

## Just the Facts...

### Korean Hemorrhagic Fever

**Q. What is Korean Hemorrhagic Fever?**

**A.** Korean hemorrhagic fever (KHF) is one of a group of very severe, clinically similar illnesses known as hemorrhagic fever with renal syndrome (HFRS). KHF is caused by Hantaan virus, a hantavirus in the family *Bunyaviridae*. Other *Bunyaviridae* viruses that cause HFRS include Puumala virus, Dobrava virus, and Seoul virus. In the Americas, viruses in the same family cause a different type of disease known as hantavirus pulmonary syndrome (HPS).

**Q. Where is KHF found?**

**A.** Hantaan virus, the agent of KHF, is widely distributed throughout eastern Asia, particularly in China, Russia, and the Korean peninsula. Korean hemorrhagic fever was first noted during the Korean War in the 1950s, and it is now considered a major health concern in China and the Republic of Korea (ROK). Among the other agents of HFRS, Puumala virus is found primarily in Scandinavia, western Europe, and Russia; Dobrava virus, is found primarily in the Balkans; and Seoul virus, is distributed worldwide.

**Q. How prevalent is KHF?**

**A.** Several hundred cases of HFRS (primarily KHF) occur in the ROK every year, most among civilians. While the vast majority of these cases are due to Hantaan virus, a small percentage may be attributed to both the Puumala and Seoul viruses. It is suspected that much larger numbers of KHF occur in North Korea. Since WWII, the largest outbreak of KHF in U.S. forces was in 1986. Among 3,754 Marines participating in a military training exercise in the ROK, 14 cases occurred: 10 were hospitalized; two of these died. In 1994, 8 cases with one death occurred in U.S. Army personnel at an ROK training range. Most recently, in 2005, 2 cases occurred in U.S. forces. It is estimated that 200,000 cases or more may occur in China per year.

**Q. How is KHF transmitted?**

**A.** Hantaviruses are carried and transmitted by rodents. Each hantavirus is associated with a single specific species of rodent (known as the reservoir). The reservoir for Hantaan virus is the striped field mouse, *Apodemus agrarius*. People become infected when they breathe in the aerosolized urine, droppings, or saliva of infected mice or the contaminated dust from their nests. Transmission may also occur when these infected materials are directly introduced into broken skin or onto mucous membranes of the eyes, nose, or mouth. Person-to-person transmission may occur, but is extremely rare. Reservoirs for the other agents of HFRS include the brown Norway rat (*Rattus norvegicus*) for Seoul virus; the bank vole (*Clethrionomys glareolus*) for Puumala virus; and the yellow-necked field mouse (*Apodemus flavicollis*) for Dobrava virus.

**Q. What are the symptoms of KHF?**

**A.** Symptoms of KHF usually develop suddenly within 1 to 2 weeks following exposure to infectious material, but may take up to 2 months in rare cases. Initial symptoms may include intense headaches, high fever, severe back and abdominal pain, nausea, vomiting, flushing of the face, inflammation of the eyes, and petechial rash (red spotted rash due to hemorrhage of capillaries in the skin). These symptoms can then be followed by reduction in blood pressure, acute shock, dramatic decrease in urinary output, increased vascular leakage (hemorrhage of blood vessels), kidney failure, and death. The fatality rate for KHF is 5-15%. Complete recovery can take weeks to months. Of the four major hemorrhagic hantaviruses, Hantaan and Dobrava usually cause the most severe symptoms.

**Q. How is KHF diagnosed?**

**A.** Several factors are considered in the diagnosis of KHF: geographic distribution of the disease, an exposure to rodents, and the patient's clinical symptoms. Blood tests are used to confirm the diagnosis. These tests usually include either IFA (indirect fluorescent antibody) assays or ELISA (enzyme-linked immunosorbent assay) techniques to demonstrate specific antibodies in the blood. Leptospirosis, dengue, and rickettsioses should be considered in the differential diagnosis.



Striped field mouse, *Apodemus agrarius*, reservoir for Hantaan virus, photographed at the DMZ, Republic of Korea

**Q. What is the treatment for KHF?**

**A.** Supportive therapy is the standard of care for patients with KHF and other HFRS infections. Quiet bed rest and hospitalization are critical. It has been noted that the jostling and effect of lowered atmospheric pressures during airborne evacuation may be injurious to patients who are critically ill with KHF. Careful attention to fluid management (hydration and electrolyte levels), maintenance of correct oxygen and blood pressure levels, and appropriate treatment of any secondary infections are very important. Dialysis may be required to correct severe fluid overload and minimize the effects of shock and kidney failure. Administration of intravenous ribavirin, an antiviral drug, as early as possible during the first few days of illness has been shown to decrease the severity of illness and death associated with KHF. If you suspect that you may have been infected with Hantaan virus, or another HFRS virus, it is **CRITICAL** that you seek medical attention immediately.

**Q. How can KHF be prevented?**

**A.** There is no FDA-approved vaccine to prevent KHF. Therefore, rodent control is the primary strategy for preventing hantavirus infections, including KHF.

- ✎ Control rodent populations near human communities and bivouac sites.
- ✎ Store foods in rodent-proof containers; all garbage should be promptly buried, burned or discarded in sturdy trash containers with tight fitting lids.
- ✎ Keep grass and shrubbery well-trimmed, leaf litter removed, and other rodent harborage moved 100 feet or as far as possible from bivouac sites and buildings.
- ✎ Do not disturb rodents or their burrows.
- ✎ Set snap traps inside or close to buildings if there is evidence of rodent infestation, such as droppings or nests (look for small piles of shredded materials such as paper, insulation, twigs, or grass).
- ✎ Exclude rodents from homes and other buildings used by people. Seal all entry holes that are ¼ inch wide or wider with steel wool, cement, caulk, or wire screening.
- ✎ Avoid contact with rodent urine, droppings, saliva, nesting materials, and other contaminated debris.
- ✎ Avoid sleeping on bare ground; use elevated cots if available.
- ✎ Before occupying or cleaning abandoned or unused structures, open them up to air out for at least 30 minutes.
  
- ✎ Clean rodent-infested areas using the following safety precautions, recommended by the Centers for Disease Control and Prevention (CDC):
  - ✎ Wear rubber, latex, vinyl, or nitrile gloves.
  - ✎ Do not stir up dust by vacuuming or sweeping.
  - ✎ Thoroughly wet contaminated areas and debris with a hypochlorite (bleach) solution or household disinfectant. A bleach solution can be made by mixing 1 ½ cups of household bleach in 1 gallon of water.
  - ✎ Once everything is dampened well, remove contaminated materials with paper towels or rags and then mop or sponge the area with bleach solution or household disinfectant.
  - ✎ Spray dead rodents and traps with bleach solution or disinfectant; then remove the rodent and place it in a plastic bag, along with all used cleaning materials. If desired, the dead rodent can be left in the trap and both disposed of in the bag. The bag should then be placed within a second plastic bag and sealed.
  - ✎ Wash gloved hands with soap and water, or spray a disinfectant or bleach solution on gloves before taking them off. Wash hands with soap and warm water after taking off gloves (use a waterless alcohol-based hand rub when soap is not available and hands are not visibly dirty).
  
  - ✎ In certain situations, where the contamination is extensive, specialized personal protective equipment will be required, to include a half-face respirator with N-100 (HEPA) cartridges or powered air purifying respirator (PAPR), coveralls, gloves, eye goggles, and non-permeable boots.

**Q. Where can I find more information on KHF and other hantavirus infections, prevention, and clean-up?**

**A.** The CDC has extensive information on HFRS and HPS on its Special Pathogens Branch web page at: <http://www.cdc.gov/ncidod/dvrd/spb/mnpages/disinfo.htm>. In addition, the Armed Forces Pest Management Board (AFPMB) has Technical Guide No. 41, "Protection from Rodent-Borne Diseases with Special Emphasis on Hantavirus" on its website: <http://www.afpmb.org/pubs/tims/tims.htm>.