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A Review Article on Nipah Virus: Rare and Intractable Disease

S.Niharika[1]; K.Hemalatha[2] ; K.Sri.Jahnavi[3] ; Dr. Sunkara Surya Lakshmi[4].
[1]Srinivasa Rao College of Pharmacy, P.M. Palem, Visakhapatnam , Andhra Pradesh, 530041 India.
[2]Srinivasa Rao College of Pharmacy, P.M. Palem, Visakhapatnam , Andhra Pradesh, 530041 India.
[3]Srinivasa Rao College of Pharmacy, P.M. Palem, Visakhapatnam , Andhra Pradesh, 530041 India.
[4] Doctor of Pharmacy, Kakinada, Andhra Pradesh, 533001, India.

Abstract:- An emerging zoonotic virus called Nipah virus (NiV) has been linked to multiple outbreaks that have resulted in high death rates, mostly in South and Southeast Asia[1]. Because spillover events happen occasionally, (HeV) continues to be a major public health concern[2]. The flying fox genus, Pteropus, is a fruit bat species found in many tropical and subtropical regions of the world, and is thought to be a major reservoir of the Nipah virus. There have been losses in the bat's habitat associated with the virus's emergence and zoonotic transmission to humans and livestock[3]. After being discovered for the first time in Malaysia twenty years ago, outbreaks have since occurred throughout South and Southeast Asia. It is extremely deadly and causes severe neurological and respiratory disease. It is extremely contagious and can infect animals or other people, which allows it to spread throughout the communit[4]. Variations exist in the clinical and epidemiological characteristics of distinct virus strains. Numerous techniques, such as molecular, virological, immune histochemical, and serological methods, can be used to make the diagnosis[5]. The identification of broad-spectrum antivirals requires both antibody-body drugs and a focus on small interfering RNAs (siRNAs). Due to the high pathogenicity of NiV in humans and the lack of treatments or vaccines to combat this illness, researchers from all over the world are focusing on creating effective NiV treatment plans and vaccines[6].

Keywords :- *Nipah Virus , Pteropus , Zoonotic , Virological ,Pathogenicity , Vaccines .*

I. INTRODUCTION

In the West Malaysian state of Perak, where pig farming was a significant industry, the first cases started in late September 1998 in villages close to the city of Ipoh. Up until the first part of February 1999, cases kept happening in this area. The second cluster happened in December 1998 and January 1999 in the vicinity of Sikamat, a small town in the neighbouring state of Negri Sembilan. In the same state, close to the city of Bukit Pelandok, the third and largest cluster started in December 1998. Since four serum samples from 28 patients in this outbreak area tested positive for JE-specific IgM and some of the patient sera contained JE nucleic acids, the cases were initially linked to Japanese B encephalitis (JE), which had previously caused porcine-associated outbreaks in Malaysia. Therefore, dusting to kill mosquitoes and increasing JE vaccinations were the first steps[7].

The Government of India's Ministry of Health and Family Welfare announced six laboratoryconfirmed cases of the Nipah virus in the Kozhikode district of Kerala between September 12 and 15, 2023, including two fatalities. The remaining cases, whose source of infection is unknown, were healthcare interaction and close relatives of the original case. Healthcare workers and highrisk contacts of the confirmed cases, as of September 27, 2023, have been identified and placed under quarantine and observation for a period of 21 days. 387 samples have been tested since September 12; six individuals tested positive for Nipah virus infection, while the remaining samples all came back negative. Since September 15th, no cases that were newly identified have been reported. Since 2001, there have occurred six Nipah virus epidemics in India.

By September 27, 2023, 1288 contacts of the identified victims—including high-risk individuals and medical personnel who handled those with confirmed diagnoses and handled their samples— had been located. For a duration of 21 days, every identified contact is placed under surveillance. The four cases are still in a stable clinical state as of September 27, 2023.

In response, the government established containment zones with movement limitations, social distancing, and mask wear requirements in public areas in nine villages within the Kozhikode district. Major public events in the Kozhikode district are prohibited by the government after October 1, 2023. States alongside neighbouring nations districts received alerts for increased surveillance.

II. TRANSMISSION

Direct contact with diseased animals, their contaminated tissues, or the environment around them is how the majority of infections are contracted. Pig secretions and contact with sick animals can both be sources of transmission. Fruits contaminated with bat urine that is infected have been known to spread the Nipah virus.[8]

III. EPIDEMIOLOGY

A member of the paramyxo viridae family, genus HENIPAVIRUS includes the Nipah virus. Genus includes CEDAR VIRUS and HENDRA VIRUS[9]. In 1998–1999, Malaysia and Singapore experienced the first Nipah virus outbreak. The second outbreak was observed in west Bengal and the Meheepue district of Bangladesh. Compared to Malaysia, where 40% of deaths occurred, a high mortality rate of roughly 70% was seen in Bangladesh and India[10]. Genetic differences exist between the three essential strains that cause NIV infection in the previously mentioned countries[5]:

- Bangladesh's NIV-B isolates.
- Indi isolates of NIV 1 with genotype B.
- Isolates of HIV-M in Malaysia[5]

Based on RT-PCR results indicating the virus's source of infection, the nipah virus recently caused an outbreak in the Philippines in 2014[9]. Swine are the biological reservoir for infection; they contract the disease by eating fruit bitten by bats carrying the NIV virus. Numerous NIV outbreaks have happened in Bangladesh during the winter, particularly in the country's central and northwest regions. In Bangladesh, the primary method of infection transmission is through the consumption of raw date palm sap[5]. Additionally, bats can transmit infections to humans through their feeding habits. Outbreak that occurs in Bangladesh nearly yearly[9]. In the Nandia district of west Bengal, India, there have been 17 outbreaks documented up until 2015. The adjacent Kozhikode district was severely impacted by the India outbreak in 2018[10].

IV. PATHOPHYSIOLOGY

The pathophysiology of Nipah virus include :

A. Initial Stage
B. Later Stage

A. Initial Stage

The nipah virus first enters the lungs and affects the bronchiole's epithelial cells directly.It primarily affects type 2 pneumocytes and the bronchial epithelium. It causes infection of the respiratory epithelium by attacking the bronchial and pneumocyte epithelium. Inflammatory mediators such as IL-6, IL-8, G-CSF, and CXCL 10 are released as a result.

B. Later Stage

The Nipah virus invades the bloodstream after first appearing in the lung endothelium. Leukocyte bound form virus, or Niv bound to the leukocyte. After leukocytes containing NIV are passively transferred, a deadly infection develops as a result.

➢ *Systemic Spread*

It affects the kidney, spleen, and other organs in addition to causing septicemia. It enters the kidney and impairs renal function. When it enters the GI tract, GI bleeding results. It also passes through the olfactory nerve and blood-brain barrier to reach the brain. Human micro vascular encephalitis is caused by NIV. It triggers the production of TNF alpha and ILI beta, which results in encephalitis, seizures, and ultimately coma[1].

V. SYMPTOMS

The virus primarily affects the nervous and respiratory systems in humans, causing severe and quickly progressing illness. When a person has a nipah virus infection, there are many different clinical signs and symptoms that can range from mild to severe. Human nipah infections can cause a deadly encephalitic syndrome that is marked by myalagia, a sudden onset of fever, and terrible migraines.[7]

A. Neurological Symptoms:

Abnormal dolls eye reflex, myoclonic jerks, reduced degree of consciousness, prominent signs of brainstem dysfunction, pupillary reflexes, and vasomotor changes. A few of the unique clinical manifestations of NIV are hypotonia , areflexia, and segmental myoclonus. Neurologic malfunction following an acute illness may last for years[6].

In extreme instances, respiratory involvement is observed. More specifically, respiratory manifestations become apparent as the illness progresses[7].

➢ *Respiratory Symptoms:*

The most prevalent signs of disease are dyspnea, cough, and cold. Occasionally, acute respiratory distress and atypical pneumonia are observed[6].

➢ *GI Symptoms*

It include constipation, discomfort in the gastrointestinal tract, and Gastritis[6].

- Patients in Bangladesh who suffer from infections may exhibit neurological symptoms like myoclonus, disorganised gait, behavioural abnormalities, and muscle spasms.
- Atypical pneumonia has been identified in 14% of situations in Malaysia[11].

VI. DIAGNOSIS

- Numerous techniques, such as molecular, chemical, virological, and immune history methods, are available for detecting NIV infection. NIV patients can undergo combined testing to determine their acute and chronic phases[5].
- When the disease is in its acute stage, RT-PCR from the throat, CSF, urine, nasal swab, and blood tests should be performed.
- An easy and affordable way to detect antibodies is with an ELISA test[12].
- Immunohistochemistry is obtained by autopsy in fatal cases and is the only test that can demonstrate the diagnosis and identify lesions such as necrosis, vasculitis, and flagosis on tissues such as the lungs, CNS, spleen, lymph nodes, kidney, and heart[6].

- **VIRUS NEUTRALISATION TEST (VNT)**: To test for prevention, viro cells are used to produce a cytopathic effect via serum.[13]
- **VIRAL ISOLATION**: PCR of culture, immune staining, and stero neutralisation are methods used to determine viruses.
- Instruments such as immune electron microscopy and electron microscopy can be used to detect the structure of NIV[5].
- **MRI**: Upon diagnosis, this test revealed deep white matter without encompassing edoema and numerous asymmetric focal lesions measuring less than 5 mm.[7]

VII. TREATMENT

A. Non Pharmacological Treatment :

- Consuming a lot of water.
- Resting in bed more.
- Managing nausea and vomiting with drugs such as antiemetic's.
- Making use of inhalation devices or aerosols to assist with respiratory issues.
- Key clinical practises include maintaining venous thrombosis prophylaxis, fluid and electrolyte balance, airway potency, and mechanical ventilation.[13]

B. Pharmacological Treatment :

To date, no particular medication has been authorised for the management of this significant illness. The development of treatments to combat NiV infection has received little attention. Monoclonal antibodies have been employed as therapeutic agents in preclinical research. The discovery of broad spectrum antivirals and an emphasis on small interfering RNAs (siRNAs) are crucial due to the high cost of antibody-based medications. (Satterfield, 2017)[14]

C. Management And Treatment :

Antiviral drugs are not available for managing the virus. This implies that the goal of treatment is to control your symptoms. This could include:

The investigators are looking into managing the nipah virus with monoclonal antibodies.
The nipah virus cannot be cured with a vaccine or medicine.[14]

The only effective treatment for NiV is supportive care, which includes getting enough rest and addressing particular symptoms as they arise. Acetaminophen and/or ibuprofen for pain and fevers[analgesics]; dimenhydrinate and/or ondansetron for nausea and vomiting; and inhalation devices or aerosols with dextromethorphan, dexamethasone, ipratropium, or salbutamol for respiratory symptoms are examples of supportive medicationsAnti-epileptic drugs, such as levetiracetam, phenytoin, and/or benzodiazepines, can be used to control neurological symptoms and lessen seizures brought on by acute encephalitis.

Although there aren't any approved medication treatments for NiV infection at the moment, monoclonal antibody therapies, an immunotherapeutic approach, are being developed and evaluated as NiV infection treatments. Clinical investigations are being conducted on monoclonal antibody m102.4, which is used on an individual basis. Studies conducted on non-human primates following exposure to NiV have demonstrated the efficacy of antiviral therapies, including remdesivir. During the first NiV epidemic, ribavirin was also administered to a small number of patients; however, it is still unknown how effective this medication is in treating humans.

VIII. PREVENTION

Numerous infection control strategies can stop the spread of the Nipah virus. It is advised that people in areas where NiV is prevalent wash their hands frequently, stay away from people who are close to pet animals and other people who are highly susceptible to NiV exposure, and stay out of areas where fruit bats are known to congregate. People should also practise proper food hygiene, which includes staying away from food and drink items that are highly likely to be contaminated by fruit bats, such as raw date palm sap, raw fruits, and fruit that has fallen to the ground. After eating, all food should be properly cleaned, peeled, and/or cooked. Food items that show evidence of animal bites should be thrown away in.

In hospitals and on animal properties where there is a high risk of exposure to NiV, strict adherence to infection control procedures by cleaning and wearing personal protective equipment, such as gloves and face masks, may effectively prevent NiV transmission. Enforcing a quarantine to limit contact between infected and non-infected organisms should happen right away in areas where a Nipah virus outbreak is suspected. Fruit bat habitats include Cambodia, Indonesia, Madagascar, the Philippines, and Thailand. These regions should prioritise taking these precautions.

Creating understanding and conducting research on the Nipah virus and its transmission are some additional and ongoing preventative initiatives. Other ones include stepping up surveillance of people, domestic animals, and fruit bats in areas where NiV is known to exist, assessing novel approaches to reduce the risk of NiV transmission between species, and creating new instruments to identify early NiV infection in humans and animals.[16]

In order to prevent contracting the nipah virus, if you exist in or visit an area where it is common, you ought to take the following precautions:

- Often wash your hands.
- Steer clear of sick bats or pigs at all costs.
- Renovate and sanitise swine farms. Virus-carrying animals should be quarantined immediately.
- Keep clear of bushes and trees where bats are known to take a nap or rest.

- Avoid foods and drinks like fruit and palm sap that may be contaminated.. Boil the palm sap before gathering it.
- Toss away any fruit that has come into contact with the ground or that has bat bites.
- Steer clear of bodily fluids such as blood or saliva that belong to someone who has the virus.
- The nipah virus can also be stopped from spreading by infection control methods. For instance, you should always wear personal protective equipment (PPE) if you are providing care for someone who has the nipah virus or is suspected of having it. PPE examples include:
- Gowns that provide full coverage or isolation against bodily fluids.
- Gloves for medical purposes.
- Safety glasses or goggles for eye protection.Masks used for surgery or medicine. Depending on how serious the outbreak is, different mask styles may be used.
- Healthcare professionals should follow standard infection control procedures in hospitals and other healthcare facilities. For the purpose of sanitising and disinfecting all clinical surfaces, the Environmental Protection Agency (EPA) advises using Q-list disinfectants.[17]

IX. CONCLUSION

NIV is a virus which causes severe life threathening conditions in both humas and animals . There no specific medicine to treat the virus and vaccine to prevent.

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