Hantavirus Pulmonary Syndrome

Investigative Guidelines

December 2018

1. DISEASE REPORTING

1.1 Purpose of Reporting and Surveillance

1. To characterize the epidemiology and clinical aspects of the disease.
2. To monitor disease trends and recognize outbreaks.
3. To target prevention and control messages.

1.2 Laboratory and Physician Reporting Requirements

Health care providers and laboratories: Hantavirus detection is notifiable to local health jurisdiction within 24 hours. Specimen submission is on request only but confirmation of positive results is recommended (see Section 4).

1.3 Local Health Department Reporting and Follow-Up Responsibilities

1. Facilitate the transport of specimens to Oregon State Public Health Laboratory (OSPHL) for confirmatory testing only after preliminary testing has occurred at a private laboratory.
2. Report all *confirmed* cases to Oregon Health Authority (OHA). (see definition below). Use the hantavirus pulmonary syndrome report form www.oregon.gov/oha/PH/DiseasesConditions/CommunicableDisease/ReportingCommunicableDisease/ReportingForms/Documents/hanta.pdf) and enter the data into Orpheus.

2. THE DISEASE AND ITS EPIDEMIOLOGY

2.1 Etiologic Agent

Multiple hantaviruses have been identified in the Americas. Sin Nombre virus is the predominant hantavirus in North America and has been responsible for all the cases identified in Oregon.

2.2 Description of Illness

Hantavirus pulmonary syndrome (HPS) is an acute viral disease characterized by a relatively short (3–5 days) prodrome of fever, myalgias (muscle aches), headache, and gastrointestinal complaints followed by the abrupt onset of acute respiratory distress syndrome (ARDS) and hypotension. The illness progresses rapidly to respiratory failure with bilateral pulmonary infiltrates, pulmonary edema, and shock. Circulating immunoblasts (immature myelocytes), elevated hematocrit and thrombocytopenia are almost always present; a rapid drop in

platelets marks onset of the cardiopulmonary phase. About a third of all cases in the United States have died. In survivors, recovery from acute illness is rapid, but full convalescence may require weeks or months. Restoration of normal lung function generally occurs, but pulmonary function abnormalities may persist in some individuals.

2.3 Reservoirs

The deer mouse (*Peromyscus maniculatus*) is the major reservoir of Sin Nombre virus in the western United States. Deer mice live in all parts of Oregon, but mainly in rural areas. They usually carry the virus without showing any signs of being sick. The deer mouse is about six inches long from the nose to the tip of its tail. It is grayish to light brown on top, with a white belly, large ears and eyes, and a furry tail that is white on the underside.

2.4 Sources and Routes Transmission

Exposure occurs by inhalation of virus that is excreted in mouse urine, feces or saliva and aerosolized during cleaning of buildings with rodent nests or other rodent contamination. Exposures have occurred in rodent-infested cabins, homes, barns, vehicles, outbuildings or less commonly when handling wild rodents without protective equipment. Nationally, rare transmission has been documented from a bite of a deer mouse.

2.5 Incubation Period

Seven to 45 days.

2.6 Period of Communicability

Person-to-person spread of hantaviruses in the United States has not occurred. However, person-to-person transmission of the related Andes virus was documented in Argentina during an outbreak of a similar syndrome.

2.7 Treatment

There is no antiviral treatment. Supportive care including intubation and ventilation and fluid and pharmacologic support of blood pressure are typically required.

3. CASE DEFINITIONS, DIAGNOSIS, AND LABORATORY SERVICES

3.1 Confirmed Case Definition

Confirmed: a clinically compatible case that is laboratory confirmed

An illness characterized by one or more of the following clinical syndromes:

- A febrile illness (i.e., temperature >101.^{0} F [>38.3^0 C]) corroborated by bilateral diffuse interstitial edema or a clinical diagnosis of acute respiratory distress syndrome (ARDS) or radiographic evidence of non-cardiogenic pulmonary edema, or unexplained respiratory illness resulting in death, and occurring in a

previously healthy person and thrombocytopenia and sometimes hemoconcentration; OR

- An unexplained respiratory illness resulting in death, with an autopsy examination demonstrating noncardiogenic pulmonary edema without an identifiable cause.

3.2 Laboratory Criteria for Diagnosis

1. Detection of hantavirus-specific immunoglobulin M (IgM), OR
2. Detection of hantavirus-specific ribonucleic acid (RNA) sequence by polymerase chain reaction (PCR) in clinical specimens, OR
3. Detection of hantavirus antigen by immunohistochemistry (IHC).

Note: Laboratory testing should be performed or confirmed at Oregon State Public Health Laboratories. Because the clinical illness is nonspecific and ARDS is common, a screening case definition should be used to determine which patients to test. In general, a predisposing medical condition (e.g., malignancy, chronic pulmonary disease, trauma, burn, or surgery) is a more likely cause of ARDS than hantavirus pulmonary syndrome. Patients with these underlying conditions and ARDS need not be tested for hantavirus.

3.3 Laboratory Diagnosis

Positive commercial laboratory results should be confirmed at a reference laboratory such as the Oregon State Public Health Laboratory.

Serology: Diagnosis is most commonly made by detection of virus-specific IgM in serum using an enzyme immunoassay (EIA). Most patients have IgM antibodies at time of hospitalization. A test for IgG is used in conjunction with the IgM-capture test. Reverse transcriptase-polymerase chain reaction (RT-PCR) can be used to detect hantavirus RNA in fresh frozen lung tissue, blood clots, or nucleated blood cells. Immunohistochemistry (IHC) testing of formalin-fixed tissues or paraffin-embedded tissues with specific monoclonal and polyclonal antibodies can be used to detect hantavirus antigens. IHC can be useful in fatal cases. To date, no isolates of Sin Nombre virus-like viruses have been recovered from humans, and, therefore, virus isolation is not a consideration for diagnostic purposes.

There is no test for exposure to the virus. In addition, there is no test to determine if the urine, droppings or nesting material are infectious. Testing mice is not recommended. Persons concerned about exposure to rodent urine, droppings or nesting material should monitor themselves and seek medical care if they develop symptoms.

Clinical signs such as decreasing platelets or the presence of immature cells (myelocytes or metamyelocytes) in the white blood count are suggestive of hantavirus infection but are not diagnostic.

3.4 Services Available at Oregon State Public Health Laboratory (OSPHL)

The OSPHL does not perform primary hantavirus testing as of January 1, 2019. Hantavirus IgM testing is available at commercial laboratories. As of the date of these guidelines, ARUP, Quest, LabCorp, and Mayo are some of the laboratories that offer Hantavirus testing. Providers pursuing Hantavirus testing should consult with their clinical laboratory for guidance on specimen collection and transport.

Confirmatory test: OSPHL can receive and forward specimens to CDC or to other state laboratories for confirmatory testing. Please contact the epidemiologist on call to coordinate sample collection and shipping to OSPHL.

3.5 Criteria for Confirmatory Testing HPS Specimens at CDC or other State Public Health Laboratories

1. Any person with laboratory evidence of hantavirus pulmonary syndrome from a commercial laboratory to confirm the positive test.
2. Patients with suspected hantavirus pulmonary syndrome (fever, hypotension, hypoxia, bilateral interstitial pulmonary infiltrates, acute respiratory distress syndrome, thrombocytopenia, hemoconcentration without an identifiable cause).
3. Deaths due to unexplained respiratory illness with autopsy demonstrating non-cardiogenic pulmonary edema without identifiable cause.

3.6 Specimen Collection for Confirmatory Purposes

Serum

1. Submit at least 1 cc (2.5 cc preferred) of serum (separated serum, not whole blood) for EIA at PHL. Serum can be drawn upon hospital admission. If possible, also obtain as late as serum is available before death or hospital discharge.
2. Separated serum specimens should be refrigerated and transported cold. Avoid repeated freeze-thaw cycles.
3. Specimens should be submitted by the clinical laboratory with a completed OSPHL form.

Please call OSPHL at 503-693-4100 for information.

Interview the case and others who may be able to provide pertinent clinical information.

4. ROUTINE CASE INVESTIGATION

4.1 Confirm the Diagnosis

If the case tests positive for hantavirus at a laboratory other than a reference laboratory, facilitate transport of the specimen (i.e., serum or tissue) to Public Health Laboratories for further testing. If a patient tests IgG positive and IgM

negative for hantavirus at a commercial laboratory, this indicates possible past exposure and does not need any further laboratory testing.

4.2 Identify Potential Sources of Infection

Obtain a history about possible exposure to fresh rodent urine, droppings, or nesting material. Exposures generally occur when urine, droppings, or nesting material are stirred up, aerosolized, and inhaled. A rodent bite can also transmit the virus, however inhaling the virus is a much more common transmission route to humans.

4.3 Identify Potentially Exposed Persons

It is very unusual to have multiple cases with the same exposure. However, other persons potentially exposed to the same source as the case should be educated about symptoms of hantavirus infection and told to seek medical attention if they develop such symptoms.

4.4 Environmental Evaluation

It is very unusual to have multiple cases with the same exposure. However, other persons potentially exposed to the same source as the case should be educated about symptoms of hantavirus infection and told to seek medical attention if they develop such symptoms.

5. CONTROLLING FURTHER SPREAD

5.1 Education

Educate the case and/or others sharing about the environment about avoiding future exposures (see Section 5.4) and the signs and symptoms them of hantavirus pulmonary syndrome; advise them to seek medical attention if symptoms develop. However, it is rare to have two cases sharing an exposure. Person-to-person spread of hantaviruses has not occurred in the United States.

5.2 Protection of Contacts

None; the infection is not spread person-to-person.

5.3 Isolation and Work or Care Restrictions

None.

5.4 Environmental Measures (prevention)

There are no immunization recommendations.

Prevention recommendations

1. **Keep rodents out of the home and workplace**. Always take precautions when cleaning, sealing and trapping in rodent-infested areas.

2. **Seal up** cracks and gaps in buildings that are larger than 1/4 inch including window and door sills, under sinks around the pipes, in foundations, attics, and any rodent entry hole.
3. **Trap indoor rats and mice** with snap traps.
4. **Remove rodent food sources.** Keep food (including pet food) in rodent proof containers.
5. **Clean up rodent infested areas:**
    - Wear rubber, latex, vinyl or nitrile gloves.
    - Do not stir up dust vacuuming, sweeping, or any other dust-generating means.
    - Thoroughly wet contaminated areas including trapped mice, droppings, nests with a bleach solution or household disinfectant**. Hypochlorite (bleach) solution**: Mix 1½ cups of household bleach in 1 gallon of water. Use only freshly mixed solution.
    - Once everything is soaked for 10 minutes, remove all of the nest material, mice or droppings with damp towel and then mop or sponge the area with bleach solution or household disinfectant.
    - Spray dead rodents with disinfectant and then double-bag along with all cleaning materials. Bury, burn, or throw out rodent in an appropriate waste disposal system.
    - Disinfect gloves with disinfectant or soap and water before taking them off.
    - After taking off the disinfected gloves, thoroughly wash hands with soap and water (or use a waterless alcohol-based hand rub when soap is not available).

Please visit the CDC HPS prevention website for more information (www.cdc.gov/hantavirus/hps/prevention.html)

5.5 Protection of Contacts

None; in North America the infection is not spread person-to-person.

UPDATE LOG

December 2018 Changes in OSPHL services and confirmatory protocol (DeBess)

December 2012. Review and update (Cieslak and DeBess)

May 2012. Created. (DeBess)