

Vectors are organisms that transmit pathogens from one infected individual to another causing serious disease in human population. Mosquitoes are the best known disease vectors. Others include ticks, flies, sandflies, fleas, bugs and some freshwater aquatic snails. Some of the world's most destructive diseases are vector borne which account for over 17% of all infectious diseases.

Vector-borne diseases (VBDs) are among the most complex of all infectious diseases to predict, prevent or control. Not only is it difficult to predict the habits of the vectors, but most vector-borne agents can infect animals as well. Mosquitoes and ticks are notoriously difficult to reach and often develop resistance to insecticides. Almost all vector-borne pathogens are zoonoses which can live in animals as well as in humans. Only a few vector borne diseases can be prevented by use of vaccines.

Every year there are more than 1 billion cases and over 1 million deaths from VBDs globally.

Rising deforestation and urbanization along with poor irrigation and water system, poor waste disposal and water storage are contributing to rise in Vector borne diseases. The World Health Day 2014 campaign, 'small bite: big threat' was aimed at raising awareness about the threats posed by insect vectors and the bacteria, viruses, and parasites they carry, and to motivate families and communities to protect themselves through simple measures.

Important vector borne diseases relevant for India are Malaria, Dengue fever, Japanese encephalitis, chikungunya, Kala Azar and lymphatic filariasis. The most widely known vector-borne diseases in the U. S. are West Nile virus, Lyme disease and Rocky Mountain spotted fever.

The risk of rare or new vector-borne pathogens continues to emerge and spread with rapid global travel and changes in agricultural practices and land use. In India urbanization, improper sanitation and widespread constructions cause breeding of the vectors which is a huge public health concern. The world's fastest growing vector-borne disease is dengue, with a 30-fold increase in disease incidence over the last 50 years. The most deadly vector-borne disease, malaria, caused an estimated 627 000 deaths in 2012. The recent scare caused by Zika virus is a testimony to the fact that medical community needs to be always on the alert against vector borne diseases. These diseases need to be notified to the local health

authorities. Control of these diseases need unified efforts from medical fraternity, law makers and the community.

### DENGUE FEVER

Dengue is a mosquito borne viral infection transmitted by *Aedes* mosquito. It presents as fever and joint pains. Acute febrile illness can vary in severity over 5–7 days. Febrile Phase lasts 2–7 days after being bitten and can be biphasic. Headache, retro-orbital pain, joint pains, muscle and/or bone pain, rash, mild bleeding (nose or gums, easy bruising), neutropenia can occur with fever. Critical phase begins at defervescence, lasts 24–48 hours. Most patients improve but some may require hospitalization.

Warning signs include evidence of plasma leakage—abdominal pain, persistent vomiting (at least 3 episodes/24 hours), fluid accumulation, liver enlargement >2 cm, mucosal bleeding, lethargy or restlessness, hemoconcentration (high hematocrit) with rapid thrombocytopenia.

Recovery phase is characterized by gradual reabsorption of extravasated fluid from plasma leakage over 48–72 hours; diuresis and stabilization of hemodynamic status. Bradycardia is often observed.

Dengue hemorrhagic fever (DHF) and Dengue shock syndrome (DSS) are severe forms of illness which can cause death. Secondary dengue infection is a risk factor for DHF.

Global incidence of the disease has increased with half of the world's population at risk. Dengue is endemic in India and outbreaks occur every year.

The detection of dengue fever is by detection of NS1 antigen, IgM or IgG by ELISA method. The rapid tests for diagnosis of dengue are not reliable. The treatment of dengue fever is symptomatic mainly fluid resuscitation and antipyretics. Early detection and appropriate medical care reduce mortality in dengue fever. Recognizing warning signs for severe dengue and providing appropriate medical management can prevent morbidity and death.

### Dengue Vaccine

Dengue vaccine development platform has progressed forward over the past few years, with a number of vaccine candidates in different phases of clinical trial. Dengue vaccine is approved in some countries but it is not available for commercial use as yet in India.

## CHIKUNGUNYA

Chikungunya is a viral disease transmitted to humans by infected mosquitoes. Chikungunya virus was first isolated from the blood of a febrile patient in Tanzania in 1953.

In India it reemerged in 2006 as epidemic after remaining quiescent for almost three decades. Analysis of the recent Indian epidemic has suggested that the increased severity of the disease is due to a change in the genetic sequence, altering the virus' coat protein, which potentially allows it to multiply more easily in mosquito cells. In India the first isolation of the virus was done in Calcutta in 1963. In 2015 a total of 27,553 clinically suspected cases have been reported.

Currently in 2016, the big epidemic is going on and a total of 14656 clinically suspected have been reported.

It causes fever and severe joint pains. Patients also complain of muscle pains, nausea, rash and headache. Joint pains can be very debilitating and may last from weeks to months. It shares some signs with Dengue.

The confirmation of Chikungunya is through any one of the following:

1. Isolation of virus
2. RT-PCR
3. Detection of IgM antibody
4. Demonstration of rising titre of IgG ( four fold)

There is no cure for the disease. Treatment is aimed at relief of symptoms. There is no vaccine for chikungunya.

Most patients recover fully however some may have joint pains for years. Neurologic, cardiac and ophthalmologic complications have been described. Some patients have persistence or relapse of rheumatologic symptoms in the months following acute illness. Mortality is rare and occurs mostly in older adults.

## ZIKA VIRUS DISEASE

Zika virus disease is an emerging viral (flavivirus) disease transmitted through the bite of an infected Aedes mosquito. This is the same mosquito that is known to transmit infections like dengue and chikungunya. Zika virus was first identified in the Zika forest of Uganda in 1947.

World Health Organization has reported 22 countries and territories in Americas from where local transmission of Zika virus has been reported.

Zika virus can also be transmitted from pregnant patients to the fetus intrapartum and during the time of delivery.

The major cause of panic and concern caused by the Zika virus is the development of microcephaly and congenital central nervous system malformations in newborn.

Other neurological syndromes like Guillain Barre Syndrome has been found to be temporally associated with Zika virus infection.

Zika virus disease has the potential for further international spread given the wide geographical distribution of the mosquito vector, a lack of immunity among population in newly affected areas and the high volume of international travel. As of now, the disease has not been reported in India. However, the mosquito that transmits Zika virus, namely *Aedes aegypti* is widely prevalent in India.

A majority of those infected with Zika virus disease either remain asymptomatic (up to 80%) or show mild symptoms of fever, rash, conjunctivitis, body ache, joint pains. Zika virus infection should be suspected in patients reporting with acute onset of fever, maculo-papular rash and arthralgia, among those individuals who travelled to areas with ongoing transmission during the two weeks preceding the onset of illness.

Based on the available information of previous outbreaks, severe forms of disease requiring hospitalization is uncommon and fatalities are rare. Zika virus specific IgM antibodies develop towards end of 1st week, but are generally positive starting near 4 day post onset of symptoms and continuing for 12 weeks. Zika MAC-ELISA is used for qualitative detection of zika virus IgM antibodies in serum. There is no vaccine or drug available to prevent/ treat Zika virus disease at present. World Health Organization has declared Zika virus disease to be a Public Health Emergency of International Concern (PHEIC) on 1<sup>st</sup> February, 2016.

## JAPANESE ENCEPHALITIS

It is a leading cause of vaccine preventable disease. It is caused by a flavivirus which can cause severe inflammation of the brain. Epidemics of JE are reported from many parts of India. Uttar Pradesh and Assam contribute to 81% of total JE burden in the country.

Virus is transmitted by infected culex mosquito- *Culex tritaeniorhynchus*. It is maintained in a cycle between mosquitoes and vertebrate hosts like pigs and wading birds. Humans are incidental hosts.

It presents like acute encephalitis like illness. Diagnosis is suspected in individuals who live in or have travelled to a JE-endemic area. To confirm JEV infection and to rule out other causes of encephalitis requires a laboratory testing of serum or, preferentially, cerebrospinal fluid.

Severe disease is characterized by rapid onset of high fever, headache, neck stiffness, disorientation, coma, seizures, spastic paralysis and ultimately death. The case-fatality rate can be as high as 30% among those with disease symptoms.

Of those who survive, 20%–30% suffer permanent intellectual, behavioural or neurological sequelae such as paralysis, recurrent seizures or inability to speak.

There is no cure for the disease. Treatment is focused on relieving severe clinical signs and supporting the patient to overcome the infection.

Safe and effective vaccines are available to prevent JE. WHO recommends that JE vaccination be integrated into

- 22 national immunization schedules in all areas where JE disease is recognized as a public health issue.

All travelers to Japanese encephalitis-endemic areas should take precautions to avoid mosquito bites to reduce the risk for JE. Personal preventive measures include the use of repellents, long-sleeved clothes, coils and vaporizers. Travelers spending extensive time in JE endemic areas are recommended to get vaccinated.

Prevention of vector borne diseases:

1. Reduction /elimination of vector breeding sites near domestic and peridomestic areas.
2. Regular emptying and drying of containers used for water storage.
3. Straining of stored water to remove mosquito larva and avoiding storage for over a week.
4. Use of larvicides - Gambusia and guppy fish which consume the larvae.
5. Use of mosquito repellants, clothing like long sleeve shirts and long pants to avoid bites for personal protection.
6. Well screened areas indoors and use of bed nets,
7. Avoid outdoor activities at dawn and dusk when mosquito activity is high.

8. Education of community.
9. Early diagnosis and appropriate treatment.
10. Use of chemoprophylaxis and preventable vaccines when applicable.

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