International Journal of Medical and Health Research
ISSN: 2454-9142, Impact Factor: RJIF 5.54
www.medicalsciencejournal.com
Volume 2; Issue 9; September 2016; Page No. 96-100

Chikungunya disease: Its symptoms and treatments

Pahul Singh

SMT Dhandevi D.A.V. Public Senior Secondary School (Punjab School Education Board) Gurdaspur, Punjab, India

Abstract
Chikungunya is an infection caused by the chikungunya virus. It causes fever and joint pains. The objective of this paper is to understand about the disease chikungunya transmission mechanism. There is a description of how the disease is diagnosed. It highlights the different types of vaccines and treatments i.e. allopathic, ayurvedic, homoepathic and natural home remedies as well to cure this fever. It also mentions how WHO responds to Chikungunya.

Keywords: Chikungunya disease, Chikungunya Virus (CHIKV)

Introduction
Chikungunya is a viral disease transmitted to humans by infected mosquitoes. Chikungunya is an infection caused by the chikungunya virus. It causes fever and severe joint pain. Aedes aegypti mosquito (also called yellow fever mosquito) is the primary transmission agent for Chikungunya Virus (CHIKV). This is usually found in tropics and hence the reason why Chikungunya is predominantly seen in Asian countries. Anyone can get infected with Chikungunya virus. The virus infection can be seen in new born to old people. It is an RNA virus that belongs to the alphavirus genus of the family Togaviridae. The name "chikungunya" derives from a word in the Kimakonde language, meaning "to become contorted", and describes the stooped appearance of sufferers with joint pain (arthralgia).

History (Epidemiology)
Historically, chikungunya has been present mostly in the developing world. The disease causes an estimated 3 million infections each year. Epidemics in the Indian Ocean, Pacific Islands, and in the Americas, continue to change the distribution of the disease. In Africa, chikungunya is spread by a sylvatic cycle in which the virus largely cycles between other non-human primates, small mammals, and mosquitos between human outbreaks. During outbreaks, due to the high concentration of virus in the blood of those in the acute phase of infection, the virus can circulate from humans to mosquitoes and back to humans. The transmission of the pathogen between humans and mosquitoes that exist in urban environments was established on multiple occasions from strains occurring on the eastern half of Africa in non-human primate hosts. This emergence and spread beyond Africa may have started as early as the 18th century. Currently, available data does not indicate whether the introduction of chikungunya into Asia occurred in the 19th century or more recently, but this epidemic Asian strain causes outbreaks in India and continues to circulate in Southeast Asia. In Africa, outbreaks were typically tied to heavy rainfall causing increased mosquito population. In urban centers, the virus has spread by circulating between humans and mosquitoes.

Global rates of chikungunya infection are variable, depending on outbreaks. When chikungunya was first identified in 1952, it had a low-level circulation in West Africa, with infection rates linked to rainfall. Beginning in the 1960s, periodic outbreaks were documented in Asia and Africa. However, since 2005, several decades of relative inactivity, chikungunya has re-emerged and caused large outbreaks in Africa, Asia, and the Americas. In India, chikungunya re-appeared following 32 years of absence of viral activity. Outbreaks have occurred in Europe, the Caribbean, and South America, areas in which chikungunya was not previously transmitted. Local transmission has also occurred in the U.S. and Australia, countries in which the virus was previously unknown. In 2005, an outbreak on the island of Réunion was the largest then documented, with an estimated 266,000 cases on an island with a population of approximately 770,000. In a 2006 outbreak, India reported 1.25 million suspected cases. Chikungunya was recently introduced to the Americas, and from 2013-14 in the Americas, 1,118,763 suspected cases and 24,682 confirmed cases were reported by the PAHO.

Analysis of chikungunya virus's genetic code suggests that the increased severity of the 2005–present outbreak may be due to a change in the genetic sequence which altered the E1 segment of the virus' viral coat protein, a variant called E1-A226V. This mutation potentially allows the virus to multiply more easily in mosquito cells. The change allows the virus to use the Asian tiger mosquito as a vector in addition to the more strictly tropical main vector, Aedes aegypti. Enhanced transmission of chikungunya virus by A. albopictus could mean an increased risk for outbreaks in other areas where the Asian tiger mosquito is present. A. albopictus is an invasive species which has spread through Europe, the Americas, the Caribbean, Africa and the Middle East.

After the detection of zika virus in Brazil in April 2015, the first ever in the Western Hemisphere, it is now thought some chikungunya and dengue cases could in fact be zika virus cases or co-infections.

Chikungunya cases reported.

- 1952 - Outbreak of Chikungunya detected in Makonde Plateau.
- 1955 - Marion Robinson and W.H.R. Lumsden identifid and described Chikungunya.
- 1963/64 - Chikungunya detected Indian cities mainly calcutta, maharashtra and vellore. The numbers of

infections were in lakhs (100,000+) and over 200 deaths were reported.
- 1969 - Chikungunya detected in Srilanka.
- 1975 - Chikungunya detected in Vietnam and Myanmar.
- 1982 - Chikungunya detected in Indonesia.
- 2005/2006 - Chikungunya was reported in Reunion Islands and about 200 people died due to the disease. It was also widely reported from south Indian states namely Kerala, Karnataka, Tamil Nadu and Andhra Pradesh.
- 2007/2008 - Chikungunya infection was reported from various parts of India. It spread to other south Asian countries including Maldives and Pakistan. By 2008, infection was reported from Italy, Singapore and Australia.
- In August 2014 researchers at the National Institute of Allergy and Infectious Diseases in the USA were testing an experimental vaccine which uses virus-like particles (VLPs) instead of attenuated virus. All the 25 people participated in this phase 1 trial developed strong immune responses. Phase 2 trial will commence using 400 adults aged 18 to 60 and take place at 6 locations in the Caribbean.

Chikungunya has returned to the Americas after an absence of ≈200 years. The return of this viral exanthema was first recognized on St. Martin, in the Caribbean, in December 2013, and as of January 9, 2015, the US Centers for Disease Control and Prevention reported that the disease had been identified in 42 countries or territories in the Caribbean, Central America, South America, and North America. A total of 1,094,661 suspected and 26,606 laboratory-confirmed chikungunya cases have been reported.

Transmission Mechanism

Chikungunya is generally transmitted from mosquitoes to humans. Less common modes of transmission include vertical transmission, which is transmission from mother to child during pregnancy or at birth. Transmission via infected blood products and through organ donation is also possible. Chikungunya is related to mosquitoes, their environments, and human behavior. The adaptation of mosquitoes to the changing climate made them seek out environments where humans stored water. Human habitation and the mosquitoes' environments were then very closely connected. During periods of epidemics humans are the reservoir of the virus. Because high amounts of virus are present in the blood in the beginning of acute infection, the virus can be spread from a viremic human to a mosquito, and back to a human. During other times, monkeys, birds and other vertebrates have served as reservoirs. Three genotypes of this virus have been described, each with a distinct genotype and antigenic character: West African, East/Central/South African, and Asian genotypes.

Chikungunya is spread through bites from *Aedes* mosquitoes, and the species. These break the skin & introduce the virus into the body. *A. aegypti* was identified as the most common vector, though the virus has recently been associated with many other species, including *A. albopictus*. Research by the Pasteur Institute in Paris has suggested chikungunya virus strains in the 2005-2006 Reunion Island outbreak incurred a mutation that facilitated transmission by the Asian tiger mosquito (*A. albopictus*). Other species potentially able to transmit the chikungunya virus include *Ae. furcifer-taylori*, *Ae. africanus*, and *Ae. luteocephalus*.

The pathogenesis of chikungunya infection in humans is still poorly understood, despite recent outbreaks. It appears that *in vitro*, chikungunya virus is able to replicate in human epithelial and endothelial cells, primary fibroblasts, and monocyte-derived macrophages. Viral replication is highly cytopathic, but susceptible to type-I and -II interferon. Chikungunya virus appears to replicate in fibroblasts, skeletal muscle progenitor cells, and myofibers.

The type-1 interferon response seems to play an important role in the host's response to chikungunya infection. Upon infection with chikungunya, the host's fibroblasts produce type-1 alpha and beta interferon (IFN-α and IFN-β). In mouse studies, deficiencies in INF-1 in mice exposed to the virus cause increased morbidity and mortality. The chikungunya-specific upstream components of the type-1 interferon pathway involved in the host's response to chikungunya infection are still unknown. Nonetheless, mouse studies suggest that IPS-1 is an important factor, and that IRF3 and IRF7 are important in an age-dependent manner. Mouse studies also suggest that chikungunya evades host defenses and counters the type-I interferon response by producing NS2, a nonstructural protein that degrades RBP1 and turns off the host cell's ability to transcribe DNA. NS2 interferes with the JAK-STAT signaling pathway and prevents STAT from becoming phosphorylated.

In the acute phase of chikungunya, the virus is typically present in the areas where symptoms present, specifically skeletal muscles, and joints. In the chronic phase, it is suggested that viral persistence (the inability of the body to entirely rid itself of the virus), lack of clearance of the antigen, or both, contribute to joint pain. The inflammation response during both the acute and chronic phase of the disease results in part from interactions between the virus and monocytes and macrophages. Chikungunya virus disease in humans is associated with elevated serum levels of specific cytokines and chemokines. High levels of specific cytokines have been linked to more severe acute disease: interleukin-6 (IL-6), IL-1β, RANTES, monocyte chemoattractant protein 1 (MCP-1), monokine induced by gamma interferon (MIG), and interferon gamma-induced protein 10 (IP-10). Cytokines may also contribute to chronic chikungunya virus disease, as persistent joint pain has been associated with elevated levels of IL-6 and granulocyte-macrophage colony-stimulating factor (GM-CSF). In those with chronic symptoms, a mild elevation of C-reactive protein (CRP) has been observed, suggesting ongoing chronic inflammation. However, there is little evidence linking chronic chikungunya virus disease and the development of autoimmunity.

Viral replication

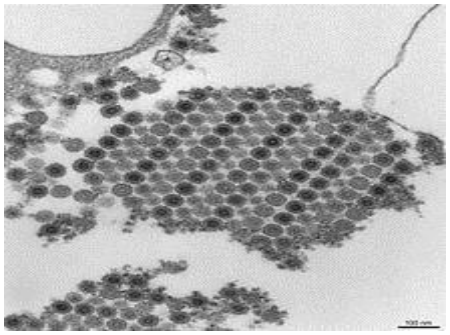

Fig 1: Transmission electron micrograph of Chikungunya virus particles

The virus consists of four nonstructural proteins 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. 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. 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.

Diagnosis

Chikungunya is diagnosed on the basis of clinical, epidemiological, and laboratory criteria. Clinically, Chikungunya begins as an acute febrile illness (high fever) and severe joint pain would lead to suspicion of chikungunya. Other common symptoms include headache, muscle pain, joint swelling, and rash. Epidemiological criteria consist of whether the individual has travelled to or spent time in an area in which chikungunya is present within the last twelve days (i.e. the potential incubation period). Laboratory criteria include a decreased lymphocyte count consistent with viremia. However a definitive laboratory diagnosis can be accomplished through viral isolation, RT-PCR, or serological diagnosis.

The differential diagnosis may include infection with other mosquito-borne viruses, such as dengue or malaria, and infection with influenza. Chronic recurrent polyarthralgia occurs in at least 20% of chikungunya patients one year after infection, whereas such symptoms are uncommon in dengue.

Virus isolation provides the most definitive diagnosis, but takes one to two weeks for completion and must be carried out in bio-safety level III laboratories. The technique involves exposing specific cell lines to samples from whole blood and identifying chikungunya virus-specific responses. RT-PCR using nested primer pairs is used to amplify several chikungunya-specific genes from whole blood, generating thousands to millions of copies of the genes in order to identify them. RT-PCR can also be used to quantify the viral load in the blood. Using RT-PCR, diagnostic results can be available in one to two days. Serological diagnosis requires a larger amount of blood than the other methods, and uses an ELISA assay to measure chikungunya-specific IgM levels in the blood serum. One advantage offered by serological diagnosis is that serum IgM is detectable from 5 days to months after the onset of symptoms, but drawbacks are that results may require two to three days, and false positives can occur with infection due to other related viruses, such as o'nyong'nyong virus and Semliki Forest virus.

Presently, there is no specific way to test for chronic signs and symptoms associated with Chikungunya fever although nonspecific laboratory findings such as C reactive protein and elevated cytokines can correlate with disease activity.

Prevention

Avoid getting bitten by mosquitoes. Keep the surroundings clear of stagnant water or pools where mosquitoes can breed. Use mosquito nets and close windows in the evening to prevent mosquitoes from entering.

Fig 2: *A. aegypti* mosquito biting a person

Because no approved vaccine exists, the most effective means of prevention are protection against contact with the disease-carrying mosquitoes and controlling mosquito populations by limiting their habitat. Mosquito control focuses on eliminating the standing water where mosquitoes lay eggs and develop as larva; if elimination of the standing water is not possible, insecticides or biological control agents can be added. Methods of protection against contact with mosquitoes include using insect repellents with substances such as DEET, icaridin, PMD (p-menthane-3,8-diol, a substance derived from the lemon eucalyptus tree), or IR3535. However, increasing insecticide resistance presents a challenge to chemical control methods. Other preventive measures are:

- Use air conditioning or window/door screens.
- Use mosquito repellents on exposed skin.
- Wear long-sleeved shirts and long pants.
- Wear permethrin-treated clothing.
- Support local vector control programs.

Vaccine & Treatments

Currently, no approved vaccines are available. A phase-II vaccine trial used a live, attenuated virus, to develop viral resistance in 98% of those tested after 28 days and 85% still showed resistance after one year. However, 8% of people reported transient joint pain, and attenuation was found to be due to only two mutations in the E2 glycoprotein. Alternative vaccine strategies have been developed, and show efficacy in mouse models. Even with a vaccine, mosquito population control and bite prevention will be necessary to control chikungunya disease.

Passive immunotherapy has potential benefit in treatment of chikungunya. Studies in animals using passive immunotherapy have been effective, and clinical studies using passive immunotherapy in those particularly vulnerable to severe infection are currently in progress. Passive immunotherapy involves administration of anti-CHIKV hyper immune human intravenous antibodies (immune globulins) to those exposed to a high risk of chikungunya infection. No antiviral treatment for chikungunya virus is currently available, though testing has shown several medications to be effective *in vitro*.

Allopathic treatment

There is no vaccine for chikungunya. Treatment is mainly symptomatic – such as giving painkillers to relieve the joint pain – using non-steroidal anti-inflammatory drugs which are not asprin-based. Drugs are mainly analgesics and antipyretics. The patient is advised to take fluids.

There is no antiviral drug or medicine specifically for Chikungunya. But since chikungunya is cured by immune system in almost all cases there is no need to worry. Aspirin should be avoided as it increases risk of bleeding.

Supportive care and rest is recommended, and symptomatic treatment of fever and joint swelling includes the use of non-steroidal anti-inflammatory drugs such as naproxen, non-aspirin analgesics such as paracetamol (acetaminophen) and taking more fluids. Despite anti-inflammatory effects, corticosteroids are not recommended during the acute phase of disease, as they may cause immuno suppression and worsen infection. Pregnant women and patients with health problems must consult a doctor.

Currently there is no vaccination against Chikungunya. Research is ongoing on the development of DNA vaccination against Chikungunya.

Usually the disease starts to decrease in intensity after 3 days and it may take up to 2 weeks for recovery. But in elderly the recovery is very slow and may take upto 3 months. In some cases the joint pain can last even upto a year.

Ayurvedic treatment of Chikungunya

Since there is no medicine for Chikungunya in allopathy, people increasingly turning to traditional indian medicines (ayurveda). Ayurveda treatment of Chikungunya uses herbal drugs. Some of the kashayams (concoctions) prescribed are Amrutharista, Mahasudarshana Churna, panchathiktha kashayam, Sudarshan Churnam, Dhanvantaram Gutika and Amruthotharam Kashayam. Ancient ayurveda describes a similar condition called Sandhijwara which is similar to Chikungunya in its symptoms (joint pain). Hence some of the medicines can sooth joint pain.

Homeopathic treatment of Chikungunya

According to homeopathic experts effective drugs are available to prevent as well as to speed up recovery from Chikungunya. In some of the south indian cities this type of treatment is tried out. It is claimed that the medicine Eupatorium perf can prevent Chikungunya infection. Other medicines prescribed for the disease include Pyroginum, Rhus-tox, Cedron, Influenzinum, China and Arnica.

Natural Home Remedies to Treat Chikungunya

- **Perform Low-Impact Aerobic Exercise to Treat Chikungunya:** One of the best approaches to relieve the chronic joint pain that goes with Chikungunya is low-affect oxygen consuming activity. It includes extending and moderate developments.
- **Massage to Treat Chikungunya:** Another effective approach to relieve pain in the joints is by kneading the fingers. Massage the center fingers to relieve leg joint pain and the external two fingers to relieve joint pain in the arms. Usually, Chikungunya patients experience the ill effects of chronic joint pain, even after the disease dies down.
- **Turmeric:** One of the highly effective home remedies to alleviate the symptoms of chikungunya is turmeric. Curcumin in the turmeric acts as a powerful antioxidant that provides anti-inflammatory effects to help you combat the adverse effects of this health condition.
- **Ginger:** Another highly effective home remedy to treat the pain and health troubles resulting due to chikungunya virus is ginger**.** Ginger provides you analgesics effect that helps you treat the condition without any side effects. It acts as a natural anti-inflammatory agent and helps you minimize the inflammation resulting due to this viral infection.
- **Cool Compress to Treat Chikungunya:** Pulverize some ice and wrap it up in a towel. Press and hold the towel over the joints for a while. Utilizing the cool pack is the best method for decreasing inflammation, pain and joint harm.
- **Pressure Point Massage to treat Chikungunya:** An infection in the stomach or liver is the symptoms of chikungunya. One should massage the weight focuses in two particular zones to diminish the pain & inflammation. It also helps in treating the infection.
- **Stew Peppers to treat Chikungunya:** Stew Peppers are rich in capsaicin and helps in treating Chikungunya. Capsaicin is rich in anti-inflammatory properties.
- **Rest to treat Chikungunya:** Rest is the one of the best remedy. Take more than 8 hours of slumber if necessary. Also take short rests and rest in a warm situation.
- **Vitamin C to treat Chikungunya:** Vitamin C has numerous antioxidant properties which make it a perfect sustenance amid anaphylaxis & infections. It helps in flushing poisons from the body. The vicinity of vitamin C triggers the action of vitamin E, which is vital for the decrease of pain & inflammation.
- **Leafy Green to treat Chikungunya:** These are the best home remedies for pain & inflammation. Vitamin E & iron are heavily found in green leafy vegetables. Vitamin E shows anti-oxidant attributes that help diminish pain & inflammation. It also helps dispose of cytokines from the body.

Chronic arthritis

In those who have more than two weeks of arthritis, ribavirin may be useful. The effect of chloroquine is not clear. It does not appear to help acute disease, but tentative evidence indicates it might help those with chronic arthritis. Steroids do not appear to be an effective treatment. NSAIDs and simple analgesics can be used to provide partial symptom relief in most cases. Methotrexate, a drug used in the treatment of rheumatoid arthritis, has been shown to have benefit in treating inflammatory poly-arthritis resulting from chikungunya, though the drug mechanism for improving viral arthritis is unclear.

Disease outbreaks

Chikungunya occurs in Africa, Asia and the Indian subcontinent. Human infections in Africa have been at relatively low levels for a number of years, but in 1999–2000 there was a large outbreak in the Democratic Republic of the Congo, and in 2007 there was an outbreak in Gabon.

Starting in February 2005, a major outbreak of chikungunya occurred in islands of the Indian Ocean. A large number of imported cases in Europe were associated with this outbreak, mostly in 2006 when the Indian Ocean epidemic was at its peak. A large outbreak of chikungunya in India occurred in 2006 and 2007. Several other countries in South-East Asia were also affected. Since 2005, India, Indonesia, Maldives, Myanmar and Thailand have reported over 1.9 million cases. In 2007 transmission was reported for the first time in Europe, in a localized outbreak in north-eastern Italy. There were 197 cases recorded during this outbreak and it confirmed that mosquito-borne outbreaks by *Ae. Albopictus* are plausible in Europe.

In December 2013, France reported 2 laboratory-confirmed autochthonous cases in the French part of the Caribbean island of St Martin. Since then, local transmission has been confirmed

in over 43 countries and territories in the WHO Region of the Americas. This is the first documented outbreak of chikungunya with autochthonous transmission in the Americas. As of April 2015, over 1 379 788 suspected cases of Chikungunya have been recorded in the Caribbean islands, Latin American countries, and the United States of America. 191 deaths have also been attributed to this disease during the same period. Canada, Mexico and USA have also recorded imported cases.

On 21 October 2014, France confirmed 4 cases of locally-acquired chikungunya infection in Montpellier, France. In late 2014, outbreaks were reported in the Pacific islands. Currently chikungunya outbreak is ongoing in Cook Islands and Marshall Islands, while the number of cases in American Samoa, French Polynesia, Kiribati and Samoa has reduced. WHO responded to small outbreaks of chikungunya in late 2015 in the city of Dakar, Senegal, and the state of Punjab, India.

In the Americas in 2015, 693 489 suspected cases and 37480 confirmed cases of chikungunya were reported to the Pan American Health Organization (PAHO) regional office, of which Colombia bore the biggest burden with 356 079 suspected cases. This was less than in 2014 when more than 1 million suspected cases were reported in the same region.

The decreasing trend continues in 2016, with about 31 000 cases reported to PAHO as of 18 March 2016, representing a 5-fold decrease compared to the same period in 2015. Despite this trend, chikungunya remains a threat for the region with Argentina recently reporting its first chikungunya outbreak.

Prognosis

The mortality rate of chikungunya is slightly less than 1 in 1000. Those over the age of 65, neonates, and those with underlying chronic medical problems are most likely to have severe complications. Neonates are vulnerable as it is possible to vertically transmit chikungunya from mother to infant during delivery, which results in high rates of morbidity, as infants lack fully developed immune systems. The likelihood of prolonged symptoms or chronic joint pain is increased with increased age and prior rheumatologic disease.

WHO response

WHO responds to chikungunya by:

- Formulating evidence-based outbreak management plans;
- Providing technical support and guidance to countries for the effective management of cases and outbreaks;
- Supporting countries to improve their reporting systems;
- Providing training on clinical management, diagnosis and vector control at the regional level with some of its collaborating centres; and
- Publishing guidelines and handbooks on case management and vector control for Member States.

WHO encourages countries to develop and maintain the capacity to detect and confirm cases, manage patients and implement social communication strategies to reduce the presence of the mosquito vectors?

Conclusion

Chikungunya is a viral fever caused by the bite of infected mosquito. The symptoms of the disease are high fever and joint pains. It takes time to get relief from pain. There is no allopathic medicine to cure this disease. There are certain ayurvedic and homeopathic medicines and different natural home remedies to cure the disease. The preventive measure is to avoid getting bitten by mosquitoes. Keep the surroundings clear of stagnant water or pools where mosquitoes can breed and use mosquito nets and close windows in the evening.

Future Aspects

There is still a research going on to find the allopathic treatment of chikungunya. Vaccination for the disease is desired to find soon. There is a scope to find out other preventive measures of the disease.

References

1. Chikungunya Virus Symptoms, Diagnosis, Treatment. CDC. 2016.
2. *Caglioti C, Lalle E, Castilletti C, Carletti F, Capobianchi MR, Bordi L. Chikungunya virus infection: an overview. The new microbiologica. 2013; 36(3):211-27.*
3. *Prevention, CDC.2016.*
4. Staples JE, Fischer M. Chikungunya virus in the Americas-what a vectorborne pathogen can do. N. Engl. J. Med. 2014; 371(10):887-9.
5. http://www.who.int/mediacentre/factsheets/fs327/en/
6. https://www.cdc.gov/chikungunya/
7. http://www.chikungunya.in/
8. http://www.chikungunyavirusnet.com/