Dengue Fever

By Amanda Moorefield

Dengue Fever; etiologic agents- Dengue viruses (DENV 1, DENV 2, DENV 3 and DENV 4)- flaviviruses

General Characteristics:

Dengue fever is considered an arbovirus since it is a tropical mosquito-borne virus. There has been debate on how to classify Dengue Fever due to its variability. There has been recent research, which classified Dengue into severe and non-severe cases, as it does tend to vary in severity as well as symptoms with no correlation to patients' age. Due to this, classification has been recorded to also take into consideration the age of infected individuals, warning signs and geographical location. Important warning signs to be aware of would be high fever and a red body rash.

Looking into the virus more from a microbiology level, it has been reported from Bente and Rico-Hesse that the dengue virus has a single stranded RNA genome. "It is referred to as positive-sense RNA because it can be directly translated into proteins. The genome is translated as a single, long polypeptide and then cut into ten proteins" (5). According to the *Latest Developments and Future Directions in Dengue Vaccines,* The RNA genome of dengue virus is about 10.7 kb and encodes three structural proteins (7).

Transmission:

Dengue is transmitted between people by the mosquitoes *Aedes aegypti* and *Aedes albopictus.* The mosquitos act as vectors in transmitting the virus.

Reservoir:

Infected adults, adolescents and children, predominantly residents of or visitors to tropical and subtropical environments.

History:

According to nature.com, In 1943, Ren Kimura and Susumu Hotta first isolated the dengue virus while studying blood samples from infected patients in Japan. After Kimura and Hotta, the Dengue virus 1 (DEN-1) was independently isolated by new scientists a year later (5).

Identification and testing:

A new diagnostic test was recently developed by the CDC to help detect the dengue virus. According to the CDC, it helps diagnose within the first week the patient becomes

symptomatic and can identify all four dengue virus types. The CDC explained, “This is the first test to detect the virus and not certain antibodies in the disease process” (1). Determining nucleotide sequences from the dengue genome is now routine in laboratories and it is believed that studying blood samples of infected populations can help determine the origin and sometimes the possibility of disease progression (6). Antibody titers, CBCs, PCR testing for virus types and liver function tests can also help in diagnosing Dengue Fever.

Signs and Symptoms:

Dengue fever begins with a sudden high fever, often as high as 104 - 105 degrees Fahrenheit, 4 to 7 days after the infection. A flat, red rash may appear over most of the body 2 to 5 days after the fever starts. A second rash, which looks like the measles, appears later in the disease (2). Other symptoms include, fatigue, headache, join and muscle aches, nausea, vomiting, sore throat and nasal stuffiness (1).

Treatment:

There is no specific treatment for Dengue Fever. The best option is to treat the fever with normal fever precautions such as taking medication to reduce fever and keeping fluid intake high to prevent dehydration. Due to the complexity of Dengue fever, an effective vaccination has not been developed or discovered yet. There are a few vaccine candidates in clinical studies. According to the research of Thisyakorn, there is a vaccine based on chimeric yellow fever dengue virus, which has progressed in the trials and has reached phase III of testing. Thisyakorn also recorded that “several other live-attenuated vaccines, as well as subunit, DNA and purified inactivated vaccine candidates, are at earlier stages of clinical development” (7).

Prevention

Since there is no treatment or vaccine at this time, the best prevention method would be to wear mosquito repellants. This can hopefully help prevent mosquito bites in the first place when traveling in tropical climates to reduce the chances of being infected by the Dengue virus.

Virulence Mechanism:

Dengue virus follows typical viral mechanism in which the virus hijacks a host cell in order to replicate the viral genome and hence spread the virus/disease. “Once a host cell is infected, the Dengue virus hijacks the host cell’s machinery to replicate the viral RNA genome and proteins” (5). Then the new viruses go on to infect new host cells. According to *Models of Dengue Virus Infection, “*the pathology of tissue specimens from DF and DHF patients suggests that lymph nodes, spleen, liver and bone marrow are involved or affected by dengue virus replication, whereas studies of live patients

showed that a variety of cell types such as dendritic cells (DCs), monocytes, macrophages, lymphocytes and endothelial cells become infected at varying rates during the course of disease" (3). Most studies do show some correlation between severity of disease and viral activity/amount in infected blood but there is still not enough evidence to conclude this as a significant result.

Incidence:

Global:

According to the CDC, Globally, there are an estimated 50 to 100 million cases of dengue fever (DF) and several hundred thousand cases of dengue hemorrhagic fever (DHF) per year (1). They go on to record that fatality rate can be as high as 10% but can be reduced to as low as 1% with early recognition and proper treatment (1). Outbreaks were reported in over ten countries outside of the US and also many suspected cases in the United States due to travelers carrying the virus back from other countries.

Local:

Even more specifically, there were reported cases in Texas due to infected people crossing the Texas-Mexico border in 2005. They were asymptomatic when in Mexico but start to show signs once they were in Texas. Also as recent as 2014, there were reported cases of Dengue fever which originated in southern Texas as opposed to imported disease due to traveling. Before this, reported cases had only occurred primarily in Hawaii and Florida due to location and tropical climate. This has caused scientists to reevaluate the specifics of dengue-carrying mosquitos and where they reside.

Work Cited

1."*Dengue*." *Centers for Disease Control and Prevention*. Centers for Disease Control and Prevention, 19 Jan. 2016. Web. 28 Feb. 2016. <http://www.cdc.gov/dengue/>.

2. "*Dengue Fever*." *MedlinePlus*. U.S. National Library of Medicine, 1 Jan. 2014. Web. 27 Feb. 1990. <https://www.nlm.nih.gov/medlineplus/dengue.html>.

3. Bente, Dennis A., and Rebeca Rico-Hesse. "*Models of Dengue Virus Infection*." *NCBI*. Drug Discov Today Dis Models, Mar. 2006. Web. 26 Feb. 2016. < http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1949394/>.

4. Hotta, Susumu. "*Experimental Studies on Dengue: I. Isolation, Identification and Modification of the Virus*". *The Journal of Infectious Diseases* 90.1 (1952): 1–9. Web. 28 Feb. 2016 <http://www.jstor.org/stable/30093992?seq=1#page_scan_tab_contents>.

5. Miko, Ilona. "*Dengue Viruses*." *Nature.com*. Nature Publishing Group, 2014. Web. 28 Feb. 2016. <http://www.nature.com/scitable/topicpage/dengue-viruses-22400925>.

6. Rico-Hesse, Rebeca. "*Dengue Virus Evolution and Virulence Models." Clinical Infectious Diseases : An Official Publication of the Infectious Diseases Society of America*. U.S. National Library of Medicine, 18 Apr. 2007. Web. 28 Feb. 2016. < http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2275049/>.

7. Thisyakorn, Usa, and Chule Thisyakorn. "*Latest Developments and Future Directions in Dengue Vaccines*." *Therapeutic Advances in Vaccines*. SAGE Publications, 2 Jan. 2014. Web. 28 Feb. 2016. < http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3991153/>.