



West Nile Virus Disease Guidelines

Definition

West Nile virus (WNV) is a mosquito-borne flavivirus that is endemic in the avian population of North America. In the late 1990's WNV spread to North America and became more virulent, capable of causing fever and neuroinvasive disease in horses and humans with regularity; previously WNV infection generally resulted in fever in humans. West Nile virus is now considered endemic in Canada, the United States, Mexico, and the Caribbean.

West Nile Virus primarily causes disease in birds, humans, and horses, though West Nile encephalitis has also been reported in sheep, alpacas, dogs, and various wildlife species. The virus is predominantly transmitted by the *Culex* species of mosquito. Virus amplification occurs in mosquitoes and birds, with house sparrows and robins documented as important amplifying hosts. West Nile Virus also amplifies in alligators, which reach a level of viremia that may make them important reservoirs of infection in the southeastern United States. The level of viremia in amplifying hosts increases throughout the summer and is generally highest in late Summer to Fall in North America.

Once a horse is infected, viremia is established, and the virus is thought to penetrate the blood brain barrier and enter the central nervous system. Mortality rates for horses diagnosed with WNV are reported to be 22-44%. Previously vaccinated but improperly boosted horses may experience less severe disease than horses with no vaccine history at all. A history of no vaccination or incomplete vaccination, persistent recumbency, and facial or tongue paralysis is associated with a poor outcome, and mortality rates increase in older horses. Treatment is supportive, and though the administration of hyperimmune WNV plasma makes good clinical sense, there are no studies in horses supporting its use.

Clinical Signs

- Clinical signs are variable and depend on the stage of disease at the time of presentation.
- Low-grade fever (101.5–103.5° F or 38.6–39.7° C) occurs in approximately 25% of affected horses.
- Fever may be preceded or accompanied by non-specific signs of lethargy and inappetence.
- Neurologic signs are often sudden in onset and may be rapidly progressive. Clinical signs reflect predilection of the virus for the gray matter of the caudal brainstem, cerebellum, and spinal cord with the cerebrum and rostral brainstem less affected. Neurologic deficits may include:
 - Fine tremors/fasciculations of the muzzle, face, and neck muscles are common, and should elicit a high index of suspicion for WNV encephalopathy.
 - Periods of hyperexcitability that may alternate with somnolence.



- Cranial nerve deficits including facial nerve paralysis, weakness of the tongue, and head tilt.
- Ataxia, weakness, paralysis, or dysmetria of a single limb or multiple limbs. Intermittent collapse may occur in the forelimbs or hindlimbs.
- Recumbency/inability to rise.
- Clinical signs consistent with colic
- Death

Neurologic recovery from WNV may take months. While some horses that survive WNV fully recover, many experience residual clinical signs. Horses that recover from WNV may experience a relapse in clinical signs 2 weeks - 5 months following initial diagnosis.

Incubation Period

7–10 days following infection

Risk Factors

- Unvaccinated or not up to date on WNV vaccination
 - [AAEP Vaccination Guidelines](#)
- Pasture turnout during dawn and dusk when mosquito activity is highest, especially during peak months of July-October.
- Lack of mosquito control and exposure to standing water.

Transmission

- Transmission occurs via mosquitoes that have fed on WNV infected birds.
- Peak WNV transmission in North America occurs from July to October but may occur year-round in tropical or sub-tropical regions.
- Horses with WNV are not contagious to other horses or humans. Horses are dead-end hosts, and do not amplify the virus sufficiently to cause disease in other animals.
- Vertical transmission and abortion following WNV infection has been reported in horses.

Diagnostic Sampling, Testing, and Handling

IgM antibody capture ELISA (MAC-ELISA): Single serum sample (red top tube)

- Positive test: WNV-specific IgM titer $\geq 1:400$
- IgM titers are preferred over IgG titers for confirmation of active infection, as IgG titers remain high for months or longer in vaccinated horses and cannot be used to confirm disease.
- *Note:* False positive results on IgM capture ELISA can occur within 30 days after vaccination

Plaque Reduction Neutralization Test (PRNT) paired serum antibody titers

- Collect samples 2–4 weeks apart in a red top tube. Serum must be shipped cold overnight.



- Four-fold or greater rise in PRNT titers between samples is considered confirmatory in a horse exhibiting clinical signs consistent with WNV which has not been vaccinated recently.
- *Note:* A single positive PRNT titer is indicative of exposure or previous vaccination and cannot be used to confirm a positive case without an appropriately timed paired sera sample.

Viral isolation may be attempted on CSF, whole blood, or serum.

CSF analysis generally reveals an elevated total nucleated cell count (0-882 cells/ul; median 14 cells/ul; mononuclear cells predominate) and/or high total protein (64-316 mg/dL; median 100 mg/dL) with mild xanthochromia.

Postmortem

Postmortem sample collection requires appropriate precautions to avoid viral exposure. [AAEP guidelines for necropsy of suspected cases with a zoonotic disease](#). A rabies protocol should be followed for ALL horses with encephalitis that undergo a postmortem examination. [AAEP Rabies Guidelines](#)

PCR can be performed on blood, CSF, or brain tissue. Immunohistochemistry and viral isolation may be performed on brain tissue.

Practitioners performing necropsies in the field are encouraged to contact a veterinary diagnostic laboratory to which they plan to submit samples for further testing such as histopathology and pathogen identification to be certain they collect the appropriate samples and handle the samples in a manner that will optimize making a definitive diagnosis. For some situations, such as neurologic cases, submission of the entire carcass to the diagnostic laboratory for postmortem examination is recommended due to the time and labor required to perform a complete exam and collection of samples from the equine CNS.

Environmental Persistence

This enveloped RNA virus is susceptible to drying, ultraviolet light, and detergent.

Specific Control Measures

Vaccination—killed or recombinant:

- Initial injection of either vaccine is followed in 4 to 6 weeks with a booster. The primary series must be fully administered to elicit optimal antibody production. Vaccination should be initiated before onset of the mosquito season to allow time for development of the neutralizing antibodies. The initial series should not be expected to provide long-term protection beyond one year.



- Follow vaccine manufacturer recommendations regarding initial immunization series and annual boosters. More frequent boosters (i.e. twice yearly) can be considered in areas with year-round mosquito seasons and in endemic areas. (See [AAEP West Nile Virus Vaccination Guidelines](#))

Limited information is available on long-term immunity from vaccination or natural exposure.

Vector management

- Use insect repellents frequently; re-apply after rain
- Keep horses in at night when possible, and apply insect repellent
- Eliminate or minimize standing water
- Stock tanks or ponds with mosquito-feeding fish
- Eliminate brush piles, gutters, old tires and litter
- Remove all equipment in which standing water can collect

Release of Animals from Isolation

No restrictions need be placed on affected or recovered animals.

Biosecurity Issues for Receiving Animals

None.

Zoonotic Potential

Suspected or confirmed cases of WNV should be reported to state animal health officials and the local public health department.

Horses are accidental hosts of WNV, and the virus does not amplify within horses to the degree that would allow transmission via an insect vector. However, an equine case of WNV should be taken as a warning that mosquitoes in the area are capable of transmitting WNV to humans

The most serious risk to humans when working with WNV-infected horses is handling infected tissues including brain, spinal cord, and CSF. Appropriate personal protective equipment must be worn during postmortem exam and sample acquisition.

[A Review of Equine Zoonotic Diseases: Risks in Veterinary Medicine](#) (J.S. Weese, DVM, DVSc, Diplomate ACVIM).

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