

## Japanese Encephalitis Virus

### Disease Agent:

- Japanese encephalitis virus (JEV)

### Disease Agent Characteristics:

- Family: *Flaviviridae*; Genus: *Flavivirus*
- Virion morphology and size: Enveloped, icosahedral nucleocapsid symmetry, spherical particles, 40 to 60 nm in diameter
- Nucleic acid: Linear, positive-sense, single-stranded RNA genome, ~11.0 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  $\beta$ -propiolactone; infectivity reduced after exposure to irradiation and inactivated at pH 1-3

### Disease Name:

- Japanese encephalitis

### Priority Level:

- Scientific/Epidemiologic evidence regarding blood safety: Theoretical; because of the similarity to WNV, transfusion risk during JEV outbreaks may occur.
- Public perception and/or regulatory concern regarding blood safety: Absent
- Public concern regarding disease agent: Absent

### Background:

- Recognized in horses and humans in 1871; severe epidemic occurred in Japan in 1924; isolated from human brain in 1935
- Increasing in India, Nepal, and South East Asia while declining in Japan, S. Korea, Taiwan, and China since 1970 because of widespread vaccination programs and other preventive measures
- Most recently detected in Australia
- Over 50,000 cases and 10,000 deaths occur annually in Asia, but the disease is greatly underreported.

### Common Human Exposure Routes:

- Vector-borne (mosquitoes)

### Likelihood of Secondary Transmission:

- Absent

### At-Risk Populations:

- Widely distributed in Asia
- Affects all ages, but especially children and the elderly

### Vector and Reservoir Involved:

- Main epidemic vector is mosquitoes of the *Culex* species, especially *C. tritaeniorhynchus*.
- In temperate regions, pigs and birds (principally ardeid species, such as egrets and black-crowned night herons, and possibly ducks) are effective amplifying hosts.

### Blood Phase:

- Virus can be isolated from the blood infrequently after the appearance of symptoms. It is unknown whether a biologically relevant viremic phase occurs during asymptomatic infections.

### Survival/Persistence in Blood Products:

- Unknown

### Transmission by Blood Transfusion:

- No cases documented; however, because of similarity to WNV (i.e., mosquito-borne flavivirus that results in community epidemics), transfusion transmission might be expected to occur during JEV outbreaks.

### Cases/Frequency in Population:

- Widely distributed in Asia; infection rates may exceed 1% during periods of peak transmission
- Where vaccination programs are not in place, nearly all persons in endemic areas have been infected (antibody-positive) by young adulthood.
- Not endemic in the US but imported by travelers from endemic areas

### Incubation Period:

- 6-16 days from exposure to onset of symptoms

### Likelihood of Clinical Disease:

- Inapparent-to-apparent infection rate ranges from 200-300 to 1

### Primary Disease Symptoms:

- Febrile headache syndrome
- Aseptic meningitis
- Encephalitis characterized by rapid onset with a 2- to 4-day prodrome of headache, fever, chills, nausea, vomiting, dizziness, and drowsiness followed by nuchal rigidity, photophobia, altered states of consciousness, hyperexcitability, and neurologic signs of CNS involvement.

### Severity of Clinical Disease:

- Severe manifestations of the disease can occur with accompanying mortality.
- Neuropsychiatric sequelae are frequent (45%-70% of survivors) and include Parkinsonism, convulsive dis-

orders, paralysis, mental retardation, and psychiatric disorders.

#### **Mortality:**

- Children and elderly are at highest risk for mortality which ranges from 5%-40% with the highest frequency usually associated with poor medical care and the most severe cases (2%-11% in US military personnel)

#### **Chronic Carriage:**

- Evidence for persistent/latent infection in humans based on recovery of JEV from PBMC of asymptomatic children 9 months after acute JEV as well as in children developing recurrent disease. JEV was also recovered from CSF 4 months after onset of symptoms. The relevance of these data remains to be elucidated.

#### **Treatment Available/Efficacious:**

- Supportive treatment

#### **Agent-specific Screening Question(s):**

- No specific question is in use.
- No sensitive or specific question is feasible.

#### **Laboratory Test(s) Available:**

- No FDA-licensed blood donor screening test exists.
- Virus can occasionally be isolated in cell culture from the blood of symptomatic cases. Isolation possibilities are better from the CSF (up to one-third of cases).
- Serology on paired serum samples showing fourfold rise in titer by neutralization, CF or HI is diagnostic.
- An IgM-capture EIA test is helpful in diagnosing JEV by detection of serum and intrathecal antibody.

#### **Currently Recommended Donor Deferral Period:**

- No FDA Guidance or AABB Standard exists.
- Prudent practice would be to defer for 1 year after resolution of symptoms based on limited data regarding persistence in PBMC.

#### **Impact on Blood Availability:**

- Agent-specific screening question(s): Not applicable
- Laboratory test(s) available: Not applicable

#### **Impact on Blood Safety:**

- Agent-specific screening question(s): Not applicable
- Laboratory test(s) available: Not applicable

#### **Leukoreduction Efficacy:**

- Unknown, but PBMC isolation study mentioned previously suggests that leukoreduction might lower a theoretical risk

#### **Pathogen Reduction Efficacy for Plasma Derivatives:**

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

#### **Other Prevention Measures:**

- Formalin-inactivated vaccines for humans have an efficacy of 91%; a live attenuated vaccine is in use in China yielding seroconversion in 95% after one dose. Genetically engineered vaccines are in development.
- Mosquito control

#### **Suggested Reading:**

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