ACUTE ENCEPHALITIS SYNDROME (AES) ASSOCIATED WITH SOCIOCULTURAL AND ENVIRONMENTAL RISK FACTORS IN INFANTS/CHILDREN OF MUZAFFARPUR, BIHAR-HOSPITAL-BASED, PROSPECTIVE STUDY

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ABSTRACT

BACKGROUND
Acute encephalitis syndrome is a group of clinical neurologic manifestation caused by wide range of viruses, bacteria, fungus, parasites, spirochetes, chemicals and toxins. According to AES guidelines- Acute encephalitis syndrome due to unknown agent is defined as a suspected case in which no diagnostic testing is performed or in which testing was performed, but no aetiological agent was identified or in which the test results were indeterminate. Acute encephalitis syndrome in children is due to interaction of several factors in combination.

The aim of the study is to evaluate the sociocultural and environmental factors, which plays a major role in AES.

MATERIALS AND METHODS
The study design was non-interventional, hospital-based, prospective study. The study was conducted at Paediatric Department of S.K.M.C.H., Muzaffarpur, Bihar, over a period of January 1, 2015, to July 31, 2017. Infants/children admitted in S.K.M.C.H., Muzaffarpur, were included in study. All defined cases according to AES guidelines were included and 92 infants/children were selected. Percentage, proportion and Chi-square test were performed for statistical analysis.

RESULTS
Among 92 selected infants/children, AES was highest in rural area, 80 (86.95%). The seasonal incidence of AES was March to July in which highest incidence was found in June, 63 (68.47%). Highest incidence of AES was seen between 1-5 years of age. There was significant statistical association among age of children and AES. AES was more common in male than female. AES was highest in dwellers of kachcha (mud) house. AES was highest, 90 (97.82%) among children of labour/farmer. AES was highest, 90 (97.82%) in which mother was illiterate. Incidence of AES was highest in Hindu religion. All AES, 92 (100%) was seen in malnourished/undernourished children.

CONCLUSION
Sociocultural and environmental factors were the major determinant risk factors for AES. Among these, malnutrition/under nutrition was the commonest risk factor followed by maternal illiteracy, occupation (labour and farmer), Hindu religion, age between 1-5 years, seasonal variation, March to July, mostly in June, higher in male children, lower housing standard and formula feeding practice. Higher incidence of these contributing factors illustrates the government and other health care providers to strengthen the surveillance of morbidity and mortality due to AES and make strategies for prevention, control and reduction of morbidity and mortality due to AES.

KEYWORDS
Acute Encephalitis Syndrome, Children, Malnutrition, Sociocultural and Environment Risk Factors.

BACKGROUND
Acute encephalitis syndrome is a group of clinical neurologic manifestation caused by wide range of viruses, bacteria,

fungus, parasites, spirochetes, chemicals and toxins.[1] According to AES guidelines- Acute encephalitis syndrome due to unknown agent is defined as a suspected case in which no diagnostic testing is performed or in which testing was performed, but no aetiological agent was identified or in which the test results were indeterminate.[2] Regarding risk factors where the disease agent is not firmly established, the aetiology is generally discussed in terms of "risk factors." It is used by different authors with at least 2 meanings- (a) An attribute or exposure that is significantly associated with the development of a disease. (b) A determinant that can be modified by intervention thereby reducing the possibility of

occurrence of disease or other specified outcome.[3] An ecologic study revealed an independent association between litchi plantation surface proportion and acute encephalitis incidence.[4] Prabhat Kumar Sinha who headed a six membered team from the Rajendra Memorial Research Institute of Medical Sciences, Patna, collected samples of litchi from orchards in affected areas for toxicology study after hue and cry over rising number of children deaths due to AES. Some scientists attributed the disease to litchi in Muzaffarpur district. But, Sinha maintained that it is a subject of in-depth research. The culprit strain of the disease remains a mystery till date.[5] AES is a social disease with medical aspects. It should be described as a barometer of social welfare. The social factors include many non-medical factors as poor quality of life, poor housing, lack of education, lack of awareness of causes of illness, under nutrition and unhygienic environment. All these factors are interrelated and contribute to the occurrence and spread of AES. The sociocultural and environmental factors play a major role in AES. In this context, the current study was done to reflect the attention of government as well as other health policy planner to formulate strategy and take appropriate action for reduction of morbidity and mortality due to AES in Muzaffarpur district. Hence, this study was designed with the following aims and objectives.

Aims and Objectives
- To identify the sociocultural and environmental risk factors of AES.
- To describe the distribution and magnitude of sociocultural and environmental risk factors of AES.
- To provide the data essential for planning, implementation and evaluation of services for prevention, control and reduction of morbidity and mortality due to AES and setting up of priorities among those services.

Study Design- A non-interventional, hospital-based prospective study.

Sample Technique and Sample Size- All children who fulfilled the AES definition as per the AES guidelines were included and 92 infants/children met the inclusion criteria.

Inclusion Criteria
- Patients admitted in Paediatric Department with fever, headache, confusion, convulsion, vomiting and stiff neck.
- Only defined cases according to AES guidelines were included for study.
- Infant/children of those parents/guardians/attendants who gave the informed consent for study.

Exclusion Criteria
- Confirmed cases of JE virus, TBM or any other pathogens.
- Age more than 15 years.
- Parents/guardians/attendants who did not give informed consent.

Duration of Study- The study was carried out during January 1, 2015 to July 31, 2017.

Data Collection, Technique and Tools- The data (target population) were collected using a structured questionnaire regarding sociocultural and environmental characteristics - nutritional status, maternal education, occupation of guardians, age, sex, seasonal variation, housing standard, cast, religion and feeding practices of the participants. The tools were checked for accuracy and consistency. The pilot testing was done prior to selection of samples.

Sources of Information- The study was carried out with the help of faculties of Paediatric Department, paramedical workers, ASHAs, hospital records and interviews of parents/guardians/attendants on a common pro forma.

Statistical Methods- Data obtained from the survey were compiled, tabulated and subjected to statistical analysis. Data entry and analysis was centralised and performed at the Department of Community Medicine, Sri Krishna Medical College, Muzaffarpur. Tests of significance had been applied whenever necessary to establish the association of various risk factors. The finding has been interpreted according to draw meaningful conclusions.

RESULTS
92 children fulfilled the AES criteria. All of them (100%) were seen in malnourished/undernourished infants/children.

Year	Infants/Children Developed AES	Nutritional Status		Percentage
		Under Nutrition/Malnutrition	AES Cases with Normal Weight for Age	
2015	37	37	0	
2016	25	25	0	
2017	30	30	0	
Total	**92**	**92**	**0**	**100%**
Table 1. AES Associated with Undernutrition/Malnutrition				

Among literacy database, AES was commonest 90 (97.82%) in infants/children of illiterate mother. In children of mothers educated up to primary school, the number of cases of AES was 1 (1.09%) and those having education up to higher secondary and above, the cases of AES was also 1 (1.09%).
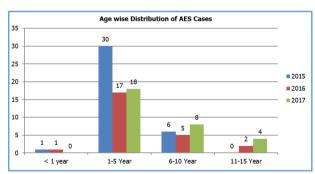
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Maternal Literacy	Number of AES Case (n=92)	Percentage
Illiterate	90	97.82
Primary school education	1	1.09
Higher secondary and above education	1	1.09

Table 2. Maternal Literacy and AES

AES was more common in infants/children of labour/farmer, 90 (97.82%). Among infants/children of businessman, AES case was 1 (1.08%) and one child (1.08%) of clerk developed AES. No AES was seen in infants/children of officer rank families.

Occupation	Number of AES Case (n=92)	Percentage
Labour/farmer	90	97.82
Business	1	1.09
Government service (clerk)	1	1.09
Government service (officer)	0	0.00

Table 3. AES Associated with Occupation of the Head of the Family

AES was mostly seen in children aged 1-5 years (65; 70.65%), followed by 6-10 years (19; 20.65%), among 11-15 years (6; 6.52%) and it was very less (2; 2.17%) in below one year of age. It indicates the more significant statistical association (p 0.263) given in Table 4.
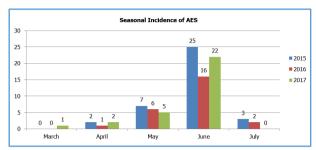

Graph 1. Age Wise Distribution of AES Cases

Age Group	Number of AES Case Year Wise			Total	Percentage
	2015	2016	2017		
<1 years	1	1	0	2	2.17
1-5 years	30	17	18	65	70.65
6-10 years	6	5	8	19	20.65
11-15 years	0	2	4	6	6.52
Total	37	25	30	92	

Table 4. Age Distribution of AES in Muzaffarpur

$x^2 = 7.67$; d.f. = 6; p = 0.263.

Seasonal variation was seen in incidence of AES. Incidence of AES was seen between March to July and

month of June was the peak season (63; 68.47%) for AES, followed by May (18; 19.56%) and it declined in April and August (5; 5.43%, respectively).

Graph 2. Seasonal Incidence of AES

Month	Year			Total	%
	2015	2016	2017		
January	0	0	0	0	0
February	0	0	0	0	0
March	0	0	1	1	1.09
April	2	1	2	5	5.43
May	7	6	5	18	19.56
June	25	16	22	63	68.47
July	3	2	0	5	5.43
August	0	0		0	0
September	0	0		0	0
October	0	0		0	0
November	0	0		0	0
December	0	0		0	0
Total	37	25	30	92	

Table 5. Seasonal Incidence of AES in Muzaffarpur

Housing standard was the more common contributing factor for AES. AES was mostly seen in dwellers of kachcha house (53; 57.60%), followed by semi-pucca house (36; 39.13%) and in children of dwellers of pucca house, only 3 (3.26%) cases of AES were found.

Type of House	Number of AES Case	Percentage
Kachcha	53	57.60
Semi-pucca	36	39.13
Pucca	3	3.26
Total	92	

Table 6. Housing Standard of Dwellers of AES

AES was seen more in male infants/children (56; 60.86%) than female (36; 39.13%).

Total Number of AES Cases	Male AES Cases	Percentage	Female AES Cases	Percentage
92	56	60.86	36	39.13

Table 7. Sex Wise Distribution of AES Case

AES was mostly seen in formula fed infants/children (46; 50.54%) and lowest in exclusive breastfed (20; 21.73%) and it was slightly more in infants of cow's and other animal milk fed infants (26; 27.77%).

Feeding Practice	Number of AES Cases n=92	Percentage
Exclusive breastfeed	20	21.73
Formula feed	46	50.54
Cow's and other animal milk feed	26	27.77
Table 8. Feeding Practice Associated with AES Case		

DISCUSSION

On analysis of the data, it was observed that malnutrition/undernutrition is the commonest risk factor, which supports the fact documented by John in 2013 who investigated the mystery of Muzaffarpur on invitation of Bihar government and concluded it was acute encephalopathy caused by malnutrition plus litchi.[6] We have observed other contributing risk factors- maternal illiteracy, kachcha house, agriculture based (labour and farmer) occupation. G.K. Singh et al documented a significant association (p<0.05) with literacy status, occupational status of parents travel using public transport mode and presence of lychee orchards near the vicinity of households.[7] According to National Centre for Disease Control and U.S. based CDC, AES was caused by toxins found in litchi.[8] On analysis of the data, we have observed the other risk group - children, 1-5 years of age, male, based on formula feeding. According to health line report, risk group for encephalitis are- older adults, children under the age of 1 and people with weak immune system.[9] Data shows there is a seasonal variation, AES becomes epidemic between March to July and peak incidence was seen in June. Jyotsna Singh has reported AES becomes epidemic in Lychee season, April to June.[10]

CONCLUSION

From our study, we conclude that sociocultural and environmental risk factors were the major determinant risk factors for AES. Among these, malnutrition/undernutrition was the commonest risk factor followed by maternal illiteracy. Agriculture-based occupation (labour and farmer) were the more common victims. AES affects mostly children of 1-5 years of age. Male children were more prone. Infants/children of Hindu families were more affected. AES were seen mostly in dwellers of lower housing standard (kachcha house). AES affects mostly in formula fed and cow's and other animal fed infants/children. AES becomes epidemic between March to July and peak incidence was seen in June.

RECOMMENDATIONS

- To ensure adequate nutritional status of risk group, 0-15 years of age.
- To ensure 100% routine immunisation coverage along with JE and Hib vaccine.
- To improve quality of life.

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