Hendra Virus Infection in Animal Workers: An Occupational Health Perspective

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Abstract

The aim of this review was to examine the available literature on equine animal workers' exposure to Hendra Virus. The review focused on the adequacy of current infection control measures and the work culture surrounding Hendra virus protective measures. Peer-reviewed journal articles paired with Australian government-issued guides and fact sheets were used to highlight Hendra virus as a serious workplace health hazard to equine animal workers. This is due largely to the Hendra virus's ability to be transmitted to humans while infected horses are asymptomatic combined with the virus's high mortality rate. Hendra virus poses a low public health risk given its low morbidity rate but is of high significance to animal workers given that five out of a total of seven human cases has been within this subset of workers. Animal workers often fail to recognise the significance of Hendra virus exposure and the dangers involved and accept sub-optimal workplace infection control measures as being adequate. A trend toward better infection control measures within workplaces to protect animal workers from Hendra virus has begun to be observed, however further improvements are still necessary.

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Introduction

Animal workers such as veterinarians and veterinary nurses are routinely faced with zoonotic diseases capable of transferring from animals to humans. As one of Australia's most serious emerging zoonotic diseases, Hendra virus (HeV) poses a great health and safety risk to animal workers and ensuring their protection from HeV exposure is of the utmost priority, particularly within Queensland and Northern New South Wales (Workplace Health and Safety Queensland, 2015). HeV, which is restricted to Australia, was first reported in 1994 when two virtually simultaneous yet unrelated instances were discovered in horses in Mackay in Northern Queensland and the Brisbane suburb of Hendra (Broder, 2012; Ksiazek, Rota & Rollin, 2011). Infections have been reported in horses as far north as Cairns, Queensland, as west of the coast as Chinchilla, Queensland, and as south as Kempsey, New South Wales, (Ball et al., 2014; Clayton, Wang & Marsh, 2013). Fifty spillover events of HeV have occurred in horses (the latest occurring in June 2014) with a total of 83 HeV confirmed equine cases resulting in a fatality or euthanasia and an additional four HeV-suspected horses being euthanised (Mendez et al., 2014; State of Queensland, Department of Agriculture, Fisheries and Forestry, 2013). Since 1994, a total of seven human cases have been confirmed (the latest occurring in July 2009) with five of those cases occurring in animal workers (Playford et al., 2010; State of Queensland, Department of Agriculture, Fisheries and Forestry, 2013). Three of the animal worker cases proved fatal (two veterinarians and a veterinary nurse), with a total of four HeV fatalities occurring to date (Playford et al., 2010; State of Queensland, Department of Agriculture, Fisheries and Forestry, 2013). The relatively high number of infected animal workers indicates that these occupations are most at risk of HeV contraction, compelling us as occupational health and safety professionals to investigate the root cause of the issue. Through this review, the relationship between HeV and animal workers, the adequacy of current infection control measures and the work culture surrounding HeV protective practices will be evaluated, culminating in a discussion focused toward the future recommended management of HeV. This review is specifically relevant to animal workers within Queensland

and Northern New South Wales given their increased risk of HeV due to the current distribution of the disease. Peer-reviewed journal articles paired with Australian government-issued guides and fact sheets will be used to critically explore the main themes, trends and arguments that surround this issue.

Background

The virus was initially named equine morbillivirus (EMV) before an extensive serological study of the Queensland equine population conducted by Ward et al. in 1996 determined that horses were not the original source of HeV. The study found that there were no detectable antibodies to the virus from over 2000 equine subjects, essentially eliminating horses as the putative reservoir (Ksiazek, Rota & Rollin, 2011; Ward et al., 1996). This indicated that a different animal species must act as the HeV reservoir. In response to this study, criteria were developed and employed to narrow the search for a potential host species before it was hypothesised that pteropid bats (commonly known as flying foxes) may be responsible (Clayton, Wang & Marsh, 2013). It was indeed confirmed in a study in 2000 by Halpin, Young, Field & Mackenzie that four mainland Australian flying fox species hosted the same HeV isolates as those obtained from the horses and humans infected in 1994 (Clayton, Wang & Marsh, 2013). While the exact mechanism of HeV transmission from pteropid bats to horses is unknown, it is suspected that the ingestion of pastures, feed or water contaminated with urine, faeces, placental tissues, birthing membranes or aborted bat fetuses are the most likely routes (Clayton, Wang & Marsh, 2013; Field et al., 2010). From horses, HeV can be transmitted to humans through contact with infected equine blood, saliva or respiratory secretions (Field et al., 2010). Playfield et al. in 2010 received a detailed exposure history of two animal workers that had been infected with HeV as a part of their case study, and it was estimated that the likely incubation period of HeV within humans is 9-16 days, longer than had previously been stated throughout the literature (Douglas, Baldock & Black, 1997; Mendez, Judd & Speare, 2013). This is corroborated by studies that have examined equine HeV and have noted similar incubation periods (5-16 days) as Playford et al. (Field & Kung, 2011; Ksiazek, Rota & Rollin, 2011). It currently seems unlikely that human to human transmission of HeV can occur (Playford et al., 2010; Wong & Ong, 2011).

The predominant post-HeV exposure treatment to date is the broad antiviral drug Ribavirin, however its effectiveness is often scrutinised and its use in experimental animal models has shown no to little therapeutic benefit (Broder, 2012; Field & Kung, 2011). A HeV vaccine specifically used for horses has been available since November 2012 and is currently the most effective strategy for preventing flying fox to horse and horse to human HeV transmission (Mendez, Büttner & Speare, 2013;).

Health Effects

HeV is a paramyxovirus of the Henipavirus genus that can produce severe health effects and has a high mortality rate (57%) in humans (Biosecurity Queensland, 2013). Although the mortality rate of HeV is high, its morbidity rate is extremely low given that only 7 cases have been confirmed since 1994 (Biosecurity Queensland, 2013, Ksiazek, Rota & Rollin, 2011). The symptoms associated with HeV can range from mild through to life threating. Headache, drowsiness and fever are mild symptoms that have been connected to HeV (Wong & Ong, 2011). Beyond these symptoms, HeV can present in two distinct ways, either neurologically or as a pulmonary syndrome (Playford et al., 2010; Wong & Ong, 2011). The neurological symptoms often present as confusion, motor deficits and seizures (Field et al., 2010; Playford et al., 2010). Influenza-like illness, hypoxemia and diffuse alveolar shadowing in chest X-Rays are the most indicative symptoms of the pulmonary syndrome associated with HeV (Field et al., 2010; Wong & Ong, 2011). It should be remarked that the pathology of HeV in humans is still debatable given the relatively low number of cases thus far. Field et al. explored the issue in their 2010 review in which five horses from a HeV outbreak in Brisbane displayed neurological features (which were novel at the time). It was theorised that the viral dose and route of infection could greatly determine the symptoms that are exhibited (Field et al., 2010). It was alternatively theorised that the presence of both neurological and respiratory symptoms may simply indicate the broad spectrum of possible symptoms a HeV infection may manifest into (Field et al., 2010). While Field et al. focused their review on equine HeV, it is possible that the same logic can be employed to explain the variation in symptoms seen in human cases.

Infection Controls:

Apart from the vaccination of horses, implementing infection control measures is the most reliable means for ensuring animal workers are protected within their workplace from being exposed and potentially infected with HeV. As outlined in the Office of the Queensland Parliamentary Counsel's 2011 "Work Health and Safety Act", it is the general duty of a Person Conducting a Business or Undertaking (PCBU) to, so far as is reasonably

practicable, provide a working environment without risks to health and safety. Therefore, it is not only good practice but also a legal requirement to introduce and maintain infection control measures to protect the health and safety of animal worker employees.

The first step to ensuring HeV exposure is controlled is to develop an equine HeV veterinary practice plan that outlines the standard protocols for dealing with potential HeV cases (Attard et al., 2012; Biosecurity Queensland, 2015). A standard equine plan ensures that animal workers within a practice are informed about the safest route of action should HeV be suspected or diagnosed within a horse and aids in preventing their exposure (Biosecurity Queensland, 2015). The first key component of an equine veterinary practice plan includes a decision as to whether potential equine HeV cases will be accepted at the practice (State of Queensland, Department of Agriculture, Fisheries and Forestry, 2013). The plan should further include details on a triage system that is to be used to help identify HeV risk factors while booking equine consultations (Attard et al., 2012; Biosecurity Queensland, 2015). Information on the appropriate methods for dealing with an equine HeV case and dealing with suspected transmission of HeV from horse to human should be included within the plan (Mendez, Judd & Speare, 2012; State of Queensland, Department of Agriculture, Fisheries and Forestry, 2013). Additionally, entry and exit procedures to be used when dealing with suspected equine HeV cases should be listed (Workplace Health and Safety Queensland, 2015).

Safe workplace protocols should be developed that are to be followed when coming into contact with horses regardless of their perceived infectious state (Mendez et al., 2014). It should be standard procedure to routinely conduct a HeV risk assessment before coming in contact with a horse, to wash hands before and after contact with horses and between contact with different horses, to cover all cuts and abrasions with water-resistant dressings, to handle, transport, store and dispose all equine related items in a safe and appropriate manner and to wear appropriate PPE at all times (Attard et al., 2012; Biosecurity Queensland, 2015; Mendez et al., 2014). Every animal worker should be trained in the correct use of both the equine HeV veterinary practice plan and the safe workplace protocols that are in place. Recurrent education for all animal workers on the risks of HeV and the importance of following infection control measures should be conducted.

PPE such as gloves, safety eyewear, gowns and P2 half-face disposable particulate respirator should be worn by animal workers as a minimum when in contact with horses (Biosecurity Queensland, 2015; Workplace Health and Safety Queensland, 2015). PPE that offer a protective barrier such as face shields, P2 particulate respirator masks (as a minimum, powered air purifying respirators (PAPR) may be required), protective overalls, nitrile gloves and rubber boots should be used for procedures and situations where an increased exposure to HeV is possible (Attard et al., 2012; Biosecurity Queensland, 2015).

Discussion

Examination of the literature highlights several trends and attitudes that have been developed by animal workers toward HeV. Animal workers that regularly come in contact with horses are faced with a real risk of HeV infection. Playford et al. in their 2010 case study describe an outbreak that occurred in 2008 in a veterinary clinic in Thornlands, Queensland, in which a male equine veterinarian (33-years-old) and a female veterinary nurse (21-years-old) were infected with HeV. It was indicated that transmission of HeV most likely occurred while the animal workers performed a nasal cavity lavage of a horse that was late in its HeV incubation period. An incubation period is the time it takes from the initial infection event until the infected individual beings to demonstrate symptoms of the disease (Ksiazek, Rota & Rollin, 2011). This highlights a serious health hazard, as HeV transmission may occur while horses are asymptomatic and animal workers are not aware of their potential for HeV exposure (Field & Kung, 2011; Playford et al., 2010).

While the risk for HeV infection exists, the implementation and correct use of the previously detailed control measures allows for a significant decrease in the danger associated with equine work. However, some studies suggest that this is not a stance commonly shared by the majority of animal workers, who tend to perceive their risk of HeV infection to be quite high (Dowd et al., 2013; Mendez, Judd & Speare, 2012). Dowd et al. conducted a study in 2013 that engaged 344 veterinarians to complete a questionnaire pertaining to their risk perceptions toward all zoonotic diseases. It was reported that 40–60% of veterinarians perceived their exposure to a zoonotic disease to be either likely or very likely throughout a variety of situations (Dowd et al., 2013). While this study does not specifically question the participants in regards to equine practice of HeV, it does offer useful insight on the subject. The perceived risk for HeV is specifically explored in a 2012 study by Mendez, Judd & Speare in which 21 veterinarians and allied staff from 14 equine and mixed private veterinary practices between Cairns and Brisbane, Queensland, were subjected to in-depth face-to-face interviews. The interviews asked a series of open-ended questions in an attempt to identify workplace health and safety issues for equine practice due to

HeV (Mendez, Judd & Speare, 2012). It was discovered that 22% of veterinarians had chosen to cease equine practice and that 44% knew of at least one colleague who had ceased equine practice in the past 12 months. It was specified that fears for personal safety were often reported as being a major contributing factor for ceasing practice (Mendez, Judd & Speare, 2012). It should be noted that this study occurred prior to the 2012 introduction of the HeV vaccine for horses and a follow-up study would need to be conducted to determine if animal worker perceived risk of HeV has decreased.

The five animal worker cases of HeV all occurred before July 2009, indicating that infection control measures for HeV prior to 2009 were sub-optimal. Additionally, the absence of HeV cases since 2009 likely indicates that an increase in the implementation and use of infection controls within veterinary practices has occurred since this time. In a 2014 study conducted by Mendez et al. the adequacy of control measures prior to 2009 was explored. Most participants agreed that they were initially reluctant to introduce infection control strategies when HeV first emerged, as it required a significant shift in their work culture (Mendez et al., 2014). Participants reported that they failed to recognise the significance of HeV exposure and the danger involved and therefore felt that the sub-optimal control measures that were in place were in fact adequate (Mendez et al., 2014). It was determined that it was not until HeV had fully emerged and animal workers were educated on its potential as a health hazard that a shift began to occur (Mendez et al., 2014). It was further found that by 2010, all participants described using some form of PPE and infection control measures to reduce HeV exposure (Mendez et al., 2014). Mendez et al. did identify that participants still felt that further improvements in the use of infection controls were necessary. This is corroborated by the study conducted by Dowd et al. that not only analysed animal workers perceived risk perceptions toward zoonotic diseases, but additionally their use of necessary PPE. Reported PPE use was compared with current national industry guidelines and it was deemed that the use of PPE was less than "adequate" for majority of participants (Dowd et al, 2013). It was additionally stated that no PPE was used by 60-70% of animal workers when treating equine neurological and respiratory cases (Dowd et al, 2013). Cases of a neurological or respiratory nature could be due to HeV infection and using no PPE would dramatically increase the potential for transmission (Dowd et al, 2013).

Conclusion

After reviewing the literature, it has become clear that problems exist regarding the management of HeV exposure by animal workers in Queensland and Northern New South Wales. While HeV may pose a low public health risk, it is of high significance to the health of animal workers. Therefore, it is important to have a plan for the future control of HeV transmission. While a shift in work culture toward the improved use of infection control measures has already begun, it is important to facilitate this shift as much as possible. A potential facilitator to change may be the introduction of standardised legislation that specifies a requirement for adequate infection control measures and outlines safe work practices that should be followed by equine animal workers. A stronger emphasis should be placed on education programs targeted to both current and future animal workers that inform of the control measures and work protocols that need to be introduced to enable safe equine practice. Further research into veterinary infection control needs to occur to increase the effectiveness of controlling HeV. Research should also be directed at investigating animal worker attitudes toward infection control practices, particularly post the introduction of the equine HeV vaccine. Furthermore, research should be devoted to monitoring the work culture of equine animal workers so as to avoid sub-optimal work practices being developed.

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