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Japanese Encephalitis Virus: Prevention & Control

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Introduction

(JEV) is a *flavivirus*, spread by the bite of carrier *Culex* mosquitoes. The subsequent disease caused is Japanese encephalitis (JE), which is the leading global cause of virus-induced encephalitis. The disease is predominant in the entire Asia-Pacific region with the potential of global spread. JEV is highly neuroinvasive with symptoms ranging from mild fever to severe encephalitis and death. One-third of JE infections are fatal, and half of the survivors develop permanent neurological sequelae. Disease prognosis is determined by a series of complex and intertwined signalling events dictated both by the virus and the host. All *flaviviruses*, including JEV replicate in close association with ER-derived membranes by channelizing the protein and lipid components of the ER. This leads to the activation of acute stress responses in the infected cell-oxidative stress, ER stress, and autophagy. The host innate immune and inflammatory responses also enter the fray, the components of which are inextricably linked to the cellular stress responses. These are especially crucial in the periphery for dendritic cell maturation and the establishment of adaptive immunity. The pathogenesis of JEV is a combination of direct virus-induced neuronal cell death and an uncontrolled neuroinflammatory response.

Keywords:-Antivirals**,** Autophagy**,** Adaptive immunity**,** Flavivirus**,** Japanese encephalitis virus**,** Innate immunity**,** Neuro inflammation**,** Vaccines

Classification, Virion and Genome Structure

JEV is a flavivirus (genus Flavivirus, family Flaviviridae) with a single stranded, non-segmented, positive sense RNA genome. The JEV genome is approximately 11 kilobases in length and encodes a single open reading frame, which is translated into a large polyprotein that is proteolytically cleaved to form three structural proteins and seven non-structural proteins. Virions are approximately 50 nm in diameter and are spherical in shape. JEV belongs to the Japanese encephalitis serocomplex, along with other important arboviruses

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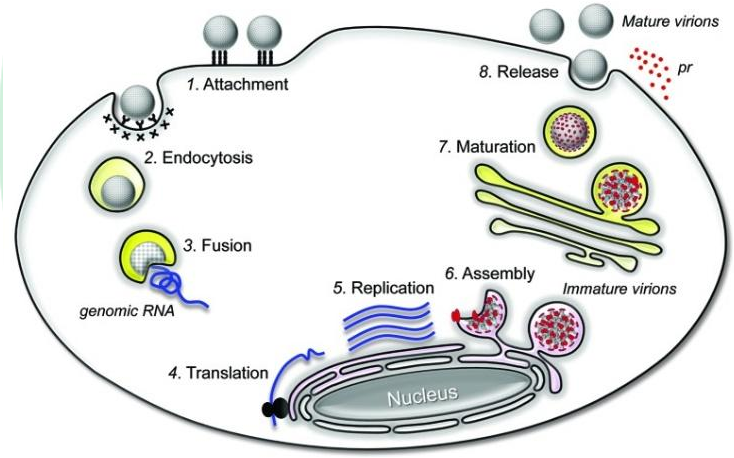
with which it shares a close genetic and antigenic relationship, such as West Nile virus (WNV), St. Louis encephalitis virus (SLEV), and Murray Valley encephalitis virus (MVEV).

Transmission of JEV

JEV is transmitted to humans through bites from infected mosquitoes of the *Culex* species (mainly *Culex tritaeniorhynchus*). Humans, once infected, do not develop sufficient viraemia to infect feeding mosquitoes. The virus exists in a transmission cycle between mosquitoes, pigs and/or water birds (enzootic cycle). The disease is predominantly found in rural and preurban settings, where humans live in closer proximity to these vertebrate hosts.

In most temperate areas of Asia, JEV is transmitted mainly during the warm season, when large epidemics can occur. In the tropics and subtropics, transmission can occur year-round but often intensifies during the rainy season and pre-harvest period in rice-cultivating regions.



JEV symptoms in humans

- Majority infections in apparent Clinical signs in 1:300 to1:1000.
- The incubation period is 5-15days
- Mild headache, high fever, stiff neck, abnormal movements
- Impaired consciousness and coma
- Case fat ality rate in JE is high(20-50%).

JEV disease in animals

Horses

- Usually subclinical, fever, impaired locomotion,
- Stupor, teeth grinding

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- Blindness, coma and death rare

Pigs

- Sows: Expo sure early in pregnancy, birth of still born or mummified foetus
- Piglets: Neurological signs, death
- Boars: Infertility, swollen testis

Diagnoses

Individuals who live in or have travelled to a JE-endemic area and experience encephalitis are considered a suspected JE case. A laboratory test is required in order to confirm JEV infection and to rule out other causes of encephalitis. WHO recommends testing for JEV-specific IgM antibody in a single sample of cerebrospinal fluid (CSF) or serum, using an IgM-capture ELISA. Testing of CSF sample is preferred to reduce false-positivity rates from previous infection or vaccination

Treatment, prevention and control

The flaviviral infections are spreading to new areas, which is alarming and calls for measures to control. In general the flaviviral control programmes include mosquito control (spraying of pesticides, impregnated mosquito nets), pig control (segregation, slaughtering, and vaccination) and human vaccination.Another way to prevent Japanese encephalitis infection is to avoid mosquito bites in endemic rural areas more specifically close to irrigated rice fields and pig farms. Many mosquitoes are most active at dusk and dawn. People can use insect repellents when they are outdoors and wear long sleeves and trousers at these times, or consider staying indoors during these hours.As there is no specific treatment, the best way to prevent Japanese encephalitis infection is to avoid mosquito bites. Inactivated vaccine is available under restrictive regulations for adults with the potential risk of exposure (e.g. travel for more than 1-2 months in rural areas).

Safe and effective JE vaccines are available to prevent disease. WHO recommends having strong JE prevention and control activities, including JE immunization in all regions where the disease is a recognized public health priority, along with strengthening surveillance and reporting mechanisms. Even if the number of JE-confirmed cases is low, vaccination should be considered where there is a suitable environment for JE virus transmission. There is little evidence to support a reduction in JE disease burden from interventions other than the

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vaccination of humans. Thus, the vaccination of humans should be prioritized over the vaccination of pigs and mosquito control measures.

There are 4 main types of JE vaccines currently in use: inactivated mouse brain-derived vaccines, inactivated Vero cell-derived vaccines, live attenuated vaccines, and live recombinant (chimeric) vaccines.