

Mosquito-Borne Viral Encephalitides

Summary

The mosquito-borne viral encephalitides (arboviral diseases) are a group of acute central nervous system illnesses. The diseases of this group that occur in New Mexico are western equine encephalitis (WEE), St. Louis encephalitis (SLE), and West Nile virus (WNV). Signs and symptoms of these diseases are similar, but vary in severity from mild fever, to aseptic meningitis, to encephalitis with coma, paralysis and death. Unapparent disease and mild infection are common. The elderly are at greatest risk of severe illness with SLE and WNV. Neurologic sequelae are most severe in children infected with WEE. Control of these diseases is through effective mosquito control and personal protective measures to prevent mosquito bites.

Agent

Each disease is caused by a specific virus: Western Equine Encephalitis virus is in the family *Togaviridae* (*Alphavirus*); St. Louis encephalitis and West Nile viruses are in the family *Flaviviridae* (*Flavivirus*).

Transmission

Reservoir:

Birds are the source of infection for feeding mosquitoes during active transmission (usually summer and early fall). Little is known about the overwintering mechanisms for these viruses. Possibly the virus remains viable in infected hibernating adult mosquitoes, birds or other animals.

Vector: In the West, *Culex tarsalis* mosquito is the principal vector of WEE and SLE. Several species of *Culex*, *Aedes* and *Ochlerotatus* mosquitoes have been implicated in the transmission of WNV in the US

Mode of transmission:

By the bite of infective mosquitoes that have acquired the virus from feeding on infected birds.

Period of communicability:

These encephalitides are not transmissible from human to human or from horse to human (in the case of WEE or WNV). Horses and humans do not develop sufficient viremia to infect feeding mosquitoes. Birds are viremic for only a few days, but mosquitoes remain infected for life.

Clinical Disease

Incubation period:

Usually 2-14 days, up to 21 days for SLE or for WNV in immunocompromised people.

Illness:

Disease in humans is most common in summer and early fall. Symptoms are quite variable depending on the virus and the age and general health of the case. Mild cases often occur as a febrile headache or aseptic meningitis. Severe infections are usually marked by acute onset of headache, high fever, meningeal signs, stupor, disorientation, coma, tremors, occasional convulsions (especially in infants), and spastic or flaccid

paralysis. Case fatality rates range from 2 – 20%, and the ratio of unapparent infections to clinical cases can be quite high. Symptoms of SLE and WNV are most severe in persons >50 years of age. Adults usually recover completely from WEE, but about half of children affected with WEE suffer permanent neurological effects, including progressive mental retardation and varying degrees of physical and mental dysfunction. Horses suffer clinical disease with WEE or WNV infection. Some bird species infected with WNV can become sick and die, unlike infections with SLE or WEE.

Laboratory Diagnosis

Patients with symptoms of encephalitis in which diagnosis of an arboviral infection is highly suspect should have blood and cerebrospinal fluid (CSF) collected for testing. Commercial laboratories in New Mexico and other states are able to test serum and/or CSF specimens. Typical patients to test include:

- Any patient with encephalitis, OR atypical Guillain-Barre type syndrome and evidence of pleocytosis in the CSF.
- Any patient with viral meningitis if other etiologic agents have been ruled out.

Most laboratories perform an antibody-capture enzyme immunoassay (EIA) to detect virus-specific IgM antibody for WNV. In cases with atypical laboratory results, New Mexico Department of Health Scientific Laboratory Division (SLD) may forward samples to CDC in Ft. Collins, Colorado for further testing. **Call the Epidemiology and Response Division at 505-827-0006 prior to shipment of any specimens.** A submission form with brief clinical information will need to be completed.

Treatment

No antiviral medication is available for any of these encephalitides. Supportive therapy is indicated and patients should be monitored for cerebral edema.

Surveillance

Case Definition:

Clinical case definition-

Cases of arboviral disease are classified either as neuroinvasive or non-neuroinvasive, according to the following criteria:

Neuroinvasive disease requires the presence of fever and at least one of the following, as documented by a physician and in the absence of a more likely clinical explanation:

- Acutely altered mental status (e.g., disorientation, obtundation, stupor, or coma), or
- Other acute signs of central or peripheral neurologic dysfunction (e.g., paresis or paralysis, nerve palsies, sensory deficits, abnormal reflexes, generalized convulsions, or abnormal movements), or
- Pleocytosis (increased number of cells in cerebrospinal fluid (CSF)) associated with illness clinically compatible with meningitis (e.g., headache or stiff neck).

Non-neuroinvasive disease requires, at minimum, the presence of documented fever, as measured by the patient or clinician, the absence of neuroinvasive disease (above), and the absence of a more likely clinical explanation for the illness. Involvement of non-

neurological organs (e.g., heart, pancreas, liver) should be documented using standard clinical and laboratory criteria.

Laboratory criteria:

Cases of arboviral disease are also classified either as confirmed or probable, according to the following laboratory criteria:

Confirmed -

- Four-fold or greater change in virus-specific serum antibody titer, or
- Isolation of virus from or demonstration of specific viral antigen or genomic sequences in tissue, blood, CSF, or other body fluid, or
- Virus-specific immunoglobulin M (IgM) antibodies demonstrated in CSF by antibody-capture enzyme immunoassay (EIA), or
- Virus-specific IgM antibodies demonstrated in serum by antibody-capture EIA and confirmed by demonstration of virus-specific serum immunoglobulin G (IgG) antibodies in the same or a later specimen by another serologic assay (e.g., neutralization or hemagglutination inhibition).

Probable-

- Stable (less than or equal to a two-fold change) but elevated titer of virus-specific serum antibodies, or
- Virus-specific serum IgM antibodies detected by antibody-capture EIA but with no available results of a confirmatory test for virus-specific serum IgG antibodies in the same or a later specimen.

Reporting:

Report all suspected or confirmed cases of encephalitis to the Epidemiology and Response Division (ERD) at 505-827-0006. Information needed includes: patient's name, age, sex, race, ethnicity, home address, home phone number, occupation, and health care provider.

Case Investigation: Use the West Nile Virus Report Form to complete the investigation. Information should also be entered into NM-EDSS per established procedures.

Control Measures

1. Case management
 - 1.1. Isolation: Isolation of patients with mosquito-borne encephalitis is not required. Contact precautions appropriate until viral meningitis is ruled out.
2. Contact management
 - 2.1. Isolation: None required.
 - 2.2. Prophylaxis: Not applicable.
3. Prevention
 - 3.1. Immunization: No vaccine is available for humans. Horses should be vaccinated against WEE, EEE, West Nile virus, and Venezuelan equine encephalitis.

- 3.2. Control the mosquito vectors through elimination of breeding sites (i.e., standing water). Educate the public on potential backyard sources of mosquito breeding such as discarded tires, abandoned swimming pools, and other water-holding containers.
- 3.3. Conduct larval and adult mosquito control through community vector control programs.
- 3.4. Screen houses.
- 3.5. Avoid exposure to mosquitoes during hours of biting. If mosquitoes cannot be avoided, wear long sleeves and long pants and apply an effective repellent (such as DEET or picaridin) to exposed skin or clothing. Do not apply repellents under clothing. Use the lowest concentration of DEET that is effective (usually 10 – 35%). Use products containing no more than 10% DEET on children and do not apply DEET-containing products to children less than two months of age. Permethrin is an effective repellent used on clothing. Do not apply Permethrin to skin. Products containing botanical essential oils such as lemon eucalyptus oil are also available as mosquito repellents, but need to be applied more frequently than DEET-containing repellents.
- 3.6. Surveillance and testing of mosquito vector populations has value by identifying rates of infection and geographic areas involved. Community vector control programs collect mosquitoes for arboviral testing by the New Mexico Department of Health Scientific Laboratory Division. The Epidemiology and Response Division maintains records of these results.

References

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- Fraddin MS. Mosquitoes and Mosquito Repellents: A Clinician's Guide. *Annals of Internal Medicine* 1998;128:931-940.
- Mandell GL, Bennett JE, Dolin R, eds. Principles and practices of infectious diseases 6th ed. NY, NY: Churchill Livingstone, 2005; 1913-20, 1926-50.