

**County of Santa Clara**  
**Public Health Department**

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**PHYSICIAN ALERT**

**Hantavirus Pulmonary Syndrome Cases  
Associated with Yosemite National Park**

**DATE:** September 4, 2012

**TO:** Emergency Room Physicians  
Urgent Care Physicians  
Pediatricians  
Internists  
Family Practice Physicians  
Pulmonary/Critical Care Physicians

**FROM:** Marty Fenstersheib, MD, MPH  
Health Officer

This fax contains 4 pages.  
**Please copy and distribute to  
ALL physicians at your location**

The California Department of Public Health (CDPH) and the Centers for Disease Control and Prevention (CDC) are currently working with the National Park Service on an investigation of Hantavirus pulmonary syndrome (HPS) in people who stayed at Yosemite National Park during June through August 2012. People who stayed in Yosemite National Park during this time may have been notified of their potential exposure and asked to consult with their healthcare provider. We are sending the following information so that you can (a) be alert to the possibility of HPS in patients with a history of travel to Yosemite National Park during this period, and (b) answer questions from concerned patients.

**Background**

HPS is an unusual disease. Since HPS was recognized in 1993, just three cases have been reported in Santa Clara County residents, and just over 60 cases have been reported statewide. However, since June 10, 2012, six confirmed cases of HPS have been associated with staying at Yosemite National Park in California. Two of the ill persons died. Additional suspected cases are being investigated from multiple health jurisdictions. Four case-patients with HPS stayed in “Signature Tent Cabins” in the Boystown area of Curry Village, and the lodging locations of the remaining 2 case-patients are currently under investigation. The “Signature Tent Cabins” have solid walls on the interior of the cabin and are covered with canvas exterior sides and roof.

An estimated 10,000 persons stayed in the “Signature Tent Cabins” from June 10 through August 24, 2012. On August 24, 2012, the tents were disinfected and visitors were relocated.

Board of Supervisors: Mike Wasserman, George Shirakawa, Dave Cortese, Ken Yeager, Liz Kniss  
County Executive: Jeffrey V. Smith

People who stayed in the tents between June 10 and August 24 may be at risk of developing HPS over the 5 to 6 weeks subsequent to their stay. Providers are reminded to consider the diagnosis of HPS in all persons presenting with clinically compatible illnesses and to ask about potential rodent exposure or if they had recently visited Yosemite National Park.

### **What is HPS?**

HPS is an acute, zoonotic viral disease that is spread by contact with infected rodents, primarily deer mice. Most persons with HPS are infected by breathing in small viral particles from rodent urine or droppings that have been stirred up into the air. The fatality rate is approximately 36%. Why some individuals develop HPS is not known, but possible factors may include the amount of virus to which the person was exposed, genetic differences in immune response, and the virulence of the virus strain.

### **Incubation period**

The incubation period for HPS is **typically 2-4 weeks** after exposure, with a range of a few days up to 6 weeks.

### **Clinical presentation**

Patients with HPS typically present in a very 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 (coryza is not present). Malaise, diarrhea, and lightheadedness are reported by approximately half of all patients, with less frequent reports of arthralgias, back pain, and abdominal pain. Patients may report shortness of breath, (respiratory rate usually 26 - 30 times per minute). **Typical findings on initial presentation include fever, tachypnea and tachycardia.** The physical examination is usually otherwise normal.

The diagnosis is seldom made at this stage, as cough and tachypnea generally do not develop until approximately day seven. Once the cardiopulmonary phase begins, however, the disease progresses rapidly, necessitating hospitalization and often ventilation within 24 hours.

Signs that make a diagnosis of HPS unlikely include rashes, conjunctival or other hemorrhages, throat or conjunctival erythema, and peripheral or periorbital edema.

### **Clinical and laboratory assessment**

If a Hantavirus infection is suspected in a patient who visited Yosemite National Park within six weeks of their illness onset, a CBC and chemistry panel, including LDH, should be done at baseline and potentially repeated every 8 to 12 hours depending on the level of concern.

Most patients with HPS will develop thrombocytopenia in the prodromal period. A dramatic fall in the platelet count may herald a transition from the prodrome to the pulmonary edema phase of the illness. Leukocytosis and hemoconcentration are common in adult patients.

A fall in the serum albumin and a rise in the hematocrit may indicate a fluid shift from the intravascular to the extravascular space. The white blood cell count tends to be raised with a marked left shift. The percentage of white blood cell precursors may be as high as 50% and atypical lymphocytes are frequently present, usually at the time of onset of pulmonary edema. Proteinuria, and mild elevations of transaminases, CPK, amylase, and creatinine have also been reported.

**The combination of atypical lymphocytes, a significant thrombocytopenia and bandemia in the setting of pulmonary edema is strongly suggestive of a Hantavirus infection.**

**Findings strongly suggestive of Hantavirus infection:**

- Precipitous respiratory decline
- Rapid onset of thrombocytopenia
- Hypocapnea
- Hemoconcentration
- Left shift in the WBC count, neutrophilic leukocytosis, and circulating immunoblasts
- Prominent gastrointestinal symptoms

### **Clinical assessment - pediatric issues**

The clinical course and mortality rate in children are similar to those for adults. However, HPS is much less common in children. For example, among 537 U.S. HPS cases reported from 1995-2009, <7% occurred in children <17 years of age and only four cases occurred in children <10 years of age (CDC. MMWR 2009;58(50):1409-1412). In this series, thrombocytopenia and elevated WBC were observed in all children. In another case series of 13 patients from the University of New Mexico, all had thrombocytopenia (median platelet count 67,000/mm<sup>3</sup>) and elevated LDH (median level 1243 IU/L) and >85% had elevated levels of AST/ALT and hypoalbuminemia (Ramos MM, et al. Pediatrics 2001;108(2):E27). Leukocytosis and hemoconcentration are less common in children than in adults. During the prodrome, abnormal laboratory findings such as leukocytosis and thrombocytopenia may appear. A left shift in the granulocytic series without toxic changes is present, but leukocytosis and hemoconcentration are relatively late findings, observed in >50% of cases during the course of illness. Unlike in adults, children's symptoms may also include sore throat.

### **Disease development**

Within 24 hours of initial evaluation, most patients develop some degree of hypotension and progressive evidence of pulmonary edema and hypoxia, usually requiring mechanical ventilation. The patients with fatal infections appear to have severe myocardial depression which can progress to sinus bradycardia with subsequent electromechanical dissociation, ventricular tachycardia or fibrillation.

Hemodynamic compromise occurs a median of 5 days after symptom onset - usually dramatically within the first day of hospitalization. Poor prognostic indicators include a plasma lactate of greater than 4.0 mmol/L or a cardiac index of less than 2.2 L/min/m<sup>2</sup>. While pulmonary edema and pleural effusions are common, multi-organ dysfunction syndrome is rarely seen. However, HPS patients sometimes have mildly impaired renal function. Survivors frequently become polyuric during convalescence and improve almost as rapidly as they decompensated.

### **Radiologic findings**

HPS has a characteristic radiological evolution, beginning with minimal changes of interstitial pulmonary edema, progressing to diffuse alveolar infiltrates, and finally to severe interstitial lung edema and extensive airspace disease with bilateral infiltrates resembling acute respiratory distress syndrome (ARDS). For HPS radiological images see:

<http://www.cdc.gov/hantavirus/technical/hps/clinical-manifestation.html>

### **Treatment**

There is no specific treatment for Hantavirus infection. Treatment of patients with HPS remains supportive in nature, with emphasis on respiratory support and treatment of hemodynamic instability.

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. Of note, extracorporeal membrane oxygenation (ECMO) support has been shown to improve survival of patients with severe HPS (Wernly JA, et al. Eur J Cardiothorac Surg 2011;40(6):1334-40).

### **Diagnostics**

**A positive serological test result**, evidence of viral antigen in tissue by immunohistochemistry, or the presence of amplifiable viral RNA sequences in blood or tissue, with compatible history of HPS, is considered diagnostic for HPS. Testing is available at the CDPH Viral and Rickettsial Diseases Laboratory for patients with a clinically compatible illness and exposure history; specimens should be submitted through the Santa Clara County Public Health Laboratory (408-885-4272) after consultation with the Health Officer on call.

### **Infection control**

**There is no evidence of person-to-person transmission of Hantavirus in North America.**

This includes healthcare settings where studies of antibody levels have not documented even asymptomatic transmission. Nonetheless, the usual Standard Precautions are recommended when managing a possible case of Hantavirus infection. These include hand hygiene, masking a coughing patient, and wearing a mask in the presence of a coughing patient. Surfaces should be cleaned with a disinfectant, and gloves and gowns may be worn if a splash or mucus membrane exposure is possible.

### **For more information**

For additional information about HPS symptoms and diagnosis, please see:

CDC's Hantavirus webpage: <http://www.cdc.gov/hantavirus/technical/hps/index.html>

CDPH Hantavirus webpage:

<http://www.cdph.ca.gov/healthinfo/discond/Pages/HantavirusPulmonarySyndrome.aspx>

### **Reporting and Consultation**

If your clinical suspicion is elevated (e.g. thrombocytopenia, hemoconcentration, elevated WBC with left shift, respiratory decline, etc.), please call the Disease Prevention and Control Program at 408-885-4214 and ask to speak to the Communicable Disease Controller to notify us of the suspect case and to arrange for specimen testing.

### **Questions**

If you have further questions about this notice, please call the Santa Clara County Disease Prevention and Control Program at 408-885-4214 and ask to speak with a public health nurse.