Hantavirus (Also known as Hantavirus Pulmonary Syndrome (HPS) and Sin Nombre)

Disease Plan

Contents:

Last updated: June 29 2015, by JoDee Baker.

Questions about this disease plan?

Contact the Utah Department of Health Bureau of Epidemiology: 801-538-6191.

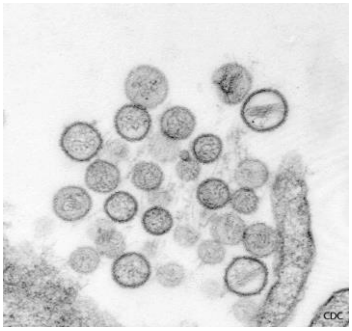
✓ WHY IS HANTAVIRUS IMPORTANT TO PUBLIC HEALTH?

Infection with hantavirus can progress to Hantavirus Pulmonary Syndrome (HPS), which although rare, has a 35-50% fatality rate. This disease is transmitted to humans through rodents, particularly deer mice, which are prevalent in North America. Education on how to prevent this disease is crucial to help protect the public while cleaning rodent infested areas or recreating outdoors where contact with rodents, or their waste, is potentially high.

✓ DISEASE AND EPIDEMIOLOGY

Clinical Description

Non-HPS hantavirus infection is a febrile illness with non-specific viral symptoms including fever, chills, myalgia (muscle pain), headache, and gastrointestinal symptoms. Typical clinical laboratory findings include hemoconcentration, left shift in the white blood cell count, neutrophilic leukocytosis, thrombocytopenia, and circulating immunoblasts. More specific clinical information can be found in the case definition section.



Causative Agent

Hantaviruses are single-stranded RNA viruses belonging to the bunyavirus family. Numerous hantavirus species exist. They are responsible for two primary syndromes: hantavirus cardiopulmonary syndrome (HCPS), more commonly known as hantavirus pulmonary syndrome (HPS), and hemorrhagic fever with renal syndrome (HFRS). In 1993, the strain of hantavirus that came to the attention of public health authorities because of an outbreak of HPS in the southwestern United States was the Sin Nombre Virus (SNV).

Differential Diagnosis

Differential diagnoses include: pneumococcal sepsis, viral myocarditis, atypical pneumonia, leptospirosis, Legionnaire's disease, mycoplasma, Q fever, Chlamydia, opportunistic infection, and in regions where the organisms are present, septicemic plague, tularemia, coccidioidomycosis and histoplasmosis. Non-infectious conditions such as Goodpasture's syndrome should also be considered.

Laboratory Identification

By the time symptoms are evident, most patients have antiviral antibodies of the immunoglobulin (Ig) M class and most have antibodies of the IgG class. Diagnostic assays include enzyme linked immunosorbent assays (ELISA), strip immunoblot tests (SIA), Western blot, indirect immunofluorescence (IFA), complement fixation, hemagglutinin inhibition, as well as focus or plaque reduction neutralization tests to detect antibodies to hantaviruses. In Utah, lab results typically seen include IgG and IgM, along with an occasional test that shows the strain of hantavirus (SNV). Most reference laboratories in Utah do not use the other tests listed.

Clinical/reference laboratories typically use a kit that has high sensitivity but low specificity, meaning that there is a possibility of many false positives. The Utah Public Health Laboratory (UPHL) is available to confirm positive or inconclusive serologies from clinical laboratories. UPHL offers hantavirus diagnostic testing use IgG and mu-capture IgM ELISAs developed and distributed by the CDC. UPHL may be able to provide primary testing for hantavirus under certain circumstances. Contact a UDOH epidemiologist for coordination of sample transport and testing at UPHL.

Treatment

There is no specific treatment or cure for hantavirus infection. Treatment of patients with HPS remains supportive in nature. Patients should receive appropriate, broad-spectrum antibiotic therapy while awaiting confirmation of a diagnosis of HPS. Care during the initial stages of the disease should include treatment to reduce fever and pain, as needed.

If there is a high degree of suspicion of HPS, patients should be immediately transferred to an emergency department or intensive care unit (ICU) for close monitoring and care. Patients presenting with fulminant (sudden and severe) illness due to HPS have a poor prognosis despite ICU care. ICU management should include careful assessment, monitoring and adjustment of volume status and cardiac function, including inotropic and vasopressor support if needed. Fluids should be administered carefully due to the potential for capillary leakage. Supplemental oxygen should be administered if patients become hypoxic. Equipment and materials for intubation and mechanical ventilation should be readily available since onset of respiratory failure may be highly likely.

Intravenous ribavirin, a guanosine analogue, has not been shown to be effective for treatment of HPS despite its effects on a related disease, hemorrhagic fever with renal syndrome (HFRS), which is caused by Old World hantaviruses.

Take-home Message for Care Providers

- ✓ Rapid transfer to ICU
- ✓ Careful monitoring
- ✓ Fluid balance
- ✓ Electrolyte balance
- ✓ Blood pressure monitoring

Case Fatality

Case fatality can be as high as 35-50%. In Utah, data since 1987 indicates a case fatality rate of 36%.

Reservoir

There are multiple hantaviruses species that cause HPS, and they are each associated primarily with a single rodent species. The deer mouse is the major reservoir of the Sin Nombre Virus (SNV), the most important cause of this syndrome in North America. Infected rodents generally develop a chronic, asymptomatic infection and can shed live virus in their saliva, feces, and urine throughout their lives. The duration of viremia and the persistence of virus in tissues indicate that rodents can contaminate the environment through their excretions and secretions for long periods. Approximately 5-20% of the predominant carrier species (in Utah, the deer mouse) demonstrate anti-hantavirus antibodies and are usually viremic. Deer mice are widespread in Utah. Hantaviruses have a worldwide distribution in accordance with the habitats of their respective hosts.

Transmission

Rodents shed the virus in their saliva, urine and feces. Humans are infected when they inhale dust that contains dried, contaminated rodent urine or feces. Transmission may also occur when dried materials contaminated by rodent feces or urine are disturbed and are directly introduced into broken skin or into the eyes, nose, or mouth. Person-to-person transmission of hantaviruses is rare and has been confined only to a single hantavirus species, Andes virus, which is found in Chile. There is no evidence of person-to-person transmission of hantavirus in the U.S.

Susceptibility

All persons without prior infection are presumed to be susceptible. Persons without serological evidence of past infection appear to be uniformly susceptible. Unapparent infections could occur, but none have been documented to date. Milder infections without pulmonary edema have occurred. Second attacks have not been documented, but the protection and duration of immunity conferred by previous infection is unknown.

Incubation Period

Since HPS is relatively uncommon, the incubation period has not been well-defined; it is believed to range from about one to five weeks, with an average of about three weeks.

Period of Communicability

There has been no evidence of person-to-person spread of hantavirus in the U.S. Rodents can develop a chronic, asymptomatic infection with hantavirus, and can remain infectious throughout their lives.

Epidemiology

In the spring of 1993, an alarming series of cases of unexplained fever and acute respiratory distress syndrome (ARDS) were recognized among members of the Navajo tribe at the northern border between New Mexico and Arizona. The case-fatality rate was approximately 80% in the initial group of patients. HPS cases have been identified in 34 states in the United States since the 1993 outbreak. Over half of the confirmed cases have been reported from areas outside of the Four Corners area. About 75% of patients with HPS have been residents of rural areas. The distribution of identified cases reflects a seasonal trend, with peaks during the spring and the summer, although cases have occurred throughout the year. Any person whose occupation (e.g., biologist, pest-control worker) puts him/her in frequent contact with rodents or their droppings is potentially at risk of getting the disease. Disturbing or inhabiting closed, actively rodent-infested structures is an important risk factor for contracting HPS. Travel to and within all areas where hantavirus infection has been reported is not considered a risk factor for infection with HPS. The possibility of exposure to hantavirus for campers, hikers, and tourists is very small, and is reduced further if steps are taken to reduce rodent contact.

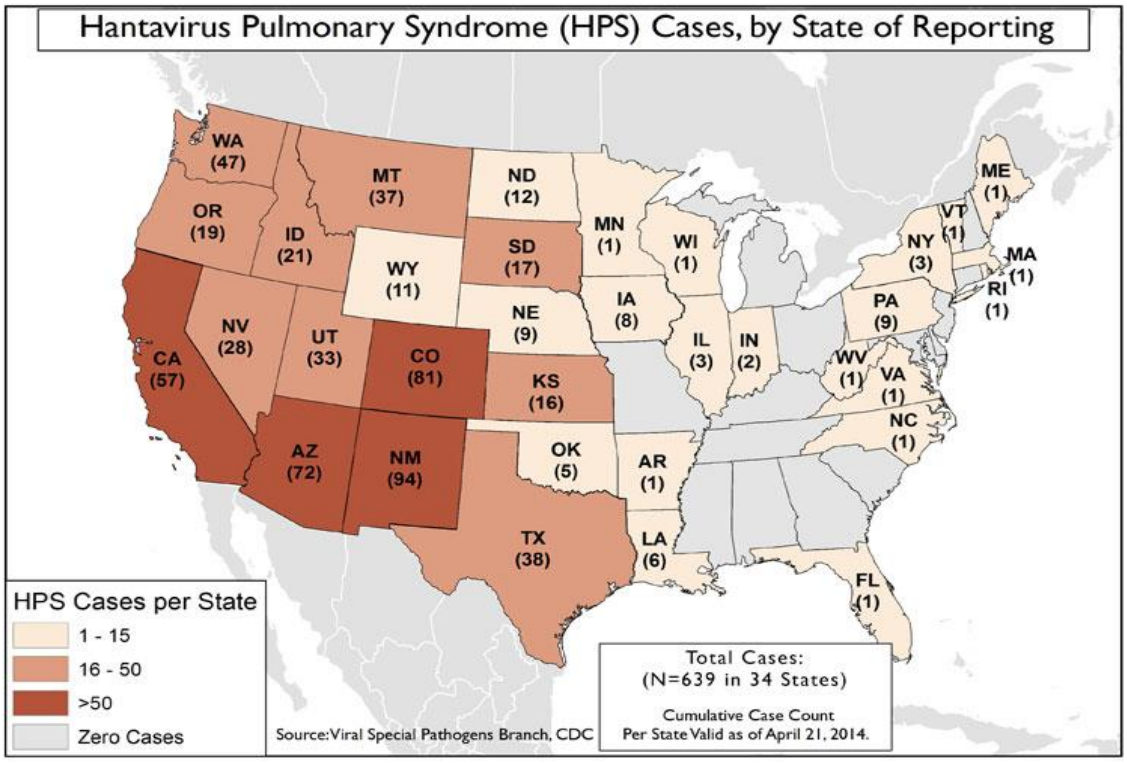
HPS occurs in North and South America. There are several hantaviruses associated with HPS in the U.S. SNV was the agent responsible for the 1993 HPS epidemic, and remains the primary causative agent of HPS in the United States. Some less common strains include Black Creek Canal virus that was implicated in a single HPS case in Florida. Bayou virus was discovered in

cases in Louisiana and Texas. New York-1 virus is similar to SNV, but it is distinct enough to suggest that it is a variant found in the eastern third of the U.S. Most cases of HPS have been associated with SNV. HFRS caused by Hantaan virus or by Dobrava-Belgrade virus occurs mainly in rural areas of Asia and the Balkans. Seoul virus, which has a worldwide distribution, causes HFRS of variable severity. The Puumala virus causes milder HFRS in Europe.

In the U.S., no person-to-person transmission has been documented; however, this type of transmission, including nosocomial transmission of Andes virus, was well documented in a single outbreak in southern Argentina.

In 2012, an outbreak of HPS occurred in Yosemite National Park. A total of 10 confirmed cases were reported and were believed to be exposed to the virus while staying at the Signature Tent Cabins in Curry Village.

As of April 2014, since 1993, there have been 639 (cumulative) cases of HPS reported nationwide. As of May, 2015, since 1987, there have been 33 (cumulative) cases identified in Utah.



✓ PUBLIC HEALTH CONTROL MEASURES

Public Health Responsibility

- Identify the source of exposure and prevent further transmission.
- Investigate all suspect cases of disease and fill out and submit appropriate disease investigation forms.
- Provide education to the general public, clinicians, and first responders regarding disease transmission and prevention.
- Identify clusters or outbreaks of this disease.

Prevention: "Seal up, Trap up, Clean Up!"

The best way to prevent hantavirus infection is to eliminate or minimize human contact with rodents or their excrement.

To prevent hantavirus infection:

Seal Up!

Trap Up!

Clean Up!

- Clear brush, grass, and garbage from around building foundations to eliminate a source of nesting materials.
- Keep tight-fitting lids on all garbage cans.
- Use metal flashing around the base of wooden, earthen, or adobe dwellings to provide a strong metal barrier.
- Seal all entry holes ¼ inch wide or wider with lath screen or lath metal, cement, wire screening, or other patching materials, inside and out.
- Elevate hay, woodpiles, and garbage cans to eliminate possible nesting sites.
- Use an EPA-approved rodenticide with bait under plywood or plastic shelter along baseboards, or use traps, and properly dispose of rodents. Live trapping of rodents is not recommended.

- Clean all food preparation areas. Store all food (both human and pet) in rodent-proof containers.
- Do not leave open bowls of pet food outside. Discard any uneaten pet food properly at the end of the day.

Personal Preventive Measures/Education

People involved in cleaning rodent-contaminated areas should keep the following recommendations in mind:

- Clean droppings using a wet method, rather than a dry method such as sweeping or vacuuming. Spray disinfectant, such as dilute bleach (1 part bleach to 10 parts water), prior to cleaning, and use a wet mop or towels moistened with disinfectant to clean.
- Work in well-ventilated areas.
- Gloves, dust/mist masks, long-sleeved clothing, and protective eyewear may help prevent exposure.

Chemoprophylaxis

None.

Vaccine

None.

Isolation and Quarantine Requirements

Isolation: None.

Hospital: None.

Quarantine: None.

✓ CASE INVESTIGATION

Reporting

Report all suspect and confirmed cases of hantavirus.

Criterion	Reporting Hantavirus Pulmonary Syndrome (HPS)	Reporting Non-HPS Hantavirus Infection
Clinical Evidence		
fever (>101°F or >38.3°C)	O	O
bilateral diffuse interstitial edema	O	
clinical diagnosis of acute respiratory distress syndrome (ARDS)	O	
radiographic evidence of noncardiogenic pulmonary edema	O	
unexplained respiratory illness resulting in death	O	
acute onset of illness	N	N
healthcare record contains a diagnosis of hantavirus pulmonary syndrome	S	
death certificate lists hantavirus pulmonary syndrome as a cause of death or a significant condition contributing to death	S	
Laboratory Evidence		
autopsy examination demonstrating noncardiogenic pulmonary edema without an identifiable cause	O	
acute thrombocytopenia (75% decrease over 2-3 days, not immune mediated	N	O
increased circulating atypical lymphocytes or immature myeloid cells	O	O
Hantavirus-specific diagnostic test result indicates acute hantaviral infection	S	N
Epidemiological Evidence		
contact with infected rodents, usually in rural settings	O	O

Notes:

S = This criterion alone is Sufficient to report a case.

N = All “N” criteria in the same column are Necessary to report a case.

O = At least one of these “O” (Optional) criteria in each category (e.g., clinical evidence and laboratory evidence) in the same column—in conjunction with all “N” criteria in the same column—is required to report a case.

* A requisition or order for any of the “S” laboratory tests is sufficient to meet the reporting criteria.

Case Definition

Hantavirus Pulmonary Syndrome (HPS), Non-HPS Hantavirus Infection (2015) Case Definition

Clinical Description

Non-HPS Hantavirus infection is a febrile illness with non-specific viral symptoms including fever, chills, myalgia, headache, and gastrointestinal symptoms. Typical clinical laboratory findings include hemoconcentration, left shift in the white blood cell count, neutrophilic leukocytosis, thrombocytopenia, and circulating immunoblasts.

Hantavirus Pulmonary Syndrome (HPS) is an acute febrile illness (i.e., temperature greater than 101.0 F [greater than 38.3 C]) with a prodrome consisting of fever, chills, myalgia, headache, and gastrointestinal symptoms, and one or more of the following clinical features: Bilateral diffuse interstitial edema, or

- Clinical diagnosis of acute respiratory distress syndrome (ARDS), or
- Radiographic evidence of noncardiogenic pulmonary edema, or
- An unexplained respiratory illness resulting in death, and includes an autopsy examination demonstrating noncardiogenic pulmonary edema without an identifiable cause, or
- Healthcare record with a diagnosis of HPS, or
- Death certificate lists HPS as a cause of death or a significant condition contributing to death.

Laboratory Criteria

- Detection of hantavirus-specific IgM or rising titers of hantavirus-specific IgG, or
- Detection of hantavirus-specific ribonucleic acid in clinical specimens, or
- Detection of hantavirus antigen by immunohistochemistry in lung biopsy or autopsy tissues.

Case Classification

- Confirmed: A clinically compatible case of HPS or Non-HPS Hantavirus infection with laboratory evidence.

Comment: Laboratory testing should be performed or confirmed at a reference laboratory. Because the clinical illness is nonspecific and ARDS is common, a screening case definition

can be used to determine which patients to test. In general, a predisposing medical condition (e.g., chronic pulmonary disease, malignancy, trauma, burn, and surgery) is a more likely cause of ARDS than HPS, and patients who have these underlying conditions and ARDS need not be tested for hantavirus.

Criterion	Hantavirus Pulmonary Syndrome Confirmed	Non HPS Hantavirus Infection Confirmed
Clinical Evidence		
fever (>101°F or >38.3°C)	N	O
bilateral diffuse interstitial edema	O	A
clinical diagnosis of acute respiratory distress syndrome (ARDS)	O	A
radiographic evidence of noncardiogenic pulmonary edema	O	A
unexplained respiratory illness resulting in death	O	A
acute onset of illness	N	N
healthcare record contains a diagnosis of hantavirus pulmonary syndrome	O	
death certificate lists hantavirus pulmonary syndrome as a cause of death or a significant condition contributing to death	O	
Laboratory Findings		
detection of hantavirus-specific immunoglobulin M	O	O
detection of rising titers of hantavirus-specific immunoglobulin G	O	O
detection of hantavirus-specific RNA in clinical specimens	O	O
detection of hantavirus-specific antigen by immunohistochemistry	O	O
acute thrombocytopenia (75% decrease over 2-3 days, not immune mediated)	O	O
autopsy examination demonstrating noncardiogenic pulmonary edema without an identifiable cause	O	A

Notes:
S = This criterion alone is Sufficient to classify a case.
N = All “N” criteria in the same column are Necessary to classify a case. A number following an “N” indicates that this criterion is only required for a specific disease/condition subtype (see below).
A = This criterion must be absent (i.e., NOT present) for the case to meet the classification criteria.
O = At least one of these “O” (Optional) criteria in each category (e.g., clinical evidence and laboratory evidence) in the same column—in conjunction with all “N” criteria in the same column—is required to classify a case. (These optional criteria are alternatives, meaning that a single column will have either no O criteria or multiple O criteria; no column should have only one O.)
A number following an “O” indicates that this criterion is only required for a specific disease/condition subtype

Case Investigation Process

- Complete CMR in UT-NEDSS.
- Verify case status.
- Complete disease investigation form.
- Determine whether patient had travel/exposure history consistent with acquisition of disease in Utah or elsewhere.
- If patient acquired disease in Utah, identify the source of transmission and assist with eliminating it.

Outbreaks

More than one case of hantavirus with a common exposure constitutes an outbreak.

Identifying Case Contacts

This disease is rarely spread person-to-person.

Case Contact Management

Environmental assessment should be done to identify likely sources of exposure in order to make sure that no one else will be exposed. Anyone who was exposed to an environment that likely was the source of infection for a case, during the same time period as the case, should be monitored for symptoms.

✓ REFERENCES

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✓ VERSION CONTROL

Updated May 2015 – Updated all sections and added tables for reporting hantavirus and for interpreting case status from CSTE. General formatting changes were made and references were revised.

✓ UT-NEDSS Minimum/Required Fields by Tab

Demographic
- ☑ Birth Gender
- ☑ County
- ☑ Date of Birth
- ☑ Ethnicity
- ☑ Race
- ☑ Last name
- ☑ First name
- ☑ State

Clinical
- ☑ Date Diagnosed
- ☑ Date of Death
- ☑ Died
- ☑ Disease
- ☑ Onset Date
- ☑ Hospitalized
- ☑ Was patient previously healthy?
- ☑ Did patient have: Fever >38.3C
- ☑ Hematocrit
- ☑ Immunoblasts, Atypical
- ☑ White blood cell count (WBC)

Laboratory
- ☑ Organism
- ☑ Specimen Source
- ☑ Test Result
- ☑ Test Type
- ☑ Laboratory
- ☑ Collection Date

Epidemiological
- ☑ Imported From
- ☑ Date of Exposure
- ☑ List date 42 days prior to disease onset:
- ☑ Between the above two dates, did the patient have rodent exposure?
- ☑ Between the above two dates, did the patient see rodent droppings?
- ☑ Between the above two dates, did the patient have contact with droppings/nests?

Investigation
- ☑ NA

Contacts
- ☑ NA

Reporting
- ☑ Date first reported to public health

Administrative
- ☑ State case status