

11 | HANTAVIRUS—NEW WORLD

11.1 | Disease agent

- New World Hantaviruses including Sin Nombre virus (SNV)

11.2 | Disease agent characteristics

Family: *Hantaviridae*; Subfamily *Mammantavirinae*;
Genus: *Orthohantavirus*.

- Virion morphology and size: Enveloped, helical nucleocapsid symmetry, spherical to pleomorphic particles, 80–120 nm in diameter.
- Nucleic acid: Circular, segmented, negative-sense, 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.

11.3 | Disease name

- Hantavirus pulmonary syndrome (HPS) is an acute and often fatal respiratory illness primarily found in the Americas.

11.4 | 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

11.5 | Background

- New World hantaviruses are indigenous to the United States and Latin America, but because of low numbers of human infections, the disease was not recognized for many years. Regardless, HPS is potentially referenced in Native American folklore.
 - In July 1959, an individual developed an HPS-compatible illness and was subsequently found to have IgG antibodies in September 1994.
 - One of the earliest cases of HPS, subsequently confirmed by immunohistochemical detection of hantavirus antigens in postmortem tissue, occurred in 1978.

- In 1993, HPS was “newly recognized” in the Four Corners region of New Mexico with a lethality of 50%. A cluster of healthy individuals in the Navajo Nation became ill with an acute cardiopulmonary illness and died a short time later. The etiologic agent was designated *Sin Nombre virus* (SNV).
- The first outbreak of HPS in Central America (Panama) occurred in 1999.
- Approximately 25 New World hantaviruses cause HPS.

11.6 | Common human exposure routes

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

11.7 | Likelihood of secondary transmission

- In general, spread to medical personnel or a contact is unlikely to occur. However, person-to-person transmission of a New World hantavirus has been described in one outbreak in southern Argentina and Chile (*Andes virus*), and nosocomial transmission occurred in southern Argentina.

11.8 | At-risk populations

- The greatest risk is among people in rural and semi-rural areas, especially if they work, play, or live in a 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 nominal but low risk of exposure through contact with material from infected rodents include campers and hikers, as well as farmers, construction, utility, and pest-control workers, and the military.

11.9 | Vector and reservoir involved

- The deer mouse (*Peromyscus maniculatus*) is the reservoir for SNV. Other reservoirs include the rice rat (*Oryzomys palustris*), which carries the *Bayou virus*; the cotton rat (*Sigmodon hispidus*), which carries the *Black Creek*

Canal virus; and the white-footed mouse (*Peromyscus leucopus*), which carries the *New York virus*.

- Some rodent species can shed hantaviruses chronically.

11.10 | Blood phase

- No data available concerning viremia in asymptomatic persons.
- High concentrations of SNV have been detected by NAT in the blood of symptomatic, hospitalized patients; these concentrations decrease rapidly during recovery.
- Hantavirus infects endothelial cells that line the inner lumen of the blood vessels of the lung, kidney, and other body parts.

11.11 | Survival/persistence in blood products

- Unknown

11.12 | Transmission by blood transfusion

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

11.13 | Cases/frequency in population

- Through 2021, 821 HPS (and 29 non-pulmonary hantavirus) cases have been identified in 40 US states.
 - More than 90% of cases occur west of the Mississippi River.
- In the United States, SNV is the hantavirus responsible for most cases of HPS. A study of healthy individuals in a US endemic area found that antibody prevalence to SNV was 0.3%.
- A study of US mammalogists and rodent workers with varying degrees of rodent exposure found that the seroprevalence of SNV antibody was 1.14%. However, another study targeting US occupational groups that had frequent exposure to rodents and their excreta showed no evidence of infection.
- HPS is more common in South America (Argentina, Chile, Uruguay, Paraguay, Brazil, and Bolivia) than in North America.
- Prevalence of hantavirus antibodies in healthy individuals in endemic areas of South America ranges widely from 0.1 to >20%. Some hantavirus infections result in asymptomatic infection or unrecognized mild disease.

11.14 | Incubation period

- 1–8 weeks after exposure to fresh urine, droppings or saliva of infected rodents.

11.15 | Likelihood of clinical disease

- Low to moderate; HPS is infrequently recognized in children.

11.16 | Primary disease symptoms

- Early phase lasts 3–5 days (100% of patients) and results in fatigue, fever, and myalgia.
 - 50% of patients experience headaches, dizziness, chills, and abdominal problems.
 - The later cardiopulmonary phase occurs 4–10 days after the initial symptoms.
 - Coughing and shortness of breath can progress rapidly to severe respiratory failure and death.

11.17 | Severity of clinical disease

- See mortality and primary disease symptoms

11.18 | Mortality

- Mortality rate is 30%–40%

11.19 | Chronic carriage

- Unknown for humans

11.20 | Treatment available/efficacious

- No known treatment; supportive care

11.21 | 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.

11.22 | 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.
- Immunoblots using recombinant antigens and class-specific conjugates for IgM-IgG differentiation are available.
- Research tests include a recombinant immunoblot assay to detect serum antibody to recombinant proteins and peptides specific for SNV and other hantaviruses and neutralizing plaque assays for serological confirmation.

11.23 | Currently recommended donor deferral

- No specific FDA Guidance or AABB Standard exists.

11.24 | Impact on blood availability

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

11.25 | Impact on blood safety

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

11.26 | Leukoreduction efficacy

- Unknown, but unlikely to be effective because of the absence of blood cell-associated infection

11.27 | 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.

11.28 | Other prevention measures

- Reduction of rodent exposure

SUGGESTED READING

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