International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

Japanese Encephalitis (JE) among Acute Encephalitis Syndrome (AES) Cases- A Hospital Based Study from Upper Assam, India

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Received: 05/04/2016 *Revised: 22/04/2016* *Accepted: 25/04/2016*

ABSTRACT

Background: Japanese Encephalitis, a mosquito borne viral disease, is endemic in the state of Assam. There have been regular outbreaks of Japanese Encephalitis in Assam every year during the hot and humid summer monsoon months and present as Acute Encephalitis Syndrome. It is a major public health problem with high mortality and morbidity of serious concern.
Vaccination is considered to be the most effective method to control JE. Government of Assam started immunisation campaigns against Japanese Encephalitis in 2006.
In light of the above background, the present study was undertaken with an objective to examine the occurrence of JE among the Acute Encephalitis Syndrome cases in Jorhat and Golaghat districts of Assam - a JE vaccinated region. Blood and CSF samples were tested for JE infection in the virology laboratory of the department of Microbiology, Jorhat Medical College, Jorhat, Assam.
Materials and Methods: Serum and CSF samples of AES patients from Jorhat and Golaghat districts of Assam were tested for JE infection using IgM antibody capture (MAC) ELISA by JE virus MAC ELISA kit.
Statistical analysis was done using online calculator available @ www.socscistatistics.com
Time of study extended from January 2011 to December 2014 and a total of 842 clinically diagnosed AES cases were tested for JE infection.
Results:
1. Highly significant decline ($P < 0.0001$ and $Z>1.96$) of JE cases were noticed in the years 2012, 2013 and 2014 when compared to 2011.
2. Strict clustering of JE cases were found in the monsoon months with peaks in July.
3. Except in 2011, no significant predilection of JE infection among paediatric population was observed.
4. There was also no significant difference of JE infection between male and female AES patients.

Discussion and conclusion: The results were almost similar to findings of many other studies in the post vaccinated period. It once again reaffirms the usefulness of vaccination for control/prevention of Japanese Encephalitis.

Keywords: Japanese encephalitis, Acute Encephalitis syndrome, Vaccination.

INTRODUCTION

Encephalitis is an inflammation of the brain parenchyma. Acute Encephalitis Syndrome (AES) has several etiologies with Japanese Encephalitis (JE) and Dengue being the prominent factor in South East Asia. [1]

Japanese Encephalitis (JE) is an important mosquito-borne viral disease. It is one of the leading causes of viral

encephalitis and neurological infections in Asia. [2] Japanese Encephalitis has spread worldwide and is a major public health problem since the isolation of the virus in Japan in 1935. [3]

JE is an envelope, positive sense, single stranded RNA virus and member of genus Flavivirus under the family Flaviviridae. [4] Phylogenic analysis showed that JE isolates in India belonged to geno group III. [4-10]

JE virus is the sole etiological agent of Japanese Encephalitis. JE is a disease of major public health importance due to its high epidemic potential, high case fatality rate (CFR) and sequelae among survivors. [11] Although most human infections are mild or asymptomatic, about 50% of patients who develop encephalitis suffer from permanent neurological defects and 30% of them die due to the disease. [12]

It is a serious risk to human, particularly in China and India, with at least 700 million potentially susceptible children. [13] Since 1973, JE epidemics had occurred in Assam, West Bengal, Bihar, Uttar Pradesh, Andhra Pradesh, Tamil Nadu and Karnataka. [14] JE has become endemic in the state of Assam with regular outbreaks every year during the rainy monsoon months. [15] There have been significant morbidity and mortality associated with JE in Assam with as many as 1343 reported cases and 229 AES related deaths in 2012. [16]

Currently there is no specific antiviral or any other curative medicines for JE. Hence, immunisation is the only reliable and effective method to control the disease. [17] JE vaccination campaign got underway in India in 2006 in a phased manner following massive JE outbreak in 2005 in Eastern Uttar Pradesh and adjoining districts of Bihar. Children of 1 to 15 years were vaccinated with single dose live attenuated SA-14-14-2 vaccines manufactured by Chengdu Institute of Biological Products, China.

JE vaccination was also introduced in Assam in 2006. Initially it was a pilot project for paediatric age group upto 15 years of age in the two upper Assam districts of Dibrugarh and Sibsagar. Later, by 2007, Jorhat and Golaghat districts were also included. Adult vaccination in Assam was started in February 2014 in seven districts which included Jorhat and Golaghat districts. [18]

Keeping in view of this background, the present study was undertaken among AES patients in the two upper Assam districts, Jorhat and Golaghat to-

1. Test for the presence of JE infection in AES patients
2. Statistically analyse the results
3. Compare the findings with other similar studies
4. And finally, critically analyse the post vaccination status of JE infection.

MATERIALS AND METHODS

Cases: Comprised of blood and CSF samples from 842 clinically diagnosed Acute Encephalitis Syndrome patients admitted in Jorhat Medical College Hospital, private hospitals of Jorhat city and Golaghat Civil hospital, Assam.

***Time of study*:** January 2011 to December 2014.

Sample collection: 1 ml of CSF and 2 ml blood, both collected in SEVs maintaining all routine precautions and statuary provisions

Blood samples were allowed to clot.

Both blood and CSF samples were then transported to the Virology laboratory of Microbiology Department of Jorhat Medical College, Jorhat; stored at 4˚C to be tested within 3days or at minus 80˚C if longer period of storage was required.

Sample testing: IgM antibody capture (MAC) ELISA was performed on CSF and serum samples by JE virus MAC ELISA kit (kit supplied by National Vector Borne Disease Control Programme). The samples were tested in accordance to the procedure guidelines provided by the National Institute of Virology, Pune for JE IgM capture ELISA.

Statistics: Data analysis was done using Online Calculator available @ www.socscistatistics.com

Two tailed Z test for difference of proportion was performed.

Z and P values obtained with 95% confidence interval.

RESULTS

The present study was carried out in the virology section of the Microbiology department of Jorhat medical College, Jorhat, Assam. Study population comprised of 842 clinically diagnosed cases of Acute Encephalitis Syndrome from Jorhat and Golaghat districts of Assam. The cases extended from January 2011 to December 2014. All the cases were tested for Japanese Encephalitis.

Table 1: Year wise distribution of JE positive cases.

Year	Total no. of AES cases tested	Number of JE positive cases	Number of JE negative cases	JE positive percentage	Z and P values for significance when 2011 is compared with the other years	
2011	144	67	77	46.5%	Z	P
2012	75	15	60	20%	3.84	0.00012
2013	367	95	272	25.9%	4.51	0.000
2014	228	55	173	24.1%	5.0361	0.000

Table 2: Age and sex distribution of JE positive cases.

Year	≤ 15 yrs JE positive/AES cases and % of JE	> 15 yrs JE positive/AES cases and % of JE	Z two tailed values |Z|	P value
2011	45/73 57.3%	24/69 34.8%	2.7103	0.00672
2012	9/45 20%	6/30 20%	0	1
2013	32/145 22.1%	63/222 28.4%	1.3491	0.17702
2014	27/107 25.2%	30/149 20%	0.9673	0.33204

Table 1 shows that out of the total AES cases, JE positive cases for the years 2011, 2012,2013 and 2014 were 46.5%, 20%, 25.9% and 24.1% respectively. There was a remarkable decline in the percentage of JE positive cases in 2012 (20%), 2013 (25.9%) and 2014 (24.15%) when compared with 2011 (46.5%). The decrease of JE positive cases from the year 2011 compared with 2012, 2013 or 2014 were statistically highly significant ($P<0.0001$ and $Z>1.96$). Of all these highly significant findings, 2011 when compared with 2014 showed the most significant decline in JE positive cases amongst the AES cases ($P=0.000$, $Z=5.0361$).

Table 2 shows that positive JE cases among AES patients in two separate age groups, i.e., ≤15 yrs (paediatric) and >15 yrs (older adults) for the years 2011, 2012, 2013and 2014. Higher occurrence of JE among the paediatric age group (≤15 yrs) was found statistically significant ($Z>1.96$ and $P<.05$) when compared with the older age group (>15 yrs) in the year 2011. In the later years 2012, 2013 and 2014 the difference in occurrence of JE cases between paediatric and older age groups were not significant.

Table 3: Sex wise distribution of JE positive cases.

Sex	Total AES cases tested	JE positive cases	P value
Male	473	134 (28.3%)	0.6927
Female	369	100 (27.1%)	

Table 4: Month wise distribution of JE positive cases.

Month	2011	2012	2013	2014	Total
January	0	0	0	0	0
February	0	0	0	0	0
March	0	0	0	0	0
April	0	0	0	0	0
May	0	0	0	0	0
June	0	0	0	0	0
July	0	0	14	1	15 (6.46%)
August	58	13	77	31	179 (77.16%)
September	8	2	4	21	35 (15.09%)
October	1	0	0	1	2 (0.86%)
November	0	0	0	0	0
December	0	0	0	1	1 (0.43%)

Table 3 also shows the sex distribution of JE positive cases among the AES patients. There was slightly higher

occurrence of JE positivity among males (28.3%) than females (27.1%). But it was statistically insignificant with P>.05.

Table 4 shows month wise distribution of JE cases with their relative percentages. Maximum number of JE positive cases occurred in the month of July (179-77.16%) followed by the months of August (35-15.09%), June (15-6.46%), September (2-0.86%) and December (1-0.43%). In rest of the other months no JE positive case was found.

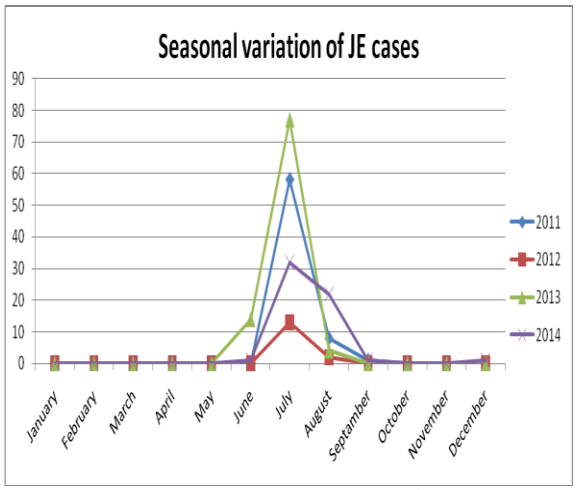

Figure 1: shows, almost absolute clustering of JE positive cases in the monsoon months with peaks in the month of July in all the years, w. e. f. 2011 to 2014.

DISCUSSION

A mass vaccination campaign is the most effective means to control Japanese Encephalitis. Vaccination against JE was started in Jorhat and Golaghat districts of Assam in 2007 among paediatric population. Adult vaccination was introduced in 2014.

Our study found statistically highly significant (P<0.0001 and Z>1.96 with 95% confidence interval) decrease of JE positive cases among the AES patients in all the years w.e.f. 2012 to 2014, when compared with 2011. This decline in JE positive cases among the AES patients could be attributed to the extensive mass vaccination drives and intensive awareness programmes. A similar finding was also recorded in West Bengal by Bandopadhyay et al. [19] though vaccination against JE was started in 2007; proportionate decrease of JE positive cases became evident in our study only in 2012. This initial delay might have been due to ignorance, slow in awareness sensitizations and concerns about the safety of the vaccine among population.

Historically, JE has been described as a disease affecting mostly the paediatric age group. Many Indian studies also agree with this fact. [4,20-23] On the other hand some studies especially done in post vaccination era had found no such co-relation of increased occurrence of JE in the paediatric population of Assam. [16,18] The present study found significantly higher (P≤.05, Z>1.96) number of JE positive cases in the paediatric age group (≤15years) compared to the older age group (>15 years) in 2011. However, later in the subsequent years, i.e., 2012,2013 and 2014, no such significant difference in JE positive cases among the AES patients of the paediatric age group (≤15 yrs) and older age group (>15yrs) could be found. Thus, even though vaccination in the paediatric age group was started in 2007, the results were evident only after 2011. This scenario might have been again due to delay in achievement of desired results of vaccination in the paediatric population till 2012 due to reasons already discussed.

The present study did not find sex predilection for JE positive cases. This finding was similar with the results of a study in West Bengal. [19]

Culex tritaeniorhynchus mosquito is the vector for Japanese Encephalitis virus. There is an increase in mosquito population as rainfall starts from the month of June in Assam. [18] Many studies in different countries like Sri Lanka, [24,25] Thailand [26] and China [27] have found increase in mosquito population leading to occurrence of Japanese Encephalitis. In Assam monsoon rains starts from June extending upto September. During this period there is heavy rainfall, weather is hot and humid - condition ideal for mosquito breeding. Our study found clustering of the JE cases in the monsoon months which was highly significant (P<.0001). Peaks of occurrence

were in the month of July for all the years. Apart from the monsoon months, no cases were found in other months except two cases (0.86%) in October and one case in (0.43%) in December. Occurrence of the highest number of JE cases in July, i.e., about one month after the onset of monsoon rains in our study was also similar to the finding in a study carried out in Taiwan which suggested one month time lag from onset of rains, increase in temperature and humidity to effect JE occurrence in humans. [28]

CONCLUSION

Mass scale effective vaccination campaigns covering the entire population is essential for prevention and effective control of Japanese Encephalitis. Intensive vector control measures and public awareness programmes are the other two important factors to be considered as vital issues for JE eradication. Isolation of the porcine population, the reservoir host for JE virus may also be taken into serious consideration to achieve the desired goal of total irradiation of Japanese encephalitis.

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How to cite this article: Borkotoki U, Borkotoki S, Barua P et al. Japanese encephalitis (JE) among acute encephalitis syndrome (AES) cases - a hospital based study from upper Assam, India. Int J Health Sci Res. 2016; 6(5):72-77.

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