37 | POWASSAN VIRUS

37.1 | Disease agent

- Powassan virus (POWV)

37.2 | Disease agent characteristics

- Family: *Flaviviridae*; Genus: *Flavivirus*.
- Enveloped, single-stranded positive-sense RNA genome, 50 nm in diameter.
- Tick-borne flaviviruses (TBFV) are divided into three groups. The largest of these is associated with mammalian hosts (typically rodents) that cause encephalitis, hemorrhagic fever and Kyasanur Forest disease in humans.
- POWV is part of the tick-borne encephalitis virus (TBEV) serocomplex. The remaining two groups are not human pathogens.
- Two genetically distinct lineages are recognized: POWV (lineage I) and deer tick virus (DTV) (lineage II).

37.3 | Disease name

- Powassan virus disease

37.4 | Priority level

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

37.5 | Background

- While rare, there has been an increase in reported cases of POWV infections in the past decade; this may be in part ascribed to greater awareness and concomitant surveillance and/or expansion of the tick vector.
- POWV is found in North America (broadly distributed in Canada, the northcentral and northeastern US), and the Russian Far East.
- ArboNET has documented 7-39 cases of POWV neuroinvasive disease cases yearly from 2012 to 2021.
- 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 viruses, Zika virus, California serogroup viruses, chikungunya virus, eastern equine encephalitis virus, POWV, St. Louis encephalitis virus, West Nile virus, western equine encephalitis virus and yellow fever virus.
- POWV is closely related to other flaviviruses including St. Louis encephalitis virus, Japanese encephalitis virus, and West Nile virus.

37.6 | Common human exposure routes

- Vector-borne transmission (i.e., bite of infected *Ixodes* ticks); POWV may be transmitted in less than 15 min of tick feeding

37.7 | Likelihood of secondary transmission

- Organ transplantation (plausible, based on experience with WNV)
- Blood transfusion (1 probable case)

37.8 | At-risk populations

- Individuals at risk for exposure to infected ticks; residence in areas where agents are endemic

37.9 | Vector and reservoir involved

- Tick vector: *Ixodes cookei* (major for POWV), *Ixodes scapularis* (major for deer tick virus), *Ixodes marxi*, *Dermacentor andersoni*.
- Host: Small- and medium-sized mammals (e.g., groundhogs, red squirrels, chipmunks, skunks, woodchucks, white-footed mice). In general, humans are dead-end hosts.

37.10 | Blood phase

- Not well characterized, but the virus can be isolated from plasma or serum

37.11 | Survival/persistence in blood products

- Unknown

37.12 | Transmission by blood transfusion

- A single probable case of transfusion transmission to the recipient of a kidney transplant in Indiana has been published. One of three donors from Wisconsin had an "inconclusive" POWV RNA on PCR testing of an archived donation specimen, and subsequently developed an IgM serological response. The other two were both seronegative and PCR negative on post-donation testing. The organ donor was negative for both antibody and RNA on pre-procurement specimens.

37.13 | Cases/frequency in population

- Rare: In the United States, the incidence of neuroinvasive POWV infection has risen from 6 to 12 cases/year during 2010–2015 to 7–39 cases/year in 2012–2019 as reported in 12 US states.
- In the United States, the traditional lineage of POWV is primarily found in the Great Lakes area whereas DTV is found in the Northeast.

37.14 | Incubation period

- 1–4 weeks

37.15 | Likelihood of clinical disease

- Most arbovirus infections are asymptomatic; given rarity of disease, clinical penetrance is uncertain.

37.16 | Primary disease symptoms

- POWV disease appears to have an asymptomatic or minimally symptomatic presentation in most people.
- Encephalitis and meningitis: fever, headache, confusion, altered level of consciousness, seizures, focal neurological deficits.
- Rash and gastrointestinal symptoms (nausea and vomiting).
- Lymphocytic pleocytosis in CSF.

37.17 | Severity of clinical disease

- 10%–15% case fatality rate with neuroinvasive infection
- Even with recovery, long-term neurological sequalae have been described in a high proportion (>50%) of survivors (e.g., memory loss, focal weakness)

37.18 | Mortality

- 10%–15% case fatality rate

37.19 | Chronic carriage

- Unknown, but unlikely

37.20 | Treatment available/efficacious

- Supportive management; no specific treatment (e.g., antivirals) or preventive measures are available.
- High dose steroids and IVIg have been used.

37.21 | Agent-specific screening question(s)

- No specific question is in use.
- Not indicated given the rarity of infection.

37.22 | Laboratory test(s) available

- No FDA-licensed blood donor screening tests for POWV
- Optimal testing approach uncertain
  - Serological (antibody and antigen) assays are available in research/reference setting (e.g., IgM antibody-capture ELISA, IFA and plaque reduction neutralization tests) using serum or CSF samples
- RT-PCR available in research/reference setting (no commercial tests are available)
  Serology is not genotype specific; that is, unable to distinguish between POWV and DTV

37.23 | Currently recommended donor deferral period

- No FDA Guidance or AABB Standard exists

37.24 | Impact on blood availability

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

37.25 | Impact on blood safety

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

37.26 | Leukoreduction efficacy

- Unknown

37.27 | 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.

37.28 | Other prevention measures

- Tick avoidance

SUGGESTED READING

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