Dengue fever
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Dengue fever (Breakbone fever); Etiological agent- Dengue virus (2).

Transmission:

Dengue fever is transmitted through an arthropod vector, specifically mosquitoes of the Aedes genus. (most commonly Aedes aegypti, also known as the yellow fever mosquito) (1)

Reservoirs:

The Aedes aegypti mosquito is the primary host, although they are unaffected. In terms of vertebrates that can be affected - only humans fall into this category. (2)

General Characteristics:

There are four serotypes of the Dengue virus, (DEN-1, DEN-2, DEN-3, and DEN-4) They belong to the genus Flavivirus, and are single stranded RNA viruses, with a host derived lipid bilayer envelope in addition to their capsid. The genetic material for the virus does not have a poly A tail at the end, however, a 5' cap is present. (3) It is related to a number of other flaviviruses, such as West Nile, and Yellow Fever, both of which are also transmitted to humans through the bite of an Aedes spp. mosquito that has been infected. (4)

Key tests for identification:

The CDC recommended means to identify the presence of the virus in a patient's blood or plasma sample is through the use of real time PCR techniques. The patient's blood is analyzed by performing PCR with the addition of specific oligonucleotide probes that will fluoresce when bound to a complementary sequence of RNA. This process allows for differential identification of all four serotypes of Dengue virus. If this test comes back negative, or the patient has been feverish for over 5 days, an alternative option would be to utilize an ELISA test to identify IgM antibodies to the virus. (5)

Signs and Symptoms:

The disease caused by the Dengue virus typically causes a high fever, in excess of 40 degrees Celsius, as well as a number of flu like symptoms, including: headaches, particularly including retro-orbital pain; rash; vomiting; swollen lymph nodes; and joint and muscle pain, (7) which apparently are excruciating enough to match breaking bones, hence the alternate title for the disease. The disease lasts for approximately 2 to 7 days, unless the rare case of severe dengue or dengue hemorrhagic fever takes place, in which case an alternate set of symptoms can arise as a result of plasma leakage into surrounding tissues. These include: a decrease in temperature, even to possibly below normal; severe abdominal pain; difficulty breathing or rapid breathing; and blood in vomit. (1)

Virulence Mechanisms:
After an initial mosquito bite, the cells of an infected person’s immune system are the first to be targeted, spreading the infection from the skin to the lymphatic system. Utilizing the host’s cellular membrane as an envelope, it evades detection and is absorbed into target cells by endocytosis. As there are four serotypes of Dengue virus, if a person who has recovered from one strain of the virus is reinfected by another, the harmful effects of the virus are amplified due to a condition referred to as Antibody-Dependent Enhancement. In such a case, the presence of antibodies to the first strain amplifies the rate at which the virus is able to replicate and invade host cells, dramatically worsening the infection. (8)

**Control/Treatment:**

Normally a person infected with dengue fever will recover within a week or so after developing symptoms, and only mild palliative care is necessary, making sure that they stay hydrated and use analgesics such as acetaminophen. Aspirin should be avoided. (7)

Once patient has recovered from infection by one serotype of the virus, they are no longer susceptible to that strain, however, this only amplifies their risk should they be infected again. As indicated above, due to ADE, they may develop the more severe symptoms of dengue hemorrhagic fever, in which case there is a very real risk of death, and the patient should be monitored carefully in the hospital. Treatment there usually includes intravenous supplementation of fluids, but a close eye must be kept on intravascular volume, as well as other key factors, to ensure that the precisely correct amount of fluids are introduced into the patient’s system. In some cases, transfusions of blood or plasma may be necessary. (4)

**Prevention:**

At this moment, there are no publically available vaccines for the Dengue virus, however, many are in development. (2)

The main way to prevent dengue in a community is to limit the ability of the Aedes spp. mosquitoes to propagate in the nearby area. The Aedes mosquitoes choose standing water in which to lay their eggs, and they prefer to do so in man-made containers where they are less likely to be disturbed by their natural predators. Thus, a great deal can be done to prevent the spread of the disease by ensuring any water storage container is covered, and if possible emptied regularly. (1) Discarded automobile tires, outdoor pots, or roof gutters that have been clogged can all collect rain water and serve as excellent habitats for the mosquitoes as well.

The Aedes mosquitoes favor tropical climates, so when travelling in areas that are endemic with dengue fever, it is prudent to dress with protection in mind, choosing long sleeves, long pants, and wearing socks and shoes. Mosquito repellent is also an excellent option that can prevent your exposure to the virus. (7)

**Local Cases:**

The climate preferred by the Aedes mosquitoes limits the risk of infection in the continental United States, but in 2009, 22 residents of Key West, Florida were afflicted by dengue fever that was locally acquired. (9)
The only recent reported case of Dengue Fever in the continental US was in 2005, in Brownsville, Texas, with 3 locally acquired cases. (10) However, just right across the border, in the Mexican state of Tamaulipas, 1,251 cases were reported that year. (11)

Global Cases:

Dengue is a rapidly spreading virus globally, and in the past decade, an average of 968,564 cases of dengue fever were reported, with nearly 60 countries reporting infection. This can be compared to the 90s, during which around half as many cases were identified. (12)

History:

Dengue came to the attention of the medical profession in the 1700s, with diseases with symptoms similar to dengue cropping up in areas all throughout the tropics. It is theorized that the spread of dengue from its origin in Africa was facilitated by ships used in commerce, including the slave trade. As the Aedes mosquito found that man-made water containers were ideal locales for them to lay their eggs undisturbed, the mosquito thrived in these new urban locales. A significant cause for the dramatic uptick in cases since then however can be attributed primarily to the events of World War II, when many soldiers were moved all across the globe, giving the virus a large number of hosts, and the destruction of water supply and sewage facilities as a consequence of the conflict gave the mosquitoes many areas to grow unchecked. As these soldiers returned to their homes all across the globe, the virus followed them. (14)

Novel prevention strategies:

As most of the strategies that show any current promise of preventing the disease focus on the vector, the most intriguing among these is the use of genetically modified male mosquitoes which are functionally sterile to prevent the growth of Aedes aegypti populations. Mosquitoes were released in Brazil in advance of this last year's World Cup, with a reported 90% drop in live wild mosquito populations. (13) However, presently support for similar strategies here in the United States is somewhat limited, with many having fears regarding the long term repercussions of using genetically modified mosquitoes. (6)

Works Cited:

https://www.dshs.state.tx.us/idcu/disease/dengue/information/faqs/


