Horses, humans and Hendra virus

Hendra virus again demonstrated its zoonotic capacity with the infection of two veterinary clinic staff (one fatally) in an outbreak in a Brisbane equine referral veterinary practice in 2008. Bats are recognised as the natural host of the virus.

Hendra virus, a large, pleomorphic, enveloped, ribonucleic acid (RNA) virus, was initially considered a morbillivirus, but subsequent studies showed limited sequence homology with morbilliviruses, respiroviruses or rubuloviruses and negligible immunologic cross-reactivity with other paramyxoviruses. Thus, it and the subsequently identified Nipah virus (which shares >90% amino acid homology) were subsequently allotted to a new genus, Henipavirus, in the subfamily Paramyxovirinae.

Eleven attributed bat-to-horse spillover events have been identified since the first description of the virus in 1994; four of these have involved horse-to-human transmission, with a total of six people having been infected to date. Hendra virus has consistently demonstrated low infectivity but high case fatality in both horses (75%) and humans (50%). All human infections have occurred from direct contact with infected horses, so particular care and precautions are warranted for any persons interacting with confirmed or suspected equine cases. The potential risk posed by the latter was underlined in recent experimental studies at the CSIRO Australian Animal Health Laboratory (AAHL) that indicated horses may be infectious prior to the onset of clinical signs. Neither bat-to-human, nor human-to-human, transmission has been recorded.

Hendra virus causes a range of clinical signs in horses, a legacy of its affinity for endothelial cells. Pathogenesis stems from its specific tropism for vascular tissues. Sporadic equine cases continue to occur in eastern Australia, typically presenting as an acute febrile illness and rapidly progressing with variable system involvement, notably, but not exclusively, acute respiratory and/or severe neurologic disease. The predominant clinical presentation may reflect the most impacted organ system, which in turn, may reflect route of infection, viral dose, or virus strain (although the recent AAHL studies did not attach great significance to the latter).

Spillover of Hendra virus from bats to horses is a rare event, given a horse population in Australia estimated in excess of 200,000 and the substantial geographic overlap of the occurrence of flying foxes and horses. The lack of an effective treatment modality either for horses or humans, plus the absence of a protective vaccine for either, limits risk management to exposure minimisation, early detection and effective case biosecurity. Animal health authorities in Australia foster increased awareness, alertness and preparedness in the horse-owning and veterinary communities and encourage husbandry practices to minimise the risk of exposure of horses to flying foxes. Infection in the latter causes no evident disease and, based on serologic studies, is widespread, both taxonomically and geographically. The apparent recent emergence of Hendra virus (and a number of other novel agents) from flying foxes has been attributed to cumulative negative ecological impacts that have precipitated changes in population dynamics and infection dynamics. Less clear are the proximate triggers for spillover; those factors or circumstances that determine why spillover events occur in some years and not others, or at some times of year and not others. Plausibly, nutritional stress and reproductive stress have recently been reported to be associated with an increased risk of infection in flying foxes.

Minimising the risk of future bat-to-horse spillovers requires an understanding of the ecology of flying foxes, of virus infection dynamics in flying foxes and of the factors that promote spillover – the factors that create the ‘epidemiologic bridge’ from flying foxes to horses.

**Addendum:** In August 2009, a Central Queensland horse stud became the site of the 12th known spillover event. Multiple horses were infected, and a number of workers considered at high risk of exposure were given antiviral prophylaxis. Outcomes were unknown at the time of going to press.

**Under the Microscope**

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Hume Field is an internationally recognized authority on emerging infectious diseases associated with wildlife. He is a veterinary epidemiologist with particular experience in bat-associated EIDs, and in the design and implementation of wildlife surveillance programs. He played a key role in the identification of fruit bats as the natural hosts of Hendra virus in Australia and Nipah virus in Malaysia. He participated in two WHO missions investigating the origins of the SARS outbreak in 2003, and was part of the team that identified bats as the reservoir of a cluster of SARS-like coronaviruses in bats. He is employed by the Department of Primary Industries and Fisheries in Brisbane, Australia, and is a Visiting Professor of Zoonoses at The University of Malaysia, Sarawak.