

RETROSPECTIVE ANALYSIS OF EPIDEMIOLOGICAL INVESTIGATION OF JAPANESE ENCEPHALITIS OUTBREAK OCCURRED IN ROURKELA, ORISSA, INDIA

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Abstract. There was an outbreak of Japanese encephalitis (JE) during July/ August of 1993 in Rourkela City of Orissa, India. Among the serum samples 40% of the sera showed antibodies against JE, while 17% of the sera showed recent infection to dengue virus. As many as 15 species of mosquitos were encountered in and around the affected areas. Species like *Culex tritaeniorhynchus*, *Cx. vishnui*, *Cx. pseudovishnui* and *Cx. bitaeniorhynchus* constituted 19% of the total collections. The above species were resistant to DDT and dieldrin, but susceptible to malathion.

INTRODUCTION

Though Japanese encephalitis (JE) has been known in India since 1952 (Work and Shah, 1956), Orissa was thought to be free from JE till it was reported in Rourkela city of Orissa during 1988 (Vajpayee *et al*, 1991). Again an outbreak of Japanese encephalitis was reported during July and August 1993 in Rourkela city. Although there has been sporadic occurrence of encephalitis cases which were admitted and treated in Ispat General Hospital, Rourkela, throughout the year from January 1992 to June 1993, there was a sudden rise in suspected JE cases admitted to the Hospital during July and August 1993. The cases were from various sectors having piggeries. Forty-two CNS cases and nine deaths were reported during these two months. The present paper reports the results of the investigations carried out shortly after that outbreak in this area.

MATERIALS AND METHODS

Study Area

Rourkela is known as steel city in the Sundargarh district, Orissa, India. The city has an area of 45 km². It is divided into two parts *ie*, steel town-ship which shows urban characteristics and civil township which shows both urban and rural characteristics. These two parts

of the city are separated by a range of hills. In the civil township there are about 10 piggeries in 10 sectors and 4 cattle-sheds. In the periphery and the area adjoining the city, there are paddy fields.

Epidemiological investigation

Though the epidemic occurred here during July and August, the epidemiological investigations were carried out in this area in the last week of August by the time the epidemic was declining. Serum samples were collected from acutely ill patients (2) and convalescing (4) patients, who were still admitted in the Hospital. The team also visited the households of deceased as well as admitted cases and collected serum samples from the 24 close contacts. The samples were stored at -70°C and latter were tested at National Institute of Virology, Pune for the presence of IgM and IgG antibodies against JE and dengue.

Entomological investigation

Indoor resting adult mosquitos were collected from human dwelling and cattle-shed and piggeries of the affected areas (from where the cases were admitted to the Hospital) during morning (06.00 to 09.00) and evening (18.00 to 21.00) hours using mechanical aspirator and sucking tubes. The mosquitos collected were identified to species level and blood meals were

collected in the Whatman filter papers No 1. Precipitin tests were conducted following the gel-diffusion technique (Collins *et al*, 1983). Each blood meal was tested against antiglobulin antisera raised against human, cow, goat, pig and bird.

RESULTS

It was interesting to note that only 40% of sera showed JE specific IgM antibodies against JE, while 17% of sera showed recent infection to dengue viruses.

Entomological studies carried-out in and around affected localities reveals as many as 15 species of mosquitos belonging to four genera were encountered (Table 1). Anopheline

mosquitos were the dominant species and *Culex vishnui* group (the known vector of JE) constituted 19% of the total collection. Mosquitos collection made during that period did not show presence of *Aedes aegypti* (Table 1). However, blood-meal analysis of *Culex tritaeniorhynchus* mosquitos showed 23.5% of these mosquitos had human blood and 5.8% had blood meals from pigs (Table 2). Insecticide susceptibility tests carried out on this species showed they were susceptible to malathion and pyrethroids but resistant to DDT.

DISCUSSION

Absence of *Ae. aegypti* in our mosquito collection could be due to our concentration of

Table 1
Mosquitos collected from Rourkela steel city.

Species	PMHD	% of total catch
<i>Anopheles annularis</i>	0.51	0.6
<i>An.culicifacies</i>	0.345	0.3
<i>An. hyrcanus</i>	0.19	0.6
<i>An. subpictus</i>	10.14	38.7
<i>An. vagus</i>	6.11	16.7
<i>Aedes edwardsi</i>	0.125	0.3
<i>Ae. vittatus</i>	0.11	0.45
<i>Culex bitaeniorhynchus</i>	0.19	0.45
<i>Cx. epidesmus</i>	0.117	0.3
<i>Cx. whitemorei</i>	0.06	0.15
<i>Cx. pseudovishnui</i>	0.15	0.45
<i>Cx. tritaeniorhynchus</i>	3.08	13.6
<i>Cx. vishnui</i>	1.05	3.9
<i>Cx. quinquefasciatus</i>	7.98	23.2
<i>Coquilletidia novochracea</i>	0.08	0.15

Table 2
Blood meal analysis of mosquitos.

Species	No. of smears tested	Smear positive for				
		Human	Cow	Goat	Pig	Bird
<i>Cx. epidesmus</i>	2		2			
<i>Cx. pseudovishnui</i>	2		2			
<i>Cx. tritaeniorhynchus</i>	34	8	18	6	2	
<i>Cx. quinquefasciatus</i>	8	6				2

effort on JE vectors, thus less indoor collections were made and perhaps the density of this mosquito could be low at that time. On the contrary, active dengue transmission was determined, as apparent from the serological investigation. Among the JE vectors, *Cx. tritaeniorhynchus* was found in abundance and showed a high human blood index. This area has good irrigation facilities, thus there are yearly two crops of paddy cultivation. Sporadic cases of encephalitis were reported from this area earlier from January to June by the local health authorities. Presence of a high proportion of piggeries and availability of vector mosquitoes due to the cultivation of two crops of paddy suggest that perhaps a low level of transmission might be occurring during these months.

Cattle which were known to act as buffers who take most of the infective bites of these zoophilic mosquito species were proportionately in low numbers. This perhaps explains why blood meal analysis showed a high human blood index of 23.5%, and outbreak of JE in this area.

Earlier studies on JE have shown the importance of transovarial transmission (TOT) of JE in this mosquito species (Mourya *et al*, 1991; Dhanda *et al*, 1989). Recent studies have shown that minimum infection rates of virus per TOT have been correlated with human cases (Mourya *et al*, 1991) Since this area has two crops of paddy and a good number of piggeries, it can be a good study area for determining the suitability of using of phenomenon of TOT in monitoring JE activity.

Most of the cities in our country are witnessing the spread of slums where sanitation and drinking water facilities are inadequate. These conditions are supportive of the proliferation of *Cx. quinquefasciatus* and *Ae. aegypti* mosquitos. Due to our national developmental projects better irrigation facilities

have become available in many areas, thus farmers have started growing more paddy. This is leading to proliferation of malaria and JE vectors in newer areas.

The noticeable features of this city are that the ecological situation is highly conducive for all the four major mosquito borne diseases like dengue, malaria, filaria and JE. Environmental intervention for mosquito control of vector-borne disease prevention in this area is needed.

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REFERENCES

- Collins RT, Dash MK, Agarwala RS, Dhal KB. An adoption of the gel diffusion technique for identifying the source of mosquito blood meals. World Health Organization. *Vector Biol Control* 1983; 83: 1-10.
- Dhanda V, Mourya DT, Mishra AC, *et al*. Japanese encephalitis virus infection in mosquitos reared from field collected immatures and wild caught males. *Am J Trop Med Hyg* 1989; 41: 732-6.
- Mourya DT, Mishra AC, Soman RS. Transmission of Japanese encephalitis virus in *Cx. pseudo-vishnui* and *Cx. tritaeniorhynchus* mosquitos. *Indian J Med Res* 1991; 93: 250-2.
- Vajpayee A, Mukherjee MK, Chakraborty AK, Chakraborty MS. Investigation of an outbreak of Japanese encephalitis in Rourkela City (Orissa) during 1989. *J Commun Dis* 1991; 23: 18-21.
- Work TH, Shah KV. Serological diagnosis of Japanese B type of encephalitis in North Arcot district of Madras state, India, with epidemiological notes. *Indian J Med Sci* 1956; 10: 582-6.