HANTAVIRUS

(Hantavirus Disease; includes Hantavirus Pulmonary Syndrome (HPS) and Hantavirus Infection (non-HPS))

REPORTING INFORMATION

- **Class B:** Report by the close of the next business day after the case or suspected case presents and/or a positive laboratory result to the local public health department where the patient resides. If patient residence is unknown, report to the local public health department in which the reporting health care provider or laboratory is located.
- Reporting Form(s) and/or Mechanism:
  - The Ohio Disease Reporting System (ODRS) should be used to report lab findings to the Ohio Department of Health (ODH). For healthcare providers without access to ODRS, you may use the Ohio Confidential Reportable Disease Form (HEA 3334, rev. 1/09 https://odh.ohio.gov/wps/portal/gov/odh/know-our-programs/infectious-disease-control-manual/forms/forms-confidential-reportable-disease)
  - The Centers for Disease Control and Prevention (CDC) Hantavirus Pulmonary Syndrome Case Report form, (OMB No. 0920-0009, rev. 10/96) should be completed. Information collected from the form should be entered into ODRS and faxed to the ODH Outbreak Response & Bioterrorism Investigation Team (ORBIT) at 614-564-2456. The mailing address for this form is: ODH Outbreak Response & Bioterrorism Investigation Team (ORBIT), 246 N. High St., Columbus, OH 43215
- Key fields for ODRS reporting include: import status (whether the infection was travel-associated or Ohio-acquired), date of illness onset, and all the fields in the Epidemiology module.
- Hantavirus Pulmonary Syndrome (HPS) and Hantavirus Infection (non-HPS) were made nationally notifiable in 1995 and 2015, respectively.

AGENT

Hantaviruses belonging to the family Bunyaviridae include Sin Nombre, Black Creek Canal, Bayou, New York, Hantaan, Prospect Hill, Puumula, Seoul viruses and others. Since 1993, about 20 new hantaviruses have been described from the Americas, half of which are pathogenic to humans. Sin Nombre virus is rare, recently recognized and causes severe respiratory distress, often leading to death.

CASE DEFINITION

Clinical Description

The clinical syndrome of HPS or hantavirus cardiopulmonary syndrome was first recognized in 1993 and has since been identified throughout the United States. Although rare, HPS is frequently fatal, with a case fatality rate of 36%.

Patients with hantavirus infection typically present in a nonspecific way with a relatively short febrile prodrome lasting 3-5 days. In addition to fever and myalgias, early symptoms include headache, chills, dizziness, non- productive cough, nausea, vomiting, and other gastrointestinal symptoms. Malaise, diarrhea, and lightheadedness are reported by approximately half of all patients, with less frequent reports of arthralgias, back pain, and abdominal pain. Symptoms of HPS generally do not develop until approximately day seven, when pulmonary symptoms such as cough and tachypnea commence. Patients may report shortness of breath. Once the cardiopulmonary phase begins, however, the disease progresses rapidly, necessitating hospitalization and often ventilation within 24 hours. In a small proportion of patients with hantavirus infection, cardio-pulmonary symptoms do not develop. These patients would be considered to have Hantavirus infection, non-HPS.

A positive serological test result on an assay using a hantavirus antigen appropriate to the geographic region, evidence of viral antigen in tissue by immunohistochemistry, or the presence of viral RNA in blood or tissue, with compatible history, is considered diagnostic for hantavirus infection

Clinical Case Definition

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 hantavirus pulmonary syndrome, or
- Death certificate lists hantavirus pulmonary syndrome as a cause of death or a significant condition contributing to death

Non-HPS Hantavirus infection is a febrile illness with non-specific viral symptoms including fever, chills, myalgia, headache, and gastrointestinal symptoms, but no cardio-pulmonary symptoms. Typical clinical laboratory findings include hemoconcentration, left shift in the white blood cell count, neutrophilic leukocytosis, thrombocytopenia, and circulating immunoblasts. Patients that develop cardio-pulmonary symptoms should be classified as having HPS.

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 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 with laboratory evidence, or
A clinically compatible case of 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.

SIGNS AND SYMPTOMS

Hantavirus pulmonary syndrome (HPS), commonly referred to as hantavirus disease or simply hantavirus, is a febrile illness characterized by bilateral interstitial pulmonary infiltrates and respiratory compromise usually requiring supplemental oxygen and clinically resembling acute respiratory disease syndrome (ARDS). The typical prodrome consists of fever, chills, myalgia, headache and gastrointestinal symptoms such as abdominal pain, nausea, and vomiting. Typical clinical laboratory findings include hemoconcentration, left shift in the white blood cell count, neutrophilic leukocytosis, thrombocytopenia and circulating immunoblasts.

The hospital course is characterized by fever, hypoxia, and hypotension (*MMWR* 1993; Vol. 42 (42), p. 819). The case fatality rate is 44%.

DIAGNOSIS

Specific serology, PCR and immunohistochemistry are used to make the diagnosis. Specimens may be submitted to the Centers for Disease Control and Prevention via the ODH Laboratory. Contact the ODH Laboratory at 888-ODH-LABS (888-634-5227) (Monday – Friday; 8 AM – 5 PM) for CDC specimen submission criteria.

EPIDEMIOLOGY

Source

Rodents are the reservoir for the hantaviruses. The deer mouse (*Peromyscus maniculatus*) is the suspect primary reservoir for Sin Nombre virus (Hantavirus Pulmonary Syndrome). Mice, voles and rats are the reservoirs for Hantaan, Puumula and Seoul viruses, respectively. These viruses have specific species of rodents as reservoir hosts.

Occurrence

In 1993, HPS was first recognized in the southwestern United States. Most cases (95%) were from states west of the Mississippi River. All cases were traced to exposure in rural areas. The reservoir host for Sin Nombre virus, the deer mouse, occurs in Ohio; however, there have been no confirmed cases in Ohio.

The other Hantaviruses are endemic in South and Central America, Europe and Asia; an estimated 100,000 cases occur annually. Antibody to Hantaan-related virus was found in wild rats collected in Columbus and Cincinnati, Ohio, as well as other inland U.S. cities, in 1983 (*J. Infectious Disease*, July 1985;152(1):126-136). Human cases due to Hantaan virus in the U.S. are not known. Some other hantaviruses occurring in the U.S. are Prospect Hill (non-pathogenic), Black Creek Canal, Bayou and New York viruses.

Mode of Transmission

Infected rodents shed hantavirus in feces, urine and saliva. Most human infections are thought to occur when infectious saliva or excreta are inhaled as aerosols produced directly from the animal. Transmission may also occur when dried materials contaminated by rodent excreta are disturbed, directly introduced into broken skin or the conjunctivae, or, possibly, ingested in contaminated food or water. Transmission via rodent bite has also occurred (*MMWR* 1993;42[RR-11]).

Period of Communicability

The types of hantavirus that cause HPS in the United States cannot be transmitted from person-to-person. Apparently healthy rodents may shed hantaviruses for many weeks.

Incubation Period

The generally recognized incubation period for hantaviruses is 5-42 days. For HPS (Sin Nombre virus), an incubation period has not yet been defined, but is thought to be approximately 2 weeks, with a range from a few days to 6 weeks.

PUBLIC HEALTH MANAGEMENT

Case

Investigation

The ODH Outbreak Response & Bioterrorism Investigation Team may be contacted for assistance in evaluating suspect cases at 614-995-5599. Once a case is confirmed, a complete travel and clinical history should be obtained for the six weeks prior to onset. The ODH Zoonotic Disease Program (614-752-1029, option 2) should be contacted regarding the environmental investigation for cases that appear to have been acquired in Ohio.

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 antipyretics and analgesia as needed.

Isolation and Follow-up Specimens

The types of hantavirus that cause HPS in the United States cannot be transmitted from one person to another, so there is no need for isolation. If IgG is not diagnostic in the acute sample, a convalescent sample should be obtained several weeks later to determine if there is a four-fold change in titer.

Public Health Significance

Possibly significant. If the patient has not travelled outside of Ohio, it could indicate that infected rodents are here and other people could be at risk for infection.

Contacts

No prophylactic treatment has yet been identified for contacts of cases. Person-to-person transmission is not believed to occur.

Prevention and Control

Rodent control measures in areas frequented by humans should be encouraged. This can be facilitated by eliminating potential food sources and harborage site. Discourage rodent infestations by storing foods in sealed containers. Remove pet foods nightly and store in a secure place. Dispose of unwanted food and garbage in tight-fitting, rodent-proof containers. Eliminate rodent harborage for a distance of 100 feet from the home and other buildings. Seal holes where rodents enter homes.

Eliminate rodents found in buildings with snap traps. Secure the trap on a length of string at least 2 feet long and tie the other end to a heavy object. Spray the trapped rodent and the area around the trap with 10% bleach solution (13 ounces of bleach to 1 gallon of water) or hospital-grade Lysol (over-the counter disinfectant sprays are apparently ineffective). The rodent and surrounding area should be thoroughly wetted before being handled. Wear rubber gloves to pick up the trap and rodent, placing the rodent in a sealable plastic bag. Place that bag into another plastic bag and seal tightly. Spray bag with disinfectant. Dispose of the bagged rodent in the trash or, if feasible, bury at a depth of 2-3 feet.

In places where the disease has occurred, the structure should be vacated until it has been professionally cleaned and disinfected and the rodents have been eliminated by a professional equipped to work in places where there is risk of infection.

See also: **http://www.cdc.gov/hantavirus/**

What is hantavirus?
Hantaviruses are rodent-borne viruses that can cause human illness. New hantaviruses are being discovered all of the time and many of them are not believed to cause human disease. The ones that cause human illness are divided into two major groups.

The first group that causes human disease is found mostly in Asia and Europe. These hantaviruses include Hantaan, Seuol, and Puumala, which result in Hemorrhagic Fever with Renal Syndrome (HFRS). Signs of HFRS include headache, fever, flushed face, redness of the eyes, and kidney failure.

The second group that causes human disease is found in North, South, and Central America. These hantaviruses include Sin Nombre, New York, Bayou, and Black Creek Canal which result in Hantavirus Pulmonary Syndrome (HPS). HPS causes severe respiratory distress often leading to death.

How common is hantavirus?
It is estimated that 100,000 cases of hantavirus occur worldwide each year.

HFRS is not present in the United States. HPS is diagnosed sporadically in the United States with cases often occurring in clusters. The largest outbreak occurred in 1993 in the Four Corners area of the Southwest. While deer mice capable of carrying hantavirus live in Ohio, there have been no known human cases in Ohio.

How is hantavirus transmitted?
Hantaviruses are carried and transmitted by rodents. People can become infected and develop illness after exposure to urine, droppings, or saliva of infected rodents or after exposure to dust from their nests. Transmission may also occur when infected urine or these other materials come into contact with open wounds or onto the mucous membranes of the eyes, nose, or mouth. In addition, individuals can be exposed to hantaviruses through rodent bites from infected animals.

Can you contract HPS from another person?
In the U.S., HPS cannot be transmitted from one person to another. You cannot get the virus from touching or kissing a person who has HPS or from a health care worker who has treated someone with the disease. In addition, you cannot contract the virus from a blood transfusion in which you receive blood from a person who survived HPS.

Who is most at risk for contracting hantavirus?
Any activity that puts you in contact with rodent droppings, urine, saliva, or nesting materials can place you at risk for infection. The chance of being exposed to hantavirus is greatest when people work, play, or live in closed spaces where rodents are actively living. Construction, utility and pest control workers can be exposed when they work in crawl spaces, under houses, or in vacant buildings that may have a rodent population

What are the symptoms of HPS hantavirus?
Early symptoms include fatigue, fever and muscle aches, especially in the large muscle groups-thighs, hips, back, and sometimes shoulders. There may also be headaches, dizziness, chills, and abdominal problems, such as nausea, vomiting, diarrhea, and abdominal pain. About half of all HPS patients experience these symptoms.

Four to 10 days after the initial phase of illness, the late symptoms of HPS appear. These include coughing, tightness in the chest, and shortness of breath. HPS is fatal in approximately 40% of the cases.

How long after exposure before I show signs of hantavirus?
Symptoms usually develop between 5 and 42 days after. It is difficult to determine the exact length of time because some people have reported no known contact with rodents or their environments, while others had contact for long periods of time before contracting the disease.

How is hantavirus diagnosed?
Blood and some tissues can be tested for specific antibodies to hantavirus.

Can hantavirus be treated?
There is no specific treatment, cure, or vaccine for hantavirus infection. However, we do know that if infected individuals are recognized early and receive medical care in an intensive care unit, they may do better. In intensive care, patients are intubated and given oxygen therapy to help them through the period of severe respiratory distress. The earlier the patient is brought in to intensive care, the better. If a patient is experiencing full distress, it is less likely the treatment will be effective.

Does past infection with hantaviruses make a person immune?
It is believed so, but there is little knowledge at present about Sin Nombre virus. A past infection with one type of hantavirus may not make a person immune to other types.

How can I prevent exposure to hantavirus?
Eliminate or minimize contact with rodents in your home or workplace. Seal up holes and gaps in your home or garage. Place traps in and around your home to decrease rodent infestation. Eliminate potential food sources. .

When cleaning in areas inhabited by rodents it is important to wear gloves and avoid actions that raise dust, such as sweeping or vacuuming. Infection occurs when you breathe in virus particles. Instead, spray the floor with a disinfectant to kill the virus. Then wipe up the contaminated materials with a damp towel followed by mopping with a disinfectant. Place contaminated debris in a plastic bag, seal it, and place it inside another plastic bag before disposal.

See also: http://www.cdc.gov/hantavirus/.

HANTAVIRUS

RESERVOIR	The **deer mouse** *(Peromyscus maniculatus)* is the primary reservoir of the hantavirus that causes hantavirus pulmonary syndrome (HPS) in the United States.
TRANSMISSION	Infected rodents shed the virus through urine, droppings, and saliva. HPS is transmitted to humans through a process called **aerosolization**. Aerosolization occurs when dried materials contaminated by rodent excreta or saliva are disturbed. Humans become infected by breathing in these infectious aerosols. HPS in the United States **cannot** be transmitted from one person to another. HPS in the United States is not known to be transmitted by farm animals, dogs, or cats or from rodents purchased from a pet store.
RISK	Anything that puts you in contact with **fresh rodent urine, droppings, saliva or nesting materials** can place you at risk for infection.
VIRUS	Hantaviruses have been shown to be viable in the environment for **2 to 3 days** at normal room temperature. The ultraviolet rays in sunlight kill hantaviruses.
PREVENTION	**Rodent control** in and around the home remains the primary strategy for preventing hantavirus infection.
CLEANING	Use a **bleach solution or household disinfectant** to effectively deactivate hantaviruses when cleaning rodent infestations.

For more information please visit the following websites:
US National Library of Medicine:
http://www.nlm.nih.gov/medlineplus/ency/article/001382.htm

CDC Hantavirus: http://www.cdc.gov/hantavirus/index.html