Biological Times

Volume No. 3 | Issue No. 6 | Pages 1-2

Nipah Virus: An Overview

Ayesha Quddus[1*], Laiba Quddus[2], Aneela Hussain[1], Abdul Raheem[1], Muhammad Zaid Khalil[1]

1. Faculty of Veterinary Science, University of Agriculture Faisalabad, Pakistan.
2. Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad, Pakistan.

*Corresponding Author: **ayeshaquddus27@gmail.com**

ABSTRACT

Nipah virus is one of the deadliest viruses that pose a serious threat to the world due to its zoonotic importance. Nipah virus is an enveloped, negative-sense RNA virus that causes infection of the respiratory system and the central nervous system. It is mostly transmitted to humans through pigs which are its intermediate host. It replicates in endothelial, epithelial, neurons, and smooth muscle cells. This viral disease shows the symptoms of cough, fever, dizziness, and loss of consciousness. RT-PCR is the best technique for its diagnosis. Although many medicines and vaccines are under trial but are not approved till now for proper human use. Due to its evolving nature and the unavailability of suitable treatments, awareness should be raised among people to stop the spread of this virus.

1. Introduction:

Diseases caused by the viruses are of great concern for public health as there is no specific treatment available for viruses due to their ability of rapid mutation. Nipah virus (NiV) has led to many epidemics, causing deaths in the developing countries of America, Asia, and Africa [1]. NiV belongs to the *Paramyxoviridae* family, genus *Henipavirus.* It is an enveloped single-stranded RNA virus having a negative sense genome. It is pleomorphic having six genes encoding for different structures e.g., matrix (M), nucleocapsid (N), attachment glycoprotein (G), phosphoprotein (P), the large (L), and fusion (F) proteins [2,3,4].

This virus is of zoonotic importance causing the disease in various mammals including humans. It emerged in Malaysia in 1998 and in 1999 in Singapore for the first time. The virus is named "Nipha" based on its detection for the very first time in the village of Malaysia, Sungai Nipah (Nipah River Village) [1,2]. It causes severe infection of the respiratory and nervous system. Its vector is a fruit bat of the genus Pteropus which is also its reservoir host. It spreads directly and indirectly from animals to humans and humans to humans. Other routes of transmission include ingestion of contaminated food, contact with bodily fluids of an infected person, and through inhalation of aerosols. Bats are the primary means of food contamination. These food items are a source of infection in pigs. Pigs are the intermediate host for NiV and act as a source of viral transmission to humans. [3,5].

2. Virus Replication

On entering the body either through inhalation or ingestion, the virus binds to the receptor proteins Ephrin-B2, -B3 that are present not only on the surface of epithelial and endothelial cells of small arteries but also on the neurons and smooth muscle cells. On attachment with receptor with the help of attachment glycoprotein (G), endocytosis is started by the fusion (F) protein when this protein of viral envelope fuses with the plasma membrane of the host cell [2,4,6]. The nuclear material is released in the cytoplasm along with capsid (proteins) then L, P, and N proteins forming the polymerase complex facilitates the transcription and translation of viral RNA. The large protein (L) and phosphoprotein (P) are associated with the transcription of RNA to mRNA, and then translated proteins lead to the replication of genetic material. N protein of the polymerase complex encloses the newly formed RNA into a capsid. Then the P, L, and N proteins of the polymerase complex are linked with the packed nucleocapsids, and glycoproteins F and G are synthesized and processed in the endoplasmic reticulum and Golgi complex respectively. As virus replication is completed, the matrix (M) protein, starts working, which is responsible for the maturation of the virus and its release [2,5,6]. The structure of NiV is shown in (Fig. 1).

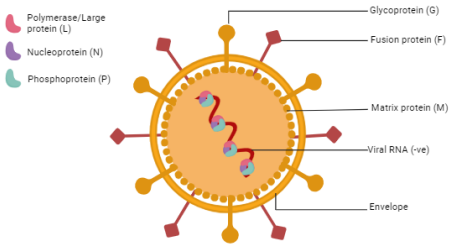

Fig.1: Structure of Nipah virus (Retrieved from Biorender)

3. Pathogenesis

Pathogenesis of the Nipah virus starts when a virus infects the epithelial cells of the respiratory system on entering the body. It replicates leading to the high concentration of viruses in the blood which disseminates the virus to other organs of cardiovascular, renal, and digestive systems. In the endothelium replication of the virus occurs after the spread of the virus in these organs [2,3,6]. This endothelial infection of NiV is the chief cause of infection in the host and this infection is more prominent in the brain and spinal cord causing encephalitis along with the inflammation of blood vessels, congestion in the spleen and liver, and inflammation of the myocardium [7,8]. This causes a systemic disease involving many organs but encephalitis occurs when the virus crosses the blood-brain barrier, and infects the endothelial cells of blood vessels/capillaries of the central nervous system [2,3,9].

4. Clinical Manifestation

Nipah virus has an incubation period of 4 to 45 days and the host remains asymptomatic for a period of 4 days to 2 weeks. In Malaysia 8-17% while more than 45% of such cases of asymptomatic infections are reported in Singapore. On acquiring the infection of NiV, the host might show the symptoms. Starting symptoms of NiV are just like the flu along with vomiting, fever, headache, and dizziness. In severe cases, acute respiratory distress syndrome is also diagnosed along with encephalopathy [1,3,4]. Nipah virus causes acute encephalitic syndrome. Its symptoms include drowsiness, fever, headache, myalgia, vomiting, dizziness, and loss of consciousness. Due to the involvement of the brain, there is a low chance of recovery of the patient. In postmortem examination of acute cases, vasculitis is visible in the brain which is absent in cases of relapse and late onset of encephalitis cases. Diagnosis of NiV includes the identification of the virus by RT-PCR. Isolation of the virus occurs from samples like the urine of the infected person, CSF, nasal swabs, tracheal secretions, and throat swabs [6]. Other methods used for the detection of this virus are the ELISA, virus neutralization test, immunohistochemistry or immunofluorescence assays, and nucleic acid amplification [2,9].

5. Treatment and Prevention

NiV is a virus of prime concern for the WHO as it has a high risk for public health. Despite its high mortality rates vaccines and medicines are not approved for human uses although many are under trial on animals [6]. Many drugs have shown their efficacy against NiV by inhibiting the spread of the virus. These include ribavirin, acyclovir, remdesivir, and favipiravir (T-705) [4]. Inoculation of monoclonal antibodies m102.4, h5B3.1, and nAH1.3 in animals showed good results and are under clinical trials now [10]. More than 10 vaccines using the mRNA, viral vectors, virus-like particles, or recombinant protein subunits are under research. As no proper treatment is available against the NiV infection preventive measures should be taken to prevent the spread of the disease. These measures include; protection from direct contact with the infected host and its body fluids, washing the fruits before eating and discarding any fruit suspected to be eaten by animals, separation and isolation of infected animals and humans, sanitization with disinfectants, washing hands, wearing proper protective clothing or personal protective equipment, raising awareness in public about its epidemic nature, risk factors and its transmission [1]..

References

[1] Skowron K, Bauza-Kaszewska J, Grudlewska-Buda K, Wiktorczyk-Kapischke N, Zacharski M, Bernaciak Z, Gospodarek-Komkowska E. Nipah virus–another threat from the world of zoonotic viruses. Frontiers in microbiology. 2022 Jan 25;12:811157.

[2] Bruno L, Nappo MA, Ferrari L, Di Lecce R, Guarnieri C, Cantoni AM, Corradi A. Nipah virus disease: epidemiological, clinical, diagnostic and legislative aspects of this unpredictable emerging zoonosis. Animals. 2022 Dec 31;13(1):159.

To cite this article: Quddus A, L Quddus, A Hussain, A Raheem & MZ Khalil. Nipah Virus: An Overview. Biological Times. 2024 June 3(6): 1-2

[3] Sharma P, Kumar R, Sharma A, Hajam YA, Kumar N. Nipah Virus: An Active Causative Agent For Respiratory And Neuronal Ailments. Epidemiology and transmission of infectious diseases. 2020:78.
[4] Orosco FL. Breaking the chains: advancements in antiviral strategies to combat Nipah virus infections. Int. J. One Health. 2023:122-33.
[5] Liew YJ, Ibrahim PA, Ong HM, Chong CN, Tan CT, Schee JP, Gómez Román R, Cherian NG, Wong WF, Chang LY. The immunobiology of Nipah virus. Microorganisms. 2022 Jun 6;10(6):1162.
[6] Halpin K, Rota PA. A review of Hendra virus and Nipah virus infections in man and other animals. Zoonoses: Infections Affecting Humans and Animals. 2023 Oct 10:1493-508.
[7] Devnath P, Wajed S, Das RC, Kar S, Islam I, Al Masud HA. The pathogenesis of Nipah virus: A review. Microbial Pathogenesis. 2022 Sep 1;170:105693.
[8] Stevens CS, Lowry J, Juelich T, Atkins C, Johnson K, Smith JK, Panis M, Ikegami T, Tenoever B, Freiberg AN, Lee B. Nipah virus Bangladesh infection elicits organ-specific innate and inflammatory responses in the marmoset model. The Journal of Infectious Diseases. 2023 Sep 1;228(5):604-14.
[9] Garbuglia AR, Lapa D, Pauciullo S, Raoul H, Pannetier D. Nipah virus: an overview of the current status of diagnostics and their role in preparedness in endemic countries. Viruses. 2023 Oct 7;15(10):2062.
[10] Kallon MK, Mami DM, Mami ET, Romba M, Martain MS. Therapeutic Advancement in Treatment and Prevention of Nipah Viral Infection: A Review. Asian Journal of Research in Infectious Diseases. 2024 Apr 29;15(4):51-65.