JAPANESE ENCEPHALITIS IN ASSAM, NORTHEAST INDIA

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Abstract. Japanese encephalitis is one of the major public health problems in Assam, northeast India. We aimed to elucidated the clinical and epidemiological profile of the disease during several outbreaks in Assam in 3 consecutive years. Cerebro-spinal fluid and or serum samples of 348 out of 773 clinically-suspected viral encephalitis patients admitted to different hospitals during the period June to August of 2000 to 2002 were tested for detection of JE specific IgM antibody, employing MAC ELISA test at RMRC (ICMR), Dibrugarh. Diagnosis was confirmed in 53.7% patients with the ratios of 1.8:1 and 1.4:1 for male to female and pediatric to adult patients respectively. Most of the cases were pediatrics at the age of 7 to 12 years (34.2%). Fever (100%), altered sensorium (81.8%), headache (70.6%), neck rigidity (54.0%), abnormal movement (51.3%), exaggerated reflexes (48.1%), restlessness (44.9%), increased muscle tone (35.3%), convulsion (33.7%) and coma (20.9%) were the major clinical findings. The majority of cases (96.3%) were from rural areas. House surroundings close to water bodies, rice cultivation, association with pigs, and climatic conditions were environmental factors affecting the abundance of the potential mosquito vectors of the disease.

INTRODUCTION

Japanese encephalitis (JE) has been emerging as one of the major public health problems in Southeast Asia. The Indian subcontinent has borne a considerable burden of the disease since the 1960s (Gourie-Devi *et al*, 1995). The disease has appeared in sporadic outbreaks or epidemic forms in Assam, since 1976. Climatic conditions, abundance of potential mosquito vectors, amplifying hosts, agricultural practices and the sociocultural behavior of the people are conducive to spread JE in the state. During the rainy summer months of June to August, the incidence of the disease reaches its peak. Detection of JE virus-specific IgM antibody is considered a reliable serodiagnostic criterion of recent infection (Tsai, 1999). However, testing facilities for confirmation are very limited in this region. Hence, at peripheral hospitals the clinician must depend on clinical judgment and epidemiological evidence. We studied the clinical and epidemiological profile of laboratory-confirmed JE cases during outbreaks in 3 consecutive years in Assam to create a handy reference for clinicians.

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MATERIALS AND METHODS

Study subjects

Three hundred and forty-eight clinically-suspected viral encephalitis patients admitted to different hospitals in Assam during the periods June to August of 2000-2002 were included in the study. The medical history and clinical findings of each patient were recorded.

Specimen collection

Sera from 322 and sera with CSF from 26, patients were obtained and stored at -20ºC till tested at the Regional Medical Research Center, Northeast Region (Indian Council of Medical Research), Dibrugarh, Assam.

IgM antibody detection

Samples were tested for JE virus-specific IgM antibody using a MAC ELISA kit developed by National Institute of Virology, Pune, India, following the EIA techniques (Gadkari and Shaikh, 1984) employing JE virus (NIV strain P-20778) as antigen. The samples showing units >50 were interpreted as JE virus-specific IgM antibody-positive; such positive cases were taken as JE

patients with recent virus infection. The test was rapid and highly sensitive with negligible cross-reactivity to other heterologous flaviviruses *ie* dengue and West Nile viruses (Burke *et al*, 1985).

Recording of epidemiological information

Information related to locality, occupation, peridomestic sanitation, use of mosquito bed-net, animal association, and immunization against JE were recorded.

Collection and identification of vectors

Adult mosquitos from cattle sheds and piggeries of nine localities with reports of JE cases were collected during evening hours in June-August of 2001-2002 and identified to species.

Collection of meteorological data

Rainfall, temperature, and humidity records from 2000-2002 were obtained from the Tea Research Association, Dikam, Dibrugarh, Assam.

RESULTS

In Assam, in the period 2000-2002, 773 clinically suspected viral encephalitis cases were reported, of which 348 patients admitted to different hospitals were studied. JE-specific IgM antibody was detected in 53.7% (Table 1). Antibody was found in 165 and 22 out of 322 and 26 patients, from whom serum alone, or both serum and CSF samples, were obtained, respectively. The study included 206 male and 142 female patients, of whom 175 were adult and 173 were pediatric patients. The ratios of male to female, and pediatric to adult, confirmed cases were 1.8:1 and 1.4:1, respectively. The largest percentage (34.2%) of cases were in the age group 7-12 years (Table 2). Clinically, it was observed that all pa-

Table 1
Annual distribution of clinically-suspected and serologically confirmed JE cases, 2000-2002.

Year	Clinically-suspected cases reported	Number of cases tested	JE positive (%) cases
2000	135	81	48 (59.3)
2001	166	104	47 (45.2)
2002	472	163	92 (56.4)
Total	773	348	187 (53.7)

Table 2
2 Age and sex distribution of serologically confirmed JE cases, 2000-2002 (n=348).

Year / Sex	Age group (years) of JE cases out of total tested (T)						Total
	1-6 (T=65)	7-12 (T=108)	13-20 (T=46)	21-40 (T=81)	41-60 (T=38)	>60 (T=10)	187 (T=348)
2000							
M	7	12	4	5	2	0	30
F	5	10	1	2	0	0	18
2001							
M	5	12	4	3	1	2	27
F	6	6	1	2	4	1	20
2002							
M	14	16	6	12	9	5	62
F	8	8	4	8	2	0	30
Total (%)							
M	26	40	14	20	12	7	119
F	19	24	6	12	6	1	68
	45 (12.9%)	64 (18.4%)	20 (5.7%)	32 (9.2%)	18 (5.2%)	8 (2.3%)	187 (53.7%)
	109 (31.3%)			78 (22.4%)			

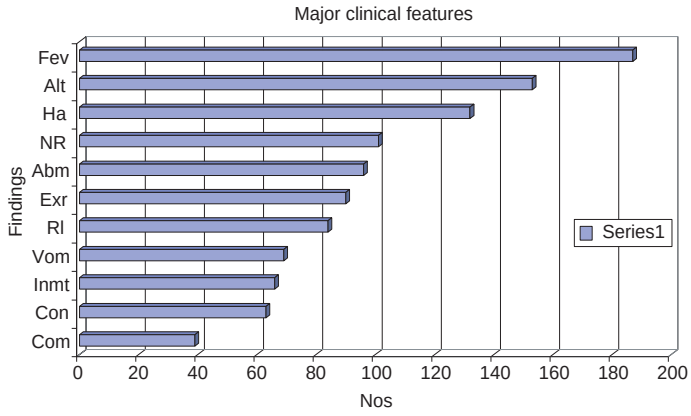

Fig 1–Clinical features of serologically-confirmed JE patients in Assam.

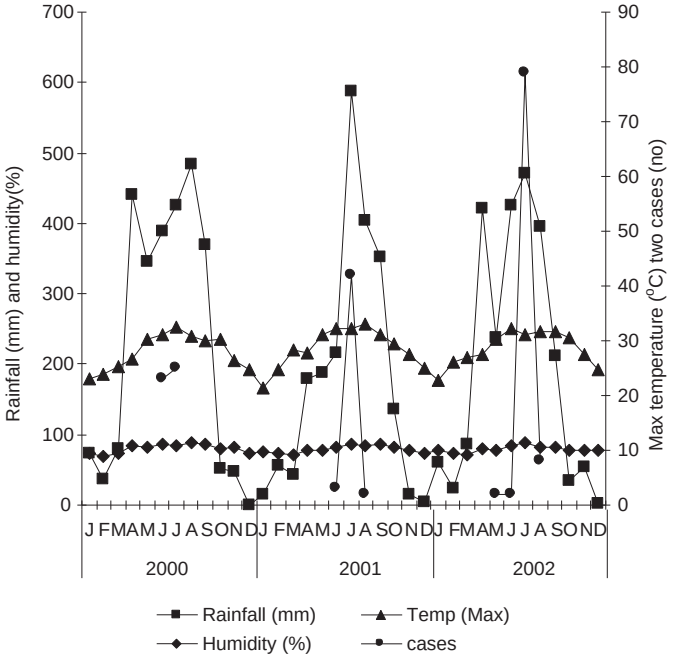

Fig 2–JE outbreaks in relation to climatic conditions in Assam, 2000-2002.

tients with JE had a history of fever associated with altered sensorium (81.8%) in the form of confusion, delirium and drowsiness. Headache (70.6%) and neck rigidity (54.0%), abnormal movement (51.3%), exaggerated reflexes (48.1%), restlessness (44.9%), and increased muscle tone (35.3%), were important features. Convulsion was found in 33.7% of the confirmed cases, whereas 20.9% of patients were comatose (Fig 1). The clinical findings were worse in patients with delayed hospitalization, particularly from remote areas. The pre-hospitalization duration of the patients ranged from 1-9 days and most of the patients (63.1%) had a duration of 3-5 days (Table 3). Epidemiologically, 96.3% of the JE patients were from rural areas. The presence of large water bodies near dwellings was a constant feature in all cases. Most of the cases were from families engaged in paddy cultivation (78.6%). Pig rearing was done by 55.1%. However, all families gave a history of using mosquito bed-nets. There was no history of immunization against the disease for all JE patients (Table 4).

Ten species of mosquitos in 9 localities represented by JE cases during the period June-August of 2001-2002, were identified, where *Culex vishnui*, followed by *Anopheles hyrcanus* and *Cx. gelidus*, were found to be most prevalent. Meteorological data of the study years are shown in Fig 2. Peak incidence was observed when the maximum temperature ranged from 31-32.5ºC with rainfall 426-587 mm and humidity from 94-97%.

DISCUSSION

Our study showed 53.7% serologically-confirmed JE cases during sporadic outbreaks in 3 consecutive years, with reports of 773 clinically-suspected viral encephalitis patients in Assam. Laboratory confirmation was made based on the serological detection of JE virus-specific IgM antibody. The antibody was detected only in sera of the majority of patients (47.4%), due to the limited availability of CSF samples from patients admitted to peripheral hospitals. The evidence of recent JE virus infection in patients with the clinical features of meningoencephalopathy and an epidemiological background of the disease supported the confirmation of JE cases in the absence of CSF testing in our study. However, higher positivity of serologically confirmed cases was possible as the samples might have JE-specific IgM antibody below the detectable level at the time of sample

Table 3
Pre-hospitalization duration of serologically-confirmed JE cases, 2000-2002 (n=348).

Duration	No of cases (%)
1-2 days	40 (21.4)
3-5 days	118 (61.1)
6-8 days	28 (15.0)
> 9 days	1 (0.5)
Total	187 (53.7)

Table 4
Epidemiological characteristics of serologically confirmed JE cases.

Characteristics	No. of cases (%)
Locality:	
i. Rural	180 (96.3)
ii. Urban	7 (3.7)
Occupation:	
i. Rice cultivation	147 (78.6)
ii. Tea plantation	34 (18.2)
iii. Others	6 (3.2)
House surroundings:	
i. Adjacent water bodies	187 (100.0)
Animal association:	
i. Pig	103 (55.1)
ii. Cattle	73 (39.0)
iii. No animal	11 (5.9)
Sleeping behavior:	
i. Using bed-net	187 (100)

collection. The disease was found in patients of all ages, with the majority being pediatric, as observed by earlier workers elsewhere (Gourie-Devi *et al*, 1982). This might be due to high exposure to infected mosquito bites with lower immunity. The occurrence was greater in the 7-12 year age group, which might be due to age-related hyperactivity of the children. However, our study showed higher involvement of the adult population, compared with reports from South India. Similarly, the male preponderance observed in our study might be due to higher exposure of male patients to mosquito vectors, and better covering of the body of the females, which acted as a protective barrier.

The clinical features observed in the study were not uniform in all JE cases. Individual variations might be due to influences of host immune status, viral load, and length of time between onset of disease and medical intervention. The frequencies of associated clinical features were much lower in our study than the reports from the eastern and southern states of the country, especially for neck rigidity (82%), convulsion (67.7%), vomiting (62.4%), and coma (30.8%) (Pavri, 1980; Gourie-Devi, 1984). However, the association of abnormal movement, exaggerated reflexes, restlessness, and increased muscle tone, were found to be higher in our study. Genetic make-up with the immune status of the host and the neurovirulence of the circulating viral strain might be the factors responsible for such differences (Donald *et al*, 2001).

The practices of paddy cultivation, domicilliary surroundings with adjacent water bodies, and high temperature and humidity were found to be the environmental factors influencing the abundance of the potential mosquito vectors responsible for transmission of the virus in the rural community (Khan *et al*, 1996). The association of pigs as viremic amplifying hosts complemented the JE virus activity in such populations (Baruah *et al*, 1991).

The study reflected a considerable burden of JE in Assam with prevailing environmental characteristics indicating adaptation of effective measures to minimize disease transmission.

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