



Viral Encephalitis: The role of birds¹

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August 1999's encephalitis outbreak in New York City and surrounding areas brought the issue of viral encephalitis to the attention of the general public. Also, news that birds from the Bronx Zoo had died from the virus raised fears in poultry keepers throughout the eastern United States who have been wondering if they are at risk of catching the disease from their birds. The purpose of this publication is to clear up some of the misconceptions with regards to viral encephalitis and the role birds play in its transmission.

What is Encephalitis?

"Encephalitis" is an inflammation of the brain. It can be caused by head injury, bacterial infections and, most commonly, viral infections. While most people infected with viral encephalitis have only mild or no symptoms, serious cases can cause headaches, high fever, lethargy, convulsions, delirium, coma and even death.

How is it transmitted?

Viral encephalitis is a vector-borne infectious disease. Vectors are organisms that transmit disease from one animal host to another. Mosquitoes are vectors for the transmission of encephalitis from small creatures, usually birds and rodents, to humans.

Viral encephalitis is transmitted through the bite of a mosquito that has become infected by feeding on an infected bird. The virus can NOT be transmitted from person to person or from birds to people. In addition, there is NO danger of being infected from consumption of poultry products, including meat and eggs.

Birds who live near bodies of standing water, such as freshwater swamps, are susceptible to infection with an encephalitis virus. For a short time after a bird is infected it carries high levels of the virus in its blood. Once the bird recovers, it develops immunity to the disease. If a mosquito feeds on a recently infected bird, the mosquito will become a lifelong carrier of the disease. The mosquito will then transmit the infection to the next bird it feeds on, which will in turn give it to more mosquitoes. This pattern of transmission usually occurs without any serious impact on either the mosquito or the birds, and without affecting humans. This is partly because mosquitoes' primary hosts are birds and small mammals, and they bite humans only as a second choice. However, sometimes environmental disasters, unusual weather or other climate changes, cause an increase in the number of infected birds, as well as mosquitoes that feed on both birds and humans. Under these conditions, humans may be infected.

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About 3,000 species of mosquitoes have been identified worldwide, and about 150 species live in North America. The main type of mosquito that carries the encephalitis virus is the *Culex* species, which is generally active from dusk to dawn.

Another type of mosquito known to carry the virus, *Aedes vexans*, is also active during the day.

Only female mosquitoes bite, because they need blood to develop fertile eggs. They require a "blood meal" for each batch of eggs to be laid, but like their male counterparts, they rely on nectar as their main food source. The mosquito tracks its targets by following exhaled carbon dioxide. When the mosquito bites, she injects saliva before drawing blood. The saliva makes penetration easier and also serves to prevent blood clots from developing in the feeding tube. The welts and itches that we experience after being bitten by a mosquito are an allergic reaction to the saliva.

Types of viral encephalitis

There are several types of mosquito-borne encephalitis that affect people in the United States. They are Equine, St. Louis, LaCrosse and, most recently, West Nile Encephalitis.

Equine Encephalitis

There are three main types of Equine Encephalitis (EE): Eastern, Western and Venezuelan. As the name suggests, EE affects horses, but it can also affect humans. EE is also called sleeping sickness because horses show signs of weakness and depression. Other symptoms include fever, walking in circles or into obstacles, refusal to eat, and standing with head lowered. This disease incubates in the horse for 1 to 3 weeks before signs are seen, and the horse may be sick for 3 to 6 weeks. Horses that recover are often called dummy horses due to the permanent damage that has occurred in the brain. Mares will not be good mothers and, if they have been through a severe bout of the disease, they are often not safe to ride.

Eastern Equine Encephalitis (EEE)

EEE is the most serious encephalitis virus affecting humans in North America. Outbreaks

occur most commonly in the eastern United States. Although some people experience it only as a mild illness, EEE is fatal in 30 to 60 percent of infected people. However, fewer than five cases are usually reported annually. Most cases occur in late summer, though they can happen year-round in southern states. Symptoms of EEE in humans usually appear 4 to 10 days after a bite by an infected mosquito.

The virus infects birds that live near freshwater swamps. All birds, including chickens, pheasants, chukars, turkeys, ducks, and 52 species of wild birds, are susceptible to EEE. However, EEE is rarely diagnosed in confinement-reared domestic poultry. Pheasants seem to be the most susceptible domestically-reared game bird, and a few outbreaks of EEE occur annually in the Atlantic coastal states. Mortality is usually high, up to 55 percent. This disease most frequently occurs in semi-mature to mature birds. Younger birds may be susceptible, but the disease is range-related and pheasants are usually not put on range until 6 to 8 weeks of age. Clinical signs of EEE-infected birds include lack of appetite, staggering, and paralysis. Surviving birds may be blind, partially paralyzed, and have difficulty holding their head.

Western Equine Encephalitis (WEE)

Most cases of WEE are reported in the central and western plains of the United States. The virus flourishes in birds that live near irrigated fields and farming areas. WEE is less often fatal for humans than its eastern cousin, but it is still serious. Brain damage and other major complications occur in about 13 percent of people of all ages infected, and in one-third of infected infants. Fortunately, the virus is rare, with less than five cases reported each year. Human infections are usually first detected in June or July with symptoms appearing 5 to 10 days after being bitten. The clinical signs of WEE in birds are identical to those of EEE.

Venezuelan Equine Encephalitis (VEE)

VEE is the most lethal form of EE, but it is rare in the United States. The southern states are at the greatest risk.

St. Louis Encephalitis

St. Louis Encephalitis (SLE) the most common mosquito-borne disease in the United States. Like most types of viral encephalitis, it is transmitted to mosquitoes by birds. The mosquito vector of SLE breeds in areas of standing water, including such places as discarded tires, polluted pools, roadside ditches, and containers such as birdbaths and flower pots.

While many young people have mild or no symptoms when infected with SLE, up to 20 percent of older people die when infected. An average of 130 cases are reported each year in the United States, although severe outbreaks have affected thousands of people in past years. Symptoms appear within 7 to 10 days of being bitten by an infected mosquito.

SLE virus has been isolated from several species of wild and domestic birds. However, it must be noted that chickens do not develop the disease and the blood virus level produced by chickens is generally low. Thus, chickens do NOT play a significant role in the bird-mosquito transmission cycle. For information on the use of chickens as sentinels in high-risk areas, refer to Factsheet VM-71, "St. Louis Encephalitis: The role of chickens."

LaCrosse Encephalitis

This virus was named for LaCrosse, Wisconsin, where the first outbreak was recognized in 1963. It is most common in the hardwood forest areas of the upper midwestern states (Minnesota, Wisconsin, Iowa, Illinois, Indiana, and Ohio). Recently, more cases are being reported from states in the mid-Atlantic (West Virginia, Virginia, North Carolina) and southeastern (Alabama and Mississippi) regions of the country. LAC usually affects children and has a mortality rate of about 1 percent. An average of 75 cases are reported annually. Symptoms appear 5 to 15 days after being bitten by an infected mosquito.

Unlike other forms of viral encephalitis, LaCrosse Encephalitis (LAC) virus cycles between the daytime-biting treehole mosquito (*Aedes triseriatus*), and the vertebrate amplifier hosts

(chipmunks, tree squirrels) in deciduous forest habitats. The virus is maintained over the winter by transmission to the mosquito eggs. If the female mosquito is infected, she may lay eggs that carry the virus, and the adults coming from those eggs may be able to transmit the virus to chipmunks and to humans.

West Nile Encephalitis

The recent encephalitis outbreak in New York has been identified as being caused by a West Nile-like virus. The virus is referred to as West Nile-like because the DNA of the strain found in New York is similar to but not exactly like that originally found on the west bank of the Nile River. West Nile Virus (WNV) is very similar to the St. Louis Encephalitis virus. In fact, they come from the same family of viruses.

Until recently, WNV was seen only in Africa, the Middle East and Australia. West Nile Encephalitis (WNE) is known as Kunjin when it originates from Australia. There has been some speculation as to how WNV made its way to North America. Ticks can also transmit WNV. Infected ticks on migrating birds, perhaps blown off course by recent hurricanes, could have brought WNV to the New York area.

The symptoms of WNV infection in humans are the same as those of SLE. That is, fever, headache, vomiting, and joint pain, all of which progress to disorientation and death.

Treatment and Prevention

Because these types of encephalitis are viral, antibiotics are not effective for treatment and no effective antiviral drugs have yet been discovered. Treatment is supportive, attempting to deal with problems such as swelling of the brain, loss of automatic breathing activity, and other treatable complications like bacterial pneumonia.

There are no commercially available human vaccines for these viral encephalitis diseases. There is a Japanese Encephalitis vaccine available in the United States. A tick-borne encephalitis vaccine is available in Europe. An equine vaccine is available for EEE, WEE, and VEE.

Viral encephalitis can be prevented in two major ways: personal protective measures and public health measures to reduce the population of infected mosquitoes. Personal protective measures include reducing time outdoors, particularly in the evening hours, wearing long pants and long-sleeved shirts, and applying mosquito repellent to exposed skin areas. Public health measures often require spraying of insecticides to kill juvenile (larvae) and adult mosquitoes.