West Nile Virus
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Disease:
West Nile virus (WNV) is commonly referred to as West Nile fever or West Nile encephalitis. It is a part of the viral family called Flaviviridae, genera flavivirus. [2] WNV is a single-stranded RNA virion that is encased in a lipid envelope. [2] WNV is usually a neurotropic virus, meaning that it tends to replicate and exert its effects within neurological related cells and regions (brain, nerves, spinal cord, etc.). [6]

Transmission:
WNV is mainly transmitted through biological vectors such as mosquitoes which are the dominating vectors), ticks, or fleas. A small percentage of transmission can also be related to “blood transfusions, organ transplants, or from mother to baby while pregnant or breastfeeding.” [8] However, West Nile Virus CANNOT be contracted from casual contact with humans or live/dead animals. Although, it is highly advised to wear proper protective gear when handling dead birds. Additionally, you cannot get the virion from eating infected animals either. [8] The virus needs a way of getting into the bloodstream in order to produce any effects.

Reservoirs:
Birds are the main animal reservoirs of WNV. Some birds are susceptible to virus and will not survive, while others are unaffected by its presence. It has been found that the American robin is the dominating species of bird within the United States to host the virus without succumbing to its effects. [2]

Characteristics of WNV:
West Nile Virus is an arbovirus, meaning that it is a virus that is transmitted via biological vectors like mosquitoes, ticks, fleas, or other arthropods. In this case, WNV is transmitted via mosquitoes from (mainly) birds to other animals and humans. WNV comes from the family Flaviviridae and genus Flavivirus. It is a single-stranded RNA virion that is encased in an spherical lipid envelope. The RNA encodes for the capsid, envelope, and for the pre-membrane proteins. According to the CDC, WNV “has 2 genetic lineages.” The first lineage originated in “North America, Europe, Asia, and Australia” [4], while the second lineage can be found in “sub-Saharan Africa and Madagascar”. [4] There have been 2 variants found in Texas. One that has a 0.18% difference in nucleotides from the first strain discovered in New York in 1999. The second one has a 0.35% difference in nucleotides. They each differed from each other by only 0.5%. These attenuated strains of WNV were found in birds in Texas and Mexico. The physical differences included reduced neuroinvasiveness and smaller plaque size resulting in lower levels of viremia. [4]

Key Tests for Identification:
The main test that is used to identify West Nile Virus infection is measurement of IgM (immunoglobulin M) antibodies in serum and cerebrospinal fluid. “A ≥4-fold change in virus-specific neutralizing antibody titer between 2 serum specimens collected 2-3 weeks apart usually confirms acute WNV infection.” [4] Microsphere immunoassays have also been used to detect the presence of IgM and IgG antibodies as well. This test appears “to be more accurate and efficient than current enzyme immunoassays.” [4] It has also been detected by using indirect immunofluorescence assays and RT-PCR (Reverse Transcriptase-Polymerase Chain Reaction) when isolated from patients with neuroinvasiveness, but this is rare. “There are however other tests like the plaque reduction neutralization test or PRNT which is the most specific test for the arthropod-borne flaviviruses.” [5] ELISA tests have also been used to test for specific antibodies against the West Nile Virus.
**Signs and Symptoms:**
Depending on the individual that is infected and the severity of the infection by the virus, signs and symptoms can range from no signs at all to permanent paralysis. Some of the mild symptoms include fever, fatigue, headache, and aches of the back and body. If the virus is extremely hostile, the fever, headache, and aches can increase in severity. Muscle can become stiff or tremors can occur which can lead to lack of coordination. Initial attacks on neurological tissue can cause one to become disoriented or confused, and in more serious cases, one can go into a stupor or coma. Ultimately, if the infection becomes highly spread amongst the neurological tissue, permanent paralysis or muscle weakness can occur, as well as, meningitis (swelling of the membranes or meninges that surround the brain) and encephalitis (swelling of the brain itself). “...Severe human meningoencephalitis is a common complication of infection and results in a considerable number of deaths. The medulla of the brainstem in the central nervous system is the primary target of WNV.” [6]

**Historical Information:**
West Nile Virus was first discovered in 1937 in Uganda. It is an infection that is most commonly found in Africa, Western Asia, and the Middle East. In September of 1999, the first outbreak of West Nile Virus was reported in the United States in the state of New York. The different strains have evolved their own specific characteristic. This means that the “American strain of the virus is almost indistinguishable from a virulent strain found in a goose on an Israeli farm in 1998.” [3]

**Virulence factors:**
As stated before, WNV is a single stranded RNA virion encased in a lipid envelope. This lipid coat is its main virulence factors as it helps the pathogen to better attach to the host cell using its projections (usually spikes or peplomers). This can also hurt that virus as it is more sensitive to heat and other factors that could destroy it. Another virulence factor is that there are so many different strains of the virus. This allows it to spread faster amongst different populations once introduced. If a population somehow gained immunity from one strain A and strain B somehow found its way to that population, that population’s immunity would not work as well against strain B as it did against strain A.

**Control/Treatment:**
“Current therapeutic options against WNV are mainly supportive; there are no FDA-approved vaccines or treatments available.” As of now, the focus is to treat the symptoms but not the virus itself. While most people overcome the infection on their own, those with severe signs and symptoms need more help. Over-the-counter pain relievers such as ibuprofen or aspirin are commonly used to treat the pain induced by the infection in mild cases. Anti-inflammatory medication should be used to reduce any swelling that occurs. “In severe cases, patients often need to be hospitalized to receive supportive treatment, such as intravenous fluids, pain medication, and nursing care.” Interferon therapy (a type of gene therapy) is currently being explored as a treatment against the encephalitis symptoms caused by WNV. Unfortunately, antibiotics are ineffective against this type of infection. There has been development of vaccines to treat horses with the infections but no vaccines have been approved to treat humans.

**Prevention/Vaccine Information:**
We currently have not developed any FDA-approved vaccines for human use. As of now there are only about 2 known vaccines that can be used on horses. Because West Nile Virus is mainly transmitted through mosquitoes, the best way to prevent contraction of the infection is through the use of mosquito repellent and long sleeved clothing, especially in warm, humid environments that have standing water areas. It might be best to avoid such areas especially in regions where the prevalence of WNV is high.
Local cases or Outbreaks (Incidence Figures):

In Texas, the incidence of human West Nile Virus neuroinvasive disease is 0.5 - 0.99 per 100,000 populations. Currently, there has been no disease reports in Travis County for 2015 and only 1 incident of West Nile Virus has been reported in Hays County for 2015. [8] Texas has had a total of 245 cases within 2015 and the United States as a whole has had a total of 1,902 cases for 2015. [8]

Global cases or Outbreaks (Incidence Figures)

In between the black lines indicates that main distribution of the West Nile Virus through the mosquito vector excluding the extreme climate areas which are indicated by the dashed lines. Number indicate other lineages that are present in those areas other than lineage #1. [1]

The largest outbreaks have occurred in countries such as “Greece, Israel, Romania, Russia, and USA.” Because birds are the primary reservoirs, these outbreaks were linked to major migratory bird routes. There has also been a high prevalence of WNV in Africa, Europe, the Middle East, West Asia, and also Australia. [9] An outbreak in Turkey in 2010-2011 had a reported 47 cases of West Nile Virus. In 2008 - 2009, Iran reported 9 cases of West Nile. In Hungary of 2008, there were a reported 22 human neuroinvasive cases. “Seropositivity for WNV in Shanghai was report in 14.9% of cats and 4.9% of
dogs tested in 2010, as well as in captive resident birds from 2009 - 2010, but no human cases have been reported for southern and eastern China.” In 2013, Serbia reported 302 cases of West Nile Virus.

References:


