**Directorate of Public Health and Preventive Medicine**

# Prevention and Control of Nipah Virus (NiV) infection in Humans

## Introduction

Nipah virus (NiV) is a member of the family Paramyxoviridae, genus Henipavirus. NiV was initially isolated and identified in 1999 during an outbreak of encephalitis and respiratory illness among pig farmers and people with close contact with pigs in Malaysia and Singapore.

Its name originated from Sungai Nipah, a village in the Malaysian Peninsula where pig farmers became ill with encephalitis. Given the relatedness of NiV to Hendra virus, bat species were quickly singled out for investigation and flying foxes (a type of bats commonly known as fruit bats) of the genus Pteropus were subsequently identified as the reservoir for NiV.

In the 1999 outbreak, Nipah virus caused a relatively mild disease in pigs, but nearly 300 human cases with over 100 deaths were reported. In order to stop the outbreak, more than a million pigs were euthanized, causing tremendous trade loss for Malaysia. Since this outbreak, no subsequent cases (in neither swine nor humans) have been reported in either Malaysia or Singapore.

In 2001, NiV was again identified as the causative agent in an outbreak of human disease occurring in Bangladesh. Genetic sequencing confirmed this virus as Nipah virus, but a strain different from the one identified in 1999.

In the same year, another outbreak was identified retrospectively in Siliguri, India with reports of person-to-person transmission in hospital settings (nosocomial transmission). Unlike the Malaysian NiV outbreak, outbreaks occur almost annually in Bangladesh and have been reported several times in India.

**Transmission**

- Nipah Virus is a zoonotic disease.
- Transmission of Nipah virus to humans may occur after direct contact with infected bats, infected pigs, or from other NiV infected people.

Fruit bats, also known as 'flying foxes,' of the genus Pteropus are natural reservoir hosts of the Nipah and Hendra viruses. The virus is present in bat urine and potentially, bat faeces, saliva, and birthing fluids. Fruits contaminated with bat secretions may potentially transmit the infection.

Perhaps as a result of deforestation programmes, the Malaysian pig farms where the disease first originated had fruit trees which attracted the bats from the tropical forest, thus exposing domestic pigs to bat urine and faeces. It is thought that these excretions and secretions initiated the infection in pigs which was then followed by a rapid spread through intensively reared pigs. Furthermore, transmission between farms may be due to fomites – or carrying the virus on clothing, equipment, boots, vehicles, etc.

In Malaysia and Singapore, humans were apparently infected with Nipah virus only through close contact with infected pigs. The NiV strain identified in this outbreak appeared to have been transmitted initially from bats to pigs, with subsequent spread within pig populations. Incidental human infections resulted after exposure to infected pigs. No occurrence of person-to-person transmission was reported in this outbreak.

Conversely, person-to-person transmission of Nipah virus in Bangladesh and India is regularly reported. This is most commonly seen in the family and caregivers of Nipah virus-infected patients.

Transmission also occurs from direct exposure to infected bats. A common example is consumption of raw date palm sap or coconut/palm tree sap contaminated with infectious bat excretions/secretions.

**Risk of Exposure**

- In the Malaysia and Singapore outbreak, Nipah virus infection was associated with close contact with Nipah virus-infected pigs.
- In Bangladesh and India, exposure has been linked to consumption of raw date palm sap or coconut/palm tree sap contaminated with bat excrement, or climbing trees coated in bat excrement, or contact with bats. It is also attributed to eating of fruits contaminated by bat secretions.
- Importantly, human-to-human transmission has been documented and exposure to other Nipah virus infected individuals is also a risk factor.

**Signs and Symptoms**

Typically the human infection presents as an encephalitic syndrome marked by fever, headache, drowsiness, disorientation, mental confusion, coma, and potentially death.

- After exposure and an incubation period of 5 to 14 days, illness presents with 3-14 days of fever and headache, followed by drowsiness, disorientation and mental confusion.
- These signs and symptoms can progress to coma within 24-48 hours.
- Some patients have a respiratory illness during the early part of their infections, and half of the patients showing severe neurological signs showed also pulmonary signs.
- Long-term sequelae following Nipah virus infection have been noted, including persistent convulsions and personality changes.
- Latent infections with subsequent reactivation of Nipah virus and death have also been reported months and even years after exposure.

During 1998-99 outbreak, 265 patients were infected with the Nipah virus. About 40% of those patients who entered hospitals with serious nervous disease died from the illness. With intensive ICU care mortality can be reduced significantly.

**Differential diagnosis of Nipah virus, Japanese encephalitis and Herpes Simplex Encephalitis**

| Characteristics | Nipah virus | Japanese encephalitis | Herpes Simplex encephalitis |
|---|---|---|---|
| **Agent** | Nipah virus (Paramyxovirus family) | JBE virus (RNA, Flavivirus) | HSV |
| **Incubation Period** | Median 10 days (range :2-21 days ) | 1-6 days, max. 14 days | 2-12 days, mean 4 days |
| **Transmission** | Drinking raw date palm sap, human-to-human, (close physical contact with Nipah case), animal (pig) to man | Culex mosquito (vector), human-to- human not reported | Human-human, respiratory, droplet |
| **Site of involvement** | Cortico-subcortical areas of cerebrum /cerebellum, brain stem | Thalamus, cortex, cerebellum, AHC | Fronto-temporal area |
| **Clinical feature** | Fever, headache, altered sensorium but specially associated with segmental myoclonus & respiratory involvement | Fever, headache, altered sensorium (100%) followed by convulsions and meningeal sign, abnormal movements | Same as JE but typically associated with a constellation of frontotemporal features with aphasia or mutism, personality change, and focal or generalized seizures |
| **Serology / PCR** | IgM /IgG (ELISA),PCR | Ag /Ab in blood /CSF | CSF PCR for HSV DNA is diagnostic |
| **CSF** | Pleocytosis (10-60 cells /mm3), , Protein (30- 60 mg/L), Normal glucose | Pleocytosis (10-980´106/L) , Protein (900mg/L), Normal glucose | Lymphocytic pleiocytosis (typically 10–200 cells/ mm3), normal glucose, and increased protein (0.6 to 6 g/l). Red blood cells and xanthochromia may be present |

**Treatment**

- Symptomatic and Supportive care is the mainstay of treatment for Nipah virus infection.
- 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).

**Laboratory diagnosis**

- 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.

**Prevention**

- Nipah virus infection can be prevented by avoiding exposure to sick pigs in endemic areas.
- Fruits and vegetables should be thoroughly washed before eating.
- Fruits bitten by bats or birds should not be eaten.
- Additional efforts focused on surveillance of Acute Encephalitis Syndrome (AES), Influenza like Illness (ILI) and Acute Febrile Illness is found to be very useful in early detection of cases.
- Close co-ordination with animal husbandry, forest department and wild life officials.
- Awareness will help prevent future outbreaks.

- Surveillance tools should also include reliable laboratory assays for early detection of disease in communities and livestock, and raising awareness of transmission and symptoms is important in reinforcing standard infection control practices to avoid human-to-human infections in hospital settings (nosocomial transmission).
- Precautions should also be taken when submitting and handling laboratory samples, as well as in slaughterhouses.
- Hand hygiene, Personal Protective Equipment (PPE) practices should be meticulously followed
- Early health seeking and clinical care are essential for early detection and better care.
- To the extent possible the microbiological cause of AES should be fixed by appropriate laboratory tests.

**References**


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