Trend of Japanese Encephalitis in Rural Areas of West Bengal, India: *A Retrospective Study*

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Abstract: The present study was conducted to find out the clinico-epidemiological profile of Japanese encephalitis (JE) during the year 2013 to 2018 (till June) in a tertiary care teaching hospital, MMC, Malda, West Bengal. It was a retrospective study. The AES (Acute Encephalitis Syndrome) cases were tested for IgM antibodies against JE virus by using IgM Mac ELISA (National Institute of Virology, Pune). A total of 293 sera samples from the patients clinically suspected with AES were collected from the year 2013 to 2018 (till June). Out of which 30/293 (10.24%) were JE positive by IgM Mac ELISA kit, where 19 (63.33%) were male and rest 11 (36.67%) were female. Maximum number of JE cases was reported in the age group 0-15 yrs (63.33%; 40% in the age group of less than 5 years and 23.33% in the age group of 5-15 years). Death occurred in 6/30 (20%) patients. The present study showed a low JE seropositivity in this region of northern part of West Bengal. As most JE infections are asymptomatic, the cases of JE may not represent the original scenario of JE in this northern part of West Bengal, may only represent the tip of the iceberg compared to the large number of inapparent infections. So JE surveillance system and the vaccination programme need to be strengthened to keep this vector borne disease under control.

Keywords: Acute encephalitis syndrome, Japanese encephalitis, ELISA, Malda

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I. Introduction

Japanese Encephalitis (JE) is among the most common cause of viral encephalitis in human beings and is found worldwide, especially in South-east Asia and less commonly in the Western Pacific region and Australia. JE is induced by infection with Japanese encephalitis virus (JEV), which belongs to the JEV serogroup in the genus Flavivirus, family Flaviviridae. The JEV is mainly transmitted by the mosquito Culex tritaeniorrhynchus, which prefers to breed in irrigated rice paddies. In the tropics and subtropics, transmission can occur year-round but often intensifies during rainy season. Pigs serve as amplifying hosts and high density of pigs can be associated with increased number of cases of JE. Humans and horses are dead-end hosts for the virus. Worldwide, it is estimated that around 68,000 cases occur annually, 40,000 in the Western Pacific region alone. Most of these cases in endemic countries occur among children under 15 years of age, as adults are often already immune to the disease. In India, nearly all states have reported JE cases except that of Jammu and Kashmir, Himachal Pradesh, and Uttarakhand. In India, the first human case was reported from North Arcot district of Tamil Nadu in 1955. Until 1973, the disease was confined to south parts of India, with low prevalence; subsequently, the disease spread to various other parts of India. The first outbreak of JE was recorded in 1973 from Burdwan and Bankura districts of West Bengal. Since 1973, epidemics of JE have occurred in West Bengal, Bihar, Uttar Pradesh, Assam, Andhra Pradesh, Tamil Nadu, and Karnataka. Every year, sporadic JE cases are reported indicating their endemicity in this state. The Incidence of JE in India is still increasing and the case fatality rate of reported cases is high, 10-30%. However overall trends for India are difficult to predict because JE endemicity is heterogeneous and socioeconomic conditions for control differ substantially from one state to another. In West Bengal, the disease occurred between May and October, and was shown to be related to the summer monsoon. During 2011-2012, JE outbreaks occurred in many parts of eastern States including Bihar and North West Bengal. During the recent outbreak JE cases were reported from four different districts (i.e. Cooch Behar, Dakshin Dinajpur, Darjeeling and Jalpaiguri) of North West Bengal from the first quarter of 2011 onwards. JE vaccination campaign was carried out for children of 1-15 years of age in five districts of North Bengal during 2013. The districts covered were Jalpaiguri, Darjeeling, Dakshin Dinajpur, Malda and Uttar Dinajpur. Most JE infections are asymptomatic, and the ratio of symptomatic to asymptomatic infections ranges from 1 in 300 to 1 in 1,000. Without early diagnosis and management, it may have mortality rate of 15-30%, and up to half of the survivors may have permanent, residual neuropsychiatric
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With a view to identify the JE cases from the AES cases, our aim in this study is to observe the present scenario of JE in rural areas of Northern district of West Bengal.

### II. Aims And Objectives

To observe the present scenario of JE in rural areas of West Bengal using recent data for the purpose of guiding prevention and control efforts.

### III. Materials And Methods

It was a retrospective record based study. The study was conducted in the department of Microbiology, Malda Medical College, Malda. All the previous cases of AES (Acute Encephalitis Syndrome) including JE cases, from Jan 2013 to June 2018 recorded in the department of Microbiology were included in this study. Data were obtained from departmental archive.

World Health Organization has quoted “a person of any age, at any time of the year, with the acute onset of fever and a change in mental status or new onset seizures (excluding simple febrile seizures)” as the basis for defining acute encephalitis syndrome (AES) cases. Japanese encephalitis (JE) is the AES case that is confirmed by detection of JE virus specific antibody in a single sample of cerebrospinal fluid (CSF) or serum. Clinically diagnosed AES cases of all age groups and either sex who admitted in IPD (in patient department) of Malda Medical College & Hospital throughout the year were selected for the study.

Blood and / or CSF samples were tested in the microbiology laboratory, Department of Microbiology, Malda Medical College, Malda. 1-2 ml CSF and 2-5 ml of clotted blood samples were obtained from the AES cases as per standard procedures. The serum was separated from the blood and both serum and CSF were stored at -30°C. The CSF and serum samples were tested for JE virus specific IgM by JE virus MAC ELISA kit supplied by the National Institute of virology, Pune. The samples were tested strictly following the manufacturer’s protocol.

### IV. Results

The present study was carried out in the department of Microbiology, MMC, Malda, West Bengal. During the present study period of five and half years, a total of 293 AES cases were reported. A total of 293 sera samples from the patients clinically suspected with acute encephalitis syndrome (AES) were collected from the year 2013 (January) to 2018 (till June). Out of which only 30 (10.24%) were positive for JE. Table 1 shows total AES and JE cases, and AES and JE deaths for Malda district from 2013 (January) to 2018 (till June).

<table>
<thead>
<tr>
<th>Year</th>
<th>AES cases</th>
<th>AES deaths</th>
<th>JE cases</th>
<th>JE deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>57</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2014</td>
<td>72</td>
<td>34</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2015</td>
<td>76</td>
<td>9</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>2016</td>
<td>30</td>
<td>2</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>2017</td>
<td>21</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2018 (till June)</td>
<td>37</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Among 293 clinically diagnosed cases of AES, 170 were male (58.02%) and rest 123 (41.98%) were females. Highest (154/293, 52.56%) positivity was found amongst the age group less than 5 years. Table 2 shows age and sex distribution of AES cases.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>2013 n=57</th>
<th>2014 n=72</th>
<th>2015 n=76</th>
<th>2016 n=30</th>
<th>2017 n=21</th>
<th>2018 (till June) n=37</th>
<th>Total n=293</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>37</td>
<td>47</td>
<td>40</td>
<td>16</td>
<td>16</td>
<td>2</td>
<td>170</td>
</tr>
<tr>
<td>Female</td>
<td>20</td>
<td>25</td>
<td>36</td>
<td>14</td>
<td>60</td>
<td>12</td>
<td>123</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 5 yrs</td>
<td>33</td>
<td>50</td>
<td>40</td>
<td>18</td>
<td>08</td>
<td>154</td>
<td></td>
</tr>
<tr>
<td>5-15 yrs</td>
<td>23</td>
<td>22</td>
<td>27</td>
<td>03</td>
<td>09</td>
<td>89</td>
<td></td>
</tr>
<tr>
<td>More than 15 yrs</td>
<td>03</td>
<td>0</td>
<td>09</td>
<td>04</td>
<td>25</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

Total AES cases in the year 2013 were 57, of which 4 were positive for JE. So the JE detection rate was 7.02%. In 2014, out of 72 AES cases, no IgM positive JE case was found. In 2015 and 2016, out of 76 and 30 AES cases, JE positive cases were 11 and 12 respectively. So the JE detection rates were 14.47% and 40% respectively. Again in the year 2017 no JE case was detected out of 21 AES cases. In 2018 (till June) 3 JE cases were detected from 37 AES cases and JE detection rate was 8.11%. Table 3 shows JE positivity rate in the year 2013 to 2018 in Malda district and figure 1 shows graphical representation of JE positive cases in different years.

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Out of 293 AES cases, only 30 (10.24%) cases were diagnosed as JE positive. Of them 19 (63.33%) were male and rest 11 (36.67%) were female. Maximum number of JE cases was reported in the age group 0-15 yrs (63.33%): 40% in the age group of less than 5 years and 23.33% in the age group of 5-15 years. Table 4 shows age and sex wise distribution of JE cases from January 2013 to 2018 (till June).

Table 4: Age and Sex wise distribution of JE cases from Jan 2013 to 2018 (till June)

<table>
<thead>
<tr>
<th>Sex</th>
<th>Number of JE cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>19</td>
<td>63.33%</td>
</tr>
<tr>
<td>Female</td>
<td>11</td>
<td>36.67%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age group</th>
<th>Number of JE cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5 yrs</td>
<td>12</td>
<td>40%</td>
</tr>
<tr>
<td>5-15 yrs</td>
<td>07</td>
<td>23.33%</td>
</tr>
<tr>
<td>More than 15 yrs</td>
<td>11</td>
<td>36.67%</td>
</tr>
</tbody>
</table>

All the JE cases were from rural areas and most were belong to low socioeconomic group. As to the seasonal variations, most of the JE positive (23/30, 76.67%) cases were reported during the monsoon and post-monsoon period (June to September). Table 5 shows Block wise distribution of JE cases in Malda District. Figure 2 shows the map of Malda and JE affected areas in Malda District.

Table 5: Block wise distribution of JE cases

<table>
<thead>
<tr>
<th>Serial no</th>
<th>Name of Blocks/ Municipality</th>
<th>No of JE cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chanchal I</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Chanchal II</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Ratua</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Ratua II</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Manikchak</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Gazole</td>
<td>3</td>
</tr>
</tbody>
</table>
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**V. Discussion**

In this study it was reported that a total of 293 sera samples from the patients clinically suspected with acute encephalitis syndrome (AES) were collected from the year 2013 to 2018 (till June). Out of which 30/293 (10.24%) were JE positive, diagnosed by IgM Mac ELISA kit. In this present study overall JE positivity rate was 10.24%, which was corroborative with the findings of the studies conducted by Chakraborty et al. (11.61%, 9 months study) and Bandypadhyay et al. (12.21%, 2 years study). However it was quite lower than the findings of studies conducted by Sarkar et al. (5 years study, 27%), Taraphdar et al. (6 years study, 35.14%) and Kumar et al. (23%).

In our study overall JE positivity rate was 10.24%, which was corroborative with the findings of the studies conducted by Chakraborty et al. (11.61%, 9 months study) and Bandypadhyay et al. (12.21%, 2 years study). However it was quite lower than the findings of studies conducted by Sarkar et al. (5 years study, 27%), Taraphdar et al. (6 years study, 35.14%) and Kumar et al. (23%).

Out of 30 JE cases, 19 (63.33%) were male and rest 11 (36.67%) were female. Death occurred in 6/30 (20%) patients. In our study, JE was found to be more common in males compared to females. This compares favorably with other studies by Aneeta et al. and Rayamajhi et al.

The causative virus remained unidentified.

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The male predilection for JE may be explained by an increased amount of outdoor activities in males. They remain outside for late hours and wear fewer clothes on the body and even sleep outdoors.

In our study maximum number of JE cases was reported in the age group 0-15 yrs (63.33%; 40% in the age group of less than 5 years and 23.33% in the age group of 5-15 years). Similar observations were seen in studies by Chakraborty et al. and Bista et al.

Although maximum JE cases were below 15 years of age group, a significant number of JE positive cases were also found in the older age group (above 15 years).

In this recent study, all the JE cases were from rural areas and most were belong to low socioeconomic group. The JE virus is particularly common in rural areas where irrigated rice fields attract the natural avian

**Figure 2: Different blocks and JE affected areas in Malda district**

<table>
<thead>
<tr>
<th>Block</th>
<th>JE Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old Malda</td>
<td>3</td>
</tr>
<tr>
<td>Kaliachak I</td>
<td>6</td>
</tr>
<tr>
<td>Kaliachak III</td>
<td>5</td>
</tr>
<tr>
<td>Habibpur</td>
<td>1</td>
</tr>
<tr>
<td>Kaliachak II</td>
<td>1</td>
</tr>
<tr>
<td>English Bazar</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>
hosts and provide abundant breeding site for the vector and also the association of pigs as viremic amplifying hosts complemented the JE virus activity in such areas. Rural predilection of JE cases was also observed in other studies.16, 17, 24, 25

As to the seasonal variations, most of the JE positive (23/30, 76.67%) cases were reported during the monsoon and post-monsoon period (June to September). In other studies conducted from West Bengal, authors reported that large number of cases occurred during rainy and post rainy season.16, 18 Studies from different states of India also showed higher JE positivity during rainy season because the paddy fields covered with stagnant water serves as good breeding environment for the vector.26, 27

VI. Conclusion

In West Bengal, JE is an important disease particularly in rural areas. No proper antiviral against JEV is available. Though at present, Suramin, a drug used to treat trypanosomal disease and diethyldithiocarbamate have shown reasonably good antiviral efficacy against Japanese encephalitis virus in vitro. The present study showed a low JE positivity amongst AES cases in this northern region of West Bengal. But, the present system of reporting JE case may not reflect the actual level of transmission. As most JE infections are asymptomatic, the cases of JE may not represent the original scenario of JE in this northern part of West Bengal, may only represent the tip of the iceberg compared to the large number of inapparent infections. So JE surveillance system and the vaccination programme need to be strengthened to keep this vector borne disease under control.

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The authors would like to thank Mr. Arun Baidya, Epidemiologist, Malda District, WB, for providing data on JE cases in the study area. We would also like to thank Mr. Bappaditya Pan, Medical Technologist (Lab), MMC&H, and Dr. SK Sananwaz Alam, Microbiologist, MMC&H, Malda, for their support and help as and when required.

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