

# West Nile Encephalitis in Humans and Horses



by Bruce Lawhorn\*

**T**he first outbreak in the United States of West Nile Encephalitis (WNE) occurred in August 1999 in the northeastern part of the country. The disease, characterized by inflammation of the brain and spinal cord, is caused by a virus that is transmitted by the bite of mosquitoes. The West Nile virus is dangerous to both humans and horses. The disease also is called West Nile fever in humans and Near Eastern equine encephalitis and louridge in horses.

## Background

The WNE outbreak, which occurred in parts of New York City and Long Island, was diagnosed in 62 people, seven of whom died. The infection also was diagnosed in several horses, and a variety of zoo birds, flamingos, a snowy owl and several thousand crows. The death of so many crows, which are normally very vigorous, was a tip-off to diagnosticians that an unusual disease condition was occurring.

It is suspected that the virus, which is closely related to strains from the Middle East, entered the United States by way of infected mosquitoes, birds or people.

The history of the West Nile virus has been well documented. The virus was first isolated from the blood of a feverish woman in Uganda in 1937. Many antibody positive, previously infected humans were subsequently identified in East and Central Africa.

Since 1937, outbreaks in humans and/or horses occurred in Israel (1950-1954, 1957); Egypt, France (1960s); South Africa (1974, 1983-1984); many locations in Europe such as Russia, Ukraine, Italy, Spain (1960s-1990s); Algeria (1994); Morocco (1996); Romania (1996-1997); Czech Republic

(1997); Democratic Republic of the Congo and Italy (1998); and Russia (1999).

In addition to the human cases in New York, the U.S. Department of Agriculture (USDA) and the Centers for Disease Control and Prevention confirmed that 23 horses had symptoms of WNE. Of these, 13 horses died or were euthanized and the remainder survived. The horses had nothing in common in relation to age, type or body size to which this disease could be linked. The horses were the following breeds: Appaloosa, Arabian, Dutch Warmblood, Palomino, Percheron, Standardbred and Thoroughbred.

## Transmission of West Nile Virus

Horses and humans are infected with WNV after being bitten by mosquitoes that transmit the virus. Occasionally, in Asia and Africa, hard or soft ticks are carriers. Mosquitoes become infected when they feed on birds that carry the virus in their bloodstreams. This means that WNV is an arbovirus (mosquito- or tick-transmitted virus carried primarily by birds).

The virus persists in infected mosquitos for their entire life span. Infected wetland and terrestrial birds maintain high levels of virus in their bloodstreams but usually show no disease symptoms; crows, pigeons and other birds may be exceptions, as in the U.S. outbreak. Migratory birds are thought to be responsible for the introduction of WNV into new areas.

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There is no evidence to suggest that horses act as a direct source of viral infection for other horses, birds or humans.

## Symptoms of West Nile Encephalitis in Humans

In humans, West Nile fever usually is a flu-like illness characterized by a moderate to high fever that occurs within 3 to 6 days after infection. The fever lasts 3 to 5 days, sometimes alternating with chills. Other symptoms include headache (often frontal), sore throat, backache, muscle or joint pain, fatigue, inflamed lining of the eyes, pain behind the eyes, rash (in approximately half the cases, spreading from the body to the arms, legs and head), swollen lymph nodes, appetite loss, nausea, abdominal pain, diarrhea and respiratory symptoms. In fewer than 15 percent of cases, severe symptoms of sudden brain inflammation (associated with neck stiffness, vomiting, confusion, disturbed consciousness, sleepiness, tremor of extremities, abnormal reflexes, convulsions, partial paralysis and coma); inflammation of the spinal cord, liver, spleen and heart; and swelling of the liver and spleen occur.

The presence of virus in the blood peaks at 4 to 8 days after infection. The virus can be recovered from the blood for up to 10 days in most patients and as late as 22 to 28 days after infection in patients with suppressed immune systems. These patients and elderly individuals are at a greater risk for severe brain inflammation. Of the 62 cases of West Nile infections in humans in New York, the seven fatalities occurred in elderly persons, all at least 75 years old. The case fatality rate is 3 to 15 percent. In some reported outbreaks, children were also at greater risk of complication of infection.

## Signs of West Nile Encephalitis in Horses

On exposure to WNV through infected mosquitos, horses can become infected. Virus in the blood occurs early in the disease, is at low levels and is present for only a short period of time. In a small number of infected horses, the virus causes a central nervous system disease with symptoms suggestive of brain inflammation or encephalitis. Horses with severe clinical signs can die. Clinical signs include loss of appetite and depression, along with any three of the following signs: fever (not a consistent sign), weakness of hind limbs, paralysis of hind limbs, impaired vision, staggering gait, head pressing, aimless wandering, convulsions, inability to swallow, circling,

extreme excitability or coma. Do not assume that horses with clinical signs of encephalitis have WNE. A veterinarian should conduct a differential diagnostic examination to include the following diseases: eastern equine encephalomyelitis (EEE), western equine encephalomyelitis (WEE), Venezuelan equine encephalomyelitis (VEE) or other arbovirus diseases; equine herpesvirus 1 infection (EHV-1); rabies; equine protozoal myeloencephalitis (EPM); wobbler syndrome (cervical myelopathy, spinal cord compression); botulism; other toxicities; and additional conditions that may also exhibit neurologic symptoms.

## Diagnosis and Treatment in Horses

Laboratories working with live WNV must operate at biosafety level 3 to protect humans from accidental exposure. Assistance from state and federal veterinarians should be sought by practicing veterinarians that suspect they may have horses infected with WNV.

Virus isolation (VI) from the brain and spinal cord confirm infection, but some infections do not cause disease. Whole blood and cerebral spinal fluid are poor VI samples except very early in infection. The microscopic lesions of viral encephalitis are not specific to WNV infection only. The polymerase chain reaction (PCR) has not been effective in disease detection in tissues and fluids from horses known to have the virus. In experimentally infected horses at Plum Island Laboratory, antibodies against WNV were not detectable by virus neutralization until 30 to 42 days after infection.

Note that USDA/APHIS/VS National Veterinary Services Laboratory (NVSL) at Ames, Iowa, and USDA/APHIS/VS/NVSL Foreign Animal Disease Diagnostic Laboratory at Plum Island, New York, are two diagnostic centers that currently work with WNV.

No specific antiviral agents have been recommended for treating WNE. Affected horses should be treated for their symptoms, and the focus should be on alleviating the severity of the symptoms of encephalitis. Supportive therapy given through stomach tubing of nutrients and intravenous fluid therapy is suggested.

## Prevention and Control in Humans

Following these seven steps will help reduce risk and exposure to any diseases, including WNV, that are transmitted by mosquitoes.

1. Stay indoors at dawn, dusk and early evening.
2. Wear long-sleeved shirts and long pants whenever you are outdoors.

3. Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35 percent DEET (N, N-dimethyl-meta-tolamide). High concentrations of DEET (greater than 35 percent) provide no additional protection.
4. Repellents may irritate the eyes of children, so avoid applying repellent to the hands of children.
5. Spray clothing with repellents containing permethrin or DEET, as mosquitoes may bite through thin clothing.
6. When using an insecticide or insect repellent, be sure to read and follow the manufacturer's directions for use.
7. It is unknown if duck, geese and wild game hunters are at risk for WNV infection. A hunter should follow usual precautions when handling wild animals. Avoid exposure to mosquitoes as previously discussed. Wear disposable gloves when handling and cleaning game to prevent blood exposure to bare hands. Cook meat thoroughly.

## Prevention and Control in Horses

Currently there is no vaccine available against WNV. Horses immunized against EEE, WEE and VEE will not be protected against WNV infection. The most appropriate measure that horse owners can take is to reduce exposure to mosquitoes. The following steps could assist horse owners in reducing the risk of mosquito exposure.

1. House horses inside screened stables during peak periods of mosquito activity (dusk through dawn).
2. Avoid turning on the lights in the barn during the evening and overnight, unless needed.
3. Because birds may serve as hosts of the virus, remove as many birds (chickens, pigeons, etc.) and bird nests as possible from the immediate stable areas. Periodic examination of property for dead birds, especially crows, should be conducted. If an unusual number of dead birds is found, the department of health should be notified. If dead birds are to be handled, use gloves and place the birds in plastic bags.
4. Topical preparations that act as mosquito repellents can be used on horses, but these may not be effective unless used in a timely manner, exactly as label instructions direct.
5. Conduct a careful examination of the property to determine locations that could serve as breeding

grounds for mosquitoes. Shallow standing water, used tires, burn piles with cans and containers, manure storage pits, and drainage areas with stagnant water are ideal places where mosquitoes can breed. Drain stagnant water to eliminate mosquito-breeding areas.

6. Fogging of stable premises can be done in the evening to reduce the mosquito load.
7. When using an insecticide or insect repellent, read and follow label directions for use.

## Disinfection/Decontamination

West Nile virus is susceptible to many common disinfectants; ultraviolet light also inactivates it after several hours. Effective disinfectants are Vikron-S™ or Tifectant™ (1 percent), One-Stroke Environ™ (2 percent), Clorox™ or Purex™ (0.5 percent, prepared by combining one part bleach to 10 parts water), iodine (1 percent) or formalin (3 to 8 percent). Disinfect equipment, containers, feed utensils, etc., as a precautionary measure to eliminate any potential risk of direct transfer of the virus.

## Surveillance

The 1999 WNV outbreak in New York occurred during the peak of the southerly bird migration but it is unknown whether WNV was dispersed to other states, including Texas, by migratory birds. During January to February 2000, three pools of overwintering *Culex* species mosquitos collected at Ft. Trotten, New York, were positive for WNV. (Note that WNV has been isolated from more than 40 mosquito species, predominately of the genus *Culex*.)

For more than 30 years, Texas' arboviral surveillance program has focused on agents of mosquito-borne encephalitis in humans. In 2000, the Texas Department of Health (TDH) is implementing procedures for the laboratory diagnosis of West Nile fever and incorporating these procedures into the currently available test panels for EEE, WEE, St. Louis encephalitis and dengue. In addition, the TDH will be disseminating surveillance information regarding any possible WNV activity.

## Summary

West Nile virus infection has never been diagnosed in Texas, but the first known WNE outbreak in the U.S. occurred in August 1999 in New York. Texas has had an arboviral surveillance program to monitor for the mosquito-borne diseases EEE, WEE, St. Louis encephalitis and dengue for the last 30 years. The

Texas Department of Health has added laboratory procedures for the detection of WNV, should it ever be introduced into Texas.

Horses displaying neurological signs of disease should be examined by a veterinarian for diagnosis and treatment. Although WNE has never occurred in Texas, veterinarians should be aware that WNE, if introduced, can cause central nervous system disease in horses. Outbreaks typically are in late summer and fall in temperate climates but may occur year-round in warm climates, depending on the vector.

Avoiding mosquito exposure is a practical way to prevent this and other mosquito-borne diseases in horses and humans. Additional information on mosquitoes, exposure and control is available from the Texas Agricultural Extension Service. Publications are available by accessing the Web address <http://texaserc.tamu.edu>. For additional internet information, access the Pennsylvania Department of Health address <http://www.westnile.state.pa.us>.

## Resources

West Nile Encephalitis in Horses, *Penn State Herd Health Memo*, June 2000.

Ostlund, E.N. (Diagnostic Virology Laboratory, USDA/APHIS/VS/NVSL, Ames Iowa 50010), West Nile Virus information sheet, presented at *USDA/APHIS/VS/NVSL Foreign Animal Disease Course, Swine emphasis*, Plum Island, New York, Jan. 24-Feb. 4, 2000.

West Nile Virus Questions and Answers, *CDC Division of Vector-Borne Infectious Disease*, June 21, 2000, <http://www.cdc.gov/ncidod/dvbid/westnile/q&a.htm>.

West Nile Virus Control Efforts: Update, *Disease Prevention News*, Texas Department of Health, Vol.60, No. 10, May 10, 2000, <http://www.tdh.state.tx.us/phpep/>

Lubroth J., Gregg, D., McKenna, T., Stc, et al, *West Nile Virus Infection in Horses: A Preliminary Report*, USDA/APHIS/ARS/NVSL Foreign Animal Disease Diagnostic Laboratory, Plum Island, New York, December 1999.

*West Nile Virus Citizen Fact Sheet*, Pennsylvania Department of Health, <http://www.westnile.state.pa.us>, April 28, 2000.

## Addendum

There is a West Nile Encephalitis vaccine for horses available from veterinarians. Two doses of vaccine are administered 3 to 6 weeks apart, and protection starts to build at 4 to 6 weeks after the second vaccination.

That means there is a minimum of 7 to 8 weeks after the start of the vaccine series before any protection can be expected.

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