

Hantavirus Pulmonary Syndrome



Public Health Branch

1. Case Definition

1.1 Confirmed Case:

Clinical illness¹ with laboratory confirmation of infection:

- Detection of IgM antibodies to hantavirus
- OR
- Detection of a significant (e.g., fourfold or greater) increase in hantavirus-specific IgG antibodies
- OR
- Detection of hantavirus RNA in an appropriate clinical specimen (e.g., blood, tissue, bronchoalveolar lavage)
- OR
- Detection of hantavirus antigen by immunohistochemistry in an appropriate clinical specimen (e.g., lung biopsy, autopsy tissue) (1, 2).

2. Reporting and Other Requirements

Laboratory:

- All positive laboratory results are reportable to the Public Health Surveillance Unit by secure fax (204-948-3044).

- Operators of Manitoba clinical laboratories are required to submit residual clinical specimens that test positive for hantavirus to Cadham Provincial Laboratory (CPL).

Health Care Professional:

- Suspect and probable (clinical) cases² are reportable to the Public Health Surveillance Unit using the *Clinical Notification of Reportable Diseases and Conditions* form available at: <http://www.gov.mb.ca/health/publichealth/cdc/protocol/form13.pdf> ONLY if a positive lab result is not anticipated (e.g., poor or no specimen taken, person has recovered).
- Cooperation in Public Health investigations is appreciated.

Regional Public Health/First Nations Inuit Health Branch (FNIHB):

- Once the case has been referred to Regional Public Health/FNIHB, the *Communicable Disease Control Investigation Form* www.gov.mb.ca/health/publichealth/cdc/protocol/form2.pdf should be completed and returned to the Public Health Surveillance Unit by secure fax (204-948-3044).

¹ Clinical illness is characterized by:

- A febrile illness (temperature > 38.3°C {101°F} oral) requiring supplemental oxygen
- AND
- Bilateral diffuse infiltrates (may resemble acute respiratory distress syndrome {ARDS})
- AND
- Develops within 72 hours of hospitalization in a previously healthy person
- OR

An unexplained illness resulting in death with an autopsy examination demonstrating non-cardiogenic pulmonary edema without an identifiable specific cause of death (1).

² **Suspect Case:** A clinically compatible prodrome illness or ARDS in a patient with an exposure history to deer mice or mice infested structures.

Probable Case: A case meeting the suspect criteria with demonstrated thrombocytopenia (platelet count <100,000/ μ l)(3).

3. Clinical Presentation/Natural History

There are four clinical phases of hantavirus pulmonary syndrome (HPS): prodrome, cardiopulmonary, diuresis and convalescence (4).

1) Prodrome Phase: HPS is characterized by a febrile prodrome lasting 3-7 days (5). In addition to fever and myalgias, early symptoms include headache, chills, dizziness, non-productive cough, nausea, vomiting and other gastrointestinal symptoms (2).

2) Cardiopulmonary Phase: This rapidly progressive phase is characterized by non-cardiogenic pulmonary edema, hypoxemia, cough, pleural effusion, gastrointestinal symptoms, tachypnea, tachycardia, myocardial depression, and cardiogenic shock (4). Hypotension and oliguria may occur (4). Approximately 30-40% of HPS cases result in death, usually within a few days of the initial symptoms (6).

3) Diuresis Phase: It involves rapid clearance of pulmonary edema and resolution of fever and shock (4).

4) Convalescence Phase: In survivors, recovery from acute infection is rapid, but full recovery may require weeks to months (7).

Asymptomatic and mild forms of disease are rare but have been documented (5, 8). Limited information suggests that clinical manifestations and prognosis are similar in adults and children (5). Serious sequelae are uncommon in those who recover (5). The clinical presentation of HPS disease and the case fatality rate vary with the strain of infecting hantavirus (9).

4. Etiology

Hantaviruses are RNA viruses of the family *Bunyaviridae* (4). The Hantavirus genus includes at least 25 different species (5). HPS is a disease

of the Americas and is more frequent in South America than in North America (10). The most important North American hantavirus is Sin Nombre virus (SNV) (10). The most important South American hantavirus is the Andes virus, which is a common cause of disease in Argentina and Chile, and is the only known hantavirus where person-to-person transmission has occurred (10).

5. Epidemiology

5.1 Reservoir and Source:

Humans are accidental hosts (7). Hantaviruses are maintained in nature through persistent infection of rodents (10). In North America, five different rodents belonging to the sigmodontine rodent subfamily are known hantavirus carriers - the deer mouse, cotton rat, rice rat, white-footed mouse and red-backed vole (11, 12). In North America, the major reservoir of the Sin Nombre virus appears to be the deer mouse, but antibodies have been detected in other rodents (7, 13). Each hantavirus species is generally associated with one rodent species but there is evidence for host switches without epidemiological implications (7). Hantaviruses do not cause overt illness in their reservoir hosts (12). The infectious dose is unknown (4). Hantaviruses probably survive less than one week in indoor environments, depending on environmental conditions, and much shorter periods (perhaps hours) when exposed to sunlight outdoors (12).

5.2 Transmission:

Aerosols of virus-contaminated rodent urine or feces are thought to represent the main vehicle for the transmission of hantaviruses. Disease has also followed the bite of infected rodents (saliva contains virus) (10). The virus can become airborne after sweeping or vacuuming excreta from infected rodents (11). Person-to-person transmission of hantaviruses has only been demonstrated in patients in Argentina and Chile

infected with the Andes virus (5, 14, 15). Activities associated with increased risk for HPS include handling grain contaminated with mouse droppings and urine, planting or harvesting field crops (16), occupying or cleaning rodent-infested buildings, sweeping or disturbing rodent excreta or nests, sleeping on the ground and handling mice without gloves (8).

5.3 Occurrence:

General: Cases of HPS in humans are determined by the geographic location of the rodents carrying the virus (5). Hantavirus infections of humans are reported primarily in adults (12). Cases are usually sporadic (14), although outbreaks have been reported (9, 13). Most cases of HPS occur in spring and summer (5). The first outbreak of HPS identified in North America was in 1993 in the United States of America (9). Since then, more than 2,000 cases of HPS caused by different strains have occurred in sporadic clusters throughout the Americas (9). Cases of HPS have been reported in the following American countries: the United States, Canada, Argentina, Bolivia, Brazil, Chile, Panama, Paraguay and Uruguay (9). HPS cases have been reported in at least 30 U.S. states, the majority in the western half of the country and occurring in residents in rural areas (9). Trappers, hunters, forestry workers, farmers and military personnel have a higher risk of contracting the disease (4) as well as laboratory workers processing clinical specimens (7). Other occupations at risk of exposure to rodents or their nesting debris include: telephone installers, oil workers, plumbers, electricians, pest control officers, certain construction and maintenance workers whose roles are to clean, demolish or otherwise work in areas that may be infested with rodents (17).

Canada: From 1989 to January 2014, 100 confirmed hantavirus cases with 27 deaths were reported in Canada (11). Cases have been largely restricted to western Canada.

Manitoba: The first confirmed case of HPS was reported in 1999. Since then, three additional cases were reported; one each in 2000, 2007 and 2012. Two of these cases died.

5.4 Incubation Period:

The incubation period is not well defined but is thought to be approximately two weeks with a range of a few days to six weeks (7).

5.5 Host Susceptibility and Resistance:

The protection and duration of immunity conferred by previous infection is unknown, but antibodies seem to persist for several years (7). Reinfection has not been shown to occur in confirmed recovered patients (7).

5.6 Period of Communicability:

Person-to-person transmission is very rare and has only been observed for the Andes virus during outbreaks in Argentina and Chile (14, 15).

6. Laboratory Diagnosis

Diagnosis requires the demonstration of specific hantavirus IgM antibodies or a significant increase in IgG antibodies. Whole blood is the preferred specimen; however, bronchoalveolar lavage (BAL) and tissue specimens will be accepted for hantavirus nucleic acid detection. If hantavirus is suspected, “suspected hantavirus” should be clearly written on the requisition. Specimens should be sent to the Cadham Provincial Laboratory (CPL) which will forward them to the National Microbiology Laboratory (NML) for testing. Autopsy or biopsy tissue specimens should also be sent to CPL for forwarding on to the NML for testing.

7. Key Investigations for Public Health Response

- Investigate for occupational or other relevant exposure (e.g., farm, forestry or other outdoor worker, camper, hiker, inadequate home rodent control etc.).

- Travel history for possible exposure to the virus elsewhere in North America or to the Andes virus in South America.
- Laboratory confirmation of hantavirus species as per the case definition.

8. Control

8.1 Management of Cases:

- Consultation with Infectious Diseases is recommended.
- Intensive supportive management of pulmonary edema, severe hypoxemia, and hypotension during the first 24 to 48 hours is critical for recovery (5).
- Although ribavirin was active in vitro against hantaviruses, including SNV (5), based on limited trials, ribavirin had no apparent clinical benefit for HPS patients (5, 9).

Infection Prevention and Control Measures:

- For cases in health care facilities, refer to page 87 of the Manitoba Health, Healthy Living and Seniors document *Routine Practices and Additional Precautions: Preventing the Transmission of Infection in Health Care* available at: <http://www.gov.mb.ca/health/publichealth/cdc/docs/ipc/rpap.pdf> .

8.2 Management of Exposed Individuals:

- Individuals who have close contact with the case (e.g., household member/caregiver) or who may have been exposed to the same source of hantavirus as the case should be encouraged to seek immediate medical care if febrile symptoms appear (14).

8.3 Management of Outbreaks:

An outbreak is defined as the occurrence of case(s) in a particular area and period of time in excess of the expected number of cases.

- Outbreaks should be investigated to identify a common source of infection and prevent further exposure to that source. The extent of outbreak investigations will depend upon the number of cases, the likely source of contamination and other factors.
- Public Health Inspectors may be asked to assist the Medical Officer of Health in outbreak investigations.
- Public notification should occur. The level of notification will usually be at the discretion of regional Public Health and/or the provincial Public Health Branch for local outbreaks but may be at the discretion of the Federal Government for nationally linked outbreaks.
- Rodent control. Professional assistance may be required.
- Surveillance for hantavirus infection in wild rodents when feasible.
- Monitoring of relevant rodent numbers and infection rates is desirable but is as yet of unproven value.
- Public education regarding rodent avoidance and rodent control in homes and appropriate precautions when dealing with rodent droppings.

8.4 Preventive Measures:

- Avoid contact with rodents and their droppings.
 - Discourage rodents from living around homes by keeping grass short, storing hay on pallets, removing abandoned vehicles, discarded tires and old unused sheds (which may serve as nesting sites).
 - Seal holes and other possible entrances for rodents to exclude them from buildings (5, 7, 11).

- Stack woodpiles away from buildings and raise 12 inches or more off the ground (11).
- Store human and animal food in rodent-proof containers (7).
- Trap and dispose of mice living in homes.
- Prior to entry/occupancy, ventilate potentially rodent-infested buildings that have been closed for some time (7).
- Consult a pest-control professional for severe or persistent rodent infestations (12).
- All rodent infested areas and droppings should be treated as potentially harmful (6).
 - Ventilate the area by opening windows and doors for 30 minutes before and after disinfection (16). When cleaning areas contaminated by rodent droppings in a confined space, consider wearing a high efficiency particulate air (HEPA) filtered respirator (6) or a properly fitted disposable N95 mask (16). Wear full length clothing to avoid skin contamination, use gloves to handle soiled clothes, wash dirty laundry with hot water and detergent and dry thoroughly. Soak rodent-contaminated areas with 10% bleach solution for 10 minutes to ensure any virus within the droppings will be killed prior to cleaning (11). Use a wet mop or towels moistened with disinfectant (10% bleach solution) to clean-up rodent-contaminated areas (7). Use a scoop to pick up rodent droppings (16). Do not dry sweep or vacuum as this may release virus into the air (7). If a wet mop was used to clean the area, clean the mop with 10% bleach solution and hot soapy water (11). Dispose of all contaminated material in sealed double plastic bags in the garbage (16).
 - Wear rubber gloves before handling trapped or dead rodents (5, 11). If traps will be reused, decontaminate first by immersing in a disinfectant solution (10% bleach) and rinsing afterward (5, 12). Use 10% bleach solution to disinfect dead rodents (5), before placing in double plastic bag for disposal (17). If rubber gloves will be reused, wash gloves in disinfectant and hot soapy water before taking them off (11), otherwise dispose of with other contaminated material in sealed double plastic bags. Then wash hands thoroughly with soap and water after removal of gloves (11).
 - Disinfect (e.g., 10% bleach solution) other surfaces (e.g., countertops) where rodents may have been (17).
- Workers in potentially high-risk settings should be informed by their employers about hantavirus transmission and symptoms of infection and given detailed guidance on prevention measures (12). Recommendations in the SAFE Work Manitoba document on hantavirus http://safemanitoba.com/sites/default/files/resources/sf_bltm_23_swmb_dec_2014.pdf may be helpful.

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