

Nipah virus

Abstract

Nipah virus infection is a deadly zoonotic disease caused by a Paramyxovirus. Outbreak with this virus first occurred in pigs and humans in Malaysia and Singapore between September 1998 to April 1999. This outbreak not only caused tremendous fear and panic but also caused huge economic loss to the Malaysian government as close to 1.1 million pigs had to be culled to control the outbreak. The disease continues to occur in India and Bangladesh only in human and pig are not involved in these outbreaks. Fruit bats of genus *Pteropus* are supposed to be natural hosts of the virus. The virus is now known to exist in various fruit bats of genus other than *Pteropus* both in Asia and Africa.

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Introduction

Nipah virus (NiV) infection is an emerging zoonotic disease of public health importance especially in countries of South East Asia. Infection with this virus was described for the first time in 1998-1999 during an outbreak of encephalitis and respiratory illness among pig farmers in Malaysia and Singapore.¹ In this outbreak NiV caused a self-limiting and mild disease in pig but in human beings it caused fatal encephalitis in more than 250 humans and claimed over 100 human lives. The Malaysian outbreak was controlled by killing more than one million pigs which caused huge economic loss to the people of Malaysia. This outbreak also caused tremendous fear and panic in Malaysia. Ever since this outbreak no case has so far been reported in Malaysia and Singapore but NiV cases continue to occur in India and Bangladesh.

Etiology

Nipah virus is an RNA virus belonging to the genus *Henipavirus* of the family *Paramyxoviridae*. This genus also contains *Hendra virus* which was discovered in 1994 in Australia where it caused infection in horses (Table 1). The *Nipah virus* gets its name from a village in Malaysia called Sungai *Nipah*, where the virus was first isolated and identified in pig farmers who suffered with fatal encephalitis and respiratory illness.

Table 1 Types of viruses

BOX: 1

Genus: *Henipavirus*

Nipah Virus

Cedar virus

Hendra virus

Reservoir of virus

Fruit bats of genus *Pteropus* are the natural reservoirs of NiV. *Pteropus* bats are also called flying foxes and they eat fruits and flowers. In Malaysia, *Nipah virus* has been isolated from urine, faces,

saliva and partially eaten fruits which have been contaminated by the saliva of bats.² The introduction of *nipah virus* into pig in Malaysia was due to the practice of having large fruit orchards in close proximity to the piggery. The transmission occurred when domesticated pigs ingested the bat's secretion which fell in the piggery or ingested the infected fruits which were partially eaten by the bats. The fruit bats are migratory and this has led to a wide geographic distribution of this virus. In India NiV RNA was detected in *Pteropus giganteus* from Myanagiri, West Bengal during a bat survey.³ The Indian flying fox (Figure 1) is also called the greater Indian fruit bat and it feeds mainly on mangoes and bananas.



Figure 1 Indian flying fox (*Pteropus giganteus*).

Mode of transmission

Animal to human

During the outbreak of NiV infection in Malaysia (1998-1999) and Singapore, animal to human transmission was first noted. Direct contact with infected pig was identified as the predominant mode of transmission.⁴ The pig farmers were mainly affected by encephalitis and this outbreak claimed more than hundred lives. It was also found that the pigs in these farmers were coughing loudly.

Human to human

Person to person transmission can occur as a result of close direct contact and this has been seen in outbreaks in Bangladesh and India. During January and February 2001, an outbreak of encephalitis occurred in Siliguri, West Bengal, and India.⁵ In this outbreak there was evidence of person to person transmission; this was best illustrated by clustering of almost 32 cases which included hospitalized patients, family contacts of the patients and medical staffs. Person to person transmission was also noted during 2004 *Nipah virus* outbreak in Faridpur in Bangladesh. In 2001 outbreak which occurred in India and Bangladesh, no intermediate vector was found between bats and humans. It was later discovered that the virus was directly transmitted to human due to consumption of date palm sap in Bangladesh. The date palm sap must have been contaminated by urine or saliva of bats. Date palm sap is a popular drink in Bangladesh and is harvested by making a cut in the trunk of the tree and collecting its sap which runs down into a clay pot. In order to prevent transmission of *Nipah virus*, the pot used for collecting palm sap should be covered by a jute skirt.

Clinical manifestation

NiV infection causes two types of clinical syndrome both in human and pigs. One is a neurological syndrome manifested as encephalitis and the other is a respiratory syndrome manifested as flu-like illness.

Infection in humans

Incubation period: The incubation period of *Nipah virus* ranges from 4 to 14 days in humans. The onset is usually with influenza-like symptoms and then the disease may proceed to encephalitis about 50% of the cases who develop encephalitis usually die.⁶

Infection in human may present with a wide range of clinical presentations ranging from asymptomatic infection to acute respiratory distress and fatal encephalitis. Lungs and central nervous system are mainly involved and symptoms can be divided into following two groups

- I. Respiratory involvement
- II. Central nervous system (CNS) involvement

Respiratory symptoms: Patient may develop acute influenza-like syndrome and complaint of fever, headache, myalgia and sore throat. Some patients may develop pneumonia and acute respiratory distress. Some patients may develop vomiting and dizziness.

CNS systems

The prodromal influenza-like syndrome is followed by encephalitis where in the patient may develop altered sensorium, drowsiness, seizure, signs of brain stem dysfunction and coma. Patients with *Nipah virus* encephalitis may also develop segmental myoclonus, ataxia and autonomic dysfunction and presence of these findings

helps it to differentiate from Japanese encephalitis. The occurrence of segmental myoclonus indicates focal involvement of neurons in the brain stem and upper cervical spinal cord.

Laboratory diagnosis

Nipah virus infection in human beings can be diagnosed by:

- A. Virus isolation
- B. Serological tests
- C. RT-PCR

Virus isolation: In human being virus can be isolated from blood, urine, throat or nasal swabs and cerebrospinal fluid. In patients who have died due to *Nipah Virus* infection, viral antigens can be detected in tissues by immunohistochemistry.

Serological tests: Serological tests include ELISA to detect Ig M or Ig G antibodies against *Nipah virus*. These serological tests can be conducted in both serum and CSF. A rising titre of IgM antibody in patients is usually diagnostic.

RT-PCR (Reverse transcriptase - Polymerase Chain Reaction): RT-PCR can be used to detect viral sequences in CSF, urine samples and throat swabs.^{7,8}

NiV has been classified as Bio Security Level IV (BSL) pathogen and so all the samples should be handled with appropriate bio security precautions. In India testing facility is available at National Institute of Virology, Pune.

Other imaging investigations

In the outbreak that occurred in Singapore, MRI of the brain showed discrete high signal intensity lesions in the cortical and deep white matter. In some patients brain stem and corpus callosum was also involved. MRI is an important investigation because it helps to distinguish *Nipah virus* encephalitis from Japanese encephalitis. In Japanese encephalitis, it is the thalamus and basal ganglia which are primarily involved.⁹

Treatment

Treatment is entirely supportive. Patients with severe respiratory and neurological complications should be admitted in intensive care unit as some of them might need mechanical ventilation. Chong et al suggested that Ribavirin was able to reduce mortality of encephalitis due to NiV but efficacy of this drug is considered to be uncertain.¹⁰

Control and prevention

Since there is no specific anti-viral therapy for *Nipah virus* and the mortality with nipah encephalitis is very high so prevention against this infection remains the only reliable option. In Malaysia and Singapore, pig was the intermediate host of *Nipah virus* infection and so the Singapore government stopped pig export from Malaysia and the Malaysian government controlled the spread of the disease by killing more than one million pigs. And since then, no outbreak has occurred in these two countries. But then outbreaks continue to occur both in Bangladesh and India. Some of the preventive measures that should be followed are as under:

- a. Infected animals should never be used for cooking.
- b. Instead should be slaughtered as was done in Malaysia. In Malaysia all sero-positive pigs were subjected to mass culling.

- c. Fruits that have been contaminated by bats should never be fed to livestock.
- d. Fruit should be washed and peeled before eating.
- e. Date palm sap should be boiled or pasteurized before consumption as this inactivates *Nipah Virus*.¹¹

Prevention through vaccination

Future research to tackle the human and animal outbreaks of *Nipah virus* infection shall focus on the following three areas

- A. Prevention through vaccination
- B. Prevention through modifying risk factors
- C. Development of newer therapeutic agents to treat *Nipah virus* infection in both human and animals

Prevention through vaccination will include not only vaccination for humans but also animals especially pigs and horses. Therefore scientists all over the world especially in south Asian countries are focusing on developing vaccine which is capable of giving protection against *Nipah virus* infection.¹²

Conclusion

Nipah virus is a zoonotic paramyxovirus that can cause lethal infection both in animals as well as in human beings. The virus gets its name from a Malaysian village Sungai Nipah where the virus was first isolated during an outbreak in pig and pig farmers in 1999. In human being the virus infects two major organs namely lung and brain. The disease can manifest either as acute respiratory syndrome or encephalitis or both. The encephalitic syndrome presents with fever, seizure, head ache, drowsiness, disorientation, coma and death. *Nipah virus* infection can be diagnosed by virus isolation (from blood, throat swab, nasal swab, CSF, urine) Serology and RT-PCR. Treatment is entirely supportive. Ribavirin appears to reduce mortality due to encephalitis the symptoms of nausea, vomiting and seizures in some outbreaks but clinical usefulness of ribavirin remains uncertain. Internationally *Nipah virus* has been classified as Bio security Level (BSL-IV) agents and so people who come in close contact with infected animals or human should wear protect clothing, impermeable glove, mask, boot and goggles. Establishing appropriate surveillance system is absolutely essential so that *Nipah virus* outbreak can be detected and controlled at the earliest.

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None.

Conflict of interest

The author has no conflicts of interests in this work.

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