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REVIEW ARTICLE

The Clinical Pathology, Transmission Dynamics, and Preventive Strategies of Hendra Virus (*Hendra henipavirus*): A Comprehensive Review

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ABSTRACT

Hendra virus (HeV) is a highly lethal, zoonotic paramyxovirus native solely to Australia. Maintained in nature by fruit bats of the genus Pteropus (flying foxes), the virus periodically spills over into domestic horses, which act as intermediate hosts capable of transmitting the virus to humans. While human cases remain extremely rare, with only **seven reported cases** in history, the virus exhibits a devastating case fatality rate of **60% in humans** and **75% in horses**. This article reviews the pathology, transmission pathways, ecological drivers (such as deforestation), and current prevention methodologies—including the equine subunit vaccine and experimental human monoclonal antibody treatments. In the 1990s, two closely related paramyxoviruses—the Nipah virus and the Hendra virus—emerged from bats and caused fatal outbreaks in both humans and farmed animals. Researchers funded by the National Institute of Allergy and Infectious Diseases (NIAID) created vaccines against the Hendra and Nipah viruses using the soluble G-glycoproteins of the viruses combined with adjuvants. Hendra virus utilizes Ephrin B2 as its primary cellular receptors allowing it to infect the host cells.[1] Vaccination for the host and awareness related to the infection can reduce the impact of the disease. Strict adherence to the protocols related to veterinary can stop the spread of disease to extend.

KEYWORDS

• Hendra Hernipavirus • Nipah Virus • Flying Foxes • Horses • Humans • Hendra seasons • Vaccination • Reservoir • Host

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INTRODUCTION

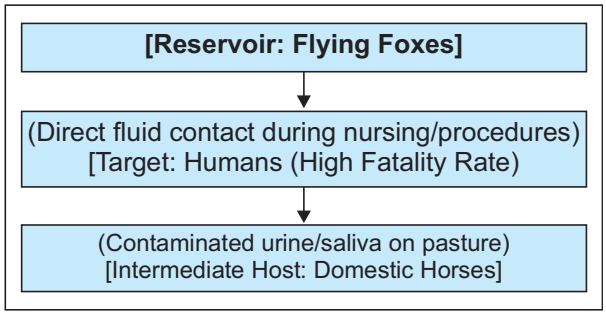
Discovered in September 1994 in the Brisbane suburb of Hendra, Australia, Hendra virus (originally termed "Equine morbillivirus") emerged following a severe outbreak of respiratory and neurological disease that claimed the lives of 13 horses and a prominent horse trainer.[2] Belonging to the genus *Henipavirus* alongside the closely related Nipah virus, HeV represents a critical biosecurity and public health challenge. The virus introduces a unique epidemiological chain: it resides asymptomatically in flying foxes, spills over into horses through environmental contamination, and poses a fatal occupational risk to veterinarians, stable hands, and horse handlers through direct contact with equine bodily fluids.[3] The identification of a new variant, **Hendra virus genotype 2 (HeV-g2)**, in 2021 highlights the evolving nature of this pathogen and underlines the necessity for continuous surveillance.[4]

- **In Flying Foxes:** Experimental infections demonstrate that bats develop viraemia and shed the virus in their saliva, urine, and faeces for approximately one week without showing visible signs of illness.[5]
- **In Horses:** The virus causes rapid clinical deterioration. Symptoms include pulmonary oedema, frothy nasal mucus, congestion, high temperature, rapid heart rate, and neurological signs like muscle spasms, uncoordinated gait, and head tilt.[6]
- **In Humans:** The incubation period ranges from 5 to 21 days. Symptoms begin with severe flu-like illness, dry cough, and breathing difficulties, which can progress to fatal complications such as **septic pneumonia** (severe lung tissue destruction) or **encephalitis** (severe brain inflammation leading to convulsions and coma).[7]

1. Transmission Pathways and Risk Factors

Epidemiological data indicates that **no direct bat-to-human** or **human-to-human** transmission has ever been documented. Instead, human infection relies entirely on horses acting as intermediate hosts.[8]

- **Bat-to-Horse:** Horses generally become infected by grazing beneath bat roosting sites, ingesting pasture, water, or masticated fruit contaminated with infected flying fox urine, faeces, or saliva.[9]
- **Horse-to-Human:** Transmission occurs during close contact (within 5 meters) with an infected horse's bodily fluids (nasal discharge, blood, saliva, or urine). Consequently, veterinarians, farriers, equine dentists, and horse owners are at the highest risk.



2. Ecological Drivers and "Hendra Season"

Outbreaks display a clear seasonal pattern, frequently peaking during the cooler months (May to October), often referred to as **"Hendra Season"**. Cooler temperatures and humidity favor the survival of the virus in the environment.[10]

Furthermore, recent research explicitly links an upsurge in **deforestation** in Australia to increased spillover events. The loss of native fruit trees places nutritional stress on bat populations, forcing them to relocate closer to agricultural lands and suburban paddocks, thereby increasing their contact with domestic horses.[11] This was particularly evident during the expanded outbreaks of 2011 and 2013.[12]

3. Prevention, Detection, and Treatment

Management of HeV relies on a multi-tiered management strategy:

Equine Vaccination: In November 2012, a commercial equine subunit vaccine composed of a soluble version of the G surface antigen was introduced. By breaking the transmission cycle from bats to horses, it effectively safeguards humans. The vaccine was registered by the APVMA in 2015 and approved for pregnant mares in 2016.[13]

Rapid Detection: Diagnostics include RT-PCR, ELISA, and virus isolation. Ongoing research into "stall-side" rapid testing focuses on utilizing antibody-conjugated magnetic particles and quantum dots for immediate field diagnosis.[14]

Human Therapeutics: There is no approved human vaccine or cure. While the antiviral drug ribavirin shows efficacy in laboratory settings, its clinical utility remains unproven. However, an **experimental monoclonal antibody drug**.[15] is in development in Australia as a post-exposure prophylactic treatment for individuals highly exposed to confirmed infected horses.

SUMMARY

Hendra virus is an endemic Australian zoonosis driven by ecological interactions between flying foxes, horses, and humans. Characterized by high case fatality rates exceeding 60% in affected populations, it targets the respiratory and central nervous systems. Spillover events are heavily influenced by seasonal weather conditions and nutritional stress caused by habitat loss. While equine vaccination serves as the primary barrier against human infection, the lack of approved human antivirals means that strict biosecurity, safety hygiene, and avoiding contact with sick horses remain the best defenses.

CONCLUSION

Hendra virus highlights the profound realities of One Health dynamics, where environmental degradation directly impacts public health. Deforestation forces reservoir populations into human-dominated landscapes, elevating spillover risks. Mitigating the threat of HeV requires a sustained commitment to horse vaccination programs, the preservation and restoration of native flying fox feeding habitats, and the continuous development of rapid diagnostic tools. Until a human vaccine or definitive cure is established, public awareness and strict adherence to veterinary biosecurity protocols are imperative to prevent future fatal outbreaks.

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