WESTERN EQUINE ENCEPHALITIS VIRUS DISEASE

(Western equine encephalitis, WEE)

REPORTING INFORMATION

- **Class B:** Report by the end of the next business day after the case or suspected case presents and/or a positive laboratory result to the local public health department where the patient resides. If patient residence is unknown, report to the local public health department in which the reporting health care provider or laboratory is located.
- Reporting Form(s) and/or Mechanism:
  - Ohio Confidential Reportable Disease form (HEA 3334, rev. 1/09)
  - Positive Laboratory Findings for Reportable Disease form (HEA 3333, rev. 8/05)
  - Via the Ohio Disease Reporting System (ODRS) or telephone
  - The Ohio Department of Health (ODH) Mosquito-borne Illness Case Investigation worksheet is available for use to assist in local disease investigation. Information collected from the form should be entered into ODRS and not sent to ODH, unless otherwise requested. If requested, the form can be faxed to ODH at 614-564-2456.
- Key fields for ODRS reporting include: import status (whether the infection was travel-associated or Ohio-acquired), date of illness onset and all the fields in the Epidemiology module.

AGENT

Western equine encephalitis (WEE) virus is an RNA virus belonging to the genus Alphavirus (formerly group A of the arboviruses) of the family Togaviridae. It is closely related to Eastern equine encephalitis and Venezuelan equine encephalitis viruses.

Infectious dose: A single bite from an infectious mosquito.

CASE DEFINITION

Clinical Description

Most arboviral infections are asymptomatic. Clinical disease ranges from mild febrile illness to severe encephalitis. For the purposes of surveillance and reporting, based on their clinical presentation, arboviral disease cases are often categorized into two primary groups: neuroinvasive disease and non-neuroinvasive disease.

Neuroinvasive disease

Many arboviruses cause neuroinvasive disease such as aseptic meningitis, encephalitis or acute flaccid paralysis (AFP). These illnesses are usually characterized by the acute onset of fever with headache, myalgia, stiff neck, altered mental status, seizures, limb weakness or CSF pleocytosis. AFP may result from anterior ("polio") myelitis, peripheral neuritis or post-infectious peripheral demyelinating neuropathy (i.e. Guillain-Barre syndrome). Less common neurological manifestations, such as cranial nerve palsies, also occur.

Non-neuroinvasive disease

Most arboviruses are capable of causing an acute systemic febrile illness (e.g. West Nile fever) that may include headache, myalgias, rash or gastrointestinal symptoms. Other physical complaints may include vertigo, stiff neck or muscle weakness without progression to more clinically apparent neurological involvement.

Clinical Criteria for Diagnosis

A clinically compatible case of arboviral disease is defined as follows:

Neuroinvasive disease:

- Meningitis, encephalitis, acute flaccid paralysis or other acute signs of central or peripheral neurologic dysfunction, as documented by a physician and
- Absence of a more likely clinical explanation.

Non-neuroinvasive disease:

- Fever or chills as reported by the patient or a healthcare provider and
- Absence of neuroinvasive disease and
- Absence of a more likely clinical explanation.

Laboratory Criteria for Diagnosis

- Isolation of virus from, or demonstration of specific viral antigen or nucleic acid in, tissue, blood, cerebrospinal fluid (CSF) or other body fluid or
- Four-fold or greater change in virus-specific quantitative antibody titers in paired sera or
- Virus-specific immunoglobulin M (IgM) antibodies in serum with confirmatory virus-specific neutralizing antibodies in the same or a later specimen or
- Virus-specific IgM antibodies in CSF or serum.

Case Classification

Probable:

- Neuroinvasive disease: A case that meets the above clinical criteria for neuroinvasive disease and with virus-specific IgM antibodies in CSF or serum but with no other testing.
- Non-neuroinvasive disease: A case that meets the above clinical criteria for non-neuroinvasive disease and with virus-specific IgM antibodies in serum but with no other testing.

Confirmed:

- Neuroinvasive disease: A case that meets the above clinical criteria for neuroinvasive disease and one or more the following laboratory criteria for a confirmed case:
  - Isolation of virus from, or demonstration of specific viral antigen or nucleic acid in, tissue, blood, CSF or other body fluid or
  - Four-fold or greater change in virus-specific quantitative antibody titers in paired sera or
  - Virus-specific IgM antibodies in serum with confirmatory virus-specific neutralizing antibodies in the same or a later specimen or
  - Virus-specific IgM antibodies in CSF and a negative result for other IgM antibodies in CSF for arboviruses endemic to the region where exposure occurred.
- Non-neuroinvasive disease: A case that meets the above clinical criteria for non-neuroinvasive disease and one or more of the following laboratory criteria for a confirmed case:
  - Isolation of virus from, or demonstration of specific viral antigen or nucleic acid in, tissue, blood or other body fluid excluding CSF or
  - Four-fold or greater change in virus-specific quantitative antibody titers in paired sera or
  - Virus-specific IgM antibodies in serum with confirmatory virus-specific neutralizing antibodies in the same or a later specimen.

Comments

Imported arboviral diseases: Human disease cases due to dengue or yellow fever viruses are nationally notifiable to CDC using specific case definitions. However, many other exotic arboviruses (e.g. chikungunya, Japanese encephalitis, tick-borne encephalitis, Venezuelan equine encephalitis and Rift Valley fever viruses) are imported public health risks for the United States as competent vectors exist that could allow for sustained transmission upon establishment of imported arboviral pathogens. Healthcare providers and public health officials should maintain a high index of clinical suspicion for cases of potentially exotic or unusual arboviral etiology, particularly in international travelers. If a suspected case occurs, it should be reported to the appropriate local/state agencies and CDC.

Interpreting arboviral laboratory results:

- **Serologic cross-reactivity:** In some instances, arboviruses from the same genus produce cross-reactive antibodies. In geographic areas where two or more closely-related arboviruses occur, serologic testing for more than one virus may be needed and results compared to determine the specific causative virus. For example, such testing might be needed to distinguish antibodies resulting from infections within genera (e.g. flaviviruses such as West Nile, St. Louis encephalitis, Powassan, dengue or Japanese encephalitis viruses).
- **Rise and fall of IgM antibodies:** For most arboviral infections, IgM antibodies are generally first detectable at 3 to 8 days after onset of illness and persist for 30 to 90 days, but longer persistence has been documented (e.g. up to 500 days for West Nile virus). Serum collected within 8 days of illness onset may not have detectable IgM and testing should be repeated on a convalescent-phase sample to rule out arboviral infection in those with a compatible clinical syndrome.
- **Persistence of IgM antibodies:** Arboviral IgM antibodies may be detected in some patients months or years after their acute infection. Therefore, the presence of these virus-specific IgM antibodies may signify a past infection and be unrelated to the current acute illness. Finding virus-specific IgM antibodies in CSF or a fourfold or greater change in virus-specific antibody titers between acute- and convalescent-phase serum specimens provides additional laboratory evidence that the arbovirus was the likely cause of the patient's recent illness. Clinical and epidemiologic history also should be carefully considered.
- **Persistence of IgG and neutralizing antibodies:** Arboviral IgG and neutralizing antibodies can persist for many years following a symptomatic or asymptomatic infection. Therefore, the presence of these antibodies alone is only evidence of previous infection and clinically compatible cases with the presence of IgG, but not IgM, should be evaluated for other etiologic agents.
- **Arboviral serologic assays:** Assays for the detection of IgM and IgG antibodies commonly include enzyme-linked immunosorbent assay (ELISA), microsphere immunoassay (MIA) or immunofluorescence assay (IFA). These assays provide a presumptive diagnosis and should have confirmatory testing performed. Confirmatory testing involves the detection of arboviral-specific neutralizing antibodies utilizing assays such as plaque reduction neutralization test (PRNT).
- **Other information to consider:** Vaccination history, detailed travel history, date of onset of symptoms and knowledge of potentially cross-reactive

arboviruses known to circulate in the geographic area should be considered when interpreting results.

SIGNS AND SYMPTOMS

Western equine encephalitis can produce a febrile illness of variable severity associated with neurologic symptoms ranging from headache to aseptic meningitis or encephalitis. Arboviral encephalitis cannot be distinguished clinically from other central nervous system (CNS) infections. Symptoms can include headache, confusion or other alteration in sensorium, nausea, and vomiting. Signs may include fever, meningismus, cranial nerve palsies, paresis or paralysis, sensory deficits, altered reflexes, convulsions, abnormal movements and coma of varying degree. Neurologic sequelae tend to be most severe in infants. The illness is fatal in about 3% of cases. [See also the Aseptic Meningitis chapter.]

DIAGNOSIS

Preliminary diagnosis is often based on a patient's clinical features, places and dates of travel (if patient is from a non-endemic country or area), activities and epidemiologic history of the location where infection likely occurred. In addition to the other more common causes of encephalitis and aseptic meningitis (e.g. herpes simplex virus and enteroviruses), arboviruses such as LaCrosse, St. Louis encephalitis, Eastern equine encephalitis, Western equine encephalitis, Powassan and West Nile viruses should also be considered in the differential etiology.

Laboratory diagnosis of arboviral infections is generally accomplished by testing of serum or CSF to detect virus-specific IgM and neutralizing antibodies. During an acute infection, certain viruses can be isolated through culture or detected by nucleic acid amplification.

In fatal cases, nucleic acid amplification, histopathology with immunohistochemistry and virus culture of autopsy tissues can also be useful. Only a few state laboratories or other specialized laboratories, including those at CDC, are capable of doing this specialized testing.

EPIDEMIOLOGY

Source

Western equine encephalitis virus is circulated between birds and the *Culex tarsalis* mosquito species, common in farming areas and around irrigated fields. Horses, humans and other mammals are accidental dead-end hosts and are not usually a source of infection to humans.

Occurrence

From 1964 to 2012, 640 human cases have been confirmed in the United States. There are usually fewer than 5 cases reported each year, and no infections have been reported since 1999. In the U.S., human cases are generally first seen in June or July. Western equine encephalitis virus is found in North, Central and South America, but most cases have been reported from the plains regions of the western and central United States. There are no records of human cases acquired in Ohio.

Mode of Transmission

The reservoir of Western equine encephalitis virus is wild birds, and the virus is transmitted by the *Culex tarsalis* mosquito. While *C.tarsalis* can be found in Ohio, it is rather uncommon.

Period of Communicability
Humans and horses are dead-end hosts for the virus (i.e. they do not circulate sufficient numbers of the Western equine encephalitis virus in the blood stream to infect a mosquito). The disease cannot be spread person-to-person.

Incubation Period
The incubation period is 5 to 10 days.

PUBLIC HEALTH MANAGEMENT
Case
Investigation

With serologic identification of Western equine encephalitis virus infection, a complete travel history for the three weeks prior to onset should be obtained. Exposure sites can be evaluated for mosquito vectors by standard mosquito collection techniques (light traps, larval samples). For advice on vector assessment, contact the ODH Zoonotic Disease Program (ZDP) at (614) 752-1029 or via e-mail at zoonoses@odh.ohio.gov.

Treatment

There is no specific therapy for Western equine encephalitis virus disease. Supportive care is indicated.

Isolation and Follow-up Specimens

Since the diagnosis of Western equine encephalitis virus disease is often not known until after patient discharge, enteroviral precautions (i.e. fecal, respiratory) are usually indicated for encephalitis. A convalescent sample 2-4 weeks after the acute is required to confirm a case.

Public Health Significance

High. Because an endemic case of Western equine encephalitis virus disease has never been found in Ohio, report of a single case may signify an outbreak is developing. A patient infected in Ohio would likely be newsworthy.

Special Information

Specific diagnosis is critical to prevention.

Contacts
No treatment or prophylaxis of contacts is indicated.

Prevention and Control
Vaccination

There is no vaccine for humans. There is a vaccine available for horses.

Vector Investigation

With the report of a human or equine case of Western equine encephalitis virus disease, a vector assessment should be done to determine if an outbreak is developing. Mosquito samples should be collected to determine the prevalence of *C. tarsalis*. For advice on vector assessment, contact the ODH ZDP at 614-752-1029 or via e-mail at zoonoses@odh.ohio.gov.

What is Western equine encephalitis?
Western equine encephalitis is a rare but serious disease that is caused by a virus spread by infected mosquitoes. Western equine encephalitis virus is one of a group of mosquito-transmitted viruses that can cause inflammation of the brain (encephalitis). Generally, fewer than 5 human cases are reported each year in the United States. No cases have been acquired in Ohio.

How do people get infected with Western equine encephalitis virus?
Western equine encephalitis virus is transmitted through the bite of an infected mosquito. Disease transmission does not occur directly from person to person.

When and where have most cases of Western equine encephalitis virus occurred?
Most cases of western equine encephalitis virus have been reported from the plains regions of the western and central United States. Most human cases are first seen in June in July in the United States.

Who is at risk for infection with Western equine encephalitis virus?
Anyone in an area where the virus is circulating can get infected with Western equine encephalitis virus. The risk is highest who work outside or participate in outdoor recreational activities because of the greater exposure to potentially infected mosquitoes.

How soon do people get sick after getting bitten by an infected mosquito?
It takes 5 to 10 days after the bite of an infected mosquito to develop symptoms of Western equine encephalitis virus disease.

What are the symptoms of Western equine encephalitis virus disease?
Many people infected with Western equine encephalitis virus have no signs of illness. Those who do get sick generally have mild flu-like symptoms including high fever, stiff neck, muscle pain, headache and a lack of energy. In some cases, inflammation of the brain, called encephalitis, can develop. Affected infants often suffer seizures. Approximately 3% of Western equine encephalitis virus disease cases are fatal. Survivors may have mild to severe neurologic deficits.

How is Western equine encephalitis virus disease diagnosed?
Diagnosis is based on tests of blood or spinal fluid. These tests typically look for antibodies that the body makes against the viral infection.

What is the treatment for Western equine encephalitis virus disease?
There is no specific treatment for Western equine encephalitis virus disease. Antibiotics are not effective against viruses, and no effective anti-viral drugs have been discovered. Severe illnesses are treated by supportive therapy which may include hospitalization, respiratory support, IV fluid and prevention of other infections.

Is there a vaccine for Western equine encephalitis virus disease?
There are no human vaccines available. A vaccine for horses is available through veterinarians.

How can people reduce the chance of getting infected with Western equine encephalitis virus?

Prevent mosquito bites. It only takes one bite from an infected mosquito to transmit disease.

- Use insect repellent containing DEET, picaridin, IR3535 or oil of lemon eucalyptus on exposed skin and/or clothing. The repellent/insecticide permethrin can be used on clothing to protect through several washes. Always follow directions on the package.
- Wear long sleeves and pants when weather permits.
- Have secure, intact screens on windows and doors to keep mosquitoes out.
- Eliminate mosquito breeding sites by emptying standing water from flower pots, buckets, barrels and other containers. Drill holes in tire swings so water drains out. Keep children's wading pools empty and on their sides when they aren't being used.

For more information, please visit these websites:

CDC Western Equine Encephalitis Virus Disease Information
http://www.cdc.gov/ncidod/dvbid/arbor/weefact.htm

CDC Insect Repellant Use and Safety http://www.cdc.gov/westnile/faq/repellent.html