	Kenya	N/A	2
2006	French Island of La Réunion	300,000	8
2006	Italy and France and Srilanka	200	2
2008	Bangladesh	N/A	9
2013	The island of Saint Martin(America)	N/A	8
2013-To date	Caribbean & many countries of Central America	1000,000	8

(N/A=Date Not available)

Table 2: Common resemblance between mosquitoes borne disorders with Chikungunya virus

Disease	Fever	Headache	Eye Pain	Fatigue	Vomit	Skin Rash	Severe Joint and Muscle Pain.	Joint Swelling	Diarrhea	Shaking Chills
Dengue Fever	Present	Present	Present	Present	Present	Present	Present	Absent	Absent	Absent
Malaria	Present	Present	Absent	Absent	Present	Absent	Absent	Absent	Absent	Absent
Chikungunya	Present	Present	Absent	Absent	Absent	Present	Present	Present	Present	Present
Yellow Fever	Present	Present	Absent	Absent	Present	Absent	Absent	Absent	Absent	Absent
West Nile Virus	Present	Present	Absent	Absent	Absent	Present	Absent	Present	Absent	Absent

4. Prevention of Chikungunya virus

Presently the control of Chikungunya virus infection is mainly based on meddling with virus spread [10]. Just like other mosquitoes borne diseases, important prevention for Chikungunya is to prevent from mosquitoes bite. Other important preventions are in Figure 1.

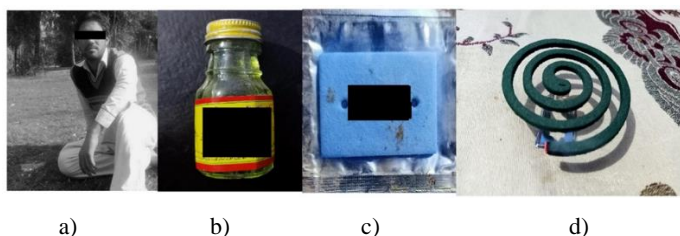


Fig 1: Common remedies to avoid mosquitoes borne disorders

- a) Using full slaves dress during night can be handy,
- b) commercially available mosquito’s repellent oil,
- (c and d) Using commercially available mosquitoes repellent bars.

5. Treatment

Although no proper vaccine/antiviral medications are available in the market for the management of this virus but use of antipyretic, anti-inflammatory, anti-allergic, analgesic drugs (oral/injection) of different pharmaceuticals companies can be handy [10].

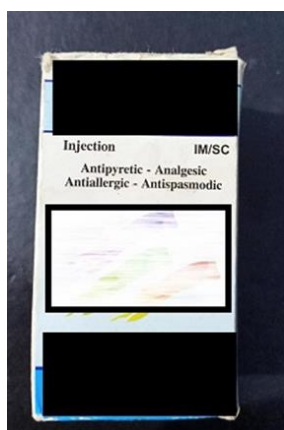


Fig 2: Commercially available drug that can be handy for treatment of Chikungunya virus.

6. Transmission of Chikungunya virus.

Chikungunya virus’s transmission consists of two cycles as described below.

6.1 The Urban Cycle

This cycle includes the transmission of virus from affected man to mosquitoes and then from the carrier mosquitoes to normal individuals by the bite of carrier mosquitoes as illustrated in figure 3. In Asian countries the urban cycle is followed by chikungunya virus. In this cycle the human, acts as hosts and the female mosquitoes work as ‘vectors’. “*Aedes aegypti*” adopted himself in urban areas and it is the major route for the spread of Chikungunya virus.

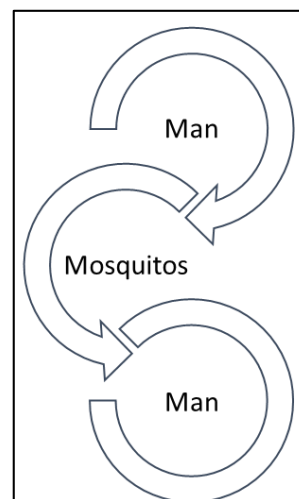


Fig 3: Common urban cycle of Chikungunya virus

6.2 The sylvatic cycle.

This cycle includes the transmission of virus from affected animal to mosquitoes and then from the carrier mosquitoes to normal individuals by the bite of carrier mosquitoes as illustrated in figure 4. This cycle is communal in African countries and is preserved between wild ecology and ‘*Aedes*’ species of forest mosquitoes. Among them: “*Aedes fuscifer*”, “*Aedes luteocephalus*”, “*Aedes taylori*” & “*Aedes africanus*” are common.

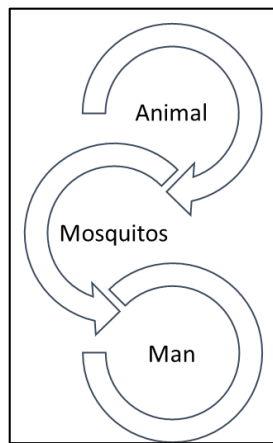


Fig 4: The sylvatic cycle of Chikungunya virus

7. Pathogenesis

Bite of female mosquito is responsible for the spread of CHIKV [11]. Plague-ridden mosquitoes nibble the host and infects through the skin. Virus is spread over fibroblasts and dermal macrophages [12, 13]. Replication of virus initiates host immunity [14, 15]. Via circulatory system. The virus quickly distributes into lymph nodes [11]. Virus replication in the body central tissue occurs and the virus can be spread through the mosquito bite [16]. When it (CHIKV) reaches target tissues (muscle, joints, the liver and the brain) resistant response is produced [17]. After the infection virus uses host machinery to replicate itself in the host cell but due to host innate immune response, cell apoptosis occurs. Apoptosis blebs are released from the affected dying cells and it increases the chance to affect the neighboring normal cell. In the body IFN type I cells play significant role in viral infection and provide antiviral pathway [12]. In case of CHIKV infection, 'IFN- α ' and 'IFN- β ' plays an important role [18]. As the virus infects knee-joints, so the level of 'IL-6 cells' increases in the body and cause persistent arthralgia [20]. Joint inflammation is also triggered by high level of 'NK cells' [19]. Again, macrophages in the blood system can spread infection and it aids as a pool for more viral infection [21].

8. Detection of Chikungunya virus

Most common methods to detect Chikungunya virus in through blood test by "Chikungunya virus ELISA Kit" or "Anti-CHIKV IGM" detection kit and PCR. Viral isolation must be performed by blood samples taken before or on around the 8th day of infection [22].

9. Conclusion

From the literature, it has been concluded that Chikungunya virus can cause severe phenotypes so its prevention is very necessary. However, if someone is affected, early detection and treatment is very necessary to overcome the severity of Chikungunya virus. This review is very helpful to understand the causes, prevention and treatment of Chikungunya virus for the readers.

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