

Chikungunya Outbreaks and Management: A Review

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Abstract: Chikungunya is caused by arbo virus belongs to the genus alpha virus which is transmitted through mosquito of genus aedes, mainly *Ae. aegypti* and *Ae. albopictus*. These geographical genotypes exhibit differences in the transmission cycles. In contrast to Africa where Sylvatic cycle is maintained between monkeys and wild mosquitoes, in Asia the cycle continues between humans and the *Aedes aegypti* mosquito. Virus was first isolated from Africa in 1952. In India first case were reported in Kolkata 1963. It can be diagnosed by various blood tests such as RT-PCR, ELISA, serological test, etc. The disease is almost self-limiting and rarely fatal. Common symptoms of chikungunya are fever, joint pain (arthralgia), rashes, etc., symptoms for chikungunya and dengue as similar. In allopathy no specific drug is available for the treatment of chikungunya. In AYUSH system of medicine various type of treatment are available. India has been reported major outbreak in 2005-2006 mainly in the states of Andhra Pradesh, Karnataka, Maharashtra, Madhya Pradesh and Tamil Nadu, since, December, 2005. Cases have also been reported from Rajasthan, Gujarat and Kerala Chikungunya Virus (CHIKV) infection can be prevented by avoiding mosquito bites.

INTRODUCTION

Chikungunya is a communicable disease transmitted to human by infected mosquitoes. It is mainly caused by a particular species of mosquitoes of genus (Fig. 1):

- *Aedes albopictus*
- *Aedes aegypti*

Chikungunya is derived from the word Kimakode language which means (to become contorted)^[1]. It can also be spelled as chickengunea, chickengunaya,



Fig. 1: Mosquitoes can be identified by the white stripes on their black bodies and legs. They are aggressive daytime bites with peak feeding activity at dawn and dusk

chickengunya. Chikungunya is a viral disease (RNA viruses) which causes fever and stooped appearance of suffer with joint pain (arthralgia). Other symptoms include muscle pain, headache, nausea, fatigue and rash. It has some common characteristics as like that of dengue so it may be undiagnosed in the area where dengue is common^[2].

The disease is caused by an arbovirus belong to the genus *alphavirus* under the family *Togaviridae*. It consist of single stranded RNA genome of about 60-70 nanometer diameter capsid and phospholipids envelope^[1]. Chikungunya disease was first detected in 1952 in Africa, Tanzania^[1].

Vectors of chikungunya: Chikungunya fever is transmitted by the bites of mosquitoes *Ae. aegypti* is considered to be the principal vector and *A. albopictus* (Asian Tiger mosquito) has also recently emerged as an important vector^[3]. Bite of only the female mosquito is considered to be infective because a blood meal is required for the formation of the egg^[4].

Vector mosquitoes ingest CHIKV from viremic vertebrate hosts during bleeding. During the extrinsic incubation period that occurs in the vector, CHIKV infects the midgut and disseminates through the body cavity to infect salivary glands for secretion into saliva. Re-feeding vectors transmit CHIKV to vertebrate hosts by expectorating virus in saliva. New vectors perpetuate the CHIKV cycle by ingesting virus during intrinsic incubation, a period of viremia in the vertebrate host. Vector competence assays test infection, dissemination and transmission of CHIKV after extrinsic incubation.

A. aegypti predominantly breeds in stored fresh water such as desert coolers, flower vases, water-tanks, etc. and in peri-domestic areas (discarded household junk items like vehicular tyres, coconut shells, pots, cans, bins, etc.) in urban and semi urban environments. Adult mosquitoes rest in cool and shady areas and bite humans during the daytime^[3].

Among the potential vectors of species of subgenus *Ae. diomorphus*, *Ae. dalzieli*, *Ae. vittatus* and *Ae. argenteopunctatus* are also thought to be involved in the transmission.

Virus: The disease is caused by an arbovirus; belong to the genus *alphavirus* under the family *Togaviridae*. It

consists of single stranded RNA genome of about 60-70 nanometer diameter capsid and phospholipids envelope. The 5' end is capped with a 7-methylguanosine while the 3' end is polyadenylated^[1].

In Africa, chikungunya virus is maintain in a sylvatic cycle which involve non-human primates and number of forest-dwelling mosquitoes^[5]. CHIKV was estimated to be in the last 300 years under a constant-population relaxed-clock model^[2].

Based on a phylogenetic analysis on partial sequences of NS4 and E1 genes showed that all earlier isolates (1963-1973) were Asian genotype whereas the 2006 and 2000 isolates were African genotype. The progenitor of the 2005-2007 viruses was found to have existed around 9 years ago and may have originated from Uganda. The A226V was present in isolates obtained from 2007 onwards in different parts of India: Tamil Nadu (2009-2010), Kerala (2009) and Orissa (2010)^[2].

The common reservoirs for chikungunya virus are monkeys and other vertebrates. In the current outbreak suspected reservoirs were macaque monkeys, lemurs and bald mouse. In the epidemic period, men also act as reservoir. The role of cattle's and rodents has also been reported in the transmission of the virus^[5].

Sign and symptoms: Symptoms generally start 4-7 days after the mosquito bites (Table 1). Commonly seen fever accompanied by joint pain muscle pain, headache, nausea, fatigue, redness of eye. The fever can reach up to 104°C.

Severity of the joint pain depends upon the various stages of disease (acute, sub-acute and chronic). The acute phase is characterized by painful polyarthralgia, high fever, asthenia, headache, vomiting, rash and myalgia, throat discomfort, abdominal pain and constipation may also be evident. Conjunctival suffusion, persistent conjunctivitis, cervical or sometimes generalized lymphadenopathy may be present^[6].

In the chronic phase, is characterized by unpredictable relapses that include sensation of fever, asthenia and exacerbation of arthralgias and stiffness. Affected patients may manifest inflammatory polyarthritis, severe sub acute tenosynovitis/bursitis (consequently nerve tunnel syndromes) in hands, wrists and exacerbation of pain on movement in previously injured joints^[7].

Table 1: Symptoms

| Common | Infrequent | Seen in children (Rare in adults) |
|-------------------------|--|-----------------------------------|
| Fever | Rash | Photophobia |
| Arthralgia (joint pain) | Stomatitis (sore mouth) | Retro-orbital pain |
| Backache | Oral ulcers | Vomiting |
| Headache | Hyper pigmentation (skin spots) | Diarrhoea |
| | Exfoliative dermatitis (peeling of skin) | Meningeal syndrome |
| | | Acute encephalopathy |

Most of the cases patient may recover the disease fully but in some cases studies show that the joint pain exists for several months or even years. In older people the disease can contribute to cause death due to its severity or the infection may unrecognise or may misdiagnose in the area where dengue occurs^[3].

HOW CHIKUNGUNYA GET TRANSMITTED?

Diagnosis: Chikungunya can be identified through various blood tests; it is the only method to determine chikungunya. The symptoms for chikungunya and dengue similar. Common test are as follows:

- RT-PCR test
- ELISA test
- Immunofluorescence assay
- PRNT test
- Hemagglutination-inhibition test
- Serological test

RT-PCR test: The full form of RT-PCR is Reverse transcriptase-Polymer chain reaction. Through this method the viral RNA can be easily detected in the serum specimen obtained from patients on the acute phase of infection. During the initial stage there will be high level of viremia which typically last for (4-6 days) after onset of illness, so, it can be easily detected within the first seven days during the acute phase. RT-PCR result can be available in 1-2 days^[8].

ELISA test: The full form of ELISA is Enzyme-Linked Immunosorbent Assay. It can detect both anti chikungunya virus immunoglobulin (IgM&IgE) antibodies during acute or convalescent phase of sample. In case of serological diagnosis, it needs large amount of blood than other method^[8-10]. ELISA result can be available in 2-3 days.

Immunofluorescence assay: These tests are sensitive and specific. It requires special equipment and well training during this method. These methods are usually used for detection of infectious agents^[11].

PRNT test: The full form of PRNT is Plaque reduction neutralization test. It is very use full for the detection of quite specific for *alphavirus*. They are golden standard for the confirmation of serological test results. Its major drawback is the usage of line virus. The test must be carried out in bio safety level 3 laboratories.

Hemoagglutination-inhibition test: It is another method to diagnosis the disease by distinguishing chikungunia strain by kinetic H-i test.

Treatment: For chikungunya there are various treatment in ayurveda, homeopathy, siddha, allopathy system of medicine.

AYURVEDIC SYSTEM OF MEDICINE

For chikungunya treatments people are majorly depending upon ayurveda chikungunya have another name in ayurveda which is known as sandhijwara (fever of joints). It is considered as vata dosha disorder. The herbs such as sacred basil (tulsi), carrot, grapes are usual recommended as relief for the pain and fever. Ayurvedic massage also done for the relief of joint pain. The treatment recommends the patients:

- To increase the intake of fluid containing foods and vegetables
- Reduce the use of oil
- Avoid the intake of tea and coffee

Ayurveda medicine for chikungunya includes:

- Amruttharishta
- Mahasudarshana churna
- Dhanvantaram gutika
- Vilvadi gutika
- Amurthotharam kashayam
- Panchathiktha kashayam^[10]

Homeopathy system of medicine: Nowadays effective medicines are available in homeopathy for the treatment of chikungunya which possess speed recovery. Some of the medicines are:

- Eupatorium-perf
- Pyrogenum
- Rhustos
- Arnica
- Bryonia

Siddha system of medicine: For chikungunya medicines are available in siddha. Some of them are:

- Nilavenbu kudineer mixture
- Pinda thailam
- Karpooraadhi thailam^[10]

Allopathy system of medicine: In case of allopathy system of medicine till now there is no particular medicine and vaccine to prevent chikungunya virus. The treatment is based upon the symptoms in which fever and joint pain is the usually seen it can be reduced by administrating the drug paracetamol (Tylenol[®]).

They also recommend the patients to take rest and intake plenty of water in order to prevent dehydration.

Prevention and control:

- In order to prevent mosquito bite
- Mosquito nets during sleeping
- Wear a dress which covers most of the body
- Use curtains and window nets in the house to prevent the entry of mosquito
- Apply creams and spray on the skin to prevent mosquito bites^[10, 12, 13]

How to reduce mosquito breeding?:

- Clean the surroundings
- Drain all the waters collected around the house (pots, water cooler)
- Cover the area where water stored
- To kill mosquito larvae use chemicals
- Guppies fishes are introduced into stagnant water to kill mosquito larvae^[12, 13]

Chikungunya outbreak: Chikungunya virus was first isolated in Africa (1952) and it recently becomes a world concern with outbreak in many (sub) tropical countries. In India, chikungunya virus was first isolated in Kolkata 1963 after that it occur in various other states of India they were in Tamil Nadu, Andhra-Pradesh and Maharashtra in (1964-65 and in Brasi in 1973). CHIKV then seems to have disappear from India, after a gap the virus re-emerged in 2005 after a gap of 32 years and caused an explosive outbreak affecting 13 state. The majorly affected state were Andhra Pradesh, Karnataka, Maharashtra, Madhya Pradesh, Tamil Nadu, Gujarat, Kerala^[14].

Majour outbreak in the following state during years in India

Kolkata: In 1963, report reveals that with almost 35 cases of Chikungunya being reported only from Salt Lake in East Kolkata, escalating number of chikungunya cases is creating a wave of panic among the people. At least 10 cases of chikungunya have been reported from areas like Beliaghata, Narkeldanga, Ultadanga and Belgachia in North and North-East Kolkata according to a report submitted by the Indian Council of Medical Research (ICMR). Thousands may have been affected by Chikungunya in North 24-Parganas, though only a handful have been admitted to hospital,” said a health department official. “The >2.5 lakh people in the district have suffered from Chikungunya and other viral infections over the past six months^[15]”.

Karnataka: At least 80,000 people in Gulbarga, Tumkur, Bidar, Raichur, Bellary, Chitradurga, Davanagere, Kolar and Bijapur districts in Karnataka state are known to be affected since December, 2005 to May, 2006^[15].

Andhra Pradesh: In early part of 2006, there was a big outbreak in the Andhra Pradesh state in India. Nearly 200,000 people were affected by this disease in the

districts of Praksham and Nellore. Some deaths have been reported but it was thought to be mainly due to the inappropriate use of antibiotics and anti-inflammatory tablets. As this virus can cause thrombocytopenia, injudicious use of these drugs can cause erosions in the gastric epithelium leading to exsanguinating upper GI bleed (due to thrombocytopenia)^[16].

Maharashtra: In 2006, high density of *Aedes aegypti* was also reported in these areas. From 1st-15th March, over 2000 cases of chikungunya have been reported from Malegaon town in Nasik district, Maharashtra state, India^[16].

Orissa: The 4904 cases of fever associated with myalgia and headache have been reported during 27th February-5th March, 2006. These signs are consistent with an arbovirus outbreak^[16].

Kerala: The mosquito-borne viral disease chikungunya, erupted in Kerala towards May-end this year, claiming 40 lives while 7,000 people were admitted in hospitals in the South and Central districts of Kollam, Pathanamthitta, Kottayam and parts of the capital city. Of the 870 confirmed chikungunya cases reported this year in India, as many as 559 were from Kerala alone? In May, 2007, another outbreak surfaced affecting almost all the districts. Clinical investigations carried out during 2007 epidemic in the four severely affected districts of Kerala, viz., Pathanamthitta, Idukki, Kottayam and Thrissur to understand the magnitude of the problem caused and the clinical signs and symptoms of chikungunya fever are reported.

Tamil Nadu: With over 62,000 cases of chikungunya reported in Tamil Nadu, the four districts of Namakkal, Dharmapuri, Vellore and Tirunelveli have seen the highest number of cases being reported in 200.

Madhya Pradesh: In 2006 over 60098 chikungunya cases were reported in Madhya Pradesh, from 21 districts, of the 70 confirmed chikungunya^[13].

Gujarat: With over 72589 cases of chikungunya cases were reported in Gujarat, from 25 district, of the 170 confirmed chikungunya, in 2006^[13].

The A226V mutation was found to occur only in the 2007 isolated from India. Lakshadweep had chikungunya outbreak only in 2007.

CONCLUSION

In 2008 almost 100,000 people in different villages of Kasargod district in Kerala were affected by chikungunya. In 2009-2010 a larger chikungunya outbreak in Tirunelveli district, Tamil Nadu. During this year cases were reported from Maharashtra also.

In 2011, chikungunya were affected in almost all state except Punjab, Dadra and Nagar, haveli and Lakshadweep.

The studies about chikungunya outbreak in India reveals that number of cases were reported in 2013 was about 18,639^[2].

Some of the records by the National Guideline for the Clinical Management of chikungunya reveal that: in 2014-16,049 cases were reported. In 2015-27,553 cases were reported.

Till 11th September, 2016, a total of 14656 cases were clinically reported from 18 State and 2 union territories.

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