

Eastern Equine Encephalitis Virus

Disease Agent:

- Eastern equine encephalitis virus (EEEV)

Disease Agent Characteristics:

- Family: *Togaviridae*; Genus: *Alphavirus*
- Virion morphology and size: Enveloped, icosahedral nucleocapsid symmetry, spherical particle, 60-65 nm in diameter
- Nucleic acid: Linear, positive-sense, single-stranded RNA genome, ~11.7 kb in length
- Physicochemical properties: Infectivity inactivated and destroyed by heating for 10 minutes at >56°C; half life of 7 hours at 37°C; sensitive to treatment with lipid solvents, detergents, ether, trypsin, chloroform, formaldehyde, heat, and β -propiolactone; infectivity reduced after exposure to irradiation and inactivated at pH 1-3

Disease Name:

- Eastern equine encephalitis

Priority Level:

- Scientific/Epidemiologic evidence regarding blood safety: Theoretical
- Public perception and/or regulatory concern regarding blood safety: Absent
- Public concern regarding disease agent: Very low

Background:

- First recognized in 1831 as a disease in horses in the northeastern US, with subsequent isolation of the virus from brain tissue in 1933. It was recognized in humans in 1938, following a widespread outbreak in children that resulted in 30 cases of fatal encephalitis.
- Enzootic in North America ranging from New Hampshire to the Atlantic seaboard, the Gulf coast to Texas, and foci in the Great Lakes region and South Dakota. It is also found in the Caribbean and Central America, inland along the north and east coasts of South America, and the Amazon River basin.
- Classified as bioterrorism agent by the CDC (Category B).

Common Human Exposure Route:

- Vector borne (mosquitoes)

Likelihood of Secondary Transmission:

- Absent

At-Risk Populations:

- All age groups, but especially children <10 years old; associated with exposure to wooded areas adjacent to

swamps and marshes in Eastern US, Canada to Gulf Coast, Caribbean, Latin America

- A threat as a bioterrorist weapon for populations not previously considered being at risk

Vector and Reservoir Involved:

- Mosquitoes: *Culiseta melanura*, *Culex* species; associated with wading birds, pheasants, passerine song-birds, and starlings

Blood Phase:

- The incidence and duration of asymptomatic viremia are unknown.
- There is a single case report of viral isolation from serum 2 days after onset of illness.
- Viremia has been detected for up to 7 days in horses and <4 days in birds.

Survival/Persistence in Blood Products:

- Unknown

Transmission by Blood Transfusion:

- No transfusion cases have been documented.

Cases/Frequency in Population:

- 220 confirmed cases in the US from 1964 through 2004 averaging five cases per year (range: 0-15)

Incubation Period:

- 3-10 days

Likelihood of Clinical Disease:

- High in children and the elderly

Primary Disease Symptoms:

- Headache of increasing severity
- Fever, chills, malaise, and myalgia
- Encephalitis, seizures, coma

Severity of Clinical Disease:

- High with death occurring within 2-10 days among patients developing encephalitis
- Encephalitis in 1 of 8 children and 1 of 23 other patients infected with EEEV
- Neurologic sequelae (paralysis, seizures, mental retardation) in up to 80% of survivors, especially in children and the elderly

Mortality:

- 30-40% of clinical cases

Chronic Carriage:

- No

Treatment Available/Efficacious:

- Supportive

Agent-specific Screening Question(s):

- No specific question is in use.
- Not indicated because transfusion transmission has not been demonstrated
- No sensitive or specific question is feasible.
- Under circumstances of a bioterrorism threat, the need for, and potential effectiveness of, specific donor screening questions would need to be addressed.

Laboratory Test(s) Available:

- No FDA-licensed blood donor screening test exists.
- IgM EIA in serum or CSF; viral isolation or antigen detection in CSF, blood, or CNS tissue; neutralization tests; NAT

Currently Recommended Donor Deferral Period:

- No FDA Guidance or AABB Standard exists.
- The appropriate deferral period for clinical infection is not known, but would likely be on the order of a few weeks after the resolution of symptoms.

Impact on Blood Availability:

- Agent-specific screening question(s): Not applicable; in response to a bioterrorism threat, impact of a local deferral would be of limited efficacy due to the historical lack of transfusion-transmitted disease and short period of viremia.
- Laboratory test(s) available: Not applicable

Impact on Blood Safety:

- Agent-specific screening question(s): Not applicable; unknown impact in response to a bioterrorism threat
- Laboratory test(s): Not applicable

Leukoreduction Efficacy:

- Unknown

Pathogen Reduction Efficacy for Plasma Derivatives:

- Multiple pathogen reduction steps used in the fractionation process have been shown to be robust in the removal of enveloped viruses.

Other Prevention Measures:

- Mosquito control
- Experimental vaccine

Suggested Reading:

1. Clarke DH. Two nonfatal human infections with the virus of eastern encephalitis. *Am J Trop Med Hyg* 1961;10:67-70.
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3. Griffin D. Alphaviruses. In: Knipe DM, Howley PM, editors. *Fields virology*, 5th ed. Philadelphia: Lippincott Williams & Wilkins; 2007. p. 1023-67.
4. Kissling RE, Chamberlain RW, Eidson ME, Sikes RK, Bucca MA. Studies on the North American arthropod-borne encephalitides. II. Eastern equine encephalitis in horses. *Am J Hyg* 1954;60:237-50.
5. Kissling RE, Chamberlain RW, Sikes RK, Eidson ME. Studies on the North American arthropod-borne encephalitides. III. Eastern equine encephalitis in wild birds. *Am J Hyg* 1954;60:251-65.
6. Tsai TE, Weaver SC, Monath TP. Alphaviruses. In: Richman DD, editor. *Clinical virology*, 2nd ed. Washington DC: ASM Press; 2002. p. 1177-210.