AMERICAN JOURNAL OF APPLIED MEDICAL SCIENCE
ISSN: 2996-5101 (online) | ResearchBib (IF) = 10.81 IMPACT FACTOR
Volume-4| Issue-3| 2026 Published: |30-03-2026

NIPAH VIRUS INFECTION: MODERN APPROACHES TO DIAGNOSIS AND TREATMENT

https://doi.org/10.5281/zenodo.19369269

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Abstract

This article provides a scientific analysis of the Nipah virus, its origin, biological characteristics, and effects on the human body. The study examines the virus's structure, replication mechanisms, routes of entry into the host, and pathogenesis. It also highlights the main clinical manifestations of the infection, stages of disease progression, and its adverse effects on human health. The routes of transmission, epidemiological features, and risk factors of the Nipah virus are analyzed. Modern laboratory diagnostic methods used for detection, including serological and molecular tests, are discussed. Furthermore, the article outlines the principles of treatment, symptomatic management strategies, and preventive measures based on scientific sources. Understanding viral infections in depth is crucial for early detection, effective treatment, and improving preventive strategies. This article serves as a valuable resource for healthcare professionals, students, and researchers in the medical field.

Keywords

Nipah virus, viral infection, pathogenesis, epidemiology, clinical manifestations, laboratory diagnostics, serological testing, prevention, treatment methods, immune system.

INTRODUCTION

In recent years, emerging and re-emerging infectious diseases have posed a serious threat to the global healthcare system. In particular, viral infections of zoonotic origin represent a significant risk to human health. One such infection is the Nipah virus, which is distinguished by its high mortality rate, rapid transmission, and severe clinical course. This virus was first identified in 1998 and

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continues to occur sporadically and in epidemic outbreaks in the Southeast Asian region.

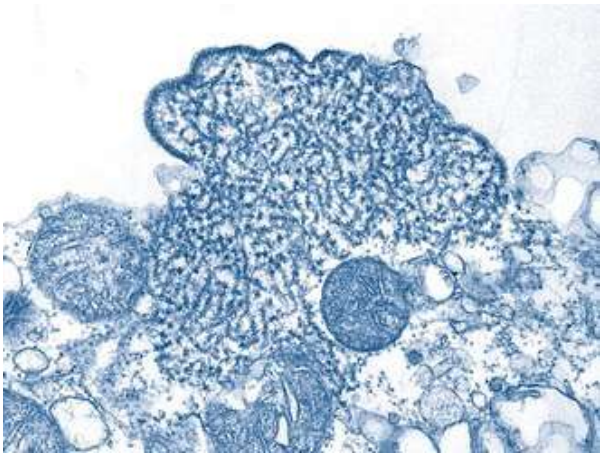
From a medical perspective, Nipah virus infection can involve central nervous system damage, severe respiratory syndrome, and multiple organ failure. The clinical signs of the disease are often nonspecific and can resemble those of other viral infections, making early diagnosis challenging. Therefore, modern laboratory methods, particularly molecular diagnostic technologies, play a crucial role in detecting the infection.

Currently, there are no specific treatments or widely available vaccines for Nipah virus infection. Management is primarily based on symptomatic and supportive therapy. At the same time, prevention of the infection, early detection, and strengthening epidemiological control measures remain among the top priorities of modern medicine.

MAIN PART.

Nipah virus is a zoonotic pathogen that is transmitted to humans from infected animals, as well as via airborne droplets and direct contact. The disease was first identified in 1998 among pig farmers in the village of Sungai Nipah, Malaysia.

In 1999, an outbreak occurred in Singapore when pigs were imported from Malaysia. That same year, the virus responsible for the disease was identified. The virus was therefore named after the village where it was first discovered – Nipah virus. Since the disease was transmitted from pigs, the Malaysian government ordered the culling of millions of pigs in 1999. As a result, the epidemic was brought under control. Since 1999, no further outbreaks have been reported in Malaysia or Singapore.



By 2018, approximately 700 human cases of Nipah virus infection had been recorded, with a mortality rate of 75% among those infected. In outbreaks observed

in Bangladesh and India, the disease was transmitted to humans through consumption of fruits contaminated by fruit bats or by drinking palm sap contaminated with bat secretions. In the most recent outbreaks in Bangladesh and India, the virus was transmitted from human to human via airborne droplets and close contact. In cases reported in Singapore and India, the virus spread as a nosocomial infection, affecting healthcare workers and close contacts of patients.

In 2001, Nipah infection was observed in India and Bangladesh. Since then, it has occurred annually in some districts of India. The most recent outbreak in India was reported in 2026.

Route of transmission: In the outbreak observed in Malaysia, the virus was transmitted to humans from pigs through direct contact and airborne droplets.

Nipah virus (NiV) belongs to the group of RNA viruses. The virus primarily circulates among fruit bats.

Nipah infection is a contagious disease caused by the Nipah virus and is transmitted via airborne droplets and direct contact.

The disease can be transmitted to humans from infected individuals or animals, including bats, pigs, and horses. During an outbreak in healthcare facilities, it can spread to caregivers and medical staff. Additionally, transmission may occur in hospital wards if ventilation is inadequate, disinfection procedures are poorly controlled, or healthcare workers do not properly use personal protective equipment.

Clinical features of the disease.

In humans, the infection can manifest in various forms, ranging from asymptomatic cases to fatal encephalitis. The incubation period of the disease ranges from 4 to 45 days.

In infected individuals, the initial clinical signs resemble influenza, including fever, headache and muscle pain, cough, nausea, diarrhea, and sore throat. Subsequently, symptoms such as dizziness, drowsiness, and signs of encephalitis may appear. Some patients develop atypical pneumonia or acute respiratory distress. In severe cases, recurrent seizures may occur, and coma can develop within 24–48 hours. The disease progresses severely in patients with neurological symptoms and can lead to death.

In 20% of individuals who recover from the disease, recurrent seizures and changes in mental status are observed. In some patients, the disease may relapse, and encephalitis can develop long after the initial infection.

Diagnosis: the diagnosis of the disease is based on clinical signs and virological analysis. Samples are taken from the patient's blood, cerebrospinal fluid, and throat swabs. Due to the high pathogenicity of the virus, these samples are

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collected by specially trained laboratory personnel and analyzed in specialized laboratories.

Treatment: there is no specific treatment or vaccine for the disease. Management is primarily symptomatic, focusing on relieving the patient's symptoms.

- Early detection of complications (such as brain swelling or pneumonia) and treatment of concurrent infections.
- Individualized approach for each patient.
- Oxygen therapy and mechanical ventilation.
- Infusion and detoxification therapy.

WHO Recommendations for Disease Prevention.

Prevention of infection in humans:

1. Be informed about the disease and its routes of transmission.
2. Boil fresh sap collected from palm trees before consumption.
3. Avoid consuming dates or fruits bitten by bats.
4. Hospitalize and isolate individuals infected with the disease.
5. Use personal protective equipment (gloves, masks, and hand hygiene) when in contact with patients.

Prevention of animal-to-human transmission:

1. Use protective clothing (gloves, specialized attire) when handling animals, especially infected ones.
2. Protect farms and animal feed from contact with bats.
3. Disinfect animal housing and establish quarantine if infected animals are identified.
4. Mandatorily slaughter or cremate infected animals.
5. Do not relocate animals from farms where the disease has been detected to other locations.

Prevention of the disease in healthcare facilities

The WHO recommends the following standard precautions for infection prevention when working with all patients:

- Place patients confirmed or suspected to be infected with Nipah virus in designated rooms.
- Use personal protective equipment (PPE) during medical care, including masks, gloves, goggles, and gowns.
- During medical procedures, to prevent airborne transmission, use a respirator and full PPE instead of a disposable mask.
- Admit the patient to an airborne infection isolation room.
- Apply the same precautions to caregivers and close contacts of the patient.

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The WHO continues to conduct research on Nipah virus to provide updated information and medical recommendations.

WHO Activities.

- The WHO maintains constant and strong communication with countries affected by the Nipah virus. In the event of an outbreak, it provides timely recommendations for patient management, conducts virological analyses, establishes epidemiological surveillance, prepares healthcare workers to work with the population, and provides material and technical support to prevent the spread of the epidemic;

- Efforts to combat the disease include learning about diagnosis and treatment, preventing deaths, controlling outbreaks, and stopping nosocomial (hospital-acquired) transmission of the virus;

- The WHO also facilitates the exchange of experiences and knowledge between countries.

DISCUSSION.

Nipah virus infection is considered one of the pressing challenges in modern medicine due to its high lethality, zoonotic origin, and potential for epidemic spread. Discussing this infection primarily requires an analysis of the current challenges in its diagnosis and treatment, as well as potential solutions for the future. Research indicates that the clinical manifestations of Nipah virus infection are often nonspecific and can resemble other viral encephalitides and respiratory diseases, complicating the process of differential diagnosis. This issue is particularly critical in resource-limited regions, where early detection of the disease is significantly hindered.

Among modern diagnostic methods, molecular-genetic analyses, particularly the RT-PCR technique, are recognized as the most reliable and sensitive. However, the high technological requirements and need for specialized laboratory conditions limit its widespread use. From this perspective, the development and implementation of rapid diagnostic tests remain an urgent priority. Although

serological tests play an important role in retrospective diagnosis, they are not sufficiently effective in the early stages of the disease.

Regarding treatment, the lack of specific antiviral agents for Nipah virus infection is one of the major challenges. Current clinical approaches are primarily symptomatic and supportive, aimed at maintaining the patient's vital functions. Some studies have noted partial effectiveness of antiviral drugs such as ribavirin, but their clinical efficacy has not yet been fully confirmed. Consequently, intensive research is underway to develop new antiviral drugs and vaccines.

Another critical aspect is the prevention of infection. Since Nipah virus is primarily transmitted from animals to humans, close cooperation between veterinary and medical sectors – applying the "One Health" approach – is essential. Public awareness, adherence to hygiene practices, and strengthened epidemiological surveillance are key factors in limiting the spread of infection.

Overall, addressing the challenges associated with Nipah virus infection requires a comprehensive approach. Improving modern diagnostic methods, developing effective treatments, and enhancing preventive measures can significantly reduce the negative impact of this dangerous infection.

CONCLUSION.

Nipah virus is a highly lethal zoonotic pathogen. The disease is mainly transmitted from animals to humans, and its clinical signs are often nonspecific, making early diagnosis difficult. There is no specific treatment or vaccine, so management is primarily supportive and symptomatic. Prevention measures include careful handling of animals, adherence to hygiene practices, isolation of infected individuals, and implementing the "One Health" approach to ensure cooperation between veterinary and medical sectors.

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