47 | WESTERN EQUINE ENCEPHALITIS VIRUS

47.1 | Disease agent

- Western equine encephalitis virus (WEEV)

47.2 | Disease agent characteristics

- Family: *Togaviridae*; Genus: *Alphavirus*
- Virion size: Enveloped, icosahedral nucleocapsid symmetry, spherical particle, 70 nm in diameter
- Nucleic acid: Linear, positive-sense, single-stranded RNA genome, ~11.5 kb in length
- Physicochemical properties: Infectivity destroyed by heating for 10 min at >56°C; half-life of 7 h at 37°C; sensitive to treatment with nonionic lipid detergents, ether, trypsin, chloroform, formaldehyde, heat, and β-propiolactone; infectivity reduced after exposure to irradiation and inactivated at pH 1–3

47.3 | Disease name

- Western equine encephalitis (WEE)

47.4 | Priority level

- Scientific/Epidemiologic evidence regarding blood safety: Theoretical because of documented transmission of eastern equine encephalitis virus (EEEV), an alphavirus phylogenetically similar to WEEV, from an organ donor to three transplant recipients
- Public perception and/or regulatory concern regarding blood safety: Absent
- Public concern regarding disease agent: Absent

47.5 | Background

- Epizootics occurred in Argentina and the central plains of the US between 1908 and 1912. WEEV was isolated in 1930 from horses with encephalitis and subsequently from the brain of a child with fatal encephalitis in 1938.
- No confirmed US cases since 1999. The last substantial epizootic in humans occurred in 1975 in North Dakota and Manitoba. The latest identification of WEEV in its enzootic cycle was a positive mosquito pool collected in 2013 in Clark County, Nevada.
- More than 130 arboviruses are known to cause human disease; most of public health importance belong to the genera: *Flavivirus*, *Alphavirus* and *Orthobunyavirus*. Many are nationally notifiable via state reporting to the US CDC (ArboNet); for example, dengue virus, Zika virus, California serogroup viruses, chikungunya virus, EEEV, Powassan virus, St. Louis encephalitis virus, West Nile virus, WEEV and yellow fever virus.
- Classified (Category B) as bioterrorism agent by the CDC.

47.6 | Common human exposure route

- Vector-borne (mosquitoes)

47.7 | Likelihood of secondary transmission

- Absent

47.8 | At-risk populations

- Very young and adults >50 years (males and females)
- Rural environment, primarily in Western US
- A threat as a bioterrorist weapon for populations not previously considered being at risk

47.9 | Vector and reservoir involved

- Principal vector: mosquitoes, primarily *Culex tarsalis* with *Aedes* spp. participating in a secondary cycle in lagomorphs, various rodents, bats, squirrels, ungulates, tortoises, and snakes in late summer
- Reservoir: associated with domestic and passerine birds (sparrows and house finches)

47.10 | Blood phase

- Unknown

47.11 | Survival/persistence in blood products

- Unknown

47.12 | Transmission by blood transfusion

- No cases have been documented.

47.13 | Cases/frequency in population

- No confirmed human cases in the United States since 1999. There have been 639 confirmed US cases since 1964.
- Seasonal occurrence (from mid-June to late September) in North America.

47.14 | Incubation period

- 4–10 days

47.15 | Likelihood of clinical disease

- Low, depending on population infected; inapparent-to-apparent infection ratio is 1:1 in infants <1 year old, 58:1 in children 1–4 years old, and 1150:1 in persons >14 years old.

47.16 | Primary disease symptoms

- Sudden onset of fever, headache, stiff neck, vomiting, or weakness. The illness may progress to disorientation, irritability, seizures and coma.

47.17 | Severity of clinical disease

- Almost all patients who contract the virus but do not develop neurologic symptoms will recover, as do most adults with mild neurologic disease. Approximately 3%–15% of the encephalitis cases are fatal, and about 5%–30% of surviving infants will have permanent brain damage
- Low to moderate, depending on the patient age
- Neurologic sequelae in 30% of recovering infants
- Adults usually recover completely

47.18 | Mortality

- Overall 3%–4%, but increases to 8% if >50 years old (50%–70% for EEEV)

47.19 | Chronic carriage

- No

47.20 | Treatment available/efficacious

- Supportive

47.21 | Agent-specific screening question(s)

- No specific question is in use.
- Not indicated because transfusion transmission has not been demonstrated and no confirmed cases have been reported in the United States since 1999.
- 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.

47.22 | Laboratory test(s) available

- No FDA-licensed blood donor screening test exists.
- Virus-specific IgM in serum or CSF; viral antigen detection or isolation of virus from brain tissue in mice or cell culture; NAT in serum or CSF.

47.23 | 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 several weeks after the resolution of symptoms.

47.24 | Impact on blood availability

- Agent-specific screening question(s): Not applicable; in response to a bioterrorism threat, impact of a local deferral would be significant.
- Laboratory test(s) available: Not applicable.

47.25 | Impact on blood safety

- Agent-specific screening question: Not applicable; unknown impact in response to a bioterrorism threat

- Laboratory tests: Not applicable

47.26 | Leukoreduction efficacy

- Unknown

47.27 | Pathogen reduction efficacy

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

47.28 | Other prevention measures

- Mosquito control such as the use of repellents or wearing clothing that minimizes skin exposure
- Experimental vaccine but no specific treatment available

SUGGESTED READING

1. Bergren NA, Haller S, Rossi SL, Seymour RL, Huang J, Miller AL, et al. "Submergence" of Western equine encephalitis virus: Evidence of positive selection argues against genetic drift and fitness reductions. PLoS Pathog. 2020;e1008102.
2. Calisher CH. Medically important arboviruses of the United States and Canada. Clin Microbiol Rev. 1994;7:89–116.
3. Griffin DE. Alphaviruses. In: Knipe DM, Howley PM, editors. Fields virology. 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2007;ch. 23. p. 651–86.
4. Reeves WC, Hammon WM. Epidemiology of the Arthropod-Borne Viral Encephalitides in Kern County, California 1943–1952. Berkeley, CA, USA: University of California at Berkeley; 1962.
5. Tsai TF, Weaver SC, Monath TP. Alphaviruses. In: Richman DD, Whitley RJ, Hayden FG, editors. Clinical virology. Washington: ASM Press; 2002. p. 1177–210.