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Hendra Virus

Formerly:
Equine morbillivirus

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Overview

- Organism
- History
- Epidemiology
- Transmission
- Disease in Humans
- Disease in Animals
- Prevention and Control

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In today's presentation we will cover information regarding the organism that causes Hendra and its epidemiology. We will also talk about the history of the disease, how it is transmitted, species that it affects (including humans), and clinical and necropsy signs observed. Finally, we will address prevention and control measures for Hendra virus.

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The Organism

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Hendra Virus

- Family Paramyxoviridae
  - Genus *Henipavirus*
  - Closely related to Nipah virus
- Enveloped single-stranded RNA virus
- Family includes
  - Mumps and measles
  - Rinderpest virus
  - Human parainfluenza virus
  - Canine distemper virus

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Hendra virus, formerly known as Equine morbillivirus, is a newly recognized member of the paramyxovirus family, genus Henipavirus. It is closely related to another recently discovered virus – Nipah. It is an enveloped, single stranded RNA virus. This family includes the viruses that cause mumps and measles, rinderpest virus, the Human parainfluenza virus, and canine distemper virus. Electron micrograph of Hendra virus from http://www.abc.net.au/science/news/stories/s17976.htm.

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History

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History

- 1994
  - First recognized outbreak
  - Brisbane, Australia
  - Respiratory and neurological disease in horses
    - 21 horses sick–14 died
    - 2 humans sick–1 died
- 1995: Second human fatality
  - Assisted in equine post-mortem in 1994

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Hendra virus was first isolated in 1994 from specimens obtained during an outbreak of respiratory and neurological disease in horses and humans in Hendra, a suburb of Brisbane, Australia. Of 21 horses that suffered from severe respiratory disease in September 1994, 14 died. Two people looking after the index horse case developed the disease and one of them died. In 1995 a third human case was recorded and thought to be associated with an earlier outbreak in another part of Queensland. The patient who died had assisted in the post-mortem exam of two horses in August 1994.

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History

- 1999: Horse fatality in Cairns, Australia
- Serology – negative
  - Human contacts of human cases
  - 2,000 horses
  - More than 5,000 samples from 46 animal species
    - 546 cats
  - Retrospective study of lab specimens

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The most recent reported animal case is of a horse in Cairns in January 1999, which died. Subsequent serological testing for Hendra virus in human contacts of the three human cases were negative. Serology on more than 2000 horses and more than 5000 samples from 46 animal species in Queensland also failed to identify a single Hendra virus infection. A retrospective study of laboratory specimens was conducted in Queensland to determine if any of the cases were caused by Hendra; no cases were found. (Photo: USDA)

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History

- Serology – positive
  - 20/240 samples from 4 species of fruit bat
    - *Pteropus* species
      - Asymptomatically infected
  - One of 3 new viruses carried by fruit bats
    - Hendra, Nipah, Menangle

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Hendra virus was found in 20 of 240 serum samples from four species of fruit bats. These samples were from as far north as Papua New Guinea and as far south as Melborne. Fruit bats seem a likely source of Hendra virus, although they appear to be asymptomatically infected. (Photo of fruit bat: http://www.thewildones.org/Jersey/livingstone.gif)

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Transmission

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Transmission: Humans

- Likely mode of transmission
  - Direct contact with fluids from infected horses
- Unlikely modes of transmission
  - Respiratory
  - Human-to-human
  - Bat-to-human

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The precise mode of virus transmission to the three Australian patients is not fully understood. All three individuals appear to have acquired their infection as a result of close contact with body fluids of infected horses. Respiratory and person to person modes of transmission are not thought to occur at this time. Despite evidence that 13-25% of fruit bats have been infected with Hendra virus, it appears that they are not a significant risk to people. This is based on the negative results of testing of 130 people, all with close contact with fruit bats. Until the reasons for spillover of Hendra virus from bats to horses are better understood, it would be advisable for those handling fruit bats to observe normal good hygiene and care. Further studies to understand transmission of Hendra virus are underway.

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Transmission: Humans

- Infected humans had extensive contact with sick horses
  - No protective gear
- Not all exposed humans became sick
- Not all exposed horses became sick
- Research on-going

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The three individuals infected had extensive contact with the infected horses. They assisted in necropsies without protective clothing. Other people were also involved with such procedures but did not become infected. Several horses were in close contact with infected horses and did not become ill and several horses that were exposed did acquire the disease. Additional controlled experiments are being carried out particularly by the Commonwealth Scientific and Industrial Research Organization (CISRO).

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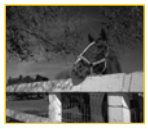
Transmission: Animals

- Mode of transmission from bats to horses unknown
  - Virus excreted in urine and saliva
  - Horse may contract by ingestion of contaminated feed
  - Tick vector has been proposed



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Scientists have shown that Hendra virus is not highly contagious. The mode of transmission from bats to horses is unknown. Infected animals can pass the virus in their urine. Research suggests that horses can be infected by eating material contaminated with the virus. There is no evidence that the virus can be spread via inhalation. A tick vector, the Australian paralysis tick, has been proposed.

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Epidemiology

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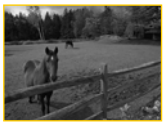
Epidemiology

- Human cases
  - Australia only
  - Close contact with infected horses
- Horse index cases
  - Female thoroughbreds
  - Over 8 years old
  - Infected while in a paddock



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Human infection in every case has been in those having extensive close contact with infected horses, and all three cases occurred in Australia. In a study done to look at the three outbreaks of Hendra virus infection in horses, several features were similar among the horses infected. On all three occasions the index cases were female thoroughbreds older than 8 years. The index cases were also out on the paddock for longer than the incubation period. Researchers thus concluded that each index case was exposed and infected in the paddock. Photo: USDA.

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Disease in Humans

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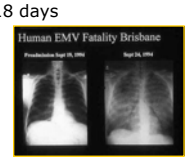
Human Disease

- Incubation period 4-18 days
  - May be up to a year
- Flu-like symptoms
  - Fever
  - Myalgia
  - Headaches
  - Vertigo
- Pneumonitis
  - Rapid progression to respiratory failure
- Meningoencephalitis



The incubation period for Hendra virus in humans is generally believed to be 4-18 days, but some reports suggest it may, in exceptional circumstances, be up to 12 months. During the first outbreak, one of the men infected with Hendra virus experienced a flu like illness with fever and myalgia. He was ill for 6 weeks and gradually recovered. The first human death due to Hendra virus was from respiratory disease. Initially the man had a viral flu like illness, which rapidly progressed to respiratory failure. The second death associated with the Hendra virus occurred approximately one year after the initial symptoms. The patient initially had a mild meningoencephalitis, which improved with antibiotics. Approximately one year later, the patient again had signs of encephalitis. Evidence of Hendra virus infection included a high serum neutralizing antibody titer against the virus and a positive polymerase chain reaction (PCR) test of cerebrospinal fluid. The patient died approximately 5 weeks after he was admitted to the hospital. Tests of autopsy specimens confirmed the infection with Hendra virus. Photo: Radiographs of a 49 year old man who contracted Hendra virus during the outbreaks of 1994. The man was a heavy smoker. He required ventilation for his respiratory distress and died after six days. EMV refers to equine morbillivirus. http://www.vet.uga.edu/vpp/ia/SRP/ERD/histo

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Diagnosis: Humans

- ELISA
- Immunoperoxidase
  - Formulin fixed tissues
- Virus isolation
- Virus neutralization
  - Detect antibodies
- PCR

As a result of work at the Australian Animal Health Laboratory since the outbreak in 1994, regional veterinary laboratories and hospitals around Australia now have an ELISA diagnostic test. Other tests developed include an immunoperoxidase test for use on formalin-fixed tissue, virus isolation, and virus neutralization and polymerase chain reaction tests (PCR). Virus isolation on fresh tissues is the method of choice for diagnosing Hendra virus. Images: www.minerva-biolabs.com/files/ diashow/pcr-prinzip.jpg , www.ntri.tamuk.edu/protocols/ elisa.gif and www.cdc.gov/.../images/ virus-isolation-cell-culture2.jpg.

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Treatment and Prognosis

- Intensive supportive care
- Ribavirin
  - May decrease duration and severity of disease
  - Clinical usefulness uncertain
- Prognosis uncertain due to lack of cases

Treatment is generally a matter of intensive supportive care. There is some evidence that antivirals such as Ribavirin may decrease duration and severity of the disease. Since there have been three human infections and two human deaths in only two outbreaks of this disease, maximum precautions should be used if Hendra virus is suspected.

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Disease in Animals

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Horses and Hendra Virus

- Incubation: 6-18 days
  - Can be asymptomatic during incubation but shed virus
- Depression, pyrexia, dyspnea, tachycardia
- Initial nasal discharge
  - Clear to serosanguinous
- Sudden death 1-3 days after onset

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Horses have shown similar clinical signs among the outbreaks. The incubation period is from 6 to 18 days, the horses may be asympotmatic during this period but are able to shed the virus. Clinical signs consisted of anorexia, depression and elevated body temperature, up to 105.8 degrees. Most horses showed elevated respiratory rates with a clear to serosanguinous nasal discharge during the initial course of the disease. Sudden death of horses was often seen 1-3 days after onset of clinical signs.

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Horses and Hendra Virus

- Injected mucous membranes, cyanotic border
- Dependant edema
- Head pressing
- Ataxia
- Frothy nasal discharge

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As the disease progresses, mucous membranes may become injected with a cyanotic border. Horses may show dependant edema, ataxia and head pressing. The nasal discharge may become frothy and red just prior to death. Sudden death of horses was often seen 1 to 3 days after the onset of initial signs. Diagnosis of Hendra virus in animals is the same as in humans. (Photo: The Gray Book)

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Species Affected

- Naturally
  - Horses and humans
- Experimentally
  - Cats and guinea pigs
- No signs of infection
  - Dogs, chickens, rats, mice

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In addition to horses and people, it has been shown that cats and guinea pigs can be infected experimentally which results in severe clinical disease. There have been no cases of natural disease in cats. Other animals that have been exposed to the virus experimentally include dogs, chickens, rats, and mice, although they have not shown any signs of infection.

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Prevention and Control

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Prevention and Control

- Difficult of assess risk
  - Sick horses in endemic areas
  - Areas inhabited by fruit bats
- In suspect cases
  - Do NOT handle infected tissues, blood or urine

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The risk of transmission of Hendra virus from sick animals to humans appears to be low. Because of the scarcity of information it is difficult to adequately assess risk. Sick horses in endemic areas or in areas inhabited by fruit bats may be at increased risk. If infections with Hendra virus is suspected, do not handle infected tissues or waste products, particularly blood or urine.

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Left Photo: Project leader Dr. Peter Hooper, a pathologist for the Australian government, handling a virus-infected fruit bat. These animals were very good at biting and scratching, and were potentially contaminated with virus-infected saliva. Thus, heavy gloves and positive pressure suits were required clothing to work with these animals. http://www.usyd.edu.au/su/rirdc/articles/disease/hendra.htm. Right Photo: In 1996 the Hendra virus was classified as requiring Level-4 security. All people working with Hendra virus, either in the laboratory or with live animals, must wear a positive pressure suit with its own air supply (Self-Contained Breathing Apparatus (SCBA), or work under an enclosed cabinet known as a flexible film isolator. This photo is also of Dr. Hooper, working with a horse infected with Hendra virus. http://www.usyd.edu.au/su/rirdc/articles/disease/hendra.htm

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Prevention and Control

- Sensitive to heat and chemical disinfection
- Directly contaminated objects
  - Autoclave or boil
- 1% sodium hypochlorite solution
- NaDCC granules

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Disinfect all articles or instruments used to treat patients with known or suspected infection. Those in contact with sick horses in endemic areas or in areas inhabited by fruit bats may be at greater risk. The virus appears to be sensitive to heat and chemical disinfection. Directly contaminated objects can be autoclaved or boiled. Disinfection 1% sodium hypochlorite or NaDCC (sodium dichloroisocyanurate) granules are effective disinfection.

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Use as Biological Weapon

- Relatively little is known about disease transmission
- Serious consequences if outbreak occurs
  - Suspected high mortality rate and lack of treatment

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There is relatively little known about Hendra virus infection, including the transmission in humans and the transmission in animals. It is suspected that mortality rates could be very high based on the limited data available. Effective treatment for the disease is also not known at this time. Its use as a biological weapon is unknown, as are the consequences.

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Acknowledgments

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