Epidemiological Characteristics Of Dengue Fever; Its Prevention And Control

N Goel, Gurpreet, H Swami

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Abstract

Dengue has become a major international public health problem in recent years. The disease is now endemic in more than 100 countries. Worldwide nearly 2.5-3 billion people continue to live at constant risk of contracting infection. The viruses are transmitted via the bite of various day-feeding mosquitoes. Humans are the main amplifying host. Significant outbreaks of dengue fever tend to occur every five or six years. Uncontrolled urbanization and concurrent population growth, deterioration of public health infrastructure, increased traveling, non-existence of effective mosquito control methods are responsible for the dramatic global emergence of dengue/DHF. Community-based programmes, active monitoring and surveillance of the larval mosquito population, etc. may help in aborting an epidemic when used together with source reduction. There is a need to develop on improved proactive, lab based surveillance system that can provide early warning of an impending dengue outbreak.

INTRODUCTION

Dengue is one of the most serious and fast emerging tropical diseases, which has become a major international public health concern in recent years[1]. It is predominately an urban and semi-urban disease, also known as 'break bone fever'[2].

DISTRIBUTION

The disease is now endemic in more than 100 countries throughout the Americas, South East Asia, the Western Pacific islands, Africa and the Eastern Mediferranean[3]. The disease is responsible for the loss of 653,000 DALYs (Disability Adjusted Life Years) across the globe and 21,000 deaths annually[3]. Worldwide nearly 2.5-3 billion people (40% of global population) continue to live at constant risk of contracting infection[1]. WHO currently estimates that there may be 50 million cases of dengue infection worldwide every year[2]. The South-east Asia region contributes 52% or 1.3 billion cases annually[1].

Other relevant epidemiological features include[2]:

- During epidemic of dengue, attack rate among susceptible are often 40-50%, but may reach 80-90%.
- An estimated 500,000 cases of Dengue hemorrhagic fever (DHF) require hospitalization each year, of which 90% are children.
- Without adequate treatment, DHF case fatality rate can exceed 20%.

CAUSATIVE AGENT

It is caused by an Arthropod-borne virus belonging to the family Flaviviradae, genus Flavivirus. There are four closely related virus serotypes: DEN-1, DEN-2, DEN-3 and DEN-4. Each serotype is sufficiently different that there is no cross-protection and epidemics caused by multiple serotypes (hyperendemicity) can occur[4].

TRANSMISSION

The viruses are transmitted via the bite of various day-feeding mosquitoes of the subgenus Stegomyia. The principal vector is Aedes aegypti. Once infected, a mosquito remains infective for life[2]. Mosquitoes generally acquire the virus while feeding on the blood of an infected person. It mainly bites 2 hour after sunrise and several hours before sunset[6]. Infected female mosquito may also transmit the virus transovarially (via the egg). Humans are the main amplifying host, though some monkeys may also serve as a source of the virus for uninfected mosquitoes[2].

INCUBATION PERIOD: The incubation period of the disease is between 3-14 days with average of 5-7 days[5].

SIGNS & SYMPTOMS

- Classic dengue fever or "break bone fever or "bonecrusher disease" is characterized by 3,4
    - Acute onset of high fever, lasting about 6-7 days, with a smaller peak of fever at the trailing end (the so-called "biphasic pattern")
    - Frontal headache, retro-orbital pain, myalgias, arthralgias, nausea, vomiting and diarrhoea.
    - Maculopapular rash, characteristically bright red petechia and usually appears first on the lower limbs and the chest, in some – it may be generalised

- Dengue Hemorrhagic Fever (DHF): a severe and sometimes fatal from of the disease. It is characterized by:
    - High fever – sudden onset, persists for 2-7 days.
    - Hemorrhagic phenomena such as skin haemorrhages as petechia or microscopic hematuria, epistaxis, bleeding gums, hematemesis and melena.
    - Enlarged liver and circulatory failure
    - Febrile convulsions

If left untreated, the patient may go into shock (DSS-Dengue shock syndrome) with a rapid, weak pulse followed by signs of circulatory failure such as cool, blotchy skin. Without adequate treatment, the patient may die within 12-24hrs[3].

DIAGNOSIS

The diagnosis of dengue is usually made clinically.

WHO CASE DEFINITIONS

Suspect case: Acute onset of high fever of 2-7 days duration and two or more of the symptoms such as Headache, retro-orbital pain, myalgias, arthralgias, rash, hemorrhagic manifestations and leucopenia.

Probable case: Suspect case and one or more of the following-

Reoccurrence of confirmed case of dengue in the same place and time along with detection of IgM antibody. IgM antibody indicates current or recent infection and is detectable 6-7 days after the onset of illness. On average Mc-Elisa test is more specific.

Confirmed case: Suspect/probable case and one or more of the following-

Isolation of virus or detection of viral genomic sequences, four fold rise in titres of IgG or IgM antibodies. For this at least two samples are taken, one at the time of reporting to a clinic or hospital and second shortly after discharge. Optimum time interval between two samples should be of 10 days.

TREATMENT

- The mainstay of treatment is supportive therapy.
- If the patient is unable to maintain oral intake, supplementation with intravenous fluids may be required.
- Platelet transfusion recommended
    - platelet count falls below 20,000 without hemorrhage / bleeding
    - or it falls to approx. 50,000 with hemorrhage / bleeding4.

EPIDEMIOLOGY

A dengue epidemic requires the presence of

1. the vector mosquito (usually Aedes aegypti)
2. the virus
3. a large number of susceptible human hosts6.

Outbreaks may be explosive or progressive, depending upon

- density and efficiency by which the vector can be infected
- the serotype and strain of dengue virus
- the number of susceptible humans in the population.
- the amount of vector-human contact6.

The first epidemic occurred almost simultaneously, in Asia, Africa and North America in 1780s. The disease was identified and named in 1779. The global pandemic began in South East Asia in 1950s and by 1975 DHF had become a leading cause of death among children in many countries in that region. Epidemic dengue has become more common since the 1980s – by the late 1990s, dengue was the most important mosquito-borne disease affecting humans after malaria[4].

Significant outbreaks of dengue fever tend to occur every five or six years. There tend to remain large number of susceptible people in the population despite previous outbreaks because there are four different strains of the virus and because of new susceptible individuals entering the target population, either through childbirth or immigration[4].

REASONS FOR DRAMATIC GLOBAL EMERGINCE OF DF/DHF

- Uncontrolled urbanization and concurrent population growth.
- Deterioration of public health infrastructure due to limited financial and human resources.
- Increased travelling by aeroplane provide ideal mechanism for infected human transport of dengue virus.
- Effective mosquito control methods are virtually non existent in most of dengue epidemic countries.

PREVENTION & CONTROL

PREVENTIVE MEASURES

- Community-based programmes to educate the masses on eliminating or destroying mosquito larval habitats and personal protective measures like use of screening, protective clothing and repellants.
- Active monitoring and surveillance of the larval mosquito population i.e. identification of larval habitats eg. for A. aegypti – artificial or natural containers holding water close to or within human habitations eg. old tires, flower pots, water storage containers, coolers, tree holes etc. To promote and implement plans for their elimination.

CONTROL OF PATIENTS, CONTACTS & THE IMMEDIATE ENVIRONMENT

- Report to local health authorities: obligatory report of epidemics
- Isolation: until fever subsides, prevent access of day-biting mosquitoes to patients by screening the sickroom or using insecticide impregnated bed-nets, for febrile patients or by spraying houses with a knockdown adulticide or residual insecticide
- Concurrent disinfection: None
- Quarantine: None
- Immunization of contacts: None.
- If dengue occurs near possible jungle foci of yellow fever, immunize the population for yellow fever, as the urban vector for the two diseases is the same.
- Investigation of contacts and source of infection: Determine place of residence of patient for two weeks before onset of illness and search for unreported or undiagnosed cases.
- Specific treatment: None, only supportive therapy.

EPIDEMIC MEASURES

- Search for and destroy the vector in places of human habitation – through application of appropriate insecticide or through small mosquito-eating fish and copepods.
- Personal protective measures to be used by the people.
- Application of insecticides as space sprays to kill adult mosquito using portable or truck-mounted machines or even aircraft. This may help in aborting an epidemic when used together with source reduction.

INTERNATIONAL MEASURES

International agreements designed to prevent spread of A. aegypti via ships, aeroplanes and land transport from areas where infestation exists, should be enforced[5].

FUTURE OUTLOOK

- Vaccine 7: No vaccine is currently licensed for

human use. Currently, six different virus based vaccines are in advanced stages of development. Two of these are traditional tissue culture based live attenuated vaccines, whereas the remaining four are chimeric recombinant vaccine viruses developed using infectious clone technology.

- Potential antiviral approaches 4 – The research for a potential antiviral drug is under experimental stage.
    - In cell culture experiments Morpholino antigens oligos have shown specific activity against dengue virus.
    - The molecular replication mechanism of the virus has been discovered, which could be attacked by disrupting the polymerase's work.
- Regular monitoring of the vectors susceptibility to the most widely used insecticides is required to ensure appropriate choice of chemicals.
- The applicability of Remote sensing technology as a tool for the surveillance of habitats, densities of vector species and even prediction of the incidence of disease, needs to be considered.
- There is a need to develop on improved proactive, lab based surveillance system that can provide early warning of an impending dengue outbreak4.

CORRESPONDENCE TO

Dr.N.K.Goel Professor Deptt. of Community Medicine, Government Medical College & Hospital, Sector-32, Chandigarh. Phone- +91172-2665253 Ext. 1043 Mobile- +919876521536 e-mail: goelnaveen2003@yahoo.co.in

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Author Information

N. K. Goel, MD, FIPHA
Dept. Of Community Medicine, Govt. Medical College

Gurpreet, MD
Dept. Of Community Medicine, Govt. Medical College

H. M. Swami
MD, FIAPSM, Dept. Of Community Medicine, Govt. Medical College