Tropical Diseases on Insurgence: Clinician’s Perspective

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Abstract
Many known and unknown factors play a synergistic role in the emergence or re-emergence of some infections in a particular area or country. In recent years, India has seen a significant increase in the prevalence of many viral or bacterial diseases. Many are vector borne and are zoonotic disease while others have different source and mode of transmission. These diseases are often associated with high morbidity and mortality. Five important diseases such as leptospirosis, dengue, chikungunya, Japanese encephalitis, and leishmaniasis have been discussed in this article.

Key Words: Chikungunya, Dengue, emerging infections, Japanese Encephalitis, Leptospirosis, Leishmaniasis, Tropical Diseases

Introduction
An emerging disease is one that has appeared in a population for the first time or that may have existed previously but is rapidly increasing in incidence or geographic range as described by the WHO. Over the past century, with the advent of newer vaccines, antibiotics and improved sanitation have made us able to control many infectious diseases. However, in the last 20 years, there is emergence or increased incidence of certain other infections in defined geographic area and beyond which is becoming a serious matter of concern in the current situation. With the changing climatic condition, the development of drug resistance and various other contributory factors existing organisms are able to infect new host population in a more virulent form. In the recent past, India was hit by many large outbreaks of emerging infections mostly zoonosis. Currently, 22 States and Union Territories of India have reported cases of chikungunya. Although mortality is not common, significant morbidity was caused due to persisting joint disease after 2006 epidemic in India.[1] Acute encephalitic syndrome was another fatal disease with rising incidence in the last 5 years mostly in Uttar Pradesh, Bihar, Assam, and West Bengal, etiology of which remained undetermined in most cases with Japanese encephalitis (JE) attributable in few. Here, we discuss few important infectious diseases that have achieved the designation of emerging infections due to their significant increase in prevalence over the last decade in India and surrounding areas.

Leptospirosis
Leptospirosis is a water-related zoonotic disease contracted through breach in the skin or mucosa by exposure through water contaminated by urine from infected animals, most commonly rodents and rarely other wild and domesticated animals. Human-to-human transmission is rare. Outdoor, agricultural, sewage workers and recreational swimmers are particularly at risk, especially during rainy season. Epidemics may occur during flooding, driving the rodents toward human habitats.

What was known?
India is a tropical country and is a major contributor in terms of population and geographical area in the south East Asia, which is considered one of the niche areas for the emerging infectious diseases in the world.
**Etiology**

*Leptospira interrogans* is the causative bacteria for leptospirosis, an acute and generalized febrile illness due to vasculitis with varied clinical manifestations ranging from asymptomatic disease to severe multisystem failure due to infections from different serovars (over 200).

Clinically, the symptomatic cases have been divided into two groups, namely, anicteric and icteric also called Weil’s disease.

Leptospirosis has a variable incubation period of 3–21 days though most of the cases develop within 3–14 days but never after 4 weeks. It is a two-stage disease – first stage called septic phase and lasts for 3–7 days during which the bacteria spreads through blood and different body fluids such as cerebrospinal fluid (CSF). All cases have identical initial symptoms with sudden onset of flu-like disease – intense headache, fever ≥102°F, conjunctival congestion, fatigue, photophobia, acalculous cholecystitis in children, myalgia and soreness (especially back and calf muscles), and a characteristic pinprick/petechiae skin rash mimicking meningitis, developing in the first 2–3 days of illness over any part of the body but most commonly over pressure areas such as the lower extremity.

**Clinical features**

After a few days of apparent recovery, a few patients with more severe disease enter the second phase (called tissue or immune phase with the clearing of bacteria from blood and intermittent bacterial positivity of CSF and other tissues), with reappearance of initial symptoms and fatigue, psychosis, renal impairment, and meningitic features. One out of ten patients develops very severe infection (depending on the strength of bacterial inoculums, virulent serovar such as icterohemorrhagiae, Batavia, Lai, and poor host immune status) called Weil’s disease with hepatic, renal, and multisystem failure occurring rapidly within 10 days and may develop these without any intermittent apparent recovery. Jaundice and renal failure are prominent features. Myocarditis and pulmonary infiltrates are also seen. Hemorrhages from different orifices even internal bleeding are common. These cases can be fatal in up to 40% cases if not properly treated early.

Most patients recover after initial stage within 6–12 weeks. Severe cases may take longer to recover. Immunity after an illness is serovar specific and rarely lasts longer than 10 years.

**Diagnosis**

Diagnosis in mild cases needs physician’s awareness as they mimic flu. During the initial stage, dark-field examination or cultures of blood or CSF may demonstrate the bacteria. During the immune phase, culture is only possible from urine. Serological tests such as IgM ELISA, macroscopic slide agglutination, microscopic agglutination with an initial titer of 1:100, or fourfold rise of titer in paired sera collected 14 days apart are helpful in diagnosis. Blood count reveals anemia with neutrophilic leukocytosis. Severe infections will cause thrombocytopenia. Urinalysis always reveals albuminuria though it may be transient. Proteinuria and hematuria are common. Conjugated hyperbilirubinemia with raised transaminases, raised serum creatinine, and creatinine phosphokinase completes the picture.

**Prevention**

Protective clothing, wearing protective gloves, and avoidance of potentially infected waters are recommended preventive measures.

**Treatment**

Treatment is based on high index of suspicion and should not wait for the confirmation of the diagnosis by laboratory means. Effective antibiotic therapy initiated within 7 days of illness is the cornerstone of therapy. Chloramphenicol, penicillin derivatives, erythromycin, doxycycline, tetracycline, and ceftriaxone have been used effectively. Penicillin may cause Jarisch–Herxheimer reaction in few cases. Postexposure prophylaxis with doxycycline has reduced the incidence of symptomatic disease.

**Dengue**

**Epidemiology**

Currently, dengue is endemic in more than 125 countries worldwide with about 75% or more disease burden borne by the South-East Asia Region including India and the Western Pacific region. Since its first reported outbreak in India in 1946, incidence is increasing day by day with outbreaks in almost every corner of the country such as Andhra Pradesh, Delhi, Goa, Haryana, Gujarat, Karnataka, Kerala, Maharashtra, Rajasthan, Uttar Pradesh, Pondicherry, Punjab, Tamil Nadu, West Bengal, and Chandigarh in 2005–2008.

**Etiology and Vector**

Dengue is a febrile, *Aedes aegypti* mosquito-borne viral illness caused by one of the four antigenically distinct type of dengue flaviruses (1–4). A patient can be infected with any two or even all four types of dengue virus and can be reinfected once in a lifetime. Apart from mosquito bite, infrequently possible mode of transmission of dengue that has been reported in various literatures is transfusion of blood from an infected donor, injuries by infected sharps to health-care workers, transplantation of organs and tissues from infected donors, and from infected pregnant mother to her fetus by vertical transmission.
Clinical presentation following dengue infection can vary from asymptomatic disease to undifferentiated fever (or viral syndromes), classical dengue fever (DF), dengue hemorrhagic fever (DHF), or dengue shock syndrome, and expanded dengue syndrome. However, with this criterion, some patients with severe dengue manifestation and those with multiorgan failure were missed, so modification in these are being made subsequently such as in 2009 by the WHO[17] and later by the Centers for Disease Control and Prevention[18] in 2015 which includes one extra category – dengue-like illness. Infections such as leptospirosis, malaria, enteric fever, scrub typhus, hantavirus, and chikungunya may have dengue-like presentation, especially during the initial phase of infection. In a study by Suharti et al.,[19] only about 49% of the total patients tested positive for dengue infection serologically and the rest 51% negative for dengue though all of them had initial features simulating a probable dengue case.

In the febrile phase, symptoms abruptly begin with a high (≥101°F) fever with chills and any two of the four symptoms, namely, severe frontal headache, retro-orbital pain, severe myalgia of back and extremities and arthralgia (termed breakbone) along with nausea, vomiting, abdominal pain, and rarely diarrhea. Sore throat, prostration, and depression are followed by conjunctival congestion and prominent flushing of skin due to cutaneous vasodilation. Initial fever subsides within 4–7 days followed by remission of few hours to few days. Mild hemorrhagic signs such as mucosal bleeding from cheeks and gums and menorrhagia may be seen.[20] Tender hepatomegaly may occur after few days of fever. Progressive leukopenia at this stage should alert the physician to high probability of dengue fever. The tourniquet test, which is positive in ≥50% cases, is a specific test for DF, done by inflating the blood pressure cuff for 5 min over the arm and looking for ≥3 petechia/cm² area [Figure 2].

Four out of five patients develop skin eruptions during the remission of fever. Half of the patients develop a centrifugal macular, maculopapular, scarlatiniform, or petechial eruption[21] typically starting over the dorsum of hands and feet, gradually involving the extremities and torso, and typically sparing the face. The rash may become confluent with small round

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**Table 1: Yearly prevalence of various dengue serotypes in India**

| Year   | State        | Prevalent serotype |
|--------|--------------|--------------------|
| 1964   | Tamil Nadu   | 2                  |
| 1968   | Tamil Nadu   | 1,2,3 and 4        |
| 1970   | Uttar Pradesh| 1,2,3 and 4        |
| 1996   | Uttar Pradesh| 2                  |
| 1996   | Delhi        | 2                  |
| 1996   | Haryana      | 3                  |
| 1997   | Delhi        | 1                  |
| 2001   | Madhya Pradesh| 2                |
| 2003-2005 | Delhi   | 1,2,3 and 4       |
| 2007-2009 | Delhi   | 1,2,3 and 4       |
| 2009-2010 | Maharashtra | 4                  |
| 2010-2011 | Delhi      | 1                  |
| 2009-2012 | Uttar Pradesh| 1,2 and 3         |

Reproduced from: Gupta E, Ballani N. Current perspectives on the spread of dengue in India. Infect Drug Resist 2014;7:337-42
island-like areas of sparing called white islands in the red sea.[22,23] The eruption lasts 2 h to several days [Figure 3].

As the fever starts to subside around 3–7 days of illness, there is increased capillary permeability which results in raised hematocrit.[24] Patients without capillary leakage usually improve while those with leakage become worse at this stage. Plasma leakage is variable, and degree of rise of hematocrit above baseline reflects the degree of leakage.

Patients with DHF may have any of the four hemorrhagic manifestations – petechia, purpura, ecchymoses, and epistaxis. Shock, preceded by warning sign of subnormal temperature, is due to significant plasma leakage caused by capillary permeability.

## Table 2: Dengue case classification - World Health Organization 2009[^16]

| Probable dengue | Dengue without warning signs |
|-----------------|------------------------------|
| Live in/travel to dengue endemic area | Fever and two of the following |
| Nausea, vomiting | Rash |
| Aches and pains | Leukopenia |
| Positive tourniquet test | Any warning sign |
| Laboratory confirmed dengue: Important when no sign of plasma leakage |

| Probable dengue | Dengue with warning signs* |
|-----------------|-----------------------------|
| Abdominal pain or tenderness | Dengue as defined above with any of the following |
| Persistent vomiting | Clinical fluid accumulation (ascites, pleural effusion) |
| Mucosal bleeding | Lethargy, restlessness |
| Liver enlargement >2 cm | Laboratory: Increase in HCT concurrent with rapid decrease in platelet count |

| Probable dengue | Severe dengue |
|-----------------|---------------|
| Severe plasma leakage leading to | Severe plasma leakage leading to |
| Shock (DSS) | Shock (DSS) |
| Fluid accumulation with respiratory distress | Fluid accumulation with respiratory distress |
| Severe bleeding as evaluated by clinician | Organ hypoperfusion due to prolonged shock result in metabolic acidosis, multiorgan dysfunction (severe hepatitis, encephalitis, and myocarditis ± bleeding), and disseminated intravascular coagulation leading to severe hemorrhage and a fall in hematocrit and rise in leukocyte count may occur. |
| Severe organ involvement | Liver: AST or ALT ≥1000 |
| Liver: AST or ALT ≥1000 | CNS: Impaired consciousness |
| CNS: Impaired consciousness | Failure of heart and other organs |

[^16]: Requires strict observation and medical intervention.

DSS: Dengue shock syndrome, AST: Aspartate transaminase, ALT: Alanine transaminase, HCT: Haematocrit

*Requires strict observation and medical intervention.

DSS: Dengue shock syndrome, AST: Aspartate transaminase, ALT: Alanine transaminase, CNS: Central nervous system, HCT: Haematocrit

**Figure 2:** Course of dengue illness. (Reproduced from: Wikipedia, [available online -https://en.wikipedia.org/wiki/Dengue_fever. Accessed on 02.08.2017])

**Diagnosis**

Diagnosis of dengue infection can be made both by direct and indirect methods. Direct method includes virus isolation, NS1 antigen detection, and reverse transcriptase-polymerase chain reaction (RT-PCR) for viral genome. Among these, virus isolation and RT-PCR need to be done during the early phase of infection[^25] whereas NS1 antigen is positive in the beginning as well as later part of infection.[^26,27] Indirect serological test detects dengue IgM and IgG antibody after around 4–5 days of illness

**Treatment**

Maintaining intravascular fluid volume by the management of fluid and electrolyte balance and monitoring platelet count and hemodynamics is the cornerstone of therapy. Antipyretics and oral fluids are important. Nonsteroidal anti-inflammatory drugs (NSAIDs) must be avoided lest it may precipitate thrombocytopenia and bleeding. Severe cases may require platelet transfusion. Treatment depends on severity of dengue. More severe cases including unconscious or disoriented patients have to be admitted in high dependency units or intensive therapy units for close observation. These patients may need intravenous fluid therapy, plasma transfusion, or blood transfusion depending on the stage of dengue severity. Renal failure may need support in the form of hemodialysis. Adult respiratory distress syndrome patients may need ventilator support. Liver dysfunction, in most cases, is self-limiting except in severe cases which need appropriate support.
Chikungunya

Chikungunya, first described in 1952–1953 in Makonde plateau of Tanzania,[28] is derived from the Swahili/Makonde word “Kunqunwala,” meaning “to become contorted” or “that which bends up.”

Etiology and Vector

Caused by the bite of Aedes mosquito transmitting the enzootic Togaviridae virus chikungunya, it stands for both the virus (chikungunya virus [CHIKV]) and the disease, characterized by fever, headache, myalgia, rash, and prominent acute and persistent arthralgia. In Africa and Asia, Aedes aegypti and the Aedes albopictus are the predominant vectors of infection.[29,30]

CHIKV in times of epidemic can circulate between human and mosquito without the need for any animal reservoir. Asymptomatic infection is very rare. The incubation period ranges from 1 to 12 days with the average being 4–5 days. This is followed by chickungunia fever with sudden onset of high fever, severe arthralgia, myalgia,[31,32] headache, photophobia, and rash,[33] sharing many features with DF.

Clinical Features

The skin rash of chickungunia is present in half of affected patients’ torso, limbs, and face, most commonly affecting the limbs with transient maculopapular rashes[34] lasting 2–3 days with occasional pruritus [Figure 4]. Other less common skin lesion includes aphthous-like ulcers, vesiculobullous lesions with desquamation, and vasculitic lesions.

The polyarthralgia is very prominent, with symmetrical involvement of joints of midtarsal region, foot, ankles, knees, small joints of hands, wrist, and elbow.[35-37] There is swelling of joints but no other signs of inflammation. Joints already damaged by underlying disorder such as osteoarthritis are particularly prone to become involved. The acute signs and symptoms resolve in 1–2 weeks though the arthralgia can persist for months to years significantly impairing the quality of life.[38] Advanced age more than 45 years, severe pain at onset, and underlying disorders are the most common factors that predict the persistence of arthralgia.

Systemic features such as nausea, vomiting, and abdominal pain are uncommon. Although not neurotropic, rare neurological complications such as encephalopathy, acute flaccid paralysis and Guillain-Barre syndrome, malaise, encephalitis, and meningoencephalitis have been reported. Underlying disorders such as stroke, diabetes, epilepsy, and hypertension may increase the likelihood of neurological complications. Children are most susceptible for neurological sequel. Conjunctivitis, cardiovascular disorders, pneumonia, prerenal failure, and respiratory failure are other rarer systemic features.

Fatality, though rare, is due to heart failure, multiorgan failure, hepatitis, and encephalitis, mostly in neonates and elderly.

Diagnosis

Diagnosis is based on clinical, epidemiological, and laboratory criterion. Acute onset of fever with severe polyarthralgia not explained by other medical disorders is a possible CHIKV infection. If the person comes from an endemic area, the case is classified as probable.[10] Laboratory confirmation is essential as the dengue, other alphaviral infections and endemic malaria are close differentials. Detection of viral nucleic acid by RT-PCR[40] in serum samples 1 day before the onset of symptoms up to the 7th day of illness, isolation of the virus, or detection of the antibody response confirms the diagnosis in acute phase. Later in the illness, diagnosis is confirmed by the detection of an immunological response, either an IgM antibody detectable as early as the 2nd–7th day
of illness or a fourfold rise of IgG antibody in paired sera drawn 2 weeks apart. IgG antibody persists for years, but IgM antibody usually becomes undetectable by 3–4 months but may rarely persist for 24 months.

**Treatment**

NSAIDs are the cornerstones of treatment. Short course of low-dose oral steroids has shown to reduce the severity of pain without affecting the disease outcome in a South Indian cohort. Passive transfer of immunity by CHIKV antibody as a prophylactic measure, chloroquine, and ribavirin is being explored as treatment options. Chloroquine is not recommended as it may interfere with protective antibody response. Ribavirin has shown moderate activity in reducing pain and swelling in chronic arthralgia, however, in small cohorts.

Several vaccines were tried. Live-attenuated and inactivated vaccines, DNA vaccines, alpha-virus chimeras, and virus-like particle vaccines which might offer advantages over inactivated and live-attenuated CHIKV vaccines in terms of efficacy or safety are in several stages of development. Recently, a live recombinant measles-virus-based chickungunia vaccine, which had good immunogenicity, even in the presence of antivector immunity, was found to be safe with a generally acceptable tolerability profile in a double-blind, placebo-controlled, active-comparator, dose-escalation phase I first-in-man trial, placing it as a strong contender for candidate vaccine in man.

**Leishmaniasis**

**Epidemiology**

The protozoan disease Leishmaniasis, caused by *Leishmania donovani*, is transmitted to humans by female phlebotome sandfly (*Phlebotomus argentipes*) bite as anthroponotic or zoonotic transmission and has been endemic in the Indian subcontinent since ancient times. Leishmaniasis thrives in poverty, ignorance, lack of health infrastructure, and apathy of pharmaceuticals toward the development of new drugs because of poor prospect of financial gains. Cutaneous leishmaniasis has reached epidemic proportions in Afghanistan and Pakistan and visceral leishmaniasis (Kala-azar in Hindi-black fever, referring to diffuse black pigmentation often seen) in India and Sudan. Bihar (31 districts), West Bengal (6 districts), Jharkhand (4 districts), and Uttar Pradesh (11 districts) are highly affected states by this disease. Furthermore, more than 70%–80% Kala-azar cases are reported from Bihar, especially North Bihar; Bihar itself contributes >50% of visceral leishmaniasis load of the world. Darjeeling, Malda, Murshidabad, South 24 Parganas, Nadia, and Hooghly are the affected districts in West Bengal in that order.

**Etiology and vector**

Initiation of infection is by bite of infected female sandflies which inoculates the flagellated promastigote into the skin. These promastigotes are then taken up by immune cells including neutrophils and macrophages where transformation to amastigote occurs which subsequently infects more neighboring cells or distant cells by dissemination. Local and systemic inflammation develops in susceptible patients but is ineffective.

**Pathogenesis**

Both innate and acquired immunities are activated together. Plasma Concentration of specific IgG antibody is highest in chronic nonhealing mucocutaneous and visceral diseases though these antibodies are not protective. Parasitized dendritic cells activate CD4+ and CD8+ cells which take part in cell-mediated immune response producing an inflammatory response and forming granuloma. Th1 response induces macrophage activation and also prevents recrudescence of latent, chronic infection. Th2-associated cytokines such as interleukin-4, -10, -13 and transforming growth factor-beta are also activated and thus limit macrophage activation but foster intracellular infection. The inflammatory response is not polarized in either Th1 or Th2 lines as both coexist. In progressive nonhealing infections such as chronic mucocutaneous and visceral infections, suppressive Th2 predominate over Th1 cell-mediated immunity in either situation is ineffective. The suppressive Th2 response does not extinguish clinically apparent persistent inflammation, the hallmark of leishmaniasis infection.

**Clinical Features**

The clinical presentation following infection may range from subclinical infection, localized skin lesion, to disseminated infection (cutaneous, mucosal, or visceral) which varies further by endemic region. Diverse parasite (infectivity, pathogenicity, and virulence) and host factors (age, nutritional state, innate, and acquired T-cell-dependent immune responses) and immune-inflammatory response of the host determine the clinical outcome. Tissue macrophages harbor residual parasite lifelong even after treatment.

Expression of visceral infection may be asymptomatic, oligosymptomatic to fully developed Kala-azar. Infection may be either be newly acquired or relapse (usually 6–12 months after successful treatment) or recrudescence from old infection. Relapse may be spontaneous but more often due to some CD4+ T-cell reducing conditions such as antirejection therapy in transplant recipients, steroid therapy, or concurrent HIV infection.

Kala-azar often presents with prolonged fever, pallor, hepatomegaly with remarkable splenomegaly, preserved appetite with significant weight loss, epistaxis, diarrhea, and growth retardation, especially in children. Blackening of skin is characteristic. Anemia, leukopenia,
and thrombocytopenia with hypergammaglobulinemia are almost always found. With time, malnutrition and secondary infection sets in preparing the stage for death.

**Diagnosis**

Gold standard for diagnosis is demonstration of amastigote in clinical specimen from tissue aspirates, sensitivity of which varies according to the tissue selected – splenic (95%), bone marrow (55%–97%) and lymph node (60%). In endemic and epidemic situations, anti-leishmania IgG antibody demonstration by direct agglutination test is also helpful diagnostically. Recently, freeze dried antigen and antibody against K39 antigen detected immunochromatographically in finger prick blood giving excellent rapid results. In symptomatic patients, anti-K39 strip test has high sensitivity (90%–100%) and variable specificity depending on the region. This test obviates the need for invasive tests and can easily be used in Indian visceral leishmaniasis and in Kala-azar dermal leishmaniasis.

**Treatment**

Till recently, intramuscular antimonial compounds were the benchmark for visceral leishmaniasis treatment. However, widespread development of resistance, particularly in Bihar, has paved the way of intravenous liposomal preparation of amphotericin B for 5 to 10 days, to take the center stage of treatment though prohibitive cost is definitely a factor. Even a single liposomal amphotericin B infusion can provide 90% long-term cure rate. Oral miltefosine is a significant advancement in therapeutic armamentarium as this self-administered drug is also effective in antimony-resistant cases. Paromomycin has completed phase III level testing in India and promises to be a cheap, highly efficacious, minimally toxic 21-day course option. Pentamidine is toxic and much hyped oral.

Sitamaquine has failed to demonstrate added benefit when given in conjunction with standard treatment.

**Japanese Encephalitis**

**Epidemiology**

JE is one of the most important viral encephalitides in Asia. Sporadic cases have been reported in northern Australia and parts of the Western Pacific. This is seen in areas where rice culture and pig farming coexist; thus, it is seen in rural areas mostly. First detected in India in 1955 from patients coming from North Tamil Nadu and adjoining Karnataka, and since its first outbreak in 1973 in West Bengal, it has spread to Uttar Pradesh, Assam, Manipur, Karnataka, Bihar, Andhra Pradesh, Goa, Pondicherry, and recently from Kerala and Maharashtra. Males are affected more than females. In North India, all age groups are affected, but children below 15 years of age are preferentially affected in Southern states. Although 15 different mosquitoes of genera Culex, Aedes, or Anopheles transmit the virus to humans. *Culex vishnui* and *Culex tritaeniorhynchus* are the main vectors and *Culex pseudovishnui* and *Anopheles subpictus* are some secondary vectors in India. The infection is enzootic with pigs as amplifying host and ardeid birds as maintenance host. Human infections are a dead end as no man-to-man transmission is possible because of transient viremia, and most of the vector mosquitoes do not feed on humans by choice. The mosquito thrives in stagnant water, paddy fields, ditches, pools, and puddles; thus, infection is highest in monsoon season in areas where pigs, ardeid birds, and human habitat are in proximity.

**Etiology and Vector**

JE is a mosquito-borne encephalitic syndrome caused by different mosquito-borne flaviviruses.
Clinical Features

Although the infection is mostly asymptomatic, the true burden is manifold as for every symptomatic case; there are about 500 asymptomatic cases. The incubation period is 5–15 days. The clinical picture can be divided in three stages, a prodromal stage characterized by nonspecific febrile presentation with nausea, vomiting, diarrhea, and cough, an acute aseptic meningitis to encephalitic/meningoencephalitic stage with prominent CNS features such as cerebellar signs, cranial nerve palsies, and cognitive and speech impairments and continuing fever, and a late stage marked either by recovery or persistence of symptoms leading to acute flaccid paralysis or neuron injury causing permanent sequelae. A parkinsonian presentation and seizure are typical in severe encephalitic cases. Even after recovery from the primary illness, some patients may develop neuropsychiatric sequelae with cognitive and language impairment which ends up as a cause of an immense social and financial burden, especially for a developing country.

Diagnosis

Diagnosis is by (i) virus isolation and propagation by tissue culture, infant mouse inoculation, or mosquito inoculation, or by (ii) antigen detection by antigen capture ELISA or immunofluorescence test, (iii) serological tests by hemagglutination inhibition, ELISA (IgG/IgM), or neutralization, and (iv) genome detection by PCR.

Prevention

Vector control, sanitation, health education, and early diagnosis and treatment are cornerstones of this acute encephalitic syndrome.

Treatment

Treatment is symptomatic with no specific treatment available. Vaccine is available for travelers to endemic region or population at risk in an endemic/epidemic region. Two intramuscular doses of vaccine given 28 days apart are effective with the last dose at least 1 week before travel or expected time of infection. Indian Government has announced 100% immunization of children with JE vaccine as topmost priority.

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Conflicts of interest

There are no conflicts of interest.

What is new?

Important emerging infectious diseases in India and surrounding countries have been discussed.

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