ENCEPHALITIS, Acute Viral

(See also **West Nile Virus**.)

1. **Agent**: Many viruses can produce this syndrome, including mumps, varicella zoster, herpes simplex 1 and 2, measles, rabies, influenza (A and B) and a variety of enteroviruses. A group of mosquito-borne viruses are especially important in California: St. Louis encephalitis virus (SLEV), West Nile virus (WNV), Western equine encephalitis virus (WEE), and California encephalitis (CE) virus. CE, a member of California serogroup viruses (CSG), is very rare compared to other viruses in CSG, such as La Crosse and Jamestown Canyon viruses. Rarely, live virus vaccines may result in acute encephalitis. A specific etiologic agent may be difficult to identify.

2. **Identification**: Clinical signs of encephalitis can occur as a primary manifestation, as an associated illness, or as a complication.

   a. **Symptoms**: Acute meningoencephalitis with variations in severity, ranging from asymptomatic to mild (fever and headache, aseptic meningitis) to severe (acute onset of headache, high fever, meningeal signs, altered level of consciousness, tremors, muscle rigidity, muscle weakness, paralysis, convulsions, coma and death). If the spinal cord is also affected, the condition is called *encephalomyelitis*; if the meninges are inflamed, the condition is called *meningoencephalitis*.

   b. **Differential Diagnosis**: Other infectious causes of meningoencephalitis (e.g., tuberculosis, other bacteria, and fungi, certain parasites), stroke, systemic lupus and other autoimmune processes.

   c. **Diagnosis**: Presence of viral-specific IgM antibodies in cerebrospinal fluid or acute-phase serum suggests recent infection. A 4-fold rise in viral-specific antibodies in paired acute and convalescent sera by neutralization, complement fixation, indirect fluorescent antibody, ELISA, or other serologic tests. Isolation of the virus from brain tissue or, rarely, from blood or CSF, demonstration of viral antigen in brain tissue by immunofluorescence, or demonstration of specific nucleic acid sequencing by PCR.

3. **Incubation**: Varies by specific virus. For arthropod-borne viruses (arboviruses), usually 3-14 days. Incubation period can be prolonged for tickborne viruses and for individuals with underlying immunocompromising conditions.

4. **Reservoir**: Varies by specific virus. For arboviruses: amphibians, bats, birds, reptiles, rodents, and others. Birds are the primary reservoir for SLEV, WEE, and WNV viruses.

5. **Source**: Varies by specific virus. For arboviruses: infective arthropod, usually a mosquito.

6. **Transmission**: Varies by specific virus. For arboviruses: bite of infective arthropod; also potentially transmitted through infected blood products and organ tissue.

7. **Communicability**: Varies by specific virus. Arboviruses are not transmitted person to person.

8. **Specific Treatment**: Supportive. Antivirals may be helpful for some viruses.

9. **Immunity**: Varies by specific virus but usually permanent for specific virus.

REPORTING PROCEDURES

1. **Reportable**. Title 17, Section 2500 *California Code of Regulations*. Reporting time varies by specific virus but usually within 1 working day. Some causes of viral encephalitis are investigated by Vaccine Preventable Disease Control Program.

   Report Form:
   Report forms are required for WNV and unusual diseases. Otherwise, no report form is required.

WEST NILE VIRUS INFECTION CASE REPORT FORM (CDPH 8687)

3. **Epidemiologic and Clinical Data**:

a. Other illnesses 3 to 4 weeks prior to onset.

b. Immunization 3 to 4 weeks prior to onset: note dates, types, and sources.

c. Results of the first spinal tap (CSF). Note the total WBC with differential, total RBC, and total protein and glucose and gram stain.

d. Results of all viral studies performed including antibody tests (serum and CSF), PCR-based diagnostics of CSF, and viral and bacterial cultures of CSF if completed.

e. Results of other appropriate clinical studies (e.g., head CT, MRI, EEG).

f. If case was bitten by mosquitoes or was in a mosquito-infested area during incubation period, identify as precisely as possible (address, city, zip) the area where the exposure occurred. Note outdoor activities during dusk.

g. Increased mortality of horses in area may indicate the presence of WEE; increased mortality of crows or other corvid species may indicate WNV.

h. Presence of other human cases.

i. Travel up to 3 weeks prior to onset.

j. Occupation and hobbies.

k. History of organ transplantation or receipt or donation of blood products within 4 weeks of symptom onset

CONTROL OF CASE, CONTACTS & CARRIERS

Follow-up depends on etiology, if known. If encephalitis is mosquito-borne (e.g., WNV), ACDC will alert appropriate vector control district where case resides.

CASE: Isolation depends on communicability of etiologic agent. If unknown or enteroviral etiology is suspected, standard precautions are recommended. If respiratory virus is suspected, then aerosol droplet isolation should also be followed. No restrictions recommended for arboviral encephalitis.

CONTACTS: No restrictions.

CARRIERS: Not applicable.

PREVENTION-EDUCATION

1. Immunization against childhood diseases. Use of good hygiene, especially hand washing.

2. Prevent mosquito bites by using screens on windows and wear protective clothing and repellents if outdoor activity in areas with mosquito infestation is necessary.

3. Eliminate mosquito-breeding sites by emptying containers with stagnant water (i.e., bird baths, old tires, planters and other containers).

4. Control adult mosquito population by applying appropriately labeled pesticides. Control of larva and eliminating large breeding areas should be referred to mosquito abatement agencies.

5. Proper use of EPA-registered insect repellant. DEET based products are safe for children ages 2 months and older. Parents should apply insect repellent to their children. Do not use oil of lemon eucalyptus or para-menthane-diol on children under 3 years old).

DIAGNOSTIC PROCEDURES

Clinical and epidemiologic history is required to aid the laboratory in test selection.

1. **Serology**: Virus-specific antibody testing in serum or CSF is the most frequently used diagnostic methodology of arboviruses. WNV serum serology is widely commercially available. Testing paired acute and convalescent sera may be helpful. All CSF specimens for arboviral testing must be

accompanied by serum specimens. WNV CSF testing is not performed by the PHL and will be forwarded to VRDL.

Container: Sterile collection tube

Laboratory Forms and Examinations Requested:

Test Requisition and Report Form H-3021
Select *Arbovirus IgG and IgM Antibody Panel, IFA (SLEV and WEE)* or *West Nile Virus IgG and IgM Antibodies, EIA*

CDPH VRDL General Purpose Specimen Submittal Form
Note serology and specify specific agent(s)

Material and Amount: 1 mL of serum, 1-2mL CSF.

Storage: Refrigerate if the specimen can be shipped within 72 hours. Freeze if shipped after 72 hours of collection.

Remarks: Samples obtained too early during primary infection within 2 weeks after onset may not contain detectable antibodies. If arboviral infection is suspected, a second (convalescent) sample should be obtained 10 to 21 days later and tested in parallel with the original (acute) sample. Confirmation of serological result of arboviral etiology by plaque reduction neutralization tests (PRNT) at CDPH Viral and Rickettsial Disease Laboratory (VRDL) may be needed due to the high degree of cross-reactivity among arboviruses.

2. **PCR**: Useful for the diagnosis of enteroviruses, human parechovirus, herpes viruses (including HSV-1, HSV-2, varicella), which can cause acute viral encephalitis. Viral-specific PCR testing of CSF and serum or whole blood is available commercially and through public health laboratories.

   Container: Sterile test tube for CSF and serum, serum separator tube (SST) or EDTA lavender/purple top for whole blood

   Laboratory Form:

   CDPH VRDL General Purpose Specimen Submittal Form

   Examinations Requested:
   Meningitis/Encephalitis PCR Panel
   or specify specific agent(s).

   Typing of enteroviruses and human parechovirus is also available at CDPH and can be requested using the **CDPH VRDL General Purpose Specimen Submittal Form.**

   Material and Amount: 1-2 mL CSF, 3-5 mL whole blood, 1mL of serum.

   Storage: Refrigerate if the specimen can be shipped within 72 hours. Freeze if shipped after 72 hours of collection.

3. **Culture**: Depends on stage of illness. Consult the Public Health Laboratory, Virology Section.

   Container: Sterile test tube for CSF, sterile 30 mL wide-mouth screw-cap bottle for other specimens

   Laboratory Forms:

   Test Requisition and Report Form H-3021

   CDPH VRDL General Purpose Specimen Submittal Form

   Examination Requested: Viral Culture.

   Material and Amount: 2-3 grams of stool, 1-2 mL CSF, Nasal Pharyngeal (NP) Swab

   Storage: For all specimens, refrigerate and deliver to Public Health Laboratory within 48 hours of collection or freeze immediately after collection at -70ºF and keep frozen until delivery. NP swab should be in viral transport medium. Do not freeze any specimen which has clinical background indicating VZV, CMV, and RSV.

   Remarks: Specimens for isolation attempts must be collected as soon as possible after the onset of symptoms.