

Hantavirus Pulmonary Syndrome

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Hantavirus pulmonary syndrome (HPS) is a disease caused by an RNA virus in the Family bunyaviridae. There are numerous hantaviruses, associated with different rodent hosts, found worldwide. The cause of HPS in the western USA is called Sin Nombre virus.

B. Clinical Description

HPS is usually characterized by an early prodrome phase followed by a rapidly progressive, potentially fulminate, cardiopulmonary phase. During the prodrome phase, early symptoms are nonspecific and include fever, fatigue, headache and muscle pain that is prominent in the large muscles of the thighs, hips, and lower back. Approximately 50% of patients experience abdominal pain, nausea, vomiting and diarrhea. Respiratory symptoms are absent during the prodrome; early onset of productive cough, sneezing, rhinorrhea, sinus congestion and other upper respiratory symptoms are not associated with HPS.

There have been a few cases reported that seem to progress no further than the prodrome phase and have mild or absent pulmonary involvement. However most patients will develop cardiopulmonary symptoms within two to ten days after onset. This phase is characterized by rapidly progressive pulmonary edema resulting in dry cough, shortness of breath, severe hypoxemia and shock. The pulmonary edema can fully involve the lungs within a few hours; the prognosis for patients not hospitalized at the onset of the cardiopulmonary phase is poor. Supplemental oxygen and mechanical ventilation are usually necessary but may be insufficient to keep the patient oxygenated. Patients surviving the initial 48-72 hours after the onset of pulmonary edema will usually recover; long-term sequelae are uncommon. The overall in Colorado mortality rate is approximately 35 %.

Typical clinical laboratory findings include hemoconcentration, left shift in the white blood cell count, neutrophilic leukocytosis, thrombocytopenia, and circulating immunoblasts. A dramatic fall in the platelet count is usually the only significant laboratory finding in early disease and may herald a transition from the prodrome to the pulmonary edema phase of the illness.

C. Reservoirs

The deer mouse (*Peromyscus maniculatus*) is the species most commonly implicated in the transmission of Hantavirus to humans in Colorado, although other *Peromyscus* species of mice can carry the virus. The virus does not cause illness or death in the infected mice. Mice remain infectious throughout their life and shed the virus in their urine, droppings and saliva. Infection rates in mice can vary greatly over time from area to area, ranging from 0 – 40%.

D. Modes of Transmission

Most people become infected when they breathe in the virus. This occurs when fresh rodent urine, droppings or nesting materials are stirred up and tiny particles contaminated with the virus become

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airborne. Other less common modes of transmission include being bitten by an infected mouse, direct inoculation of urine or contaminated material into mucous membranes or eating foods contaminated with rodent's excreta.

E. Incubation Period

The incubation period ranges from 1 to 6 weeks, with an average of 2-3 weeks.

F. Period of Communicability or Infectious Period

Person-to-person transmission of HPS has not been documented in the USA. Mice remain infected and shed virus throughout their life. The virus does not survive long outside a host, usually no more than a few hours, probably 2-3 days at most. However as long as live mice are present, new virus will be shed into the environment daily.

G. Epidemiology

Peridomestic exposure has been associated with most human infections in Colorado. Activities such as cleaning rodent infested homes or structures, working in enclosed spaces (like a crawlspace or shed), moving woodpiles, clearing brush and junk piles and other work that disturbs areas contaminated with mice dropping are associated with greatest risk of contracting the disease. Many cases reported seeing a large, rapid, increase in numbers of mice around the house prior to becoming ill. Entering structures that have been closed or uninhabited for long periods can pose a potential risk. Occupationally acquired infections have been recognized but are infrequent. Potential occupational exposures have included ranchers and farmers, field mammalogists and agricultural, construction, utility and feedlot workers. The risk of exposure for campers, hikers, and tourists is very small. Risk of infection can be reduced with simple steps to reduce contact with mice and their excreta.

Colorado Hantavirus pulmonary syndrome statistics are available at the CDPHE website:

<http://www.cdphe.state.co.us/dc/zoonosis/hanta>

2) CASE DEFINITION

Clinical Description

A clinically compatible case would be characterized by fever ($>101^{\circ}$ F), headaches, myalgias, chills and gastrointestinal symptoms (abdominal pain, vomiting) and the absence of a productive cough or other upper respiratory symptoms (rhinorrhea, sinusitis, sneezing, productive cough) at the onset of illness OR the rapid onset of ARDS or severe pulmonary edema AND a low platelet count ($<100,000/\mu\text{l}$).

Laboratory Criteria for Diagnosis

Detection of hantavirus-specific immunoglobulin M or rising titers of hantavirus-specific immunoglobulin G, or detection of hantavirus-specific ribonucleic acid sequence by polymerase chain reaction in clinical specimens, or detection of hantavirus antigen by immunohistochemistry. The standard diagnostic test is Sin Nombre specific IgM antibodies in a serum sample.

Case Classification

Confirmed: A clinically compatible, IgM positive case.

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Probable: A case meeting the suspect criteria with demonstrated thrombocytopenia (platelet count <100,000/ μ l).

Suspected: A clinically compatible prodrome illness or ARDS in a patient with an exposure history to deer mice or mice infested structures

3) REPORTING CRITERIA

What to Report to the Colorado Department of Public Health and Environment (CDPHE) or local health agency

- Hantavirus cases should be reported within 7 days of diagnosis or positive laboratory results
- Report any suspected cases of Hantavirus based on the healthcare provider's impression or preliminary laboratory results.
- Cases should be reported through the Colorado Electronic Disease Reporting System (CEDRS), fax or telephone to CDPHE or the local health department.

Purpose of Surveillance and Reporting

- To identify cases for investigation and potential outbreaks.
- Initiate control measures to prevent additional cases in the household.
- To monitor trends in disease incidence.

Important Phone Numbers and Web Resources

- CDPHE Communicable Disease Epidemiology Program
 - Phone: 303-692-2700 or 800-866-2759
 - Fax: 303-782-0338
 - After hours: 303-370-9395
- CDPHE Microbiology Laboratory: 303-692-3480
- Communicable Disease (CD) Manual website:
http://www.cdph.state.co.us/dc/epidemiology/dc_manual.html

4) STATE LABORATORY SERVICES

Laboratory Testing Services Available

There is a fee for laboratory services for primary diagnostic specimens; clinical laboratories submitting human specimens for confirmation are not charged. Blood for serologic testing from suspect hantavirus cases should be sent to CDPHE laboratory for confirmation. CDPHE may submit the samples to the Centers for Disease Control and Prevention (CDC) for further evaluation.

5) CASE INVESTIGATION

All reports of hantavirus should be investigated, including suspected cases. The first step is to collect exposure history, clinical and laboratory information to determine whether the case meets the "suspect" or "presumptive" case definition. Obtain and submit serum samples for IgM antibody testing if this has not already been done. In cases where the patient is intubated or cannot be

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interviewed gather information from health care providers, infection control practitioners, family, or friends.

Organized local health departments and public health nursing services must coordinate with CDPHE regional epidemiologists to conduct preliminary case interviews and subsequent field investigations. Follow-up need to be performed in cooperation with an epidemiologist with hantavirus case investigation experience.

A. Case Investigation / Forms

- Complete CDC's Hantavirus [Case Investigation Report Form](#) found on CDPHE's Hantavirus webpage: <http://www.cdphe.state.co.us/dc/zoonosis/hanta>
- Fax completed forms to the Communicable Disease Program at 303-782-0338.
 - Or mail to CDPHE DSI-A3 4300 Cherry Creek Dr South, Denver, CO 80246
- Coordinate with CDPHE to complete a Case Interview Form and coordinate an environmental assessment at the suspected site of exposure. Enter any possible mouse exposure history information into CEDRS under "Case Notes" for all confirmed and probable cases and update other CEDRS record information as appropriate.

B. Identify and Evaluate Contacts

Asymptomatic individuals who have been in household or presumptive area of exposure should be provided with information about HPS symptoms and counseled to seek medical care if symptoms develop. Prevention steps and clean-up methods should be reviewed.

C. Reported Incidence Is Higher than Usual/Outbreak Suspected

If you suspect an outbreak (≥ 2 clustered cases), investigate to determine linkage and the source of infection. Consult with a CDPHE Communicable Disease Epidemiologist on additional steps.

6) DISEASE CONTROL MEASURES

A. Treatment

Consideration should be given to admitting patients with highly suspected HPS (thrombocytopenia and compatible clinical picture) to a critical-care unit as early as possible to initiate supportive care. Supportive measures may include fluid management guided by Swan-Ganz catheter data, hypotension treated with inotropes (i.e. dobutamine), and oxygenation with supplemental oxygen and mechanical ventilation. Due to concerns about pneumonic plague, another rapidly developing ARDS in persons with rodent exposure, patients with suspected HPS should be under respiratory isolation until the diagnosis of HPS is confirmed. No approved antiviral therapy is available for HPS.

B. Prophylaxis

There is no prophylactic treatment or vaccination available to prevent hantavirus infections. Prevention is based on minimizing exposure to infected rodents and rodent infested structures.

C. Education

People living in rural and semi rural areas should be educated on the modes of transmission of the disease and methods to reduce exposures.

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D. Environmental Measures

There are 4 basic recommended measures to minimize exposure:

- 1) Rodent-proof homes, barns and other structures
- 2) Eliminate food sources and harborage
- 3) Conduct year round rodent control around the home site
- 4) Use special precautions when cleaning rodent infested areas

For more detailed information on these prevention measures please visit the Colorado Department of Public Health and Environment's Hantavirus webpage:

<http://www.cdphe.state.co.us/dc/zoonosis/hanta>

REFERENCES

Case Definitions for Infectious Conditions Under Public Health Surveillance.

<http://www.cdc.gov/epo/dphsi/casedef/>

CDC Website: <http://www.cdc.gov/> → click on "A-Z Index".

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