27 | LYMPHOCYTIC CHORIOMENINGITIS VIRUS

27.1 | Disease agent

- Lymphocytic choriomeningitis virus (LCMV)

27.2 | Disease agent characteristics

- Family: *Arenaviridae*; Genus: *Mammarenavirus*.
- Part of the Lassa-lymphocytic choriomeningitis serocomplex.
- Virion morphology and size: Enveloped, pleomorphic virions with filamentous helical nucleocapsids, diameter 50–300 nm (mean: 110–130 nm).
- Nucleic acid: Ambisense genomic organization (two viral genes separated by an intergenic region), bisegmented, negative-sense, single-stranded RNA genome, S (small, ~3.5 kb) and L (large, ~7.2 kb) segments.
- Physicochemical properties: Inactivated by low-level disinfectants, such as quaternary ammonium-based products, phenolics, chlorine-based products, and iodophor formulations; susceptible to 1% sodium hypochlorite, 2% glutaraldehyde, 70% ethanol, formaldehyde, and quaternary ammonium compounds; sensitive to heat inactivation; LCMV survives in rodent droppings and urine.

27.3 | Disease name

- Lymphocytic choriomeningitis virus infection

27.4 | Priority level

- Scientific/Epidemiologic evidence regarding blood safety: Theoretical because of documented transmission via organ transplantation
- Public perception regarding blood safety: Absent
- Public concern regarding disease agent: Absent

27.5 | Background

- Discovered in 1933 during a St. Louis encephalitis epidemic
- This virus is widespread in mice (*Mus* species).
- Transmission to humans is generally the result of contact with rodent secretions and excretions in rodent-infected barns, substandard housing, and movement of mice into dwellings as weather becomes colder.
- Transmission by organ transplantation was reported from one donor to three recipients in 2003 and one donor to four recipients of organ transplants in 2005. This caused speculation about a theoretical risk of parenteral transmission by blood or blood components. Subsequently, there have been several confirmed transmissions from organ allografts, totaling five clusters in the United States encompassing 14 infected recipients and 11 deaths. Cornea recipients from infected donors did not develop symptomatic infection, although follow-up was incomplete.
- Outside the US in 2008, three additional organ transplant recipients were fatally infected with a novel arenavirus from a single donor; the novel arenavirus shared 80%–90% homology with LCMV at the amino acid level.

27.6 | Common human exposure routes

- Exposure to urine or saliva of other wild, pet, or laboratory rodents (rats, guinea pigs, and hamsters)
- Contact (broken skin, nares, eyes, mouth) with urine, saliva, feces, blood, or nesting materials of infected natural hosts, *Mus musculus domesticus* and *M. musculus musculus* (the habitat of *M. musculus* spans from Central Europe, east to China and Japan, while the habitat of *M. domesticus* encompasses Western Europe and the Mediterranean basin, Near-East, Americas, and Australia)
- In the mouse host, LCMV is transmitted horizontally and *in utero*. Once infected, these mice can become chronically infected, maintaining virus in their blood or persistently shedding virus in their urine.

27.7 | Likelihood of secondary transmission

- Uncommon
- Maternal-fetal and solid organ transmission well documented

27.8 | At-risk populations

- Children and adults

27.9 | Vector and reservoir involved

- Domestic mice are the primary reservoir.

- Focality is common (uneven distribution of virus due to nonoverlapping reservoir species).

27.10 | Blood phase

- Viremia is present during the acute febrile phase and during the meningitis phase; however, it is unknown to what extent viremia precedes the onset of symptoms.

27.11 | Survival/persistence in blood products

- Unknown

27.12 | Transmission by blood transfusion

- Viremia in mild or asymptomatic infection is possible but not documented
- No reported cases of transmission by blood transfusion
- Several reports of transmission by infected organ donors
- No reports of transmission through cornea from known infected donors

27.13 | Cases/frequency in population

- Studies in endemic areas show seroprevalence range of 1%–10% (2%–5% in US inner cities)
- Incidence of recognized acute LCMV infection in the United States is very low with previous outbreaks identified in organ-transplant recipients or linked to exposure to pet hamsters or virus-contaminated laboratory rodents and cell lines derived from them.

27.14 | Incubation period

- About 10 days (range of 5–21 days) after exposure

27.15 | Likelihood of clinical disease

- Recognized disease is rare but thought to be underdiagnosed.

27.16 | Primary disease symptoms

- Illness is biphasic; usually recognized as aseptic meningitis
  - Phase 1: (common symptoms) fever, malaise, anorexia, muscle ache, nausea, vomiting; (less common) sore throat, cough, joint pain, testicular pain, parotid pain
  - Phase 2: (common) meningitis, encephalitis (diagnosed in 5%–34% of hospitalized patients); (less common) hydrocephalus, myelitis
  - May cause hydrocephalus transiently or congenital hydrocephalus and chorioretinitis after fetal infection; deafness may occur late in the course of the disease, unilaterally or bilaterally.

27.17 | Severity of clinical disease

- Full recovery is usual in previously healthy individuals; patients developing meningitis or encephalitis usually recover without sequelae.
- Fetal infection can lead to permanent developmental deficits.
- Sequelae are highly likely in organ transplant recipients acquiring infection from the donor.

27.18 | Mortality

- Greater than 1% overall, but significantly higher mortality has been observed in immunosuppressed organ-transplant patients receiving infected donor organs resulting in multiorgan failure with hepatitis as a prominent feature in the infected organ recipient.

27.19 | Chronic carriage

- None described in humans

27.20 | Treatment available/efficacious

- None; the efficacy of ribavirin has not been confirmed but may improve outcome in more serious disease.

27.21 | Agent-specific screening question(s)

- No specific question is in use.
- Not indicated because transfusion transmission has not been demonstrated.

- Questions about contact with wild rodents, pet hamsters, or guinea pigs or their excreta are unlikely to be sensitive or specific.

27.22 | Laboratory test(s) available

- No FDA-licensed blood donor screening test exists.
- Clinical specimens may be tested by NAT, virus culture or immunohistochemical staining.
- Plasma and serum may be tested for IgM and IgG antibodies.

27.23 | Currently recommended donor deferral period

- No FDA Guidance or AABB Standard exists.
- Because viremia can persist through the meningitis phase and neutralizing antibodies appear late, donor deferral should continue until full recovery.

27.24 | Impact on blood availability

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

27.25 | Impact on blood safety

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

27.26 | Leukoreduction efficacy

- Unknown but not likely to be effective

27.27 | Pathogen reduction efficacy for plasma derivatives

- No specific data are available but presumed to be robust as the agent is an enveloped virus that should be sensitive to many measures used in the fractionation process.

27.28 | Other prevention measures

- LCMV testing of hamster colonies
- Rodent control
- Consider LCMV infection in patients presenting with aseptic meningitis or encephalitis, especially in alcoholics, who may be potential organ donors, and in recipients with fever, neurologic changes, and multiorgan dysfunction in the early post-transplant period.

SUGGESTED READING

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