Zoology, Bio and Pharma Research
Content Available at www.saapjournals.org
(An International Online Peer-Reviewed Journal) ISSN (O): XXXX-XXXX

Review Article
OPEN ACCESS

NIPAH VIRUS: AN EMERGING ZOONOTIC THREAT-A REVIEW

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Article History: Received: 24 Oct 2025, Revised: 07 14 2025, Accepted: 07 Dec 2025

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Abstract

Nipah virus (NiV) is a highly pathogenic zoonotic virus belonging to the genus *Henipavirus* within the family *Paramyxoviridae*. Since its first identification during an outbreak in Malaysia in 1998–1999, NiV has caused repeated outbreaks in South and Southeast Asia, particularly in Bangladesh and India. The virus is transmitted from natural reservoir hosts, fruit bats (*Pteropus* species), to humans either directly or through intermediate animal hosts, contaminated food sources, or human-to-human transmission. Clinically, NiV infection ranges from mild febrile illness to severe respiratory disease and fatal encephalitis, with case fatality rates ranging from 40% to 75%. The absence of specific antiviral therapy or licensed vaccines underscores the importance of early diagnosis, supportive management, and preventive public health strategies. This review summarizes the virology, epidemiology, transmission, clinical manifestations, diagnosis, management, and prevention of Nipah virus infection.

Keywords: *Nipah virus; Henipavirus; zoonotic diseases; encephalitis; fruit bats; emerging infections..*

INTRODUCTION

Nipah virus (NiV) is an emerging zoonotic pathogen recognized for its high mortality rate and potential for epidemic spread. The virus was first identified during an outbreak of encephalitis among pig farmers in Malaysia and Singapore between 1998 and 1999 [1]. Since then, recurrent outbreaks have been reported in Bangladesh and India, highlighting its continued public health significance [2]. NiV is classified as a Biosafety Level-4 (BSL-4) pathogen due to its high virulence, lack of effective treatment, and capacity for human-to-human transmission.

VIROLOGY AND PATHOGENESIS

Nipah virus is an enveloped, single-stranded, negative-sense RNA virus. Its genome encodes six major structural proteins: nucleocapsid (N), phosphoprotein (P), matrix protein (M), fusion protein (F), glycoprotein (G), and large polymerase protein (L) [3]. The G and F glycoproteins play a crucial role in viral attachment and membrane fusion by binding to ephrin-B2 and ephrin-B3 receptors, which are widely expressed in endothelial and neuronal tissues. This broad receptor distribution explains the virus's ability to cause systemic infection, vasculitis, and severe neurological disease [4].

EPIDEMIOLOGY AND GEOGRAPHIC DISTRIBUTION

NiV outbreaks have been documented primarily in Southeast Asia. Malaysia and Singapore experienced outbreaks linked to infected pigs, while outbreaks in Bangladesh and India have been associated with direct bat-to-human transmission or human-to-human spread [1,2]. In Bangladesh, outbreaks occur almost annually and are often associated with consumption of raw date palm sap contaminated with bat secretions [5]. The high fatality rates and recurring outbreaks emphasize the virus's epidemic potential.

TRANSMISSION

Transmission of NiV occurs through multiple routes. Fruit bats of the genus *Pteropus* serve as the natural reservoir hosts. Humans may become infected through direct contact with bats, consumption of contaminated food products, contact with infected intermediate hosts such as pigs, or through close contact with infected individuals [2,5]. Human-to-human transmission has been well documented, particularly in healthcare settings and among caregivers, contributing to outbreak amplification [6].

CLINICAL MANIFESTATIONS

The incubation period of NiV infection typically ranges from 4 to 14 days, although longer periods have been reported [2]. Early symptoms include fever, headache,

myalgia, sore throat, and vomiting. As the disease progresses, patients may develop respiratory distress and acute encephalitis characterized by drowsiness, confusion, seizures, and coma [1]. Severe cases often result in death within days, and survivors may experience long-term neurological sequelae, including persistent convulsions and personality changes [7].

DIAGNOSIS

Laboratory diagnosis of NiV infection relies on molecular and serological methods. Real-time reverse transcription polymerase chain reaction (RT-PCR) is used to detect viral RNA in blood, cerebrospinal fluid, throat swabs, and urine samples [2]. Serological assays, including enzyme-linked immunosorbent assays (ELISA), are employed to detect IgM and IgG antibodies. Due to the virus's high pathogenicity, laboratory testing must be conducted in high-containment facilities.

TREATMENT AND MANAGEMENT

Currently, there is no specific antiviral treatment approved for Nipah virus infection. Management is primarily supportive and includes intensive care, respiratory support, and management of neurological complications [1]. Ribavirin has been used experimentally during outbreaks, but its efficacy remains inconclusive [6]. Monoclonal antibodies and vaccine candidates are under development, but none have yet received regulatory approval [8].

PREVENTION AND CONTROL

Preventive measures focus on reducing exposure to reservoir hosts and interrupting transmission pathways. Strategies include preventing bat access to date palm sap, improving infection control practices in healthcare settings, use of personal protective equipment, and public health education [5]. Surveillance of animal and human populations, along with rapid outbreak response, is essential to limit spread.

CONCLUSION

Nipah virus remains a serious emerging infectious disease due to its high mortality, zoonotic nature, and lack of effective treatment or vaccines. Strengthening surveillance systems, improving diagnostic capacity, and advancing research into vaccines and therapeutics are critical for reducing the impact of future outbreaks.

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