Dengue Fever

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Introduction

With more than one-third of the world's population living in areas at risk for transmission, dengue infection is a leading cause of illness and death in the tropics and subtropics. As many as 100 million people are infected yearly. Dengue is caused by any one of four related viruses transmitted by mosquitoes. There are not yet any vaccines to prevent infection with dengue virus (DENV) and the most effective protective measures are those that avoid mosquito bites. When infected, early recognition and prompt supportive treatment can substantially lower the risk of developing severe disease.

Dengue has emerged as a worldwide problem only since the 1950s. Although dengue rarely occurs in the continental United States, it is endemic in Puerto Rico, and in many popular tourist destinations in Latin America and Southeast Asia; periodic outbreaks occur in Samoa and Guam.

Epidemiology

Dengue fever (DF) is caused by any of four closely related viruses, or serotypes: dengue 1-4. Infection with one serotype does not protect against the others, and sequential infections put people at greater risk for dengue hemorraghic fever (DHF) and dengue shock syndrome (DSS).

Transmission of the Dengue Virus

Dengue is transmitted between people by the mosquitoes Aedes aegypti and Aedes albopictus, which are found throughout the world. Insects that transmit disease are vectors. Symptoms of infection usually begin 4 - 7 days after the mosquito bite and typically last 3 - 10 days. In order for transmission to occur the mosquito must feed on a person during a 5- day period when large amounts of virus are in the blood; this period usually begins a little before the person become symptomatic. Some people never have significant symptoms but can still infect mosquitoes. After entering the mosquito in the blood meal, the virus will require an additional 8-12 days incubation before it can

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then be transmitted to another human. The mosquito remains infected for the remainder of its life, which might be days or a few weeks.

In rare cases dengue can be transmitted in organ transplants or blood transfusions from infected donors, and there is evidence of transmission from an infected pregnant mother to her fetus. But in the vast majority of infections, a mosquito bite is responsible.

In many parts of the tropics and subtropics, dengue is endemic, that is, it occurs every year, usually during a season when Aedes mosquito populations are high, often when rainfall is optimal for breeding. These areas are, however, additionally at periodic risk for epidemic dengue, when large numbers of people become infected during a short period. Dengue epidemics require a coincidence of large numbers of vector mosquitoes, large numbers of people with no immunity to one of the four virus types (DENV 1, DENV 2, DENV 3, DENV 4), and the opportunity for contact between the two. Although Aedes are common in the southern U. S., dengue is endemic in northern Mexico, and the U.S. population has no immunity, the lack of dengue transmission in the continental U.S. is primarily because contact between people and the vectors is too infrequent to sustain transmission.

Dengue is an Emerging Disease

The four dengue viruses originated in monkeys and independently jumped to humans in Africa or Southeast Asia between 100 and 800 years ago. Dengue remained a relatively minor, geographically restricted disease until the middle of the 20th century. The disruption of the second world war – in particular the coincidental transport of Aedes mosquitoes around the world in cargo - are thought to have played a crucial role in the dissemination of the viruses. DHF was first documented only in the 1950s during epidemics in the Philippines and Thailand. It was not until 1981 that large numbers of DHF cases began to appear in the Carribean and Latin America, where highly effective Aedes control programs had been in place until the early 1970s.

Global Dengue

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Today about 2.5 billion people, or 40% of the world's population, live in areas where there is a risk of dengue transmission see WHO/Impact of Dengue. Dengue is endemic in at least 100 countries in Asia, the Pacific, the Americas, Africa, and the Caribbean. The World Health Organization (WHO) estimates that 50 to 100 million infections occur yearly, including 500,000 DHF cases and 22,000 deaths, mostly among children.

Dengue in the United States

Nearly all dengue cases reported in the 48 continental states were acquired elsewhere by travelers or immigrants. Because contact between Aedes and people is infrequent in the continental U.S., these imported cases rarely result in secondary transmission. The last reported continental dengue outbreak was in south Texas in 2005. A small dengue outbreak occurred in Hawaii in 2001.

Most dengue cases in U.S. citizens occur in those inhabitants of Puerto Rico, the U.S. Virgin Islands, Samoa and Guam, which are endemic for the virus. Dengue and DHF have been a particular challenge in Puerto Rico, where outbreaks have been reported since 1915 and large island-wide epidemics have been documented since the late 1960s. The most recent island-wide epidemic occurred in 2007, when more than 10,000 cases were diagnosed. In Puerto Rico, and most of the Caribbean Basin, the principle dengue vector Ae. aegypti is abundant year-round. Dengue transmission in the Puerto Rico follows a seasonal pattern. Low transmission season begins in March and lasts until June, and high transmission begins in August until November.

Dengue Surveillance in the U.S.

DF and DHF cases have long been reportable by law to public health authorities in 26 states. Beginning in 2009, all nationally diagnosed dengue infections will be reportable to the CDC.

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Statistics on cases have been compiled in Puerto Rico since 1915 and, since 1969, CDC's Dengue Branch, located at San Juan, has operated the island-wide passive dengue surveillance system (PDSS) in partnership with the Puerto Rico Department of Health. PDSS was instrumental in confirming the endemic presence of dengue transmission in Puerto Rico, identifying the first case of DHF in the Americas, and detecting the first cluster of cases of DHF and the first laboratory-confirmed, dengue-related death in Puerto Rico. Instructions and forms for reporting suspected or confirmed cases of dengue are linked below.

Entomology and Ecology

Aedes aegypti, the principal mosquito vector of dengue viruses is an insect closely associated with humans and their dwellings. People not only provide the mosquitoes with blood meals but also water-holding containers in and around the home needed to complete their development. The mosquito lays her eggs on the sides of containers with water and eggs hatch into larvae after a rain or flooding. A larva changes into a pupa in about a week and into a mosquito in two days. See Aedes main aquatic habitats; from tree cavities to toilets and learn about the mosquitoes life cycle. People also furnish shelter as Ae. aegypti preferentially rests in darker cool areas, such as closets leading to their ability to bite indoors.

It is very difficult to control or eliminate Ae. aegypti mosquitoes because they have adaptations to the environment that make them highly resilient, or with the ability to rapidly bounce back to initial numbers after disturbances resulting from natural phenomena (e.g., droughts) or human interventions (e.g., control measures). One such adaptation is the ability of the eggs to withstand desiccation (drying) and to survive without water for several months on the inner walls of containers. For example, if we were to eliminate all larvae, pupae, and adult Ae. aegypti at once from a site, its population could recover two weeks later as a result of egg hatching following rainfall or the addition of water to containers harboring eggs.

It is likely that Ae.aegypti is continually responding or adapting to environmental change. For example, it was recently found that Ae. aegypti is able to undergo immature development in broken or open septic tanks in Puerto Rico, resulting in the production of hundreds or housands of Ae.aegypti adults per day. In general, it is expected that control interventions will change the spatial and temporal dispersal of Ae. aegypti and perhaps the pattern of habitat utilization. For these reasons, entomological studies should be included to give support before and throughout vector control operations.

Dengue Transmission Vectors:

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Aedes aegypti

Dengue viruses are mainly transmitted by the bite of infected Aedes aegypti mosquitoes; an invasive, domestic species with tropical and subtropical worldwide distribution that originated in Africa.

Aedes albopictus

Another important mosquito vector of dengue is Aedes albopictus, which is also an invasive species originally from Asia.

Prevention

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This photograph shows a mother applying mosquito repellent to her child's skin in order to prevent mosquitos from biting.

How to reduce your risk of dengue infection:

There is no vaccine available against dengue, and there are no specific medications to treat a dengue infection. This makes prevention the most important step, and prevention means avoiding mosquito bites if you live in or travel to an endemic area.

The best way to reduce mosquitoes is to eliminate the places where the mosquito lays her eggs, like artificial containers that hold water in and around the home. Outdoors, clean water containers like pet and animal watering containers, flower planter dishes or cover water storage barrels. Look for standing water indoors such as in vases with fresh flowers and clean at least once a week.

The adult mosquitoes like to bite inside as well as around homes, during the day and at night when the lights are on. To protect yourself, use repellent on your skin while indoors or out. When possible, wear long sleeves and pants for additional protection. Also, make sure window and door screens are secure and without holes. If available, use air-conditioning.

If someone in your house is ill with dengue, take extra precautions to prevent mosquitoes from biting the patient and going on to bite others in the household. Sleep under a mosquito bed net, eliminate mosquitoes you find indoors and wear repellent!

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Symptoms

The principal symptoms of dengue are:

- High fever and at least two of the following:
  - Severe headache
  - Severe eye pain (behind eyes)
  - Joint pain
  - Muscle and/or bone pain
  - Rash
  - Mild bleeding manifestation (e.g., nose or gum bleed, petechiae, or easy bruising)
  - Low white cell count

Generally, younger children and those with their first dengue infection have a milder illness than older children and adults.

Watch for warning signs as temperature declines 3 to 7 days after symptoms began. Go IMMEDIATELY to an emergency room or the closest health care provider if any of the following warning signs appear:

- Severe abdominal pain or persistent vomiting
- Red spots or patches on the skin
- Bleeding from nose or gums
- Vomiting blood
- Black, tarry stools (feces, excrement)
- Drowsiness or irritability
- Pale, cold, or clammy skin
- Difficulty breathing

Dengue hemorrhagic fever (DHF) is characterized by a fever that lasts from 2 to 7 days, with general signs and symptoms consistent with dengue fever. When the fever declines, warning signs may develop. This marks the beginning of a 24 to 48 hour period when the smallest blood vessels (capillaries) become excessively permeable ("leaky"), allowing the fluid component to escape from the blood vessels into the peritoneum (causing ascites) and pleural cavity (leading to pleural effusions). This may lead to failure of the circulatory system and shock, and possibly death without prompt, appropriate treatment. In addition, the patient with DHF has a low platelet count and hemorrhagic manifestations, tendency to bruise easily or have other types of skin hemorrhages, bleeding nose or gums, and possibly internal bleeding.

Treatment

There is no specific medication for treatment of a dengue infection. Persons who think they have dengue should use analgesics (pain relievers) with acetaminophen and avoid those containing ibuprofen, Naproxen, aspirin or aspirin containing drugs. They should also rest, drink plenty of fluids to prevent dehydration, avoid mosquito bites while febrile and consult a physician.

As with dengue, there is no specific medication for DHF. If a clinical diagnosis is made early, a health care provider can effectively treat DHF using fluid replacement therapy. Adequately management of DHF generally requires hospitalization.

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