

Hantavirus Pulmonary Syndrome

Summary

Hantavirus Pulmonary Syndrome (HPS)¹ is an acute zoonotic viral disease characterized by fever, myalgia, and gastrointestinal complaints followed by the abrupt onset of respiratory distress and hypotension. The illness can progress rapidly to severe respiratory failure and shock. The reservoir for the virus in New Mexico is rodents of the genus *Peromyscus*, mainly the deer mouse, which excretes the virus in its urine, feces, and saliva. Humans acquire infection through direct contact with infected rodents, rodent droppings, nests, or inhalation of aerosolized virus particles from rodent urine, droppings, or saliva.

Agent

- Hantaviruses are RNA viruses of the Bunyaviridae family that in humans cause HPS or hemorrhagic fever with renal syndrome (HFRS). Within the hantavirus genus are the viruses that cause HFRS in Europe and Asia and the viruses associated with HPS in the Americas. In the United States, 5 virus variants are known to cause disease in humans. Sin Nombre virus is a major cause of disease in the U.S. and New Mexico. Bayou and Black Creek Canal viruses in the southeastern U.S. and New York, and Monongahela viruses in the eastern U.S. have caused sporadic cases. Numerous hantavirus variants are also associated with HPS in South America.

Transmission

- **Reservoir:** Rodents, the natural hosts for hantaviruses, acquire a lifelong asymptomatic, chronic infection with persistent viremia, viruria, and virus in saliva. New World hantaviruses are associated with rodent species of the subfamily Sigmodontinae. Each hantavirus variant has a single primary rodent host. In New Mexico and the U.S., the deer mouse, *Peromyscus maniculatus*, is the major reservoir of Sin Nombre virus. Prevalence of infection varies widely geographically and temporally. Other Sigmodontine rodent species are associated with additional hantaviruses that have yet to be implicated in human disease. Therefore, it is best to consider all wild mice and rats as infected when considering potential exposures.
- **Mode of Transmission:** Humans acquire infection most commonly through inhalation of aerosolized virus particles from rodent urine, droppings, or saliva. Transmission can also occur through direct contact with infected rodents, rodent droppings, or nests.

¹ Also known as Hantavirus Cardiopulmonary Syndrome (HCPS)

- Period of communicability: Person-to-person transmission of the viruses in the United States has not been demonstrated, but cases of person-to-person spread have occurred with the Andes virus variant in South America.

Clinical Disease

- Incubation Period: Has not been completely defined, but is thought to be approximately 2 weeks with a possible range from 1 to 6 weeks.
- Illness: The prodromal illness of 1 to 7 days is characterized by fever, chills, headache, myalgia of the shoulders, lower back, and thighs, nausea, vomiting, diarrhea, and dizziness. Cough and other upper respiratory symptoms are not present in the prodromal phase but begin at the onset of the cardiopulmonary phase.
- The transition from the prodrome to the cardiopulmonary phase is typically heralded by the abrupt onset of cough, shortness of breath, hypoxia, and the appearance of pulmonary edema on chest radiographs. The extensive bilateral interstitial and alveolar pulmonary edema and pleural effusions are the result of a diffuse pulmonary capillary leak and seem to be immune-mediated. Severe myocardial depression is also seen in some cases. The crude mortality rate is around 40%.

Laboratory Diagnosis

- Presumptive laboratory values on a complete blood count (CBC) include a neutrophilic leukocytosis with immature granulocytes, more than 10% atypical immunoblasts (basophilic cytoplasm, prominent nucleoli, and an increased nuclear-cytoplasmic ratio), thrombocytopenia (falls below 150,000), absence of toxic granules in neutrophils and elevated hematocrit.
- Confirmatory diagnosis is made by the demonstration of hantavirus-specific IgM antibodies by using ELISA, Western blot, or strip immunoblot techniques. Most patients have IgM antibodies at the time of hospitalization. DNA-based assays (e.g., PCR) of autopsy or biopsy tissues and immunohistochemistry are also established diagnostic techniques in specialized laboratories.
- Specific diagnostic testing in New Mexico is done by the Molecular Diagnostic Core Laboratory of TriCore Reference Laboratories (505-272-4783). It is important for physicians with suspected cases to discuss the case with the on-call infectious disease physician at University Hospital in Albuquerque (1-888-UNM-PALS) to assist in diagnosis.

Treatment

- Patients with suspected HPS should be rapidly transferred to a tertiary care facility. Supportive management of the pulmonary edema, severe hypoxemia, and hypotension during the first 24 to 48 hours is complex and critical for recovery. Overhydration needs to be avoided or pulmonary edema can be

exacerbated. A flow-directed pulmonary catheter for monitoring fluid administration and use of inotropic support, vasopressors, and careful ventilatory control are important. Extracorporeal membrane oxygenation (ECMO) may provide important short-term support for the severe capillary leak syndrome in the lungs.

Surveillance

- **Case Definition:**
Laboratory criteria - Detection of hantavirus-specific IgM antibody or rising titers of hantavirus-specific IgG antibody; or detection of hantavirus-specific ribonucleic acid sequence by polymerase chain reaction (PCR) in clinical specimens; or detection of hantavirus antigen by immunohistochemistry.
Confirmed – a clinically compatible case that is laboratory confirmed.
- **Reporting:** **Report all suspected or confirmed cases of hantavirus within 24 hours to the Epidemiology and Response Division (ERD) at 505-827-0006.** Information needed includes: patient's name, age, sex, race, ethnicity, home address, home phone number, occupation and health care provider.
- **Case Investigation:** Complete the CDC Hantavirus Pulmonary Syndrome Surveillance Report form and mail to the Epidemiology and Response Division P.O. Box 26110, Santa Fe, New Mexico 87501-6110, or fax to 505-827-0013. Investigation information should also be entered in NM-EDSS per established procedures.

Control Measures

1. **Case management**
 - 1.1. Isolation: None required.
 - 1.2. Prophylaxis: Not applicable.
2. **Contact management**
 - 2.1. Isolation: None required
 - 2.2. Prophylaxis: Not applicable.
3. **Prevention**
 - 3.1. **Environmental Control:** Infections with HPS are associated with domestic, occupational, or leisure activities bringing humans into contact with infected rodents, usually in a rural setting. Eradicating the host reservoir is neither feasible nor desirable. The best approach for disease control and prevention is risk reduction through environmental hygiene practices that discourage rodents from colonizing the home and work environment and that minimize aerosolization and contact with virus in saliva and excreta. The hantavirus has a lipid envelop which makes it susceptible to most disinfectants, including 10% bleach solution, detergents, and most general household disinfectants. Depending on environmental conditions, these viruses probably survive <1 week in indoor environments and much shorter periods when exposed to sunlight

outdoors. Measures to decrease exposure in the home and workplace include:

- Eliminating food sources, limiting possible nesting sites, sealing holes and other possible entrances (mice can squeeze through a hole the size of a dime), and using snap traps.
- Rodenticides can be effective but need to be used carefully to prevent poisoning of children and pets.
- Rodents killed with snap traps should be disinfected with 10% bleach solution and disposed of in the garbage. Rubber gloves should be worn and disinfected after use.
- Before entering areas with potential rodent infestations, doors and windows should be opened to ventilate the enclosure. Persons entering these areas should avoid stirring up or breathing potentially contaminated dust.
- Dusty or dirty areas should be moistened with 10% bleach or other disinfectant solution before being cleaned.
- Brooms and vacuum cleaners should not be used to clean rodent-infested areas.
- A respirator with a filter with an N-100, P-100 or R-100 rating can be used to further decrease potential exposure to aerosolized virus particles. The person using this respirator needs to have a lung function test and have the respirator fit tested prior to use.

3.2. Immunization: Not applicable.

Management of HPS in Child Care Centers

- Person-to-person transmission of the viruses in the United States has not been demonstrated; therefore, no specific intervention is required.

References

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