



SPOTLIGHT ON NIPAH VIRUS: AN IN-DEPTH REVIEW

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ABSTRACT Summary Nipah virus (NiV) is a contagious and hazardous zoonotic virus that belongs to the Paramyxoviridae family. First recognized in 1999 during an outbreak in Malaysia, Nipah virus primarily infects both animals and humans. Fruit bats, particularly the Pteropus genus, serve as the natural reservoir for Nipah virus. Other animals like pigs can also become infected. Human infections usually occur through direct contact with infected bats, eating of contaminated food or fruits, or close contact with infected pigs. In severe cases, it can lead to encephalitis (brain inflammation) and respiratory problems. The mortality rate can be high, ranging from 40% to 75% during outbreaks. Nipah virus outbreaks have primarily occurred in South and Southeast Asia, with the most remarkable outbreaks in Malaysia, Singapore, Bangladesh, and India. There is no definite antiviral treatment for Nipah virus infection, so prevention and control measures are critical. Nipah virus is considered as a global health threat due to its high mortality rate, person-to-person transmission, and the lack of specific treatment. It is classified under Biosafety Level 4 (BSL-4) agent, representing its high potential for causing severe disease and the need for proper containment measures.

KEYWORDS : Paramyxoviridae family, encephalitis, human-to-human transmission, pharyngitis, biosafety level (BSL).

The Nipah virus

Nipah virus (NiV) is a highly pathogenic zoonotic virus that has drawn considerable attention in the field of infectious diseases due to its potential for causing severe outbreaks in humans. First acknowledged in Malaysia in 1999, Nipah virus belongs to the Paramyxoviridae family. Nipah virus is an enveloped, single-stranded RNA virus characterized by its distinct genetic makeup. It is classified into two main genotypes, Malaysia and Bangladesh, each with specific outbreaks and varying clinical presentations. To know the genetic diversity and evolution of the virus is vital for tracking and responding to outbreaks. The two strains are roughly 92% identical on sequencing but they differ in their pathogenicity and the way they transmit

measures, and public health awareness campaigns.

- Kerala experienced outbreaks of Nipah virus in this year with 5 infected people and two deaths.

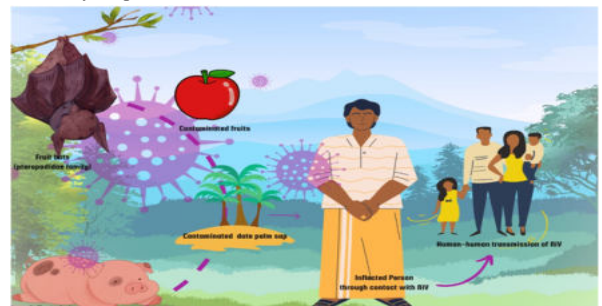
Transmission and Risk Factors

- The spread of Nipah virus in Kerala is believed to be due to the consumption of contaminated date palm sap, which can be infected by fruit bats, the natural reservoir of the virus.
- In Addition, human-to-human transmission has also occurred during few outbreaks, above all in healthcare settings, raising concerns about wider transmission.

Human-to-human transmission is through respiratory secretions and a close personal contact, making it a worry during outbreaks. Changes in their habitat, behaviour, or patterns of migration can bring them into nearer contact with humans and domestic animals, increasing the risk of virus wild spread.

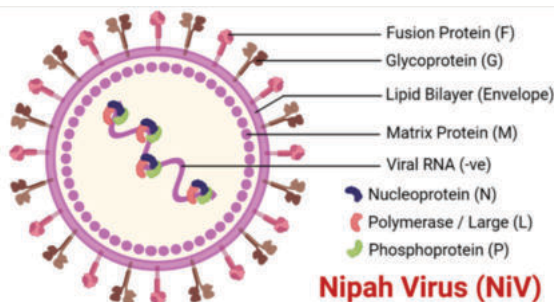
Factors that show impact on pig farming practices, such as changes in transportation, or trade, can have likelihood of virus transmission to humans.

Cultural practices related to the eating of bat-derived foods, such as bat meat or raw date palm sap, play a key role in virus transmission. Finding out these practices and encouraging safe alternatives is necessary for prevention.



Clinical manifestations

Nipah virus infection had a range of symptoms, including fever, headache, dizziness, drowsiness, and confusion. In more severe cases, it can also lead to encephalitis (brain inflammation) and a chance of



BACKGROUND

- Nipah virus was first acknowledged in Malaysia in 1999 but has since been reported in several countries in South and Southeast Asia, also India.
- Kerala, a state in southwestern India, has experienced numerous outbreaks of Nipah virus in recent years, holding attention from public health authorities and the media.

Outbreaks in Kerala

Nipah virus (NiV) has been a cause for concern in the Indian state of Kerala, sudden outbreaks and health responses.

- Kerala experienced its first outbreak of Nipah virus in May 2018. The outbreak originated in the Kozhikode and Malappuram districts.
- During this outbreak, they noticed cases of acute encephalitis, and several people lost their lives.
- The state government, in support with national health agencies, started a rapid response to contain the outbreak, quarantine

experiencing respiratory problems. The mortality rate can be as high as 40% to 75% during outbreaks.

Signs and symptoms of Nipah virus infection can vary widely in according to severity and presentation. The below is a general overview of clinical manifestations with approximate percentages of occurrence which is based on previous outbreak data. Note that these percentages can vary from one outbreak to another.

Fever (100%): almost all Nipah virus-infected individuals experience fever, which is often the First symptom.

Headache (70-100%): Headache is a general symptom and is one of the early signs of infection.

Dizziness (50-70%): Many cases show evidences of dizziness or lightheadedness.

Altered Mental State (40-92%): Encephalitis, characterized by disturbance consciousness, confusion, disorientation, and sometimes seizures, can occur in a few number of cases.

Cough (20-75%): Cough and difficulty breathing, may develop as the infection progresses.

Nausea and Vomiting (20-60%): In few cases gastrointestinal symptoms such as nausea and vomiting persist.

Myalgia (20-50%): Muscle pain and weakness are often seen in some patients.

Sore Throat (10-40%): Pharyngitis is seen in minor cases.

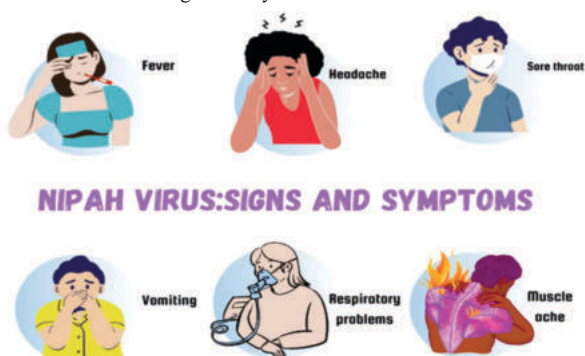
Seizures (10-30%): Seizures with encephalitis can occur in small number of patients.

Coma (20-30%): Severe cases of infection can lead to a coma, which may be lead to death.

Respiratory Distress (20-30%): In few severe cases, respiratory distress may lead to respiratory failure.

Death (40-75%): The overall case fatal outcome rate for Nipah virus infection varies but can be high, with mortality rates often more than 40% and, in few outbreaks, reaching up to 75%.

The clinical course of Nipah virus infection can increase rapidly, with individuals initially with mild symptoms that can lead to severe encephalitis or respiratory distress and even death. Early finding, isolation, and necessary medical care are important for optimal outcomes and reducing mortality.



Diagnosis

The diagnosis of Nipah virus (NiV) infection involves a grouping of epidemiological investigation, clinical evaluation and laboratory testing. timely and precise diagnosis is crucial for the prompt management of cases and the prevention of further transmission. Here are the vital components of diagnosing Nipah virus infection:

Clinical Evaluation:

Healthcare providers should think Nipah virus infection in the differential diagnosis of patients presenting with acute febrile illness, headache, encephalitis, or respiratory symptoms, particularly in locations with a history of Nipah virus outbreaks.

Patient History and Epidemiological Investigation:

Collecting information about the patient's recent travel and being exposed to potential sources of infection, such as making contact with bats or consumption of date palm sap which is infected, is crucial. Epidemiological investigation helps identify potential clusters of cases and identify the source of infection.

Laboratory Testing:

Laboratory confirmation of Nipah virus infection typically involves the following tests:

a. Real-Time Reverse Transcription Polymerase Chain Reaction (RT-PCR):

RT-PCR is the most important diagnostic test for Nipah virus. It detects viral RNA in clinical specimens, such as blood, cerebrospinal fluid (CSF), throat swabs, or respiratory secretions.

RT-PCR is highly precise and can provide rapid results, allowing for timely diagnosis.

b. Serology:

Blood samples are tested for the presence of antibodies against Nipah virus. This helps confirm presence of infection or determine immune status.

An ascend in antibody levels between acute and convalescent samples can point out an active infection.

Imaging Studies:

CT scans or MRI, may help to sort out encephalitis and other neurological abnormalities.

Biosafety Precautions:

To detect Nipah virus infection every diagnostic test should be conducted under appropriate biosafety level (BSL) containment conditions (usually BSL-4).

Case Notification and Reporting:

Assumed or confirmed cases of Nipah virus infection must be immediately reported to local health agency and appropriate international health organizations to facilitate outbreak response and control measures.

Differential Diagnosis:

Nipah virus infection shares clinical manifestation with other viral illnesses, including other encephalitides, influenza, and other respiratory viruses. Differential diagnosis is key to rule out other main causes of illness

Treatment and Vaccination

- Current research efforts in Kerala and India are spotlighted on understanding the virus in clear and developing vaccines and treatment alternatives to mitigate its impact.
- In September 2021, there was no approved vaccine for Nipah virus, but research was actively ongoing to treat infection. Clinical trials are going on mRNA based vaccine. The Nipah Virus Vaccine (PHV02) is a live, attenuated, recombinant vesicular stomatitis virus (rVSV) vector vaccine candidate that expresses the glycoprotein of the Nipah virus and the Ebola virus glycoprotein, which is required for receptor-mediated viral entry. The primary approach to control Nipah virus infection involves supportive care and infection control measures. Here are the key aspects of Nipah virus treatment:

Supportive Care:

Patients with suspected or diagnosed with Nipah virus infection often require exhaustive medical support. This includes maintaining hydration, treating fever and pain, and to give respiratory support if necessary.

Optimal supportive care can perk up the patient's chances of recovery, especially in milder cases.

Infection Control Measures:

Firm infection control measures are fundamental to prevent human-to-human transmission, particularly in healthcare settings like hospitals.

Healthcare workers particularly in outbreak areas should use personal protective equipment (PPE), including gloves, masks, gowns, and eye protection, when caring for Nipah virus patients.

quarantine of infected individuals and appropriate disinfection procedures are essential to prevent further spread.

Experimental Treatments:

During Nipah virus outbreaks, experimental treatments, such as antiviral drugs and monoclonal antibodies, may be considered on a case-by-case basis. These treatments are often administered under concerned use protocols.

Research into accurate antiviral therapies and treatments for Nipah virus is ongoing, but yet, no specific antiviral drug had been approved for general use.

Vaccination:

Attempts develop vaccines against Nipah virus, but no Nipah virus is approval for human use.

Antiviral therapies for example remdesivir, have shown to be effective in studies on non-human primates after NiV exposure. The drug ribavirin is used to treat a minor number of patients in the starting stage of NiV outbreak; however, the efficacy of this drug in humans remains uncertain.

Prevention and Response

There is no specific antiviral treatment for Nipah virus infection, so prevention and control measures are critical. This includes avoiding close contact with infected individuals, practicing good hygiene, wearing protective gear (masks, gloves) when caring for sick patients, and implementing measures to prevent bat-to-human and pig-to-human transmission. Preventing Nipah virus (NiV) infection involves a combination of public health measures, personal hygiene practices, and community awareness. Given that Nipah virus can be transmitted from animals to humans and, in some cases, between humans, comprehensive prevention strategies are essential. Here are key prevention methods for Nipah virus:

Awareness and Education:

Public education is crucial in regions where Nipah virus outbreaks have occurred. Communities should be informed about the virus, its transmission, and preventive measures.

Encourage people to report sick animals and individuals with symptoms consistent with Nipah virus infection to local health authorities.

Avoid Contact with Bats and Their Secretions:

Do not handle, hunt, or consume bats or their products, such as bat meat.

Avoid entering caves or areas where bats roost without appropriate protective gear.

Be cautious of fruits and foods that may have been exposed to bat excreta, such as date palm sap.

Prevent Close Contact with Infected Animals:

If you live in or near areas where Nipah virus outbreaks have occurred, minimize contact with pigs and other livestock.

Use personal protective equipment when working with animals or handling animal products, and practice good hygiene afterward.

Safe Food Handling Practices:

Avoid consuming raw date palm sap, especially in areas where Nipah virus is endemic. Boiling or cooking date palm sap can reduce the risk of contamination.

Practice good food hygiene, including washing hands and cooking utensils thoroughly.

Infection Control in Healthcare Settings:

Healthcare facilities should be prepared to recognize and manage Nipah virus cases promptly.

Implement strict infection control measures, including isolation of suspected or confirmed cases and appropriate use of personal protective equipment by healthcare workers.

Vaccination:

While there were no approved vaccines for Nipah virus as of my last

update in September 2021, ongoing research may lead to the development of preventive vaccines in the future.

Healthcare workers and individuals at high risk of exposure should consider vaccination once a safe and effective vaccine becomes available.

Environmental Measures:

Implement measures to prevent bat access to date palm sap collection sites, such as using nets or physical barriers.

Promote the use of covered containers for storing and transporting date palm sap to prevent bat contamination.

Surveillance and Early Detection:

Maintain surveillance systems for monitoring cases of Nipah virus infection and unusual illness patterns.

Early detection and rapid response are critical to containing outbreaks.

Travel Precautions:

Travelers to regions with a history of Nipah virus outbreaks should be aware of the risks and take appropriate precautions, such as avoiding consumption of raw date palm sap and minimizing contact with animals.

It is important to note that Nipah virus prevention measures may vary depending on the specific circumstances and the local prevalence of the virus. Public health authorities play a central role in educating communities, monitoring and responding to outbreaks, and implementing preventive strategies to reduce the risk of Nipah virus transmission. Controlling Nipah virus in Kerala requires collaboration between health agencies, veterinarians, and other stakeholders to monitor and address potential sources of transmission.

Kerala's health authorities and the Indian government have implemented stringent measures to prevent and control Nipah virus outbreaks, including isolating infected individuals, contact tracing, and raising public awareness.



CONCLUSION

In conclusion, Nipah virus is a dangerous zoonotic virus primarily transmitted from fruit bats to humans through intermediate hosts like pigs. It can lead to severe illness and has caused outbreaks in several areas. Prevention and control measures, as well as ongoing research into vaccines and treatments, are essential to diminish the risk of Nipah virus infection. Timely detection, effective public health responses, and ongoing research are critical to managing and mitigating the impact of Nipah virus in this region. A wide-range of understanding Nipah virus is crucial for mitigating its impact on human health and preventing future outbreaks.

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