

**HENDRA VIRUS**



*“Mares and Foals in a Landscape”, oil on canvas, Romantic Period; George Stubbs, 1763-68, Tate Gallery London.*

*Today it is difficult to imagine the horror that the Aztecs felt at the close of the Fifteenth century. Supreme in their confidence of empire over all, they were suddenly confronted with a terrifying alien invasion from the sea. Arriving en masse in fantastic sea going vessels, they laid violent and devastating siege to Montezuma’s lands. Their silver skin seemed impervious to their weapons, arrows harmlessly bouncing off them. They could kill at will at many meters away with a loud cracking device that when heard meant that one of their warriors instantly fell dead to the ground. Many of the Aztecs became ill and started dying from mysterious diseases, never before seen; at first in their hundreds, then in their thousands. Most terrifying of all however was the very nature of the invaders themselves, who spoke in an incomprehensible tongue. First reports told of demonic creatures, emerging from their immense ships, half man, half four-legged beast. Armageddon had come to the Aztecs.*

*The Aztecs of Montezuma’s day had never before seen a horse; but the incredible thing about their terror of the Spanish Conquistadors, mounted on their horses, was that their own far distant ancestors would have held no fear of the horse at all! To them the*

*horse was simply another large animal to be hunted for food! They hunted so efficiently in fact that the wild horse in the New World became extinct, along with many other large mammals, around 10,000 years ago. While humans of the Old World learnt to live with the horse, domesticate it and use it to their advantage, those of the New World, simply exploited a valuable resource to the point of extinction - perhaps a lesson to us today of the vital importance of preserving the biodiversity of our planet - the inability to see value in a fellow creature of nature today, does not negate the possibility of the development of profound importance at some future date! Once a species is extinct we lose forever a trove of untold millions of years of nature's genetic secrets. Secrets that could in some ways have the utmost importance to us in the future in ways that today we have not the slightest comprehension.*

*The horse is an ancient mammal. It evolved from a herbivore no larger than a medium sized dog, known as a Hyracotherium, (previously known by the far more aesthetic name of Eohippus - the "Dawn Horse") sometime in the Eocene period, around 54 million years ago. It was so successful it spread in vast number across the Old World as well as the New. The earliest hunter-gather humans, living constantly on the verge of extinction, hunted the wild horse as a valuable source of food, as is evidenced by prehistoric cave paintings in France and in Spain, as well as the remains of butchered wild horses that have been found at Neolithic archeological sites. Over the eons the horse evolved to become bigger, stronger and partly by losing its toes to a single hoof, much faster. About 4 million years ago, in the Pleistocene period we see the first evidence of the modern species of horse, *Equus ferus caballus*. Around 10,000 years ago humans changed from a hunter gather society to a settled agrarian one. Then around the fourth millennium BC we find the first evidence for the domestication of the horse on the steppes of central Asia, in current day Kazakhstan. This was a region of vast herds of wild horses, which humans hunted. We know the process of domestication began here from the remains of horses morphologically distinct from the typical wild type. They were being bred to make them even larger and stronger. From a periodic source of food, the domesticated horse, became an insurance policy for food in lean times, as well as being used for its hide and its milk. Later it was incorporated into the work of agriculture as a beast of burden, greatly increasing the productivity of the land and helping to fuel explosive human population increases.*

*It is not known exactly, but around 2000 - 3000 B.C it was realized that with some training horses could be mounted and ridden. The earliest astonished witnesses to a mounted rider on a horse, were probably the ancient source of the legends of the centaur. As history sadly long confirms any new advance is quickly adapted to warfare where possible, and this is precisely what happened in the case of the horse. The central Asian tribesmen essentially became nomadic pastoralists. The horse gave them unprecedented maneuverability and speed in warfare, a point not lost on the Macedonians, but only slowly taken up by the Romans. Empires could now arise by the fact of the ability to use the horse as a means of mass transport and of long distance communication. The technical advances of the saddle and the stirrup so essential to efficient riding actually occurred relatively late, the saddle first appearing in the in the Second century AD and the stirrup in the Third century AD in China. The age long conflict between the nomadic pastoralists and the settled agrarian communities would culminate in the early Fourteenth century with the rise of the Mongol empire that stretched from China to Poland. An empire built on the back of the horse. In the middle ages the armored knights*

*made their appearance, and it would require an animal of immense strength to carry them, and here again the horse was ideally suited. With the development of gunpowder in the late Middle Ages, the horse lost some of its strategic value in warfare, no better demonstrated than in the infamous charge of the Light Brigade, at Balaclava during the Crimean War, with well over half the brigade lost to a withering barrage of Russian artillery. Yet the horse persisted as an important part of the transport of heavy artillery, right up until the time of the First World War, where it still played a significant role in the massed armies of the day. Indeed the last great cavalry charge in warfare was by the Australian Light Horse at Beersheba (in modern day Israel) on 31 October 1917. Although the Battle of Beersheba was won against the Ottomans, by the end of the war, the horse had largely had its day in warfare. It was rendered obsolete by automatic weapons, artillery and mechanized transport.*

*By this time however the horse had gained an elite status in many human societies. The ownership of a horse had become a symbol of high status. No longer was it abused simply as a beast of burden, of transport, or in warfare, but increasingly it was appreciated in pursuits of leisure. Riding for its own sake, became popular, but above all in sport in the form of racing and for high stakes gambling - the “sport of kings”. The horse from the time of the Renaissance became increasingly recognized for its magnificent beauty which was celebrated in great works of art, in particular by the animal artist George Stubbs. By the Eighteenth century, individual horses could reach local celebrity status, such as the Marquis of Rockingham’s racehorse, Whistlejacket, painted by Stubbs. By the Twentieth Century the racehorse could reach national cult status; the great Australian racer Phar Lap being the prime example; and in the 21st century international renown is seen in the magnificent Australian mare, Black Caviar, the fastest horse on the planet. It is difficult to overestimate the importance of the horse as one of the most crucial animals of domestication that drove the evolution of human civilizations. Humanity’s long association with this animal, unfortunately is primarily*

*one of exploitation, although this is much less so today. Unfortunately one medical consequence of the close association with horses today is seen in the deadly Hendra virus. Fortunately however, we maintain our close relationship with the horse knowing that an equine vaccine has recently been developed.*



*“Whistlejacket”, oil on canvas, George Stubbs, c.1762; said to be one of the finest scientifically accurate depictions of a horse ever painted.*

## HENDRA VIRUS

### Introduction

**Hendra virus** is a relatively recently recognized zoonotic viral disease.

It is thought to have emerged from fruit bats in Australia.

**Horses** however seem to be the intermediary host most commonly associated with human infections.

Hendra virus infection should be suspected in someone with **close association with (sick) horses or bats** who presents acutely with:

- An influenza type illness
- A pneumonia
- An encephalitis.

### Epidemiology

#### Australia:

- The first described outbreak of Hendra virus infection occurred in the Brisbane suburb of Hendra in 1994.

This outbreak involved 21 horses (14 fatal cases) and two of their human handlers (one fatal case).

- A smaller outbreak occurred in 1995 which involved two horses and a farmer (who died) from the far northern Queensland town of Mackay.
- So far in Australia the disease has only be detected in Queensland (as of February 2012).

#### New Guinea:

The Hendra virus has also been detected in Papua New Guinea.

### Organism

- The Hendra virus is an RNA virus of the Paramyxoviridae family

It is closely related to the Nipah virus seen in Malaysia, which is also thought to have originated in fruit bats.

## Reservoir

- Fruit bats (*Pteropus* species) are the primary reservoir for the Hendra virus.
  - ♥ The bats appear to be *asymptomatic carriers*.
  - ♥ A 20% seropositive rate to Hendra virus has been found among *Pteropus* bats in Queensland.
- Horses are the most likely *intermediary host* in human infection .

Some other species however, such as cats, have shown serological evidence of exposure to the Hendra virus.



*Australian fruit bats (Pteropus species).*<sup>3</sup>

## Transmission

- The mode of transmission is essentially unknown, although a respiratory route seems most likely.
- Human infection has been most commonly associated with direct contact with infected horses.
- Symptomatic infections have also been documented in cats and some other animals.

- The virus has been isolated from the urine of infected bats and other infected animals.

### Incubation Period

- This can vary from 4 to 18 days and rarely up to three months.

### Period of communicability

- There has been to date no documented case of person to person transmission.

### Susceptibility and resistance

- This is essentially unknown.
- Wildlife workers who frequently come in to contact with Australian bats have only very low seropositive rates.

### Clinical Features

Hendra virus infection should be suspected in someone with **close association with (sick) horses or bats** who presents acutely with:

- An “influenza type” illness:

In other words, non-specific “constitutional” symptoms are seen:

- ♥ Fever
- ♥ Nausea/ anorexia
- ♥ Headache
- ♥ Lethargy/ malaise
- ♥ Myalgias.

- A pneumonia:

Here non-specific symptoms are seen in association with symptoms more directly related to the lower respiratory tract:

- ♥ Tachypnoea/ respiratory distress
- ♥ Lowered SaO<sub>2</sub>
- ♥ Cough
- ♥ Dyspnoea

- ♥ Chest pain.
- An encephalitis:
  - These cases may include:
    - ♥ Significant headache
    - ♥ Nausea and vomiting
    - ♥ Confusion
    - ♥ Altered conscious state/ coma
    - ♥ Seizures
    - ♥ Neck stiffness.

Two of the three recorded cases of Hendra virus in humans in Australia were fatal. One death was due to pneumonia while the other was due to encephalitis.

### Investigations

Diagnosis is be made by the detection of specific neutralising:

- IgM antibodies (acute infection).
- IgG antibodies (recent or past infection).

Testing is currently available through the CSIRO Australian Animal Health Laboratory at Geelong.

The diagnosis can also be confirmed by virus isolation from infected tissues.

### Management

There is no specific treatment for Hendra virus infection, and so management is currently supportive.

One uncontrolled trial of the antiviral drug ribavirin has suggested it may reduce the mortality in (the closely related) Nipah virus encephalitis.

Expert treatment advice should be sought from an infectious diseases physician.

### Vaccination

- An Equine vaccine (killed) became available in Australia in November 2012.

- There is no vaccine currently available for humans, and so horse vaccination is critically important in preventing any secondary human infection.

*Notification:*

- Notification is not currently required however any new case of emerging infections should always be discussed with the Department of Health as a matter of urgency.

*School exclusion*

- School exclusion is not required.

*Patient Information Resource:*

- <http://www.hendravirus.org/>



*Plaster casts of the fossilized skeletons of Hyracotherium (previously known as the Eohippus or “Dawn Horse”) and Merychippus compared to an original modern Equus specimen. The evolutionary story of the horse is demonstrated (from right to left), including the tremendous increase in size of the Equine line, as well as the progressive reduction in the number of toes. The Hyracotherium, (arose about 54 million years ago) had four toes on its front legs (and three on its hind). The Miohippus (arose about 30 million years ago) had three toes, a central large toe and two lateral smaller ones. The Merychippus, (arose about 20 million years ago) had three toes, but the two lateral ones had become greatly foreshortened and only touched the ground during running. The Pliohippus, (arose about 12 million years) had three toes, but by this period, the two lateral toes had become mere vestiges. This was the first truly hoofed horse. Finally (on the far left) is the modern horse, Equus, with a single toe only designed for pure speed. There is no vestige of any other toe. Interestingly however, there are occasional instances of modern horses being born with two, but very small, lateral toes - a faint echo of their 54 million year old evolutionary history.*

*This fascinating display was presented at an exhibition on Charles Darwin and the Theory of Evolution at the Natural History Museum, San Diego, in 2010.*



*Phar Lap wins the 1930 Melbourne Cup*



*The preserved hide, heart and skeleton of the legendary racehorse, Phar Lap, (Museum Victoria Exhibition, Melbourne).*

## References

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