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Full Length Research Paper

A study on outbreak of dengue from Bihar, India-establishing new foci, attributable to climatic changes

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Dengue fever (DF) is a mosquito-borne viral infection which is emerging fast in terms of mortality and morbidity in humans worldwide, particularly in tropical and subtropical countries. DF is characterized clinically by headache, retro-orbital pain, myalgia, arthralgia, integumentary rashes, and sometimes with haemorrhagic manifestations. *Aedes aegypti*, the main vector species of dengue fever/dengue haemorrhagic fever (DHF) is commonly found in urban areas which can be attributed to the availability of breeding sites such as water storage containers due to poor management of water and limited supply of drinking water, non degradable tyres, long lasting plastic containers and ineffective community participation in eliminating the breeding places. However, new foci are a major concern for public health by affecting the epidemiology of this disease such as rural and semi-urban areas, which may be linked to climate change. Climate change has led to unusual rainfall pattern leading to excess rain in some parts and deficient rainfall in other parts. This is accompanied by overall rise in average temperature which favors fast circulation of the vector and consequently of dengue virus in the environment. Thus, epidemiological, environmental and entomological observations were made to confirm the aetiology of a focal outbreak of dengue fever in rural and semi-urban areas providing breeding sites for larval growth. The present research aimed to record outbreak of dengue from new foci from Bihar, India, and correlates it with climate change. Bihar was said to be free from dengue but in September, 2010, outbreaks have been reported specially from three districts: Patna, Munger and Begusarai. The epidemiological investigation of probable cases showed clustered distribution of cases in adjacent houses and streets and absence of travellers to dengue endemic regions, though many cases of migration was also noted during early phase of outbreak. Cases reported from Patna were mostly related to migration from different areas in order to get better treatment facilities. Entomological investigations were carried out in 60, 94 and 75 houses in the districts of Patna, Munger and Begusarai respectively. The index of House, Container and Breteau from Patna, Munger and Begusarai found were 20, 40 and 29, 11.11, 43 and 31, and 26, 91.48 and 56, respectively, thereby indicating the high receptivity of Munger to DF/DHF transmission which can subsequently be confirmed with the number of cases reported from there. The environmental investigations included in this study were average temperature, humidity and rainfall of three affected districts. The averages temperatures during the outbreak from Patna were 32.21 (maximum) and 25.09 (minimum), from Munger were 32.39 (maximum) and 25.19 (minimum) and from Begusarai were 32.33 (maximum) and 25.43 (minimum). The rate of humidity from Patna were 86.29 (morning) and 82.43 (evening), from Munger were 84.97 (morning) and 82.86 (evening) and from Begusarai were 84.12 (morning) and 83.43 (evening). The rate of rainfall in the year 2010 was 226.9, 220.00 and 224.45 mm for Patna, Munger and Begusarai respectively. The reasons for death may be attributed to absence of herd immunity in new foci.

Key words: Rural areas, new foci of dengue, *Aedes aegypti*, house index, container index, Breteau index, climate change.

INTRODUCTION

Dengue fever (DF) is a mosquito-borne viral infection which is emerging fast in terms of mortality and morbidity in humans worldwide, particularly in tropical and subtropical countries (Gubler and Kuno, 1997). *Aedes*

aegypti is among the most important vectors of dengue fever (Warren and Mahmoud, 1990). The density and distribution of the vector depends on latitude, altitude, temperature, rainfall, humidity, seasons, etc. (Chinery, 1970; Surtees, 1967). In India, dengue fever was recognized as a classical disease with a high morbidity but no mortality and being mainly restricted to urban areas of the country (Pandya, 1982; Mohan, 1987; Yadava and Narasimaham, 1992). However, during the past few years, the frequency of dengue haemorrhagic fever (DHF) outbreaks has increased (Bandyopadhyay et al., 1996; Ramachandran et al., 1990). Earlier, the disease was mainly restricted to urban and semi-urban areas of the country because of the availability of favourable breeding sites of the mosquito vector species, *A. aegypti,* and rural areas were reported to be largely free of the vector species (Yadava and Narasimaham, 1992). Introduction of safe drinking water in rural areas has led to water storage practices providing breeding grounds for vectors (Ramachandran et al., 1990; Rakesh et al., 1997). Unusual rainfall pattern and changing climatic conditions and other developmental activities can also be attributable to outbreaks at new foci (Ilkal et al., 1991; Mehendale et al., 1991). Bihar was said to be free from dengue, but in September, 2010, outbreaks have been reported specially from three districts, viz., Munger, Begusarai and Patna. The epidemiological studies included the study of data source regarding blood samples for serology, clinical profile of patients, age distribution of patients, and clinical symptoms of the disease. The entomological investigations included study of breeding of *A. aegypti* habitats and calculation of House, Container and Breteau indices. The landing rate of *A. aegypti* and the total catch of adult mosquitoes by pyrethrum space spray was also undertaken.

METHODS

A wide epidemiological, environmental and entomological investigation was carried out in three affected districts from 16 September, 2010 to 23 September, 2010. The epidemiological studies included the study of data source regarding blood samples for serology, clinical profile of patients, age distribution of patients, and clinical symptoms of the disease. The entomological investigations included larval survey for the study of breeding sites of *A. aegypti* habitats and calculation of House, Container and Breteau indices. Environmental investigations included the study of temperature and general climatic conditions of the affected areas with the help of records existing in the metereological department.

RESULTS AND DISCUSSION

The epidemiological investigation of maximum probable cases showed clustered distribution of cases in adjacent houses and streets and absence of travellers to dengue endemic regions, though many cases of migration was also noted during early phase of outbreak. Serological investigations revealed that 41.08% were positive for the presence of dengue specific antibodies (Table 1). The age group affected maximally lies between16 and 20 years (Table 2). The clinical history revealed that all the patients had suffered from fever ranging from 38 to 42°C; details of clinical symptoms have been shown in Table 3. The platelet count varied from 18000 to 2.8 lakhs. The affected ratio of male: female was 1.44:1.00, respectively. Entomological investigations were carried out in 60, 94 and 75 houses in the districts of Patna, Munger and Begusarai, respectively. The index of House container and Breteau from Patna, Munger and Begusarai found were 20, 40 and 29, 11.11, 43 and 31, and 26, 91.48 and 56, respectively, thereby indicating the high receptivity of Munger to DF/DHF transmission which can subsequently be confirmed with the number of cases reported from there. (Tables 4 to 5). Due to acute shortage of water, people stored water in the containers like cisterns, cement tank and plastic drum. Some of the peri domestic containers like mud tubs, grinding stones, metal container, tyre and unused well were also surveyed. Examination showed that mud tubs and cement tanks were positive for the *Aedes* larva. Environmental investigations included the study of temperature and general climatic conditions of the affected areas. The average maximum and minimum temperature and humidity in the morning and evening during the outbreak were collected from the Metereological Department. The average temperature from Patna, Munger and Begusarai were 32.21 (maximum) and 25.09 (minimum), 32.39 (maximum) and 25.19 (minimum) and 32.33 (maximum) and 25.43 (minimum) respectively. The average humidity in the morning and evening of Patna, Munger and Begusarai were 86.29 and 82.43, 84.97 and 82.86 and 84.12 and 83.43 respectively. The average rainfall in the year 2010 in Patna, Munger and Begusarai were 226.9, 220.00 and 224.45 mm, respectively.

Conclusion

These results shows that the spread of dengue fever in rural and semi-urban areas is a matter of concern for public health and it can be co-related with unusual climatic pattern arising on account of global warming. The results propose that community involvement in control of vectors and eliminating the breeding places are required through intensive behavior change communication.

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Table 1. Total IgM and IgG positive cases.

IgM (+ve) (%)	IgG (+ve) (%)	IgM and IgG (+ve) (%)
46	40	14

Table 2. Age distribution of suspected DF cases.

Age group (years)	Munger	Begusarai	Patna	Total
0-5	26	0	6	32
6-10	92	6	10	108
11-15	111	0	21	132
16-20	136	12	30	178
21-25	77	5	32	114
26-30	76	10	36	122
31-35	55	6	23	84
36-40	55	1	14	70
41-45	49	2	13	64
46-50	19	0	9	28
51-55	18	0	8	26
56-60	19	0	2	21
61-65	6	0	5	11
65-70	9	1	0	10
71-75	1	0	4	5
	749	42	213	1004 (+ve)

Table 3. Clinical presentations of “suspected” DF/DHF cases.

Clinical symptom	Affected (%)
Fever	100
Headache	100
Myalgia	80
Giddiness	5
Nausea/vomitting	75
Diarrhoea	25
Pain abdomen	90
Hepatosplenomegaly	5
Petechiae/rash	10
Dark coloured stool (malaena)	5
Bleeding gums	1

Table 4. *Aedes* larval survey of Patna District.

Variable	Statistic
Houses surveyed	60
Positive for *Aedes* breeding	12
House index	20
Containers searched	20
Containers positive	144
Container index	11.11
Breteau index	26

Table 5. *Aedes* larval survey of Munger District.

Variable	Statistic
Houses surveyed	94
Positive for *Aedes* breeding	38
House index	40
Containers searched	200
Containers positive	86
Container index	43
Breteau index	91.48

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