

Rhabdovirus (Rabies Virus)

Disease Agent:

- Rabies virus

Disease Agent Characteristics:

- Family: *Rhabdoviridae*; Genus: *Lyssavirus*
- Virion morphology and size: Enveloped, bullet-shaped, 45-100 nm in diameter, 100-430 nm in length
- Nucleic acid: Single-stranded, linear, negative-sense RNA genome, ~11.9 kb in length
- Physicochemical properties: Susceptible to 1% sodium hypochlorite, 2% glutaraldehyde, 70% ethanol, formaldehyde, and quaternary ammonium compounds. Inactivated on exposure to ultraviolet radiation, by heat (1 hour at 50°C), and by lipid solvents. Rabies virus is inactivated rapidly in sunlight and does not survive for long periods out of the host unless protected in a cool, dark area.

Disease Name:

- Rabies

Priority Level

- Scientific/Epidemiologic evidence regarding blood safety: Absent; rare cases of transmission by organ/tissue transplantation probably associated with infection of neurologic tissue; no recognized viremic phase
- Public perception and/or regulatory concern regarding blood safety: Very low
- Public concern regarding disease agent: Moderate

Background:

- Human cases in the US have been stable since the 1960s. Pathogenesis involves transport of virus centripetally along peripheral nerves to the central nervous system, where virus replicates, followed by centrifugal transport via peripheral nerves to multiple organs and tissues. The latter is responsible for transmission via transplantation. Viremia has not been demonstrated.

Common Human Exposure Routes:

- Rabid animal bite, which can be inapparent especially from infected bats
- Aerosol exposure has been recognized in laboratory spread and natural settings.
- Organ and tissue transplants have been implicated.

Likelihood of Secondary Transmission:

- Low; rare cases in organ/tissue transplant recipients receiving a kidney, liver, arterial segment, or cornea

At-Risk Populations:

- Animal handlers (veterinarians, etc.)
- Individuals living in proximity to infected mammals, especially bats. Those at risk include urban residents as well as rural populations.

Vector and Reservoir Involved:

- Wild animals: bats, raccoons, skunks, foxes
- Domestic animals can be infected following contact with infected feral species.

Blood Phase:

- None

Survival/Persistence in Blood Products:

- No data

Transmission by Blood Transfusion:

- There has never been a reported case of rabies infection via a blood transfusion. Viremia has not been demonstrated, and the virus is intraneuronal during the incubation period. There is no evidence to suggest that an apparently healthy blood donor can transmit rabies, even if incubating clinical rabies.

Cases/Frequency in Population:

- One to four human cases per year in the US

Incubation Period:

- <30 days (25%)
- 30-90 days (50%)
- 90 days-1 year (20%)
- >1 year (5%)

Likelihood of Clinical Disease:

- High after significant exposure without postexposure prophylaxis

Primary Disease Symptoms:

- Fever, malaise, anorexia
- Paresthesias or pain at wound site
- Rapidly progressive to cerebral dysfunction and death
- Two polar clinical syndromes: "furious" or encephalitic rabies and "dumb" or paralytic rabies

Severity of Clinical Disease:

- High

Mortality:

- Virtually 100%

Chronic Carriage:

- None, although incubation period may last >1 year

Treatment Available/Efficacious:

- Investigational and anecdotal
- Postexposure prophylaxis

Agent-Specific Screening Question(s):

- No specific question is in use, except for recent immunizations
- Not indicated because transfusion transmission has not been demonstrated
- No sensitive or specific question is feasible.

Laboratory Test(s) Available:

- No FDA-licensed blood donor screening test exists.
- Antemortem:
 - Skin biopsy from nape of neck
 - Fluorescent microscopy
 - Virus isolation or NAT from saliva
 - Viral antibody in serum or cerebrospinal fluid

Currently Recommended Donor Deferral Period:

- No FDA Guidance or AABB Standard exists.
- No deferral after possible rabies exposure is required. Some facilities may require temporary deferral for prophylaxis because of confusing infectious disease test serologies that may occur following receipt of hyperimmune globulin (e.g., anti-HBc).

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

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:

- Postexposure prophylaxis with hyperimmune globulin and vaccine
- Vaccination (with inactivated vaccine)
- Education

Suggested Reading

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4. Helmick CG, Tauxe RV, Vernon AA. Is there a risk to contacts of patients with rabies? *Rev Infect Dis* 1987; 9:511-8.
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6. Srinivasan A, Burton EC, Kuehnert MJ, Rupprecht C, Sutker WL, Ksiazek TG, Paddock CD, Guarner J, Shieh WJ, Goldsmith C, Hanlon CA, Zoretic J, Fischbach B, Niezgodka M, El-Feky WH, Orciari L, Sanchez EQ, Likos A, Klintmalm GB, Cardo D, LeDuc J, Chamberland ME, Jernigan DB, Zaki SR; Rabies in Transplant Recipients Investigation Team. Transmission of rabies virus from an organ donor to four transplant recipients. *N Engl J Med* 2005;352:1103-11.
7. Willoughby RE Jr, Tieves KS, Hoffman GM, Ghanayem NS, Amlie-Lefond CM, Schwabe MJ, Chusid MJ, Rupprecht CE. Survival after treatment of rabies with induction of coma. *N Engl J Med* 2005;352:2508-14.