

Original Research Article

A study on epidemiology, demographic and clinical presentation of acute encephalitis syndrome in children admitted to a tertiary care hospital in Central Gujarat

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ABSTRACT

Background: Acute Encephalitis Syndrome is a major public health problem in major parts of the world especially in South and South East Asia. Globally, viral infections remain the most common cause of encephalitis in children. Present study was done to identify epidemiology, demographic and clinical presentation of Acute Encephalitis Syndrome in Children.

Methods: This was tertiary care hospital based retrospective study. Data were collected from case record forms from month of July 2024 till December 2024. 57 patients fulfilling the criteria of AES in the age group of 1-12 years were enrolled in the study. Detailed history and investigations were sent including molecular testing of viral titre.

Results: Total 57 children were enrolled. Mean age of presentation was 3.8 years. Majority of cases occur were seen in children less than 6 years of age. Slight male predominance (30 males=52.6% and 27 female 47.4%) was observed. Most patients were referred from rural area. Case fatality rate was observed to be 54.39%. 22 children were discharged while 4 patients went LAMA. CHPV was detected in 7 patients (12.28%) and Japanese encephalitis in one patient (1.75%). Fever was the major presenting complaint (85.96%) while vomiting was presenting complaints in 36 patients (63.16%). Altered sensorium was present in 23 patients (40.35%).

Conclusions: AES remains a life-threatening neurological emergency in children. Young age, rural residence and severe clinical presentation contribute to poor outcome. Strengthening surveillance, early diagnosis and critical care management are essential to reduce mortality and long-term neurological sequelae.

Keywords: Acute encephalitis syndrome, Altered sensorium, Status epilepticus, Refractory shock

INTRODUCTION

Acute Encephalitis Syndrome (AES) is a major public health problem in many parts of the world, particularly in South and Southeast Asia. In India, AES continues to cause significant morbidity and mortality among children. Children are particularly vulnerable to AES due to immature immunity and increased exposure to infectious agents. Early diagnosis and prompt management are essential to reduce mortality and prevent

long-term neurological sequelae. AES is characterised by an acute onset of fever, and altered mental status, seizures, or neurological deficits, indicating brain inflammation or dysfunction.¹ AES represents a clinical syndrome rather than a single disease entity, encompassing a wide spectrum of infectious and non-infectious aetiologies that result in acute brain dysfunction. Children with AES present with mild febrile illness with or without altered sensorium to severe neurological complications such as status epilepticus,

coma, and long-term neurodevelopmental impairment. Globally, viral infections remain the most common cause of encephalitis in children. Among them, Japanese encephalitis is one of the most important causes in Asia, including India. In addition to Japanese encephalitis, other viruses such as herpes simplex, enterovirus, and West Nile viruses, Chandipura virus are Important Causes.

In addition to viral causes, bacterial infections, rickettsial diseases, parasitic infections, and immune-mediated processes may contribute to the syndrome. Seasonal outbreaks, particularly during the monsoon and post-monsoon seasons, have been reported from several states across India, particularly in rural and endemic regions where vector-borne diseases are prevalent, including rural areas of Gujarat. Despite advances in diagnostic techniques and supportive care, a substantial proportion of AES cases remain etiologically undiagnosed, which requires robust surveillance system and proper case identification, therefore the National Vector Borne Disease Control Programme under the Ministry of Health and Family Welfare, Government of India, adopted the term AES for surveillance of all cases presenting with acute febrile illness and neurological manifestations suggestive of encephalitis.³ Epidemiological studies for understanding the clinical spectrum, demographic characteristics, and outcomes of AES in children is much needed, for guiding public health interventions, improving early recognition, and optimizing management strategies.^{4,5} Therefore, the present study was undertaken to evaluate the epidemiology, demographic profile, and clinical presentation of AES in children admitted to a tertiary care hospital in Central Gujarat, which is a major referral hospital of Central Gujarat.

METHODS

Study type

This was a hospital-based retrospective observational Study Setting -The study was conducted in the Department of Paediatrics at a tertiary care hospital in Central Gujarat, India. The study was conducted over a period of 6 months from July 2024 to December 2024. The study included children admitted to the Paediatric Ward and Paediatric Intensive Care Unit (PICU) of the tertiary care hospital, Sir Sayajirao Gayekwad General Hospital, Vadodara, Gujarat, India. All children aged 1 month to 12 years admitted with a diagnosis of AES during the study period were included.

AES was defined as per the operational case definition recommended by the National Vector Borne Disease Control Programme under the Ministry of Health and Family Welfare, Government of India as Acute onset of fever and a change in mental status (including confusion, disorientation, coma, or inability to talk) and/or new onset of seizures (excluding simple febrile seizures) and patients with, Simple febrile seizures, cases of epilepsy,

Metabolic encephalopathy, Intracranial space-occupying lesions, Traumatic brain injury were excluded from study. All eligible children admitted during the study period were included by a consecutive sampling method, so 57 patients in total were enrolled. After obtaining written informed consent from parents/guardians, detailed information was collected using a pre-designed, pre-tested proforma, including, demographic data like age, gender, residence (rural/urban), socioeconomic status.

Epidemiological data like seasonal variation, immunization status, including Japanese Encephalitis vaccination, where applicable history of travel, exposure to mosquitoes or pigs' cattle. Clinical Presentation in form of duration of fever, seizures including type and frequency, altered sensorium, vomiting, headache, focal neurological deficits, signs of raised intracranial pressure. Laboratory investigations in the form of Complete blood count, Blood sugar, Liver and renal function tests, Serum electrolytes, fluid (CSF) analysis, CSF cytology and biochemistry, CSF viral studies where feasible, Serology for Japanese Encephalitis Neuroimaging (CT/MRI brain) when indicated. Outcome assessment in form of duration of hospital stay, need for mechanical ventilation, Complications, Survival outcome (discharge/death), and neurological status at discharge were assessed. Data were summarized in Microsoft excel and analyzed using appropriate statistical software (e.g., SPSS version. Categorical variables were expressed as frequency and percentage. Continuous variables were expressed as mean±standard deviation (SD) or median with interquartile range (IQR) as appropriate. Association between categorical variables was analysed using the Chi-square test or Fisher's exact test. A p value <0.05 was considered statistically significant.

RESULTS

In our study, Fever was most common presenting complaint observed in 49 patients (85.96%) of patients. Vomiting was the second most common complaint, presented 36 (63.16%) patients.

Table 1: Profile of AES.

Chief complaints	Number (n=57)	Percentage (%)
Fever	49	85.96
Vomiting	36	63.16
Diarhhea	17	29.82
Altered sensorium	15	26.32
Breathing difficulty	11	19.30
Convulsions	7	12.28
Cough	5	8.77
Cold	3	5.26
Red eye	1	1.75
Headache	1	1.75
Reduced oral intake	1	1.75

Diarrhoea was present in 17 (29.82%) patients, and 11 patients (19.30%) presented with difficulty in breathing in the form of severe respiratory distress. Altered sensorium was observed in 15 patients (26.32%). 7 patients (12.28%) had convulsions. Minor complaints like cough, cold, conjunctivitis, headache and decreased oral intake were observed in 5 (8.77%), 3 (5.26%), 1 (1.75%), 1 (1.75%), and 1 (1.75%), respectively.

Table 2: Clinical presentation of acute encephalitis syndrome (AES).

Condition on receiving	Number (n=57)	Percentage (%)
Altered sensorium	23	40.35
S/O shock	20	35.09
Respiratory failure	16	28.07
Status epilepticus	13	22.81
Hypoglycemia	9	15.79
Severe dehydration	6	10.53
Nasal bleeding	5	8.77
Raised ICT	2	3.51
Catecholamine resistant shock	2	3.51
Bradycardia	2	3.51
Tachycardia	2	3.51
Oral and nasal bleeding	1	1.75
Fluid refractory shock	1	1.75
Hyperglycemia	1	1.75

The most common clinical condition observed was altered sensorium in 23 patients (40.35%). Shock was observed in 20 (30.09%). Respiratory failure was observed in 16 (28.07%) patients. Status epilepticus was present in 13 patients (22.81%).

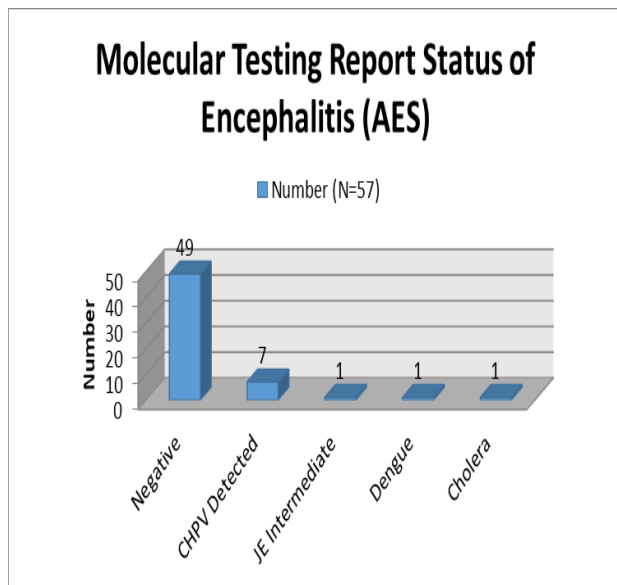


Figure 1: Molecular testing report status of encephalitis.

Hypoglycemia was observed in 9 patients (15.79%). Severe dehydration was observed in 6 patients (10.53%). 5 patients (8.77%) had nasal bleeding. Raised intracranial tension was observed in 2 patients (3.51%). Catecholamine-resistant shock was observed in 2 patients (3.51%). Bradycardia and tachycardia were observed in 2 patients each (3.51%). One patient (1.75%), had both oral and nasal bleeding. One patient (1.75%) had fluid-refractory shock and hyperglycemia each. In our study, out of 57 patients, 50 patients (87.72%) were from rural areas, and 5 patients (8.77%) were from urban areas. 2 patients (3.51%) were from a tribal area.

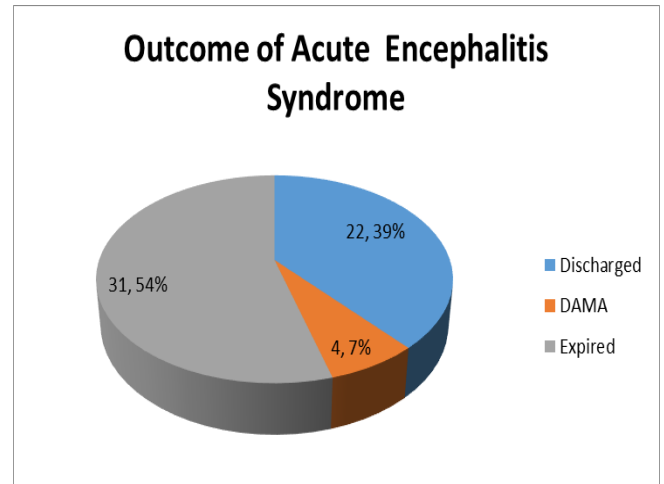


Figure 2: Outcome of acute encephalitis syndrome.

In our study, the majority of the patients were between 1-5 years of age (57.89%), followed by 5-15 years were 31.58%. Less than one year were 10.53%.

In our study, out of 57 patients, 30 patients (52.63%) were male and 27 patients (47.37%) were female. The observed male: female ratio was 1.11. In the present study, 16 (53.33%) male patients were between 1 and 5 years of age, whereas 17 female patients (62.96%) were between 1-5 years of age. In the 5-15 years age group, 9 patients (30%) were male and 9 patients (33.33%) were female.

In infant group, 5 patients (16.67%) were male and one patient (3.7%) was female. However, the P value was found to be insignificant. In the current study, majority of the patients, 32 (57.14%), stayed for the period of 1-10 days, while 11 patients (19.64%) stayed less than one day. 8 patients (14.29%) were stayed between 10-20 days. 5 patients (8.93%) stayed for more than 20 days. In this study, 49 patients (85.96%) patients were tested negative for viral titre. Whereas 7 patients (12.28%) had tested positive for chandipura virus (CHPV). Japanese encephalitis, Dengue, Cholera were observed in one patient (1.75%) each. In our study, we have observed that out of 57 patients, 31 patients (54.39%) died. While 22 patients (38.60%) were discharged. While 4 patients (7.02%) went to LAMA. In the present study, between 1

and 5 years of age, 16 patients (48.48%) were discharged, 15 patients (45.45%) died, and 2 patients (6.06%) went LAMA. Between the 5-15 years of age group, 13 patients

(72.22%) died, 3 patients (16.16%) were discharged, and two patients (11.11%) went LAMA. In infants, 3 patients (50%) died, and three patients (50%) were discharged.

Table 3: Distribution of AES cases according to age, sex.

Age (years)	Male	Percentage (%)	Female	Percentage (%)
<1 year	5	16.67	1	3.70
1 to 5 years	16	53.33	17	62.96
5 to 15 years	9	30.00	9	33.33
Total	30	100.00	27	100.00
Chi-square test	Chi-square 2.546, P= 0.2800			

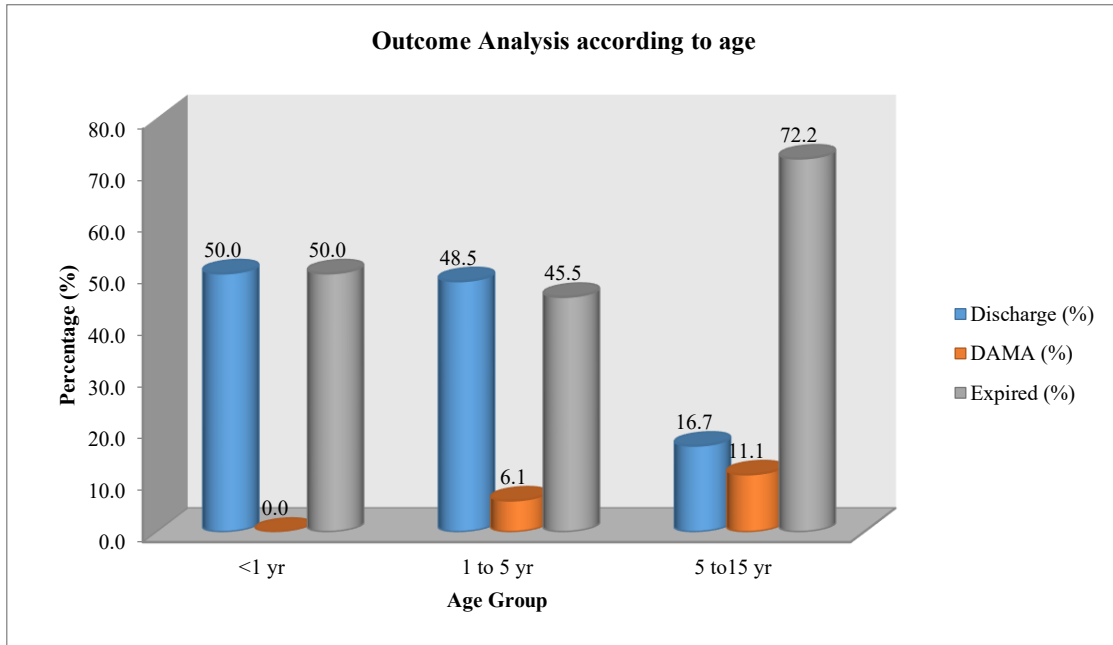


Figure 3: Outcome analysis according to age.

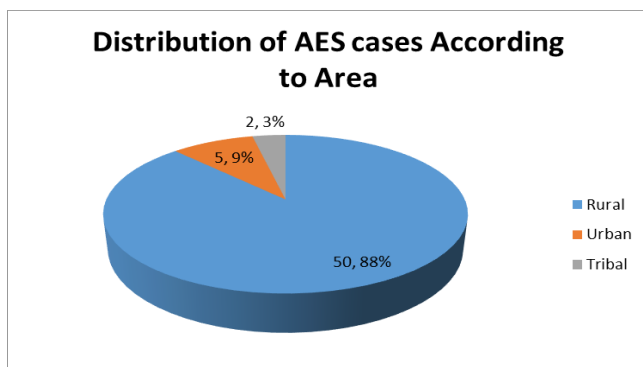


Figure 4: Distribution of AES according to demographic area.

DISCUSSION

In the present study, a total 57 patients, fulfilling the definition of AES, were enrolled in the study period of 6 months from July 2024 to December 2024. In a study by Murhekar et al suggested that the majority of cases of AES occurred in the monsoon and post-monsoon season,

with high case fatality.⁶ In our study, out of the total 351 patients admitted to the paediatric ICU from July 2024 to December 2024, 57 patients were diagnosed as AES, being 16.2% of total admission to ICU. Out of 57 patients in the study, 31 patients expired with a case fatality rate of 54.39%. In a study by Girishkumar et al, case fatality rate was 27.4%.⁷ In study by Sushmitha et al, the case fatality rate was 13%.⁹ In our study, the majority of the patients were from a rural region, i.e. 87.21%. In a study by Murhekar et al, all cases were from a rural region.⁶ In our study, the male:female ratio was 1.1, while in the study by Murhekar et al, the male:female ratio was 1.⁶ In this study, the majority of the cases were observed between 5 and 15 years of age, i.e. 57.89%. In a study by Tripathi et al, the 5-15-year age group were significantly affected by viral AES, and the median age of the patient was 6 years.⁸ In a study by Sushmitha et al, 5-12-year-old children were affected significantly with 81.8%.⁹ In the present study, between 1 and 5 years of age, 16 patients (48.48%) were discharged, 15 patients (45.45%) died, and 2 patients (6.06%) went to LAMA. Between the 5-15 years of age group, 13 patients (72.22%) died, 3 patients (16.16%) were discharged, and two patients (11.11%)

went to LAMA. In infants, 3 patients (50%) died, and three patients (50%) were discharged.

In the present study, fever was observed in 85.96% patients, whereas in the study by Sushmitha et al, fever was observed in 100% cases.⁹ In our study, vomiting was present in 63.16%, while in the study by Sushmitha et al, it was 33%.⁹ In our study, seizures (convulsion and status epilepticus) were 21.25% whereas in the study by Sushmitha et al, seizures were present in 76%.⁹ Altered sensorium was present in 40.30% in our study, while Sushmitha et al observed it to be 85.7%.⁹ In a study by Ravi et al, vomiting (41.4%), seizures (79.3%), and altered sensorium (51.7%) were observed.¹⁰ In our examination, GCS score less than 8 were observed in 23 patients (40.35%). In a study by Sushmitha et al, it was 32%.⁹

AES is often triggered by viral infections. The immune system can trigger a massive cytokine storm, leading to systemic inflammatory response syndrome (SIRS), which can manifest as septic shock. In this study, 35.09% patients had septic shock, 3.51% patients had catecholamine-resistant shock, and one patient had catecholamine and fluid-refractory shock. DIC (disseminated Intravascular Coagulation) in the form of oral and nasal bleeding was observed in 6 patients (12.38%). DIC in the patient contributes to 30-50% cause of mortality in AES. 30 out of 57 patients in our study required (52.6%) mechanical ventilation.

While a study by Sushmitha et al had 32.1% patients requiring mechanical ventilation.⁹ Signs of meningeal irritation and raised intracranial tension were seen in two patients (3.51%). In a study by Sushmitha et al (ref), meningeal symptoms were present in 32.1% patients and raised intracranial tension in 41.1%.⁹ In our study, dysglycemia was observed in 10 patients, of whom 9 patients had hypoglycaemia, and one patient had hyperglycaemia. In the study by Sushmitha et al, two patients had hypoglycaemia and 10 had hyperglycaemia. In a study by Sambasvam et al had prevalence rate of dysglycemia at 39.9%.¹¹

Viral titre by using molecular testing, including testing of CHPV, Influenza, Zika, Dengue, Enterovirus, Japanese encephalitis, Chikungunya, scrub typhus, tetra parvovirus, was done in our study in all patients enrolled. 49 patients were tested negative for all of the above, while 7 patients were positive for CHPV (12.28%), Japanese encephalitis (11.75%), and Dengue in one patient (1.75%), In a study by Priya et al, aetiology was identified in 28.75% cases while 70.32% remain unidentified, whereas in a study by Rathore KS et al Viral aetiology was identified in 17.2% cases with HSV being the most prevalent agent.^{12,13} In a study by Mishra UK et al, specific aetiology could be found in 62% patients, 20 Patients had neurological AES out of which 12 had Herpes Simplex, and 8 patients had Japanese encephalitis.¹⁴ The majority of patients stayed for 1-10

days. The mean duration of stay was 14 days in our study. 22 patients were discharged (38.6%). 31 patients (54.39%) expired. 100% Patients with Chandipura Virus and Japanese Encephalitis virus died, suggesting high virulence. 3 patients less than one year old expired, whereas 15 patients between the age group of 1-5 years old expired. 13 patients in the 5-15 years age group expired. 3 patients in the age group of less than one year were discharged whereas 16 patients in the age group of 1-5 years were discharged, and 3 patients between 5-15 years were discharged. So, the age group of 5-15 years had a mortality of 72.2%, making it a vulnerable age group. In a study done at Assam, where children aged 5-12 years were found to be at risk of AES.¹⁵

Limitations of the study

This is a single-centre study, so more studies are required from other rural and tribal areas of Gujarat. As it is a rapidly progressing disease with a very high case fatality rate, neuroimaging and post-mortem brain biopsy for identification of possible aetiology were not done.

CONCLUSION

AES remains a life-threatening neurological emergency in children. Young age, rural residence, and severe clinical presentation contribute to poor outcomes. Strengthening surveillance, early diagnosis, and critical care management are essential to reduce mortality and long-term neurological sequelae.

Recommendations

Prevention and control of AES in children require a comprehensive public health approach. Based on the findings of the present study, the following measures are recommended:

Strengthening immunization

Expansion of vaccination coverage against Japanese Encephalitis through the Universal Immunization Programme, particularly in endemic regions, to reduce the burden of AES.

Vector control

Implementation of effective mosquito control strategies, including elimination of stagnant water, use of insecticide-treated bed nets, and promotion of personal protective measures.

Early recognition and referral

Training healthcare workers and caregivers to recognize early symptoms of AES such as fever, seizures, and altered sensorium, with prompt referral to higher centres.

Improved nutrition and child health services

Strengthening nutritional programs and routine child health services to enhance immunity and reduce susceptibility to infections.

Community awareness

Conducting health education campaigns to increase awareness about preventive practices and early healthcare-seeking behaviour.

Strengthening surveillance

Enhancing case reporting and monitoring through systems such as the Integrated Disease Surveillance Programme to facilitate early detection and timely public health response.

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Ethical approval: Not required

REFERENCES

- Solomon T, Dung NM, Kneen R, Gainsborough M, Vaughn DW, Khanh VT. Japanese encephalitis. *Lancet.* 2000;355(9206):869-80.
- World Health Organization. Japanese encephalitis surveillance standards. Geneva: World Health Organization. 2008. Available at: <https://www.who.int/newsroom/factsheets/detail/japanese-encephalitis>. Accessed on 11 February 2026.
- Ministry of Health and Family Welfare, Government of India. Guidelines for surveillance of Acute Encephalitis Syndrome (AES). New Delhi: Directorate of National Vector Borne Disease Control Programme. 2014. Available at: <https://nvbdcp.gov.in/index1.php?lang=1&level=2&sublinkid=459&lid=317>. Accessed on 11 February 2026.
- Granerod J, Ambrose HE, Davies NW, Clewley JP, Walsh AL, Morgan D, et al. Causes of encephalitis and differences in their clinical presentations in England: a multicentre, population-based prospective study. *Lancet Infect Dis.* 2010;10(12):835-44.
- Misra UK, Kalita J. Overview: Japanese encephalitis. *Prog Neurobiol.* 2010;91(2):108-20.
- Murhekar MV, Wesley J, Candasamy VT, Sadananda, Mittal M, Gupta N, et al. Investigations of seasonal outbreaks of acute encephalitis syndrome due to *Orientia tsutsugamushi* in Gorakhpur region, India: A One Health case study. *Indian J Med Res.* 2021;153:375-81.
- Singh G, Mani C, Ranjan A, Agrawal N, Pandey S, Kumar P, et al. Determinants of Acute Viral Encephalitis in Muzaffar Nagar District of Bihar, India. *Clin epidemiol glob health.* 2016;4:181-7.
- Tripathy SK, Mishra P, Bhagirathi D, Lipsa P, Ranjan RD. Clinico-epidemiological Study of Viral Acute Encephalitis Syndrome Cases and Comparison to Nonviral Cases in Children from Eastern India. *J Glob Infect Dis.* 2019;11(1):7-12.
- Sushmitha M, Chetty S, Rao VSR. A study on etiological profile of children admitted with acute encephalitis syndrome. *Int J Contemp Pediatr.* 2025;12:779-83.
- Ravi V, Mani R, Govekar S, Deasai A, Lakshman L, Ravikumar BVI. Aetiology and laboratory diagnosis of Acute Encephalitis Syndrome with special reference to India. *J Communicable Dis.* 2024;46:12-23.
- Sambasivan K, Iyer R, Thomas T. Hyponatremia in acute encephalitis syndrome; prevalence and clinical implications. *Int J Contemp Pediatr.* 2020;7(6):1284-8.
- Sharma P, Parmar K, Datta A, Ghosh B, Sarmah D, Borah A, et al. Recent Progress and Challenges of acute encephalitis syndrome; an update on pathogenesis and interventional approaches. *Brain Disord.* 2025;19:100267.
- Rathore SK, Dwivedi B, Kar SK, Dixit S, Sabat J, Panda M. Viral aetiology and clinico-epidemiological features of acute encephalitis syndrome in eastern India. *Epidemiol Infect.* 2014;142(12):2514-21.
- Misra UK, Mani VE, Kalita J. A Cost-Effective Approach to the Diagnosis and Management of Acute Infectious Encephalitis. *Eur Neurol.* 2017;77(2):66-74.
- Rebecca B, Thomas M, Abraham AM, Yoganathan S, Jacob E, Kumar S, et al. Acute Encephalitis Syndrome in children and Adolescents; A Five-Year Descriptive Study from South India. *Indian Pediatr.* 2024;61:413-8.

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