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Silent spread of dengue and dengue haemorrhagic fever to Coimbatore and Erode districts in Tamil Nadu, India, 1998: need for effective surveillance to monitor and control the disease

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SUMMARY

Dengue fever (DF) or dengue haemorrhagic fever (DHF) has not previously been reported in Coimbatore and Erode districts in Tamil Nadu in India. In 1998, 20 hospitalized cases of fever tested positive for dengue virus IgM and/or IgG antibodies. All of them had dengue-compatible illness, and at least four had DHF. Two of them died. Sixteen cases were below 10 years of age. The cases were scattered in 15 distantly located villages and 5 urban localities that had a high *Aedes aegypti* population. Although the incidence of dengue-like illness has not increased recently, almost 89% (95/107) of samples from healthy persons in the community tested positive for dengue IgG antibodies. The study showed that dengue has been endemic in the area, but was not suspected earlier. A strong laboratory-based surveillance system is essential to monitor and control DF/DHF.

INTRODUCTION

After the recent outbreaks of dengue haemorrhagic fever (DHF) in the National Capital Territory of Delhi [1] and many other areas [2], dengue has become a major public health concern in India. For this reason clinicians in Coimbatore (Tamil Nadu) started using commercial kits (Panbio-Australia) in 1998 to test blood samples from patients with acute febrile illness for dengue virus antibodies. Of 41 samples tested from January through March 1998, 11 were found positive for dengue IgM and/or IgG antibodies. They were notified as cases of dengue fever (DF)/DHF to the district/state health authorities. Since dengue fever had not previously been reported in this part of the country (although many other areas in Tamil Nadu have reported dengue cases and deaths) (Fig. 1) the public health authorities decided to investigate the episode systematically. The results are presented in this paper.

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METHODS

All the major hospitals in Coimbatore were visited to find out whether they had recently observed an unusual increase in fever cases, or whether they had admitted cases that had dengue-compatible illness recently or in previous years. Hospital records of all

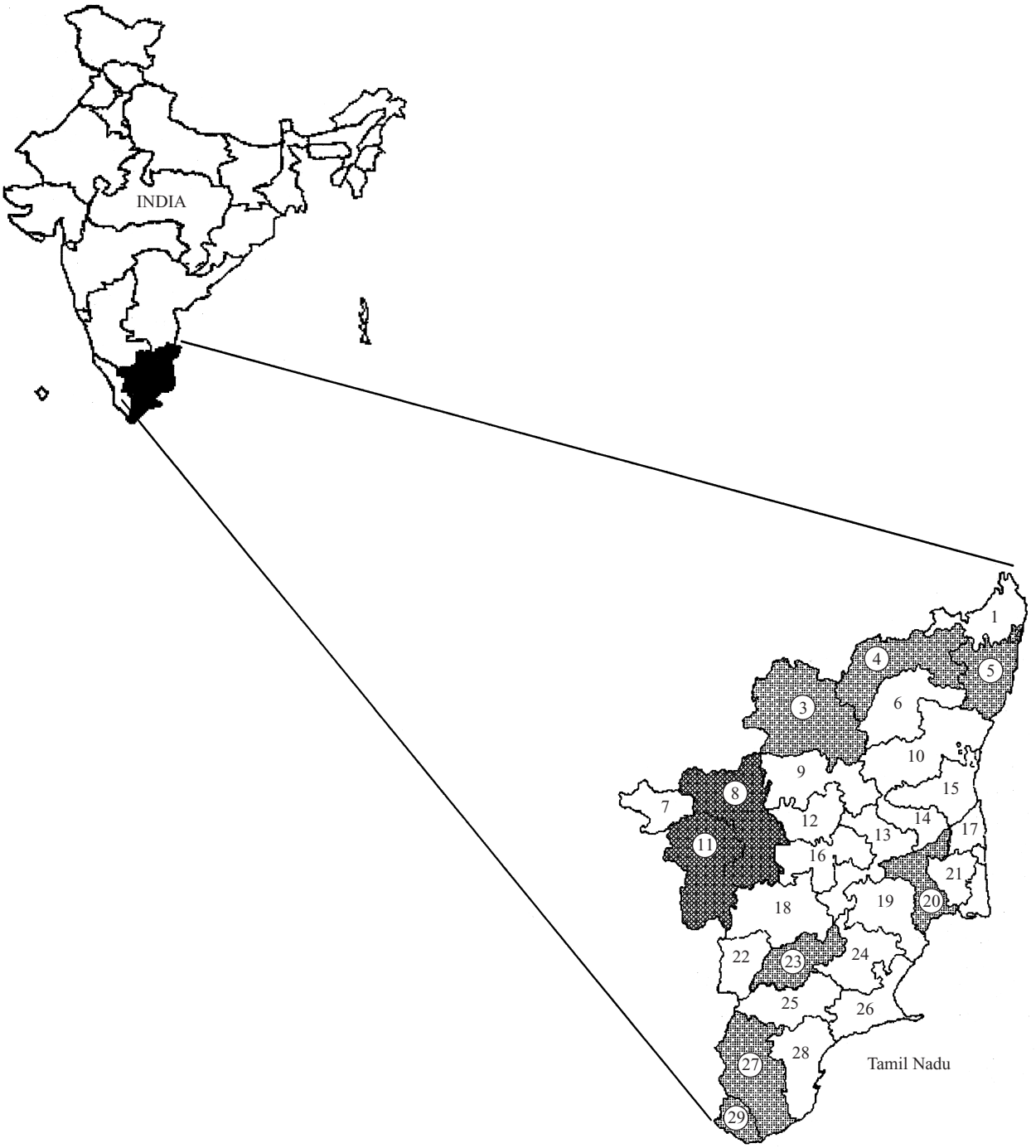

Fig. 1. Dengue/DHF affected districts in Tamil Nadu, India. The present study was carried out in districts 8 (Erode) and 11 (Coimbatore) (heavy shaded) in Tamil Nadu state. Districts 2 (Chennai), 3 (Dharmapuri), 4 (Vellore), 5 (Kanchipuram), 20 (Thanjavur), 23 (Madurai), 27 (Tirunelveli) and 29 (Kanyakumari) (light shaded) have also reported DF or DHF. Note: Maps not to scale.

the notified cases and nine additional dengue virus antibody-positive cases identified through hospital visits were scrutinized to determine their age, sex, address, date of onset of illness, signs and symptoms and result of laboratory investigations. The patients, their family members, or doctors who had treated them were also interviewed to supplement the information collected from hospital records.

Local health authorities carried out entomological investigations in 72 wards of Coimbatore town on a sampling basis. Houses were searched for adult mosquitoes and breeding of aedes mosquitoes. Similar

Table 1. *Probable cases of dengue fever or dengue haemorrhagic fever hospitalized in Coimbatore during January–April 1998*

Case no.	District	Age (yrs)	Sex	D.O.A.	D.O.D.	Serology for dengue			Bleeding	Liver palpable	Platelets < 100000 per mm^3	Evidence of plasma leakage	Died
						IgM	IgG	HI titre					
1	Coimbatore	36	F	23 Jan	26 Jan	+ve	+ve	NT					Yes
2	Coimbatore*	16	M	24 Jan	3 Feb	+ve	+ve	> 640			No		
3	Coimbatore*	5	M	5 Feb	7 Feb	+ve	+ve	NT			Yes	Yes, PCV	Yes
4	Coimbatore*	5	F	8 Feb	14 Feb	Neg	+ve	> 640		Yes	Yes	Yes, Pleural effusion	
5	Coimbatore	2 y	M	2 Feb	11 Feb	+ve	+ve	NT	Yes		Yes	Yes, PCV, Pleural effusion	
6	Coimbatore	10 m	M	7 Feb	16 Feb	+ve	Neg	NT		Yes	Yes	Yes, Pleural effusion	
7	Coimbatore	10	M	22 Feb	28 Feb	+ve	+ve	> 640			Yes		
8	Coimbatore	8	F	22 Feb	28 Feb	+ve	+ve	> 640			Yes		
9	Erode	12	M	23 Jan	28 Jan	+ve	+ve	> 640			Yes	Yes, Ascitis, Pleural effusion	
10	Erode	6	F	7 Feb	14 Feb	+ve	+ve	80		Yes	Yes	Yes, PCV, Ascitis, Pleural effusion	
11	Erode	3 m	M	7 Feb	16 Feb	+ve	Neg	NT	Yes	Yes	Yes		
12	Coimbatore	8 m	F	1 Feb	6 Feb	+ve	Neg	NT		Yes	No	Yes, Pleural effusion	
13	Coimbatore	9 m	M	12 Feb	16 Feb	+ve	Neg	NT		Yes	Yes		
14	Coimbatore	4	M	25 Feb	2 Mar		+ve	NT		Yes	Yes	Yes, PCV, Pleural effusion	
15	Coimbatore	5 y	M	7 Mar	10 Mar		+ve	NT		Yes	Yes	Yes, Pleural effusion	
16	Coimbatore*	8 m	M	8 Mar	14 Mar	+ve		NT	Yes	Yes	Yes	Yes, Pleural effusion	
17	Coimbatore*	11 m	M	4 Mar	14 Mar	+ve		NT		Yes	Yes	Yes, PCV, Pleural effusion	
18	Coimbatore	9 m	M	14 Mar	30 Mar	+ve		NT			Yes	Yes, PCV, Pleural effusion	
19	Coimbatore	8 m	M	23 Mar	28 Mar	+ve		NT		Yes	No		
20	Coimbatore	7	F	31 Mar	5 Apr	+ve	+ve	NT	Yes	Yes	Yes	Yes, Pleural effusion	

* Urban area, D.O.A. = Date of admission; D.O.D. = Date of discharge/death; PCV = Packed cell volume, Neg = Negative, NT = not tested. Blank space means data not available.

surveys were carried out in nine other urban and rural areas inhabited by some of the cases. These surveys were combined with inquiries for fever cases that occurred within a reference period of 2 weeks. We evaluated the vector control measures by repeating surveys in eight areas many weeks after the employment of these measures; two additional areas were also surveyed for the first time.

Blood samples were collected from 107 apparently healthy household and community contacts of notified cases. These samples were tested in the laboratories of National Institute of Communicable Diseases (NICD), Delhi for dengue virus IgG antibody using commercial kits (Genelabs, Singapore). Late convalescent blood samples (more than 1 month after the onset of illness) collected from seven cases were also

tested for haemagglutination inhibition (HI) antibodies for evidence of recent dengue infection using criteria adopted by the WHO [3]. Paired serum samples were not available for all the patients. We did not have the facility for the isolation of dengue virus or the detection of dengue virus antigen.

RESULTS

The details of 20 cases who had DF/DHF-compatible illness are shown in Table 1. Eighty percent of the cases (16/20) were children below 10 years of age; 14 cases were males. Two patients died within a few days of hospitalization.

Seventeen cases lived in the Coimbatore district, and three cases came from the Erode district. Only five cases occurred in urban districts; the remaining cases occurred in rural areas of the two districts. These cases were scattered in distantly located villages/areas and there were no apparent linkages between them.

All of these patients were admitted to private institutions. Although detailed clinical features were not available for all the cases, all of them had acute febrile illness of short duration along with constitutional symptoms. At least four patients provided a clear history of haemorrhagic manifestations. Tourniquet tests were not done in any case. Eighty four percent of the cases (16/19) had thrombocytopenia (platelets < 100000 per cubic mm). At least 13 cases had evidence of plasma leakage in the form of an increased haematocrit of equal to or more than 20% and/or pleural effusion or ascites. Such information was not available for other cases. All of them were positive for dengue virus IgM and/or IgG antibodies (Table 1).

About 14·6% (385/2638) of the houses and 9·4% (532/5685) of the containers searched in Coimbatore town in the early months of 1998 had evidence of breeding *Aedes aegypti*; Breteau index was found to be 20·2. Entomological investigations undertaken in many other villages and urban localities in Coimbatore and Erode districts also revealed heavy breeding of aedes mosquitoes in all these areas. Most of the people stored water in cement tanks, which contained aedes larvae. Repeat surveys in eight areas many weeks after the intervention measures had been undertaken showed that the number of larvae had declined in three areas including two where patients had died. In the remaining five areas, similar or even higher numbers of larvae were observed (Table 2).

House-to-house surveys revealed that there was no unusual increase in fever cases in the affected villages/areas. Only a few cases were found having acute febrile illness during these investigations.

While going through the morbidity data in two primary health centres affected during this episode, it was observed that about 19 and 14%, respectively of the cases during 1997–8 were diagnosed as pyrexia of unknown origin (PUO) by treating physicians. These patients had an acute febrile illness of short duration along with constitutional symptoms. They did not have respiratory symptoms and were negative for malarial parasites. All of them recovered without any specific treatment. At the time, the clinicians did not suspect them of having DF, but now they realize that these patients had DF-compatible illness.

The results of dengue virus antibody tests on blood samples drawn from the reported cases are shown in Table 1. Eighty nine percent (95/107) of the healthy household and community contacts were found to be positive for dengue virus IgG antibody.

DISCUSSION

Of 20 cases considered in this study, at least four fulfilled all the criteria of WHO's case definition for DHF [3]. Use of the tourniquet test for evidence of bleeding tendencies might have diagnosed more cases of DHF. Nevertheless, the remaining cases had clinical illness compatible with dengue fever. It was initially thought that these were the first cases of DF in this area because DF/DHF has never been reported in this part of the country. However, there was sufficient epidemiological, entomological and laboratory evidence to show that this was not the case. Morbidity data in two primary health centres showed that about 18% of the cases were diagnosed as PUO by their treating physicians during 1997–8. These patients had illness compatible with DF, but this diagnosis was not suspected because the area had always been considered free from dengue infection. All the reported cases were scattered in distantly located villages/areas and there was no clustering of cases with acute febrile illness in any community. We would not expect such a distribution when dengue infection enters an area for the first time. The majority (89%) of healthy persons in urban as well as rural areas had dengue virus IgG antibody. Entomological investigations revealed that the vector had established itself in the entire district; there was heavy breeding of *Aedes aegypti* in all the areas surveyed. Clearly, the dengue

Table 2. *Results of entomological surveys in Coimbatore and Erode districts, 1998*

Area surveyed	Type of area	District	House index % (No. +ve/No. searched)			Container index % (No. +ve/No. searched)		
			First round	Second round	*P* for difference	First round	Second round	*P* for difference
Sengalipalayam*	Rural	Coimbatore	9·8 (4/41)	0 (0/50)	0·02	6 (4/67)	0 (0/177)	0·001
Avarampalayam*	Urban	Coimbatore	35·7 (15/42)	6·7 (3/45)	0·0008	35·8 (43/120)	2·7 (3/110)	< 0·0000001
Upplipalayam	Urban	Coimbatore	22·2 (26/117)	20·9 (9/43)	0·9	9 (26/289)	12·9 (9/70)	0·3
Ganapathy	Urban	Coimbatore	37·9 (11/29)	27·3 (9/33)	0·37	21·7 (33/152)	17 (9/53)	0·46
Semmanichettipalayam	Rural	Coimbatore	12·5 (4/32)	10·5 (2/19)	0·83	14·5 (12/83)	9·1 (2/22)	0·51
V. Ayyampalayam	Rural	Coimbatore	4·2 (2/48)	40 (6/15)	0·0003	0·9 (2/218)	31·6 (6/19)	0·000003
Semmandanpalayam	Rural	Coimbatore		33·3 (8/24)			44·8 (13/29)	
Iduvai	Rural	Coimbatore		22·2 (4/18)			18·2 (4/22)	
Orathupalayam	Rural	Erode	7·4 (6/81)	35·2 (19/54)	0·00005	4·9 (6/123)	15·3 (11/72)	0·012
Nattanvalasu	Rural	Erode	61 (47/77)	14·7 (5/34)	0·000007	53·8 (141/262)	12·8 (6/47)	0·0000002

Note: First round before and second round after intervention measures. Blank space means data not available.
* The patients died in these areas.

infection has been endemic in Coimbatore and Erode districts for a long period and the cases of DF/DHF notified by the physicians were sporadic in nature.

The disease affected mainly children. One child probably died due to dengue shock syndrome (DSS), whereas the precise reason of the death of an adult female could not be ascertained in the absence of relevant data. It is worth mentioning that both deaths occurred in the beginning of the episode when the physicians did not suspect dengue and start the appropriate treatment early in the illness. Since the area is now known to be highly endemic for dengue infection, the clinicians should have a high degree of suspicion for DHF/DSS. There is also a need to make them aware of the usefulness of tourniquet test in the clinical evaluation of patients.

Dengue was considered a disease of primarily urban areas until the 1970s. Soon it spread to smaller towns and then to rural areas in most endemic countries including India. It was considered that rural areas had a low incidence of dengue infection. The present episode has shown that dengue has become equally, if not more, prevalent in the rural community of the Coimbatore district. Fifteen of 20 cases were from villages. Seropositivity rates for dengue antibody in healthy persons were also high in rural areas. Public health authorities at national level may consider dengue as a priority for surveillance and control in urban as well as rural areas.

Because of the operational difficulties and high cost involved in pesticide treatment of all the domestic water containers (having potable or non-potable water) in such a wide area, people were encouraged to eliminate the mosquito habitats by emptying water containers once a week and to keep the permanent water containers covered with a tight-fitting lid. However, the results showed that the number of larvae decreased significantly in only three areas including two where the patients died of DHF/DSS; larval indices remained at the same levels or even increased in the remaining areas (Table 2). We interviewed many villagers and community leaders to find out why the community did not act in those areas where there was no mortality. It was found that the people were not concerned for a few cases of fever that occurred in their areas even if they needed hospitalization. They also believed that insecticide spray alone

would combat the mosquitoes and therefore, there was no need for emptying of water containers containing breeding mosquitoes. After all, the water was a scarce commodity and was needed not only for domestic purposes but also for commercial activities (weaving cotton yarn into cloth is the cottage industry in the entire Coimbatore district). The results highlight the need to tell the people that space spraying is only an emergency measure and that DF/DHF can be prevented/controlled more efficiently by source reduction methods than by other means [3, 4]. Almost all the households stored water in cement tanks (capacity 300–500 litres) that were not covered by a lid. It may not be easy to empty and refill them on a weekly basis but people should be encouraged to cover them with tight lids. We also feel that including a small element of fear in the health messages would also be useful to get the community participation on a continuing basis.

Most countries in Western Pacific and South-East Asian Regions where dengue has become endemic have shown an interesting sequence of spread of disease: frequent transmission of dengue virus, first associated with sporadic cases of DHF, followed by DHF epidemics which progressively become more frequent until DHF cases are seen virtually every year with major epidemics occurring at 3- to 5-year intervals [3]. Since dengue has been found to have a similar epidemiological pattern in Coimbatore and Erode districts, we suspect that these areas are in danger of a severe outbreak of DHF in future. In addition, the disease may not remain confined to a few months because these areas receive some rainfall in all the months, and the temperature (summer, 23·3–39·4 °C; winter, 20·7–32·8 °C) remains favourable for mosquito breeding throughout the year. The situation calls for the establishment of an effective surveillance system to monitor the disease and vector throughout the year so that appropriate control measures can be taken to reduce both to a minimum acceptable level.

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