Acute Encephalitis Syndrome-The Socio-economic Burden in India

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Abstract

Acute encephalitis syndrome is a clinical condition caused by infection with Japanese encephalitis virus or other infectious and noninfectious causes. Acute poses a great public health problem in India, occurring both in epidemics and sporadically. Seasonal outbreaks of acute encephalitis syndrome occur with striking regularity in India and lead to substantial mortality. Several viruses, endemic in many parts of India, account for AES. Although Japanese encephalitis virus is a key aetiological agent for AES in India, and has attracted countrywide attention, many recent studies suggest that enteroviruses and rhabdo viruses might account for outbreaks of AES. It is a neurological disorder which affects the brain and the limbic system when a specific strain of virus or a bacteria attacks the body. Encephalitis is an inflammation of the brain tissue. Once the virus enters inside the blood, it starts migrating to the brain tissues and multiplies itself into numbers. As soon as the signal reaches to our immune system, it generates a response to it in the form of inflamed brain or we can say swelled up brain. When this self-generated response and the infection combines, this leads to viral encephalitis and it majorly affects the spinal cord and our central nervous system causing damage to the brain cells through virus-infected blood vessels.

Keywords: Acute encephalitis syndrome, Neurological disorder, Malnutrition

1 Introduction

Acute encephalitis syndrome (AES) is a clinical condition, of which the most common cause is Japanese encephalitis (JE). Though there is deficiency of data on AES and JE from Bihar, the state ranks third in the reporting of JE cases after Uttar Pradesh and Assam. Acute encephalitis syndrome (AES) is a multifactorial clinical condition, the most common cause being Japanese encephalitis (JE). JE is a vector-borne viral disease caused by the JE virus of group B arbovirus (Flavivirus) and is transmitted to humans by the Culicine mosquito. JE affects the central nervous system (CNS), and can cause serious complications and death. The case fatality rate (CFR) is high and those who survive may suffer from neurological sequelae such as convulsions, episodic headache, autonomic disturbance, abnormal behaviour, mood disorder, intellectual deficit, paresis, incoordination of movements, jerky limb movements, speech disorder, cranial nerve palsy, gaze palsy, parkinsonian features, impaired hearing, etc. An estimated 25% of affected children die from the disease, and among those who survive, 30%–40% suffer from physical and mental impairment. Children suffer the highest attack rate due to lack of cumulative immunity from natural infections.

Viral encephalitis is an important cause of mortality and morbidity in children. It may be sporadic like herpes simplex encephalitis (HSE), or epidemic such as Japanese B encephalitis (JE). The etiological agents are varied, and physicians treating such children often feel limited by the lack of availability of diagnostic testing for most of these agents. There are numerous lacunae in our knowledge, problems in epidemiological investigations, lack of diagnostic facilities, as well as difficulties in managing these critically ill children in smaller centers in our country. Acute Encephalitis Syndrome (AES) is a group of Clinical neurologic manifestation caused by wide range of viruses, bacteria, fungus, parasites, spirochetes, chemical and toxins.
The most common causes of acute viral encephalitis are Japanese encephalitis virus, West Nile virus (WNV), Eastern equine encephalitis virus (EEEV), Western equine encephalitis virus (WEEV), Hendra virus (HeV), enteroviruses (ENV), Chandipura virus (CHPV), Nipah (NiV), Kyasanur forest disease (KFD), St. Louis encephalitis virus, Herpes simplex, poliovirus and measles virus. The causative agent of the AES varies with season and geographical location. The outbreak of AES and JE usually coincides with the monsoon and post monsoon period when the density of mosquitoes increases. Encephalitis due to enteroviruses occurs throughout the year as it is a water borne disease.

Most of the times, it may be difficult to differentiate Japanese Encephalitis from those caused by other bacteria and viruses, as clinical signs of JE are indistinguishable from other causes of AES. Acute Encephalitis Syndrome (AES) including Japanese Encephalitis (JE) is a group of clinically similar neurologic manifestation caused by several different viruses, bacteria, fungus, parasites, spirochetes, chemical/ toxins etc. The outbreak of JE usually coincides with the monsoon and post monsoon period when the density of mosquitoes increases while encephalitis due to other viruses specially entero-viruses occurs throughout the year as it is a water borne disease.

1.1 History

The history of AES in India has paralleled with that of the Japanese encephalitis virus (JEV) since the first report in 1955 from Vellore, Tamil Nadu. The first outbreak of JEV was reported in Bankura district, West Bengal in 1973. Thereafter, sporadic cases of AES and outbreaks have been the leading cause of premature deaths due to the disease in India. Based on various surveillance reports and outbreak investigations, history of AES in India into 3 phases: (a) period before 1975 when a few cases with JE aetiology were identified; (b) between 1975 and 1999 when more JEV cases were reported with frequent outbreaks that resulted in the development of JE endemic regions near the Gangetic plains and in parts of Deccan and Tamil Nadu; (c) between 2000 and 2010, a dramatic change was observed in the AES scenario, which saw the rise in non-JE outbreaks mostly caused by viruses such as Chandipura virus (CHPV), Nipah virus (NiV), and other enteroviruses. Cases of acute encephalitis syndrome have been observed mostly during April to June in Muzaffarpur, Bihar, particularly in children who are undernourished with a history of visiting litchi orchards, as per a report in National Health Portal of India. Since 1978, outbreaks of the disease with high case-fatality rates have also been occurring in Gorakhpur Division of Uttar Pradesh.

Every year, children in the north Bihar and eastern Uttar Pradesh regions are impacted because of the epidemics. The UP government claimed that the disease claimed at least 187 lives in 2018 against 553 in 2017.

2 Causes of encephalitis

Three groups of viruses are common causes of encephalitis:

1) Herpes viruses, such as chickenpox, EBV (Epstein-Barr virus, which causes mono), and herpes simplex (which causes cold sores).
2) Viruses and other germs transmitted by insects, like West Nile virus (spread through a mosquito bite) and the germs that cause Lyme disease and Rocky Mountain spotted fever (spread through tick bites).
3) Viruses that cause once-common childhood infections, such as measles, mumps, and German measles. Thanks to immunizations, it’s rare today for someone to develop encephalitis from these illnesses.

Less often, encephalitis can be:

- Caused by an infection from bacteria, such as bacterial meningitis
- A complication of other infectious diseases like syphilis
- Due to a parasite, like toxoplasmosis (found in infected cat feces) in people with weakened immune systems

I. Soaring Temperatures: Heat and humidity have been a common factor in the spikes of reported cases of encephalitis in Bihar. The state witnessed high temperatures in the range of 40 degrees Celsius and above in 2019, which has led to multiple heat strokes and an insurgence of reported cases of encephalitis in the state.

II. Malnutrition: Hypoglycemia, or low blood sugar, is a major contributing factor to encephalitis attacks and has a direct relation to malnutrition and lack of proper health programmes in place. The 2019 outbreak is suspected to have erupted from the litchi fruit and has seen a cyclical pattern during the harvest season. Children are more prone to consuming fallen fruits, staying out in the sun without proper food, and getting dehydrated - which could have lead to the outbreak once again.

III. Lack of Awareness: Rural areas have seen the most cases of this virus and can be associated with a lack of awareness and understanding. Most affected and their families are not aware of the threats or prevention and precaution methods, thereby making them more susceptible to such viruses than usual.

You can avoid diseases that can lead to encephalitis, especially with children. Here are a few preventive measures you can take:

1) Immunisations: Protect your kids from common infections and conditions by getting them immunised according to the schedule recommended by your doctor.
2) **Avoid contact**: Take extra care to avoid being around people who are already affected by the virus causing encephalitis.

3) **Maintain hygiene**: Ensure your children wash their hands and maintain an antiseptic hygiene regime, especially after coming back from outside.

4) **Avoid Mosquito Bites**: Stay indoors after sunset, use mosquito repellents and nets, avoid waterlogged spots in and around your neighbourhood as these can be mosquito breeding sites and wear protective clothing whenever you step outside.

5) **Avoid Tick Bites**: Make sure your child is not playing with soil, leaves, vegetation and stray animals. Ensure your pets are tick-free and healthy.

### 3 Diagnosis of encephalitis

Doctors use several tests to diagnose encephalitis, including:

- Imaging tests, such as computed tomography (CT) scans or magnetic resonance imaging (MRI), to check the brain for swelling, bleeding, or other problems.
- Electroencephalogram (EEG), which records the electrical signals in the brain, to check for unusual brain waves.
- Blood tests to look for bacteria or viruses in the blood. These also can show if the body is making antibodies (specific proteins that fight infection) in response to a germ.
- Lumbar puncture, or spinal tap, which checks cerebrospinal fluid (the fluid that surrounds the brain and spinal cord) for signs of infection.

### 4 Sign and Symptoms of encephalitis

Symptoms in mild cases of encephalitis usually include:

- Fever
- Headache
- Poor appetite
- Loss of energy
- A general sick feeling

Serious cases of encephalitis can cause:

- A high fever
- Severe headache
- Nausea and vomiting
- Stiff neck
- Confusion
- Personality changes
- Convulsions (seizures)
- Problems with speech or hearing
- Hallucinations
- Memory loss
- Drowsiness
- Coma

It's harder to spot some of these symptoms in infants. Important signs to look for include:

- Vomiting
- A full or bulging soft spot (fontanel)
- Crying that doesn't stop or that seems worse when the baby is picked up or handled
- Body stiffness

Because encephalitis can happen during or after common viral illnesses, symptoms of these illnesses can start before encephalitis happens. But often, it appears without warning.

### 5 Prevention of encephalitis

- Increase access to safe drinking water and proper sanitation facilities.
- Improve nutritional status of children at risk of JE/AES.
- Vector control:
  1. The preventive measures are directed at reducing the vector (mosquito) density.
  2. JE vectors are exophilic and endophagic in nature. The risk of transmission increases when the human dwellings and animal sheds particularly piggeries are situated very close to each other. Piggeries may be kept away (4-5 kms) from human dwellings. When they are situated far from each other, the risk of transmission is reduced.
  3. Personal protection against mosquito bites using insecticide treated mosquito nets.
  4. Clothing reduces the risk of mosquito biting if the cloth is sufficiently thick or loosely fitting. Long sleeves and trousers with stockings may protect the arms and legs, the preferred sites for mosquito bites. School children should adhere to these practices whenever possible.
  5. Household insecticidal products, namely mosquito coils, pyrethrum space spray and aerosols.
Acute Encephalitis Syndrome (AES) is a major public health concern in India. Large outbreaks of AES affecting particularly children, occur annually in the country post monsoon from July to November. The National Vector Borne Disease Control Programme in India set up country wide surveillance for AES through sentinel sites with a focus on detecting Japanese encephalitis (JEV). Although JEV is the major cause of AES in India (ranging from 5-35%), the etiology in a large number of cases however remains unidentified.

According to the National Centre for Disease Control officials, AES outbreaks in Muzaffarpur have been reported since 1995. This year the main cause of death in most cases has been attributed to hypoglycemia (low blood sugar level). How is hypoglycemia related to these deaths and what are researchers suggesting? Usually, the disease strikes during monsoon (June-October) but Bihar reportedly showed a high number of affected people during April-June this year.

Acute Encephalitis Syndrome (AES) is considered a very complex disease as it can be caused by various agents including bacteria, fungi, virus and many other agents. In most of the cases reported in India, Japanese Encephalitis (JE) virus is considered the most common cause according to an estimate by Union Health Ministry. As much as 5 per cent to 35 per cent cases reported involve Japanese Encephalitis (JE) virus. The most worrying fact is that the syndrome can also be caused by agents like dengue, mumps, measles, even Nipah or Zika virus. In several cases, the cause of AES remains clinically unidentified.

In India, the numbers of people infected last year mount to as much as 10,485 cases of AES with 632 deaths across 17 states according to the National Vector Borne Diseases Control Programme (NVBDCP). The fatality rate due to Acute Encephalitis Syndrome (AES) is as high as 6 per cent in India, but it rises to 25 per cent amongst children. The state of Bihar, Assam, Jharkhand, Uttar Pradesh, Manipur, Meghalaya, Tamil Nadu, Karnataka, and Tripura are worst affected.

According to Bihar government officials, AES is not a disease but a syndrome and the main cause of death among children due to AES was prolonged hypoglycemia with delayed treatment. A
2014 research study on ‘Epidemiology of Acute Encephalitis Syndrome in India: Changing Paradigm and Implication for Control’ co-authored by six researchers compared Muzaffarpur and Vietnam’s Bac Giang province as both the places had similar condition and undernourished children were suffering from AES and hypoglycemia at the same time with presence of Litchi Orchards in neighbourhood. According to the research, “The findings of the possible association with some toxin in Litchi or in the environment is required. Methylene cyclopropyl glycine (MCPG), a toxin present in litchi fruit has been shown to cause hypoglycemia in experimental animals,” it stated.

The researchers also found that there has been a history of visit to litchi orchards among children of Muzaffarpur who suffered from AES before 2014. Undernourished children who remain hungry for several hours face much worse impact.

8 Conclusion

Acute Encephalitis Syndrome is a group of clinically similar neurologic manifestation which is characterised as acute-onset of fever and mental status of a person is changed like disorientation, delirium, mental confusion, coma, personality changes, weakness, new onset of seizures in a person of any age at any time of the year and other symptoms depending on the part of the brain affected. It has been observed that the cases of this disease mostly occurred during April to June mainly in children who are undernourished and also those who have a history of visiting litchi orchards. Japanese encephalitis virus has its endemic zones along the Gangetic plain including states of eastern UP, Bihar, West Bengal, Assam and parts of Tamil Nadu.

Let us tell you that according to some studies it is said that in India Acute Encephalitis Syndrome outbreaks in north and eastern India have been linked to children eating unripe litchi fruit on empty stomachs. Toxins hypoglycin A and methylenecyclopropyl glycine (MCPG) are present in an unripe fruit which cause vomiting if ingested in large quantities. Hypoglycin A has amino acid which is found in unripened litchi and MCPG is a poisonous compound found in the seeds of litchi that cause sudden drop in blood sugar, vomiting, altered mental states, unconsciousness, coma and death. These toxins cause sudden high fever and seizures and require immediate treatment, hospitalisation especially in malnourished children.

5 Conflict of interests

None

6 Author’s contributions

CB and DB were equally participated in the preparation of manuscript. All authors read and approved the final manuscript.

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