

Review Article

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## Nipah virus – An overview

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### ABSTRACT

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The emergence of Nipah virus (NiV) were noticed in the last decade of the twentieth century. It has been observed that, it can infect a wide range of species and human-to-human transmission also occurs. The majority of bat species for which there is evidence of Nipah virus infection belong to the group known as the old world family of fruit and nectar feeding bats. An outbreak of fatal human encephalitis during 1998 and 1999 was attributed to a newly recognized paramyxovirus acquired from swine. Pigs, people who were predominantly pig farmers, dogs, and cats were infected. This article discuss about the overview of Nipah virus and its epidemiology.

### Introduction

Nipah virus (NiV) is a member of the genus Henipavirus (HNV; family Paramyxoviridae) that causes acute and severe respiratory illness and encephalitis in humans (Escaffre *et al.*, 2013). Rockx *et al.*, (2012) reported that several outbreaks of NiV have been identified in Malaysia, Singapore, Bangladesh and India since 1998. No new outbreaks have been reported in Malaysia and Singapore since 1999 (WHO).

Their unique genetic constitution, high virulence and wide host range set them apart from other paramyxoviruses. These features led to their classification into the new genus

Henipavirus within the family *Paramyxoviridae* and to their designation as Biosafety Level 4 pathogens (Eaton *et al.*, 2006).

NiV was first recognized in Bangladesh in 2001 and nearly annual outbreaks have occurred in that country since, with disease also identified periodically in eastern India.

Other regions may be at risk for NiV infection, as serologic evidence for NiV has been found in the known natural reservoir (Pteropus bat species) and several other bat species in a number of countries, including Cambodia, Thailand, Indonesia, Madagascar, Ghana and the Philippines (WHO).

## **Transmission**

Fruit bats (Pteropodidae family, Suborder Megachiroptera) have been identified as the reservoir for HNV (Young *et al.*, 1996). Infected bats primarily shed HNV via the urinary route and can infect humans through involvement of intermediate amplification hosts such as horses (HeV) and pigs (Escaffret *et al.*, 2013).

Transmission is believed to be through contact with respiratory secretions or aerosols, as the virus can be isolated from throat swabs (Chua *et al.*, 2001).

WHO reports that limited human to human transmission of NiV has also been reported among family and care givers of infected NiV patients. During the later outbreaks in Bangladesh and India, Nipah virus spread directly from human-to-human through close contact with people's secretions and excretions. In Siliguri, India, transmission of the virus was also reported within a health-care setting (nosocomial), where 75% of cases occurred among hospital staff or visitors. From 2001 to 2008, around half of reported cases in Bangladesh were due to human-to-human transmission through providing care to infected patients.

An E-article published in express by Rachel (2018) reported that, in 2004, residents in Bangladesh also caught the infections after they ate contaminated fruits or consumed products such as raw date palm juice that were contaminated by saliva or urine of infected fruit bats.

## **Infection in pigs**

When Nipah virus was first identified in Kampung Sungai Nipah, Malaysia in 1998, the pigs were the intermediate hosts during that outbreak. Around 1.1 million pigs had to

be killed to control the outbreak. However, it is not necessary to have an intermediate host during Nipah Virus outbreak.

Pigs, people who were predominantly pig farmers, dogs, and cats were infected. Although illness resulted in the other species, the disease in pigs was self-limiting and, in some cases, subclinical (Greene, 2012).

An E-article was published in Business Standard (2018) stated that, in India, Nipah Virus affected the humans without any involvement of pigs. The first outbreak was observed in Siliguri, West Bengal in 2001. The second incident also emerged in Nadia district in West Bengal in 2007.

OIE reported that, Nipah Virus in pigs affects the respiratory and nervous systems. It is known as porcine respiratory and neurologic syndrome, porcine respiratory and encephalitic syndrome (PRES), and barking pig syndrome (BPS). It is a highly contagious disease in pigs; however the clinical signs vary depending on the age and the individual animal's response to the virus. In general, mortality (death due to the disease) is low except in piglets. However, morbidity (illness from the disease) is high in all age groups.

## **Infection in dogs and cats**

The role of dogs or cats as secondary sources of infection could not be excluded. Results of serosurveys of feral cats in endemic areas suggest that transmission between bats and cats may be uncommon. Cats are more likely than dogs to develop illness from these infections. Respiratory and neurologic disease was observed in the cats, and virus was found in secretions of the oropharynx and excreted in urine. The virus causes a widespread vasculitis in many organs, especially the respiratory tract and CNS. Eosinophilic, predominantly cytoplasmic, inclusions are

seen within neurons. Pulmonary lesions are giant cell pneumonia, and the secretions and tissues contain large amounts of virus.

Transplacental infection also occurs in pregnant cats with resultant infection of kittens. Experimental subunit vaccines containing soluble glycoprotein G of either Hendra or Nipah virus protected cats against subsequent challenge with virulent Nipah virus (Greene, 2012).

Dogs were suspected of being reservoirs of infection during the epidemic in people in Malaysia of febrile encephalitis caused by Nipah virus. The infected dogs were acting as dead-end hosts; infection did not spread in the absence of the infected pigs that had been depopulated (Greene, 2012).

### **Infection in human**

Human infection was attributed to close contact with pigs. Nipah virus infection in humans causes a range of clinical presentations, from asymptomatic infection (subclinical) to acute respiratory infection and fatal encephalitis (WHO).

As per WHO report, the symptoms of Nipah virus infection in Human range from asymptomatic infection, acute respiratory infection (mild, severe), and fatal encephalitis.

Infected people initially develop influenza-like symptoms of fever, headaches, myalgia (muscle pain), vomiting and sore throat. This can be followed by dizziness, drowsiness, altered consciousness, and neurological signs that indicate acute encephalitis. Some people can also experience atypical pneumonia and severe respiratory problems, including acute respiratory distress. Encephalitis and seizures occur in severe cases, progressing to coma within 24 to 48 hours.

Escaffre *et al.*, (2013) reported that, the respiratory epithelium is an important first line of defense and actively involved in inflammation and host defense against infectious diseases.

Patients with symptomatic respiratory tract infections were significantly more likely to transmit NiV (Homaira *et al.*, 2010).

During the late stages of disease, virus replication spreads from the respiratory epithelium to the endothelium in the lungs (Rockx *et al.*, 2011). He also stated that, HNV infection of the CNS and the development of neurological signs are associated with the disruption of the blood-brain barrier (BBB) and expression of TNF- $\alpha$  and IL-1 $\beta$ .

### **Diagnosis**

As per Centers for Disease Control and Prevention (CDC) (2014), the laboratory diagnosis of a patient with a clinical history of NiV can be made during the acute and convalescent phases of the disease by using a combination of tests. Virus isolation attempts and real time polymerase chain reaction (RT-PCR) from throat and nasal swabs, cerebrospinal fluid, urine, and blood should be performed in the early stages of disease. Antibody detection by ELISA (IgG and IgM) can be used later on. In fatal cases, immunohistochemistry on tissues collected during autopsy may be the only way to confirm a diagnosis.

### **Treatment and vaccine**

According to CDC (2014) the treatment is limited to supportive care. Because Nipah virus encephalitis can be transmitted person-to-person, standard infection control practices and proper barrier nursing techniques are important in preventing hospital-acquired infections (nosocomial transmission).

Ribavirin is a guanosine analogue and broad spectrum nucleoside antimetabolite antiviral drug which features on the WHO Essential medicines list. An inhalation solution of ribavirin is also indicated for the treatment, in young children, of severe lower respiratory tract infections due to respiratory syncytial virus, another paramyxovirus. Currently, there are no vaccines available against Nipah virus.

### **Prevention and control**

Nipah virus infection can be prevented by avoiding exposure to sick pigs and bats in endemic areas. Prevention and control measures focus on immediate eradication by mass culling of infected and in-contact pigs and on antibody surveillance of high risk farms to prevent future outbreaks. Routine and thorough cleaning and disinfection of pig farms may be effective in preventing infection.

WHO recommends, if an outbreak is suspected, the animal premises should be quarantined immediately. Culling of infected animals – with close supervision of burial or incineration of carcasses – may be necessary to reduce the risk of transmission to people. Restricting or banning the movement of animals from infected farms to other areas can reduce the spread of the disease.

In the absence of a licensed vaccine, the only way to reduce infection in people is by raising awareness of the risk factors and educating people about the measures they can take to reduce exposure to and decrease infection from NiV.

Since fruits bats are the primary cause of Nipah virus infection, people who have domestic animals or have farm animals should prevent the animals from eating fruits contaminated by bats. Consumption of contaminated date palm sap including toddy

should also be avoided. Physical barriers can be erected in order to prevent fruit bats from accessing and contaminating palm sap.

In conclusion, the article focuses on the available data pertaining to NiV epidemiology, diagnostics, as well as vaccines, therapeutics and other methods for prevention and control. Nipah is one of fifth diseases considered as in urgent need of R&D attention in the revised priority list of pathogens issued by WHO in February 2018 – second annual review (<http://www.who.int/blueprint/priority-diseases/en/>).

Nipah is a zoonotic disease. As its reservoir, the Pteropus bat, has a flying range that can cover huge areas, the risk of further spread of the disease is perceived as very high. Research is needed to better understand the ecology of bats and Nipah virus. At last establishing or reinforcing surveillance systems is of utmost importance to ensure that NiV outbreaks can be detected quickly and appropriate control measures promptly initiated.

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