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In practice

Outbreak-related Hendra virus infection in a NSW pet dog

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Key points

- Detection of Hendra virus (HeV) infection in a companion dog in July 2013 highlighted possible gaps in existing risk assessment and risk management procedures relating to potential exposure of domestic pets to HeV
- Since the June–July 2013 HeV outbreak, New South Wales Health and Department of Primary Industries HeV response protocols have been adapted to include more specific requirements for the safe management of companion animals
- Strict quarantine measures for all potentially exposed animals are warranted to reduce human exposure to HeV

Abstract

Hendra virus (HeV) infection is a zoonosis of importance in Australia. An outbreak of HeV occurred on the mid-north coast region of New South Wales (NSW) in June and July 2013. Four unvaccinated horses on four separate properties were confirmed to have HeV infection. A pet dog that had close contact with one of the horses was also confirmed to be infected with HeV. This paper documents the response to the canine infection and the resulting change to the public health management of HeV infection.

Introduction

Hendra virus (HeV), formerly known as equine morbillivirus, is a member of the genus *Henipavirus* in the family *Paramyxoviridae*.[1–4] Flying foxes (also known as fruit bats), are the natural reservoir for HeV.[1] HeV was first detected in September 1994 at horse stables in the Brisbane suburb of Hendra and resulted in 20 horses and two people becoming infected.[1,2,5,6] All known cases in humans (seven cases, including four deaths) and horses (91 cases, all either fatal or subsequently euthanased) have been confined to northeast New South Wales (NSW) and Queensland, Australia.[1,2,4–6] HeV infection attracts extensive media and public interest because of the high mortality rate in infected horses and humans.[1–8]

The exact route of transmission of HeV from bats to horses is unknown; however, horses are thought to contract HeV from contact with pasture or feed contaminated with body fluids, birthing products, excretions or spats (small compressed pieces of fruit spat out after the bat has extracted the juice) of infected bats.[1,2,4,6] Transmission between horses has mainly occurred in close contact situations where an uninfected horse is directly exposed to the infectious body fluids from an infected horse, or from contact with surfaces or equipment contaminated with infectious material.[1,2,4,6,8,9]

HeV infection in humans has only been reported after close contact with the respiratory secretions or blood from an infected horse.[1,2,4,6–10] Inconsistent use of personal protective equipment (PPE) was considered an important contributing factor in all human cases.[2,7,8] There has been no evidence of bat-to-person, person-to-person or person-to-horse transmission of HeV.[2,5,6]

There have, however, been two instances of suspected horse-to-dog transmission. The first occurred in Queensland in 2011, which was a subclinical infection in a dog on a HeV-quarantined farm that was detected by serology.[1,2,4,8,9] The second occurred in NSW in July 2013 in a pet dog on a property with an infected horse, during a HeV outbreak on the NSW mid-north coast. This paper describes the response to the second canine infection and the rationale for changes to the management protocols of HeV infection in both animals and humans.

Methods

In NSW, when a horse is confirmed to have HeV infection, a Local Lands Services (LLS) or NSW Department of Primary Industries (DPI) (authorities responsible for animal health) veterinarian is notified.[4,6,11,12] This leads to a cascade of actions, including notification to Health Protection NSW (HPNSW), the state body responsible for responding to human health aspects of communicable disease outbreaks.[6,11] If HeV infection is confirmed, an LLS veterinarian conducts investigations and risk assessments of all other animals that have potentially had contact with the infected horse or its excretions, and quarantines any potentially contaminated property or property that has potentially exposed animals.[4,11–14] The veterinarian also arranges blood and respiratory tract sampling of all potentially exposed animals at baseline, and at 12 and 20 days from the last possible date of exposure to the infectious horse.[4,9,11,13] Risk of exposure to HeV is assessed in all human contacts on the property by the local public health unit (PHU) and managed according to national guidelines.[2,6,8,11]

On receiving DPI advice of a confirmed infection in a pet dog, staff from HPNSW, the PHU, DPI and the LLS held a series of teleconferences to discuss how to assess and manage the immediate risk of infection to the dog's owners, and to revise guidance documents and procedures to reduce future HeV infection risk for pets on infected properties and the potential risk to their owners.

Results

NSW HeV outbreak, June–July 2013

The infection of a dog with HeV was in the context of an outbreak on the NSW mid-north coast region between 5 June and 8 July 2013, involving infection of four unvaccinated horses on four separate properties (Infected Property [IP]1, IP2, IP3 and IP4). IP1, IP2 and IP3 were within a 20-km radius of each other, and IP4 was approximately 70 km from the other three. All the human contacts identified in these four properties were assessed by the local PHU as having nil-to-moderate level of exposure risk from the infected horses, and were followed up according to national guidelines.[2] The property assessments indicated that the source of infection in all properties was likely to be flying foxes in flowering or fruiting trees found near or on the properties. Across the border, Queensland simultaneously had an outbreak of HeV involving two confirmed horse cases on unrelated properties.

Canine HeV infection case report

On 4 July 2013, a horse from IP2 developed an illness consistent with HeV, and was euthanased and buried the following day. Testing confirmed the diagnosis of HeV infection. Five human contacts were identified and were assessed by the PHU to have nil-to-moderate risk: two of the contacts – the owner and the attending private veterinarian – were assessed as having low-to-moderate exposure risk because they took blood samples from the infected horse without using PPE. They were advised by the PHU to monitor their health daily and to urgently report any symptoms. The LLS quarantined the property, tested and vaccinated two companion horses, and also baseline-tested two dogs on 6 July.

One of the two companion dogs from IP2 was a 4-year-old terrier, a family pet that spent most of its time in the house or in the immediate company of its owners. Despite routine advice provided by the LLS about quarantining animals on the property that had been potentially exposed to HeV, the dog continued to live closely with the owners. By day 13 of the quarantine period, the dog appeared to remain well, apart from an episode of sporadic yelping, possibly indicating pain or sensitisation.[15] A sample collected from the dog on 6 July (day 2 of quarantine – respiratory tract swab only) tested negative, but all samples (respiratory tract swabs and blood) collected on day 13 of quarantine tested positive for HeV.[15] The dog was subsequently euthanased in accordance with the National Biosecurity Policy.[4,11,13,15] A necropsy found evidence of HeV infection in several organs.[15]

Revision of human risk assessment

Once advised of the dog's HeV infection, the local PHU assessed the exposure risk of the dog's owners, their family and the two attending veterinarians. The exposure period was determined to be from the first negative HeV test to the receipt of the positive result.

The dog was a pet, not a working dog, and human contact was reported to be close and frequent, including extended periods on one owner's lap. Nevertheless, no incidents were identified of human mucous membrane or open wound exposure to the dog's blood or secretions during the exposure period, and the human exposure risk was assessed as low. No human contacts developed symptoms during the subsequent quarantine period, and all other animals on the property tested negative for HeV infection.

Revision of NSW HeV protocols

Following discussion during the interagency teleconferences, NSW Health and DPI HeV response protocols have been adapted to include more specific requirements for the safe management of companion animals.[11–14,15] Under the new requirements, companion animals that have been potentially exposed to the virus from a sick horse or confirmed HeV-infected case on a property must be isolated.[11] For example, dogs are to be held in a secure yard or tied up, and cats are to be confined to a cage or a secure area, such as a garage or shed.[11] Only a limited number of adults should have contact with the quarantined companion animals and only for the purpose of performing essential animal welfare tasks.[11–14] Strict PPE is also required when performing the tasks.[9,11,13,14,15,21]

Because there was no existing risk assessment tool for human contacts of infected companion animals, the PHU developed an assessment tool as part of the incident response. The tool includes assessment of the character of the animal (e.g. the dog's habits), type of contact (including pets sleeping outside or inside with humans, type of play), frequency of contact, habits of the owners following potential exposure to the animal's secretions and disposal of excreta, handwashing frequency and whether this is habitual, grazes to hands, licks to the face (especially the mouth or mucous membranes and, if licked on the lips, whether there were any open lesions), use of PPE and whether the animal had been effectively quarantined.

Discussion

Experimentally, several other mammalian species (such as African green monkeys, guinea pigs, cats, hamsters, ferrets and pigs) have developed clinical disease after being inoculated with HeV.[1,2,4,9,17,18] Other animals (such as mice, chickens, rats, rabbits and dogs) do not appear to develop clinical disease after experimental inoculation, but rabbits, dogs and rats develop a neutralising antibody response.[1,9,17,18] The necropsy findings in this case indicate that canine infection can be more extensive than indicated by previous experimental studies, suggesting that more research on canine HeV is required to understand this risk.

Cats appear to develop clinical disease similar to that in horses and humans.[1,17,18] HeV can be isolated in the lung, spleen, kidney, brain, rectum, trachea, bladder, heart muscle, liver, lymph nodes, pleural fluid, urine and blood of infected cats.[17,18] Transmission study data also showed cat-to-cat transmission from sharing a cage, and cat-to-horse transmission, but not horse-to-cat transmission.[1,4,9,19] Experimental data from pigs have raised the possibility of other animals serving as additional spillover hosts from flying foxes.[1,16]

This case is the second dog reported to be naturally infected with HeV. Confirmation of active multiorgan infection via a necropsy has highlighted the potential human health risk from infected companion animals. The first HeV-infected dog from Queensland in 2011 tested positive for neutralising antibodies to HeV (indicating exposure to HeV) but was clinically asymptomatic.[4,8,9] That dog was euthanased, but was not necropsied or further studied.[20] The presence of active infection at necropsy in the second HeV-infected dog highlighted gaps in risk assessment and risk management procedures relating to potential infection of domestic pets. These gaps have subsequently been addressed.

Although this incident confirms that spillover of HeV infection to animals other than horses can occur in a nonexperimental setting, it does not suggest that dogs can be infected with HeV directly from flying foxes. The source of infection of the dog remains unknown. However, it is likely that the amplification of viral load that occurs in the horse may increase the potential for transmission to dogs. This risk may be increased by the habit of some dogs to ingest waste products of other animals.[10,17,18]

Conclusion

Given the high mortality of HeV infection and lack of specific treatment available, strict quarantine measures for all potentially exposed animals are warranted to reduce human exposure to HeV. The occurrence of HeV infection in horses should start to decrease with the availability of the HeV vaccine for horses, but, in the interim, collaboration between animal and human health authorities with a robust and adaptive outbreak investigation response process remains essential.

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Competing interests

None declared

Author contributions

SH was responsible for the design, drafting, analysis of information and editing of the manuscript. BP was responsible for the design, drafting, and editing of the manuscript. GB was responsible for the drafting and editing of the manuscript. DvdB was responsible for the drafting and editing of the manuscript. VS was responsible for the reviewing and editing of the manuscript.

References

1. Mahalingam S, Herrero LJ, Playford EG, Spann K, Herring B, Rolph MS, et al. Hendra virus: an emerging paramyxovirus in Australia. Lancet Infect Dis. 2012;12(10):799–807.
2. Communicable Disease Network Australia. Hendra virus: CDNA national guidelines for public health units. Canberra: Commonwealth of Australia; 2011 [cited 2013 Aug 29]. Available from: www.health.gov.au/internet/main/publishing.nsf/Content/0E7D7BF4F17C1A96CA257BF0001CBF10/$File/Hendra-nov11.pdf
3. Van der Kolk JH, Kroeze EJB. Infectious diseases of the horse. London: Manson Publishing Ltd; 2013.
4. Animal Health Australia. Australian Veterinary Emergency Plan. AUSVETPLAN response policy brief: Hendra virus infection. Version 3.5. Canberra: Commonwealth of Australia, 2013 [cited 2014 Apr 11]. Available from: www.animalhealthaustralia.com.au/wp-content/uploads/2011/04/Hendra-17-FINAL22Jul13.pdf
5. Department of Agriculture and Fisheries. Hendra Virus. Brisbane: Queensland Government; c2010–2015 [cited 2013 Sep 2]. Available from: www.daff.qld.gov.au/animal-industries/animal-health-and-diseases/a-z-list/hendra-virus
6. Isabel MRH, Massey PD, Walker B, Middleton DJ, Wright TM. Hendra virus: what do we know? NSW Public Health Bull. 2011;22(5–6);118–22.
7. Playford EG, McCall B, Smith G, Slinko V, Allen G, Smith I, et al. Human Hendra virus encephalitis associated with equine outbreak, Australia, 2008. Emerg Infect Dis. 2010;16(2):219–23.
8. Queensland Health. Hendra virus infection. Brisbane: Queensland Government; c1996–2015 [cited 2015 Aug 12]. Available from: www.health.qld.gov.au/cdcg/index/hendra.asp
9. Department of Agriculture, Fisheries and Forestry. Guidelines for veterinarians handling potential Hendra virus infection in horses. Version 5.1. Brisbane: Queensland Government; 2013 [cited 2014 May 12]. Available from: www.daff.qld.gov.au/__data/assets/pdf_file/0005/126770/2913_-Guidelines-for-veterinarians-handling-potential-Hendra-virus-infection-in-horses-V5.1.pdf
10. Westbury HA. Hendra virus disease in horses. Rev Sci Tech. 2000;19(1):151–9.
11. Department of Primary Industries. Response to Hendra virus infection in animals. Sydney: NSW Government; 2013 [cited 2014 May 12]. Available from: www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/489093/Response-to-hendra-virus-infection-in-animals.pdf
12. Department of Primary Industries and Livestock Health and Pest Authorities. Hendra virus. Sydney: NSW Government; 2013 [cited 2014 Jul 25]. Available from: http://www.industry.nsw.gov.au/__data/assets/pdf_file/0016/74041/Policy-Hendra-Virus.pdf
13. Department of Primary Industries. Hendra virus – managing operations on quarantined properties. Sydney: NSW Government; 2013 [cited 2014 July 25]. Available from: www.dpi.nsw.gov.au/__data/assets/pdf_file/0012/499692/Procedure-Hendra-managing-operations-on-quarantined-premises.pdf
14. Department of Primary Industries. Hendra virus – WHS risk assessment. Sydney: NSW Government; 2013 [cited 2014 Jul 25]. Available from: www.dpi.nsw.gov.au/__data/assets/pdf_file/0014/504311/hendra-virus-whs-risk-assessment.pdf
15. Department of Primary Industries. Hendra virus – investigating suspect cases. Sydney: NSW Government; 2013 [cited 2014 Jul 25]. Available from: www.dpi.nsw.gov.au/__data/assets/pdf_file/0010/494407/Hendra-virus-investigating-suspect-cases.pdf
16. Department of Primary Industries. CVO bulletin to NSW veterinarians. Sydney: NSW Government: 2013 August 14 [cited 2013 Aug 29]. Available from: www.dpi.nsw.gov.au/__data/assets/pdf_file/0007/474307/CVOBulletin_20130819_Hendra.pdf
17. Dhondt KP, Horvat B. Henipavirus infections: lessons from animal models. Pathogens. 2013:2;264–87.
18. Williamson MM, Torres-Valez FJ. Henipavirus: a review of laboratory animal pathology. Vet Pathol. 2010;47(5):871–80.
19. Williamson MM, Hooper PT, Selleck PW, Gleeson LJ, Daniels PW, Westbury, Murray PK. Transmission studies of Hendra virus (equine morbillivirus) in fruit bats, horses, cats. Aus Vet J. 1998;76(12):813–8.
20. Macdonald A. Fearon family make heartbreaking decision to have Dusty the dog destroyed after he tested positive to Hendra antibodies. The Courier Mail. 2011 Aug 1 [cited 2013 Aug 29]. Available from: http://www.couriermail.com.au/news/queensland/fearon-family-make-heartbreaking-decision-to-have-dusty-the-dog-destroyed-after-he-tested-positive-to-hendra-antibodies/story-e6freoof-1226105461468
21. Department of Primary Industries. Hendra virus – personal protective equipment (PPE) and decontamination procedures for property owners. Sydney: NSW Government; 2013 [cited 2014 July 25]. Available from: www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/494202/Hendra-virus-ppe-procedures.pdf