

**International Journal of Biomedical and Advance Research**

ISSN: 2229-3809 (Online); 2455-0558 (Print)

Journal DOI: <https://dx.doi.org/10.7439/ijbar>

CODEN: IJBABN

Review Article

**Brief overview on dengue viral disease****Rajesh K. Sharma\*** and Reba Chhabra*National Institute of Biologicals, (Ministry of Health & Family Welfare) Government of India, A-32, Sector-62, Noida 201309, (UP), India*

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Noida 201309, (UP), India**\*Article History:****Received:** 28/03/2017**Revised:** 09/04/2017**Accepted:** 09/04/2017**DOI:** <https://dx.doi.org/10.7439/ijbar.v8i4.4060>**Abstract**

Dengue is an arthropod-borne flavivirus belongs to Flaviviridae family and it comprises of four serotypes i.e. DENV-1, DENV-2, DENV-3 and DENV-4. Laboratory diagnosis of this disease can be executed by various commercially available serological based diagnostic kits but the sensitivity and specificity of these kits varies from each other. The cell culture and / or molecular based diagnostic kits are also used at very high-end set-up, hence, it does not to be reached for general public. Although in absence of an anti-viral drugs & vaccines, the only control measures have to reduce the vector, means, prevention of dengue disease is better than cure.

**Keywords:** Dengue, Global & National scenario of dengue, History of Dengue, DF / DHF, Laboratory diagnosis.

**1. Introduction**

Over one million people worldwide die from mosquito-borne diseases every year. Mosquito-borne viral diseases transmitted through mosquito can cause more human suffering than any other organism [1].

Malaria, Dengue, West Nile Virus [2] Chikungunya, Yellow Fever, Filariasis, Japanese Encephalitis, Saint Louis Encephalitis, Western Equine Encephalitis, Eastern Equine Encephalitis, Venezuelan Equine Encephalitis, La Crosse Encephalitis and Zika Fever are some of the arthropod borne viral diseases. As per Centers for Disease Control and Prevention, USA [3] more than one-third of the world's population living in areas at risk for infection, dengue virus is a leading cause of illness and death in the tropics and subtropics. As many as 400 million people are infected yearly.

According to the WHO Technical Handbook, 2016, dengue, a mosquito-borne viral disease, is emerging as one of the world's rapidly spreading and important infectious diseases of the 21<sup>st</sup> century [4-6] which occurs in endemic proportions in South-East Asia and Pacific

Countries [7], currently close to 75% of the global population exposed to dengue are in the Asia-Pacific region [8] and an estimated 96 million cases annually in tropical and subtropical countries [9]. The World Health Organization (WHO) estimates that 50-100 million dengue infections occur each year and that almost half the world's population lives in countries where dengue is endemic [8].

Dengue has been identified as one of the 17 neglectable tropic diseases by WHO as mentioned in their first report on neglectable tropical diseases [10]. Of the 11 countries of South-East Asia Region (SEAR), only exception is the Democratic People's Republic of Korea, all other 10 countries including India are endemic for dengue [8]. During 2013, highest number of cases were reported in India but deaths have declined. The Case Fatality Ratio (CFR) which was 3.3% in 1996 had come down to 0.4% in 2010 and 0.3% in 2013 [11].

There are four closely related serotypes namely DENV-1, DENV-2, DENV-3 & DENV-4 of dengue viruses caused infection but each have different interactions with

the antibodies in human blood serum. Although there are no specific antiviral treatments or vaccines available to prevent infection with dengue virus, patient usually recovers when the need for fluid management is identified early and electrolytes are administered [12].

As the absence of an antiviral treatment or vaccine against dengue infection, the only available control measures remains focusing on the incrimination and reduction of mosquito population to suppress the virus transmission [13] and the most effective protective measures are those that avoid mosquito bites.

## 2. History of Dengue

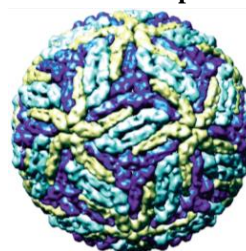
The first recognized dengue epidemics occurred almost simultaneously in Asia, Africa, and North America in the 1780s, shortly after the identification and naming of the disease in 1779. The first confirmed case report dates from 1789 and is by Benjamin Rush, who coined the term "Breakbone Fever" because of the symptoms of myalgia and arthralgia [14].

In India, first dengue virus was isolated in 1945 and occurrence of dengue fever was first reported during 1956 from Vellore district of Tamil Nadu [8]. The first Dengue Hemorrhagic Fever (DHF) outbreak occurred in Calcutta (West Bengal) in 1963 [15, 16].

## 3. Structure and general characteristics of Dengue Virus

The Dengue Viruses (DENVs) are members of the genus *Flavivirus* in the family *Flaviviridae* contain 50 nm single stranded RNA and enveloped with lipid membrane. It is a roughly spherical shaped virus having envelope and membrane proteins in the virus envelope. The core region of the virus is a nucleocapsid which is made of the virus genome and capsid proteins (Figure 1).

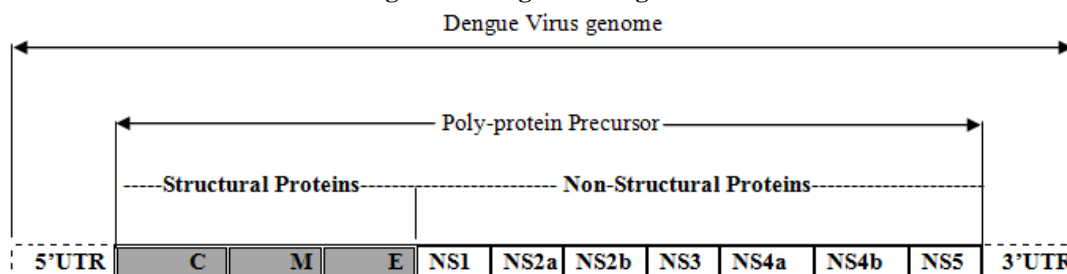
**Figure 1: An electronic microscopic view of dengue virus**



Source: NVBDCP

The dengue virus has a genome of about 11000 bases encoded a single large polyprotein [14]. This polyprotein is divided into total 10 proteins which includes 3 structural (C, M, E) which are responsible for viral structure and viral attachment to host cell and 7 non-structural (NS1, NS2a, NS2b, NS3, NS4a, NS4b, NS5) which are responsible for viral replication and other cellular function along with non-coding regions on both the 5' and 3' ends figure 2.

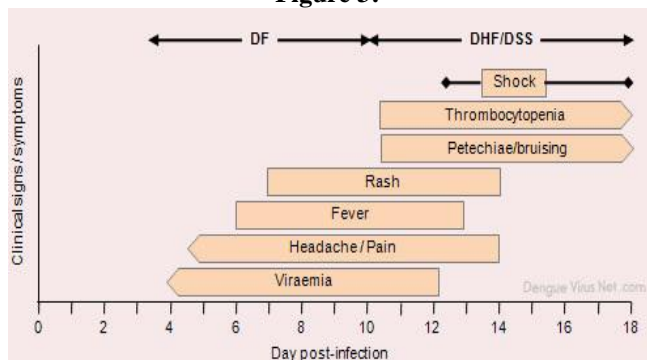
**Figure 2: Dengue Virus genome**



## 4. Dengue Fever (DF) / Dengue haemorrhage Fever (DHF) / Dengue Shock Syndrome (DSS)

Dengue fever is a vector borne disease transmitted through *Aedes* mosquitoes. *Aedes aegypti* and *Aedes albopictus* species of mosquitoes are involved in transmission of dengue infection. In India *Aedes aegypti* is the main vector in most of the urban area, however, *Aedes albopictus* is also incriminated in many states. The other species of *Aedes* like *polynesiensis* and *niveus* have also been incriminated as secondary vectors in some countries [8].

Dengue fever (DF) is a self-limiting acute disease characterized by severe headache, chills, pain upon moving the eyes, and low backache. Painful aching in the legs and joints occurs during the first hours of illness. DHF is caused by the same virus and is characterized by increased vascular permeability, hypovolaemia and abnormal blood clotting mechanisms. DHF is a potentially deadly complication with symptoms similar to those of dengue fever and in its severe form Dengue Shock Syndrome (DSS) can threaten the patient's life primarily through increase vascular permeability and shock due to bleeding from internal organs [11]. Figure 3 shows generalized time course of the event associated with DF, DHF & DSS.

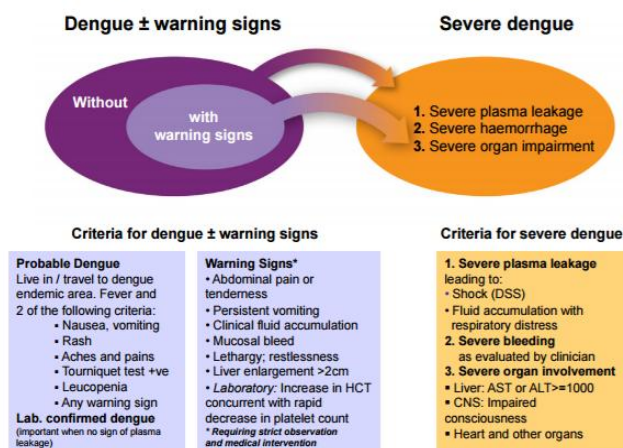
**Figure 3:**

Source: Dengue Virus Net.com

The classification of dengue disease on the basis of severity has been published by WHO TDR 2009 (Figure 4).

**Figure 4:**

### Dengue case classification by severity



Source: WHO/TDR (2009)

## 5. Diagnosis of Dengue

Different serological assays are commercially available for the diagnosis of dengue infection at diagnostic center / hospitals. Rapid diagnostic assay based on immunochromatographic method to capture anti-dengue specific IgM and IgG Antibody is commonly used for detection of dengue infection because of easy to use. However, the performance of these commercially available Rapid Diagnostic Tests (RTDs) varies greatly [17-24]. Enzyme-linked immunosorbent assay (ELISA) is a micro-titer plate based assay and is also used for detection of IgM and IgG but Rapid and MAC-ELISA do not necessarily provide early diagnosis of acute dengue infection, as in most cases the first detectable IgM appears only on 4 to 5 days of illness [25]. The laboratory confirmation of dengue infection relies on isolation of the virus in cell culture, the identification of viral nucleic acid or antigens or the detection of virus specific antibodies [26,24].

## 6. Conclusion

Rapid assay for NS1, anti-dengue IgM & IgG capture and MAC-ELISA can be performed in a resources limited setting as a screening purpose and can be confirmed by Nucleic Acid Test (NAT) / Polymerase Chain Reaction (PCR) or cell culture. The mortality can be reduced by early diagnosis and prompt systematic management of the case. However, as dengue infection occurs due to the particular species of infected Aedes mosquito bite and there are neither anti-viral drugs nor vaccines available, hence, prevention is better than cure.

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