

Chandipura Virus: A Deadly Unknown Virus

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Abstract

Chandipura virus (CHPV) is a member of the Rhabdoviridae family under the Vesiculovirus genus which poses a significant public health threat primarily in Asia. It was discovered during an outbreak in Maharashtra, India in 1965. CHPV is transmitted by sandflies of the Phlebotomus genus, affecting predominantly children with acute encephalitis syndrome (AES). Clinical manifestations include fever, seizures and neurological complications, often leading to high mortality rates. The management focuses on early detection, supportive care, and vector control strategies. Further research is needed to enhance understanding, vaccine development and effective public health interventions against this emerging pathogen.

Keywords: Chandipura virus, Sandflies, Acute encephalitis syndrome.

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Introduction

Viral encephalitis is an important global public-health problem. In India, although many encephalitis outbreaks have been associated with Japanese encephalitis virus, several of them have remained undiagnosed.^[1] In the realm of emerging infectious diseases, viruses often pose significant challenges due to their ability to mutate and adapt rapidly. One such virus that has garnered attention in recent years is the Chandipura virus (CHPV) which is named after the town Chandipura in Maharashtra, India, where it was first discovered in 1965.^[2] Chandipura vesiculovirus (CHPV) is a member of the Rhabdoviridae family that is associated with an encephalitic illness, Chandipura encephalitis or Chandipura viral encephalitis, in humans.^[3]

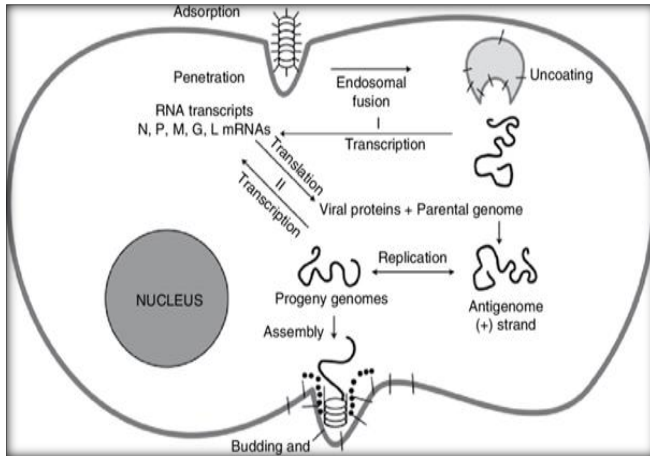
Chandipura Virus: A General Overview

Chandipura virus belongs to the Rhabdoviridae family and is primarily transmitted through the bite of infected sandflies, specifically Phlebotomus species.^[3] These sandflies are commonly found in rural areas, especially during the rainy season. CHPV primarily affects humans, causing a range of symptoms from mild flu-like illness to severe encephalitis (inflammation of the brain). Children are particularly vulnerable, with mortality rates reported to be as high as 55% in affected outbreaks.^[4]

Life Cycle of Chandipura Virus

Chandipura virus primarily targets neuronal cells within the central nervous system (CNS) of its host.^[3] The virus enters the host cell by attaching to specific receptors on the cell surface.^[5] Once inside the host cell, the virus begins to replicate. Viral RNA is released into the cytoplasm of the

cell, where it serves as a template for the synthesis of viral proteins and new viral RNA. Newly synthesized viral components move to the cell surface, where they assemble into new virus particles. Mature virus particles are released from the host cell, often causing cell death in the process. These newly formed viruses can then infect neighbouring cells, continuing the cycle of infection. Chandipura virus is primarily transmitted to humans through the bite of infected sandflies, especially from the genus Phlebotomus.^[4] These sandflies acquire the virus when they feed on infected hosts (typically mammals such as cattle, sheep, and humans) during a blood meal.^[6] In humans, Chandipura virus infection can lead to acute encephalitis syndrome (AES), characterized by symptoms such as fever, altered mental status, seizures, and coma. The virus has been associated with outbreaks of AES in various parts of India. Sandflies infected with Chandipura virus play a crucial role in its transmission cycle. They act as vectors, transmitting the virus between vertebrate hosts during blood feeding.^[6] The precise reservoir hosts of Chandipura virus are not fully established, but studies suggest that certain mammals may serve via sandfly bites.



Life cycle of Chandipura virus. The steps involved are virus adsorption and penetration by endocytosis, fusion of the envelope with endosomal membranes, release of parental genome into the cytoplasm, primary (I) transcription, genome replication to produce nucleocapsids containing antigenomes (+ strand) and progeny genomes, secondary transcription(II), and assembly by budding from host plasma membrane. G, glycoprotein; L, large protein; M, matrix protein; N, nucleoprotein; P, phosphoprotein.^[5]

Previous Outbreak

The Chandipura virus (CHPV) has been associated with several outbreaks since its discovery in 1965. These outbreaks have primarily occurred in India, with sporadic cases reported in neighbouring countries as well. One of the most significant occurred in 2003 in several districts of Maharashtra, India.^[2] This primarily affected children, with a high mortality rate observed among those infected. This led to intense public health efforts to control the spread of the virus and treat affected individuals. In 2005, outbreak was reported in Andhra Pradesh, India and occurred during the monsoon season, which is conducive to increased sandfly activity, the vector responsible for transmitting the virus. This highlighted the seasonal and geographical patterns of Chandipura virus transmission. Gujarat, a state in western India, witnessed an outbreak of Chandipura virus in 2010.^[6] This affected several districts, again predominantly impacting children. The mortality rate underscored the severity of Chandipura virus infection, particularly among younger age groups. Apart from these, virus has been responsible for sporadic cases and small outbreaks in various parts of India over the years. These outbreaks often coincide with the monsoon season, when environmental conditions favour the breeding and activity of sandflies, thus facilitating virus transmission.^[7]

Recent Outbreak

In July 2024, Sabarkantha district of Gujarat in India experienced a suspected outbreak particularly in children. This suspected outbreak has raised significant public health concerns due to the rapid spread and the severity of symptoms observed in the affected individuals.^[8,9]

Clinical Manifestations

Clinical manifestations of Chandipura virus infection vary widely, ranging from fever, headache, convulsions,

unconsciousness, vomiting to more severe neurological symptoms such as seizures and progressing rapidly to coma and death in severe cases. Children under 15 years old are particularly vulnerable, with mortality rates reaching up to 55% in affected populations.^[2]

Diagnosis

Diagnosing CHPV infection can be challenging due to its similarity with other viral encephalitides. Laboratory testing involving molecular techniques to detect viral RNA or serological methods to detect antibodies are crucial for accurate diagnosis.

Molecular Tests (PCR): Polymerase Chain Reaction (PCR) assays are used to detect viral RNA in clinical samples such as blood, cerebrospinal fluid (CSF), or throat swabs.^[2] PCR is a sensitive and specific method for confirming Chandipura virus infection during acute illness.

Serological Tests: Enzyme-linked immunosorbent assay (ELISA) and other serological tests detect antibodies produced by the immune system in response to Chandipura virus infection.^[5] Serology is useful for detecting both IgM (indicative of recent infection) and IgG antibodies (indicative of past infection or immunity).

Rapid Diagnostic Tests (RDTs): Developing field-appropriate RDTs for Chandipura virus is crucial for rapid diagnosis in resource-limited settings. These tests may include antigen detection assays or simple serological tests that provide quick results, aiding in early detection and management of outbreaks.^[7]

Treatment and Management

Currently, there is no specific antiviral treatment available for Chandipura virus infection. Supportive care remains the cornerstone of management, focusing on alleviating symptoms and maintaining vital functions.^[10] Early detection and prompt medical intervention are critical in improving outcomes, particularly in severe cases.

Prevention and Control Measures

Preventive measures against Chandipura virus primarily revolve around vector control strategies. Vector control plays a critical role in managing diseases like Chandipura virus that are transmitted by insects such as sandflies. Identification and elimination or modification of breeding sites of sandflies, such as stagnant water bodies, organic matter, and animal shelters.^[2] Trimming of bushes reduces resting sites for sandflies. Use of approved insecticides to treat indoor resting places of sandflies, such as walls and ceilings of houses. Insecticide-treated nets can also be effective in preventing sandfly bites.^[2] Conduction of periodic insecticide spraying in affected areas to reduce adult sandfly populations. Wearing long-sleeved shirts, long pants, and socks to minimize exposed skin where sandflies can bite. Promoting natural enemies of sandflies by maintaining ecological balance in affected areas. Public health awareness campaigns play a pivotal role in educating communities about preventive measures and early recognition of symptoms.^[6]

Ongoing Research and Future Directions

Research efforts are underway to better understand the epidemiology, pathogenesis, and genetic diversity of Chandipura virus. Considering the rapid progression of the

disease resulting in case fatalities, vaccination of the population in endemic areas seems to be the choice to prevent outbreaks. This led to the development of a recombinant and an inactivated vaccine. Both the vaccine candidates induced high immunogenicity in mice and appeared to be promising.^[2] International collaborations and surveillance networks are crucial in monitoring and responding to potential outbreaks beyond current endemic areas.^[6]

Conclusion

Despite the advancements made in understanding the virus and development of diagnostics, antivirals and prophylactics, CHPV remained a major concern in certain parts of Maharashtra, Gujrat and Andhra Pradesh. Case fatality, though reduced, still continues to occur in these areas. The natural factors contributing towards the amplification of the virus leading to outbreaks are still not understood. Similarly, the host/genetic factors that contribute to high case fatality are also not clear. A licensed vaccine, which is the need of the hour, for vaccination of children at least in the endemic areas is still not available despite the availability of the technology. Combined efforts from virologists, neurologists, paediatricians and the government are warranted to address this important issue of public health importance for minimizing the recurrence of the disease.

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