

Hantavirus—Old World

Disease Agent:

- Old World Hantaviruses

Disease Agent Characteristics:

- Family: *Bunyaviridae*; Genus: *Hantavirus*
- Virion morphology and size: Enveloped, helical nucleocapsid symmetry, spherical to pleomorphic particles, 80-120 nm in diameter
- Nucleic acid: Circular, segmented, negative-sense and ambisense, single-stranded RNA, 11.8-13.8 kb in length
- Physicochemical properties: Inactivated by dry heat (56°C for 30 min) and solvent-detergent treatments

Disease Name:

- Hemorrhagic fever with renal syndrome (HFRS)

Priority Level:

- Scientific/Epidemiologic evidence regarding blood safety: Theoretical
- Public perception and/or regulatory concern regarding blood safety: Very low to absent
- Public concern regarding disease agent: Low but moderate in endemic areas

Background:

- In 1913, HFRS was first described in Russia.
- In 1951, an HFRS outbreak occurred in US troops stationed in Korea.
- At least four serotypes (Hantaan, Seoul, Puumala, and Dobrava) are known to cause HFRS.
- The genus is named after the Hantaan River in South Korea.
- HFRS is an acute febrile illness that progresses to renal failure, hemorrhage, and shock and is primarily found in Europe and Asia.

Common Human Exposure Routes:

- The main route of transmission is by inhaling airborne particles of urine, feces, or saliva from infected rodents.
- Other potential routes of transmission are rodent bites, touching the nose or mouth after handling objects contaminated with rodent urine, droppings, or saliva, or eating contaminated food.

Likelihood of Secondary Transmission:

- Old World hantaviruses are not known to be transmitted from person to person or through blood transfusion.

At-Risk Populations:

- The greatest risk is among people in rural and semi-rural areas, especially if they work, play, or live in any closed space where rodents are present. Primary exposure occurs during cleaning in and around houses that are infested with rodents and opening and cleaning of previously unused buildings.
- Other individuals who are at increased risk include campers and hikers as well as farmers, construction, utility, and pest-control workers, and the military.

Vector and Reservoir Involved:

- Each virus has a single primary rodent host.
- Old World rats and mice (Asia and Europe): Examples include the Norway rat (*Rattus norvegicus*), which carries the Seoul virus, and the striped field mouse (*Apodemus agrarius*), which carries the Hantaan virus.

Blood Phase:

- No data available for blood phase in asymptomatic persons
- Virus isolated and/or DNA demonstrated in blood from symptomatic patients with several hantavirus virus infections.
- Hantavirus infects endothelial cells that line the inner lumen of the blood vessels of the lung, kidney, and other body parts.

Survival/Persistence in Blood Products:

- Unknown

Transmission by Blood Transfusion:

- Hantaviruses have not been associated with transmission by blood transfusion.

Cases/Frequency in Population:

- Approximately 100,000 cases of HFRS are estimated annually in Asia and Europe.

Incubation Period:

- Days to weeks after exposure to infected material

Likelihood of Clinical Disease:

- Low to moderate

Primary Disease Symptoms:

- Severity of illness is quite variable and ranges from mild flu-like symptoms to shock.
- Fever and myalgia are followed by hemorrhage (gastrointestinal, subconjunctival), renal failure, and hemodynamic instability, which occasionally progresses to shock.
- Death is usually the result of shock or hemorrhage.

Severity of Clinical Disease:

- See mortality and primary disease symptoms

Mortality:

- Mortality rate for HFRS is 1-15%

Chronic Carriage:

- Unknown for humans

Treatment Available/Efficacious:

- No known treatment; supportive care

Agent-Specific Screening Question(s):

- No specific question is in use.
- Not indicated because transfusion transmission has not been demonstrated.
- No sensitive or specific question is feasible. A question about rodent contact in endemic areas would likely have low positive predictive value.

Laboratory(s) Test Available:

- No FDA-licensed blood donor screening test exists.
- EIA detects hantavirus-specific IgM antibody or rising hantavirus-specific IgG antibody.
- RT-PCR detects RNA in blood or tissue.
- Hantavirus-specific antigen can be detected in tissue by immunohistochemistry.
- Western blot assay using recombinant antigens and class-specific conjugates for IgM-IgG differentiation is available.

Currently Recommended Donor Deferral:

- No FDA Guidance or AABB Standard exists.

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 as some of these viruses have been isolated from peripheral blood mononuclear cells

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 Preventive Measures:

- Unknown

Suggested Reading:

1. Caldwell JD. Hantavirus cardiopulmonary syndrome, 2005. [cited 2009 May]. Available from: <http://www.emedicine.com/emerg/topic861.htm>
2. Centers for Disease Control and Prevention. All about Hantaviruses, 2006. [cited 2009 May]. Available from: <http://www.cdc.gov/ncidod/diseases/hanta/hps/index.htm>
3. Centers for Disease Control and Prevention. Hantavirus pulmonary syndrome—United States: updated recommendations for risk reduction. *Morb Mortal Wkly Rep MMWR* 2002;51:1-12.
4. Evander M, Eriksson I, Pettersson L, Juto P, Ahlm C, Olsson GE, Bucht G, Allard A. Puumala hantavirus viremia diagnosed by real-time reverse transcriptase PCR using samples from patients with hemorrhagic fever and renal syndrome. *J Clin Microbiol* 2007;45:2491-7.
5. Hjelle B. Hantaviruses, with emphasis on Four Corners Hantavirus. 1995. [cited 2009 May]. Available from: <http://bvs.insp.mx/articulos/5/22/092001.htm>
6. Sacher D. Hantavirus infection in an active duty U.S. Army soldier stationed in Seoul, Korea. *Military Medicine*; March 2003.
7. Saksida A, Duh D, Korva M, Avsic-Zupanc T. Dobrava virus RNA load in patients who have hemorrhagic fever with renal syndrome. *J Infect Dis* 2008;197:681-5.
8. Terajima M, Hendershot JD 3rd, Kariwa H, Koster FT, Hjelle B, Goade D, DeFronzo MC, Ennis FA. High levels of viremia in patients with the Hantavirus pulmonary syndrome. *J Infect Dis* 1999;180:2030-4.
9. Yao ZQ, Yang WS, Zhang WB, Bai XF. The duration of viremia patients with epidemic hemorrhagic fever. *Chin Med J (Engl)* 1989;102:116-9.
10. Yao ZO, Yang WS, Zhang WB, Bai XF. The distribution and duration of hantaan virus in the body fluids of patients with hemorrhagic fever with renal syndrome. *J Infect Dis*. 1989;160:218-24.
11. Zeier M, Handermann M, Bahr U, Rensch B, Müller S, Kehm R, Muranyi W, Darai G. New ecological aspects of hantavirus infection: a change of paradigm and a challenge of prevention—a review. *Virus Genes* 2005;30:157-80.