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Twine outbreak at Kirungakottai village, South India, India

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Abstract
Background & Objectives: Mixed fever outbreak recorded at village Kirungakottai located in Sivagangai district of the Southern Indian state of Tamil Nadu in September 2014. This outbreak was investigated to identify the etiology and epidemiology.
Methods: Epidemiological parameters were collected from the village and health centers. Blood samples were collected and examined with standard microbiological techniques were adopted for this fever investigation.
Results: 145 fever cases (4.09%) recorded from the affected village Kirungakottai. All age groups affected, but no death occurred. Mixed infection reported in the population. 15 dengue cases and 7 leptospirosis cases recorded from the fever cases. 4 individual infected with both dengue and leptospirosis.
Interpretation and Conclusion: Our study reported the first mixed disease outbreak in the remote village of Sivagangai district, Tamil Nadu, South India. It also indicated the proper planning and management of public health emergencies in the country.

Keywords: Mixed infection, House Index, Container Index, Mixed dwelling

1. Introduction
Dengue and Leptospirosis are notified and most prevalent and life threatening diseases in India with as many as 50222 dengue cases and 242 deaths reported during 2012 and 74168 dengue cases and 168 deaths reported during 2013 [1]. Leptospirosis contributes substantially to high epidemic potential due to lack of standards of hygiene. While these diseases no longer poses a threat to developed countries having appropriate standards of hygiene, it remains a challenge in India and other developing countries where access of safe drinking water adequate sanitation facilities are often limited. Cases of dengue have been increasing in India from 2009 to 2013 and Tamil Nadu stands on 2nd place at 2011, 1st place at 2012, 5th place at 2013 in India [1]. Leptospirosis is a zoonotic disease which has become an important urban slum health problem. It is also known that leptospirosis is a common infection in India and also under-reported due to lack of clinical awareness and early diagnostic facilities. A multicentric study in India shows that leptospirosis accounts for about 12.7% of cases of acute febrile illness responsible for attendance at hospitals [2]. The highest rates occur during October and November, with sero prevalence of up to 55% in the general population. Some strains like lai may cause earlier mortality in the first three days [3]. A programme for prevention and control of leptospirosis under the 12th Five year plan (2012-2017) with a total budget allocation of Rs.3.753 crores is being implemented in endemic states including Tamil Nadu. The main objective of the programme is a reduction in morbidity and mortality due to leptospirosis [4]. Till May 2001, 16 health units, including Chennai have reported leptospirosis in Tamil Nadu. Major contribution of cases had been rendered by Chennai, Tamil Nadu with 509 cases [5].
Status of leptospirosis and mixed infection of dengue and leptospirosis in Sivagangai district is unknown. The only three dengue cases reported in Kirungakottai village, but this district reported 358 dengue cases during 2013. In this communication, we report the first mixed disease outbreak at Kirungakottai is remote location at Northern part of Sivagangai district, Tamil Nadu, India. This study revealed the spectrum of mixed infections, the incidence and transmission factors of dengue and leptospirosis in Sivagangai district.

2. Material and Methods

2.1 Study area

Kirungakottai is a remote village with a population of 3537 located about 50Km away from the district headquarter. This village belongs to the Singampunari community health centre (CHC). Mixed dwelling (cattle and human) and open air defecation are common and also lack of chlorinated water supply and sanitation facilities.

2.2 Case definition of leptospirosis

Among fever cases, leptospirosis could be identified by sudden onset of headache, sever myalgia and fever, abdominal pain, vomiting and conjunctival suffusion may follow.

2.3 Case definition of dengue

According to the IDSP manual, dengue is defined as an acute febrile illness of 2-7 days duration with two or more of the following symptoms: headache, retro-orbital pain, myalgia, arthralgia, rash, hemorrhagic manifestations and leucopenia [6].

2.4 Outbreak, fever surveillance and control measures

On September 5, 2014 an outbreak of fever was detected in Kirungakottai village when four patients were admitted at the community health centre with fever and abdominal pain symptoms. Blood samples collected to rule out malaria, Typhoid, dengue and leptospirosis on delineated by the National Vector Borne Diseases Control Programme (NVBDCP), Government of India. All patients were put on medical care. The Rapid Response Team from district headquarter investigated the outbreak up to October 2, 2014. Tests were performed with Zonal Entomological Team, Sivagangai and Madurai Medical College, Madurai. The standard procedures of MSAT and Ig-M ELISA were followed to analyze all samples.

2.5 Active fever surveillance

Information on fever was collected with the resources available by active (door-to-door search) and passive surveillance (Institutional surveillance) as fever is the prime sign and symptom for dengue and leptospirosis. The active surveillance was performed by field staffs, health Inspectors and village health nurses. When the number of cases exceeded two, it was considered as an outbreak and efforts were made to determine the sources of the disease and to improve the sanitation in the affected village through community participation and information education and communication (IEC).

2.6 Treatment for positive cases of leptospirosis and dengue

Positive cases of leptospirosis were treated with doxycycline 100 mg twice a day for 7 days in patients above 15 years old, and erythromycin 250mg was a drug of choice for patients below 15 years old, to avoid blacking of teeth. The dengue cases were treated as per treatment protocol given by NVBDCP, Government of India.

2.7 Entomological Surveillance

Entomological surveillance has used for the anti larval (AL) and anti adult measures. The AL work was performed by skilled field workers and trained volunteers by identifying immature stages of Aedes spp. in common mosquito habitats near the premises of human dwelling such as tires, coconut shells, cement cisterns and over head tanks [7]. These sources were removed with all possible efforts and in case where removal was not possible larvicide (50% Temephos emulsified concentration at the dosage of 1 ppm as per NVBDCP guideline was used to kill the mosquito larvae. The 6 days activities recommended based on the life cycle of mosquito as it has usually taken between 7 and 10 days for the imago to emerge from the egg.

Anti adult measures were carried out using ultra low volume thermal fogging machine with a formulation of pyrethrum and diesel in the ratio of 1:19. Since dengue vectors A. aegypti and A. albopictus have diurnal periodicity fogging was performed from 8 Am to 11 Am and from 3 Pm to 5 Pm to ensure the knock down effect of the insecticides [8].

2.8 Appraising method for the AL work

To appraise the AL work performed by the field staffs and trained volunteers, the entomologist team investigated a minimum of 25 houses in which the field workers carried out the AL works the previous day. The data matched with the entomological indices (HI, CI,) and discussed in the daily review meeting in order to improve the quality of the work by the field workers. This method was continued every day until the outbreak was halted completely.

2.9 Rectification of water distributing system in the affected village

Leptospirosis is spread through contamination of water when urine and excreta of animal reservoirs like rodent, cattle and dogs mix with the drinking water through perforations in the water distributing system, which was rectified wherever it was noticed. Chlorination and IEC on personal hygiene are also associated, as this disease is transmitted to individuals who walk barefoot during a rainy season, those whose occupation is related to paddy cultivation, those with a degree of association with pet animals and those occupation are veterinarians, butchers, etc.

3. Chlorination

Chlorination is indispensable in delivering safe drinking water to the community. A standard procedure has been adopted (9). This involves the application of 4.20g of bleaching powder, which should contain 32% chlorine to 1000 L of drinking water. To introduce 1.2 ppm/4.20g of chlorine to 1000 L of water, a sufficient quantity of bleaching powder should be pasted in a pail and water poured in to dissolve the paste; this is then left for 30 minutes to settle all lime. Then, the surface water, which contains chlorine, should be decanted over the storage of drinking water, and may be given to consumers after 30 minutes.

3.1 Community participation

To encourage the community to take part in control measures, various meeting were conducted in schools, and with elected bodies, self help groups member. The basic epidemiology of dengue and leptospirosis, conducive environment which prevailed in the village, like breeding sources and contamination of drinking water by animals and sewages were highlighted. These IEC activities were performed by the public addressing system and interpersonal communication.

3.2 Statistical analysis

The values of the indices calculated by both field workers and appraisers were analyzed by Chi-square test using the Statistical Package of Social Sciences version 12.0 (SPSS Inc.,

Chicago, IL, USA).

3.3 Result

This study was carried out in the Kirungakottai village (Sivagangai, Tamil Nadu, India; Latitude 9.42'N, longitude 78.49'E) wherein there was a twine fever outbreak in September 2014. The primary information on fever was obtained from various sources to understand the degree of outbreak and to prioritize the AL work, chlorination of water, prophylactic treatment for contacts and anti adult measures to be taken. To determine the impact of control measures the data collected on fever in a week were taken as before and after outbreak intervention. Before the intervention, the reported numbers of fever cases from week 1 to 4 in Kirungakottai village were 57, 58, 24 and 6 which shows the magnitude of the problem. In fever surveillance all probable cases of dengue and leptospirosis were identified according to the case definition in the IDSP manual. Blood samples were collected from fever cases for laboratory examination. The test results were positive for dengue virus infection and leptospirosis infection based on the immunoglobulin M (IgM) antibodies in IgM capture enzyme-linked immunosorbent assay.

An observation of on entomological surveillance data revealed that the HI, CI and were above the permissible level in the 1st week of intervention, but the values gradually reduced after the AL work and control measures. The HI, CI was 48.6%, 28.6% before the entomological intervention; however, after the intervention, these indices were considerably reduced as the HI values were 10.2%, 5.2% and 1.6% in the 2nd, 3rd and 4th week, respectively; the CI values were 2.3%, 0.9% and 0 respectively. The weekly progress of Aedes indices during the entomological surveillance is shown in figure [1]. These findings reflected the considerable reduction in the population of Aedes spp. (both pupae and adult) and subsequently a reduction in the number of dengue cases reported.

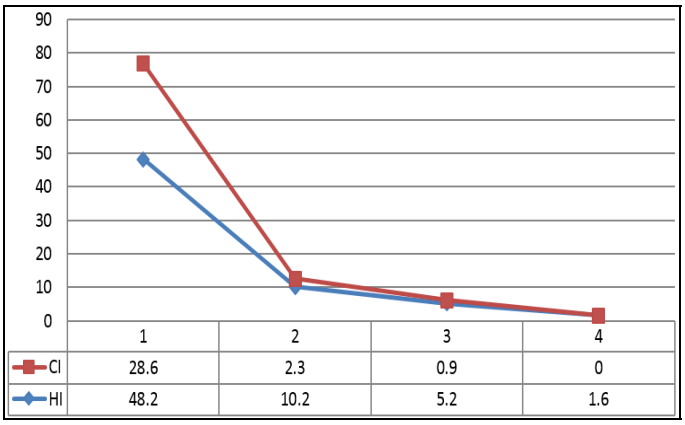

Fig 1: Aedes indices during the progress of entomological surveillance at Kirungakottai village.

The AL works performed by field workers was appraised by entomologists who inspected a minimum of 25 houses. We found that there was a consistent reduction in the value of indices from the 1st week of intervention onward. When the data of appraisers were matched with the field workers data, some inconsistencies were found ($p>0.005$). Because these data reflect quality of AL works, inconsistencies were reviewed in the daily meeting in order to improve the quality of the AL works. The incubation period of the dengue virus is 4-14 days, which was also considered to appraise the quality of AL works i.e., if the interventions were successful, there should be a descending trend from the second fortnight of intervention. In this study, the fever cases in the first week 57, but it was reduced to 24,6 and 0 in the subsequent weeks showing the success of the intervention Figure (2).

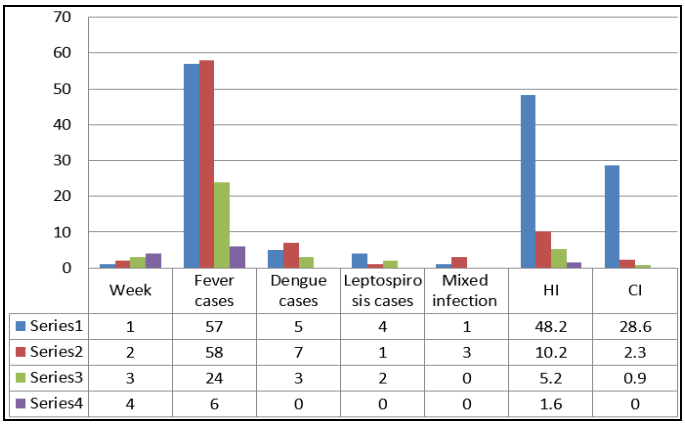

Fig 2: Impact of entomological intervention during the fever epidemic in Kirungakottai village.

During the course of the outbreak, the following also been observed and highlighted; the HI not only provided information about the geographical distribution, but it also useful as an evaluating tool. We ascertained how long dengue and leptospirosis cases have been prevailing in the community. Children (1-14years) also susceptible in the first phase (15 days from the onset of confirmed cases). Any delay in the control of cases within 15 days might reflect on the quality of control measures. A team monitored the chlorination of drinking water and prophylactic treatment to the contacts in the village. Leptospirosis transmission also curtailed due to timely intervention. Mostly, adult cases of leptospirosis were reported.

4. Discussion

Entomological surveillance is an appropriate tool for the prevention and control of dengue outbreak until a suitable vaccine and specific drugs for DF, DHF and DSS are made available. It was ascertained by the world health organization (WHO) that preventing or reducing the transmission of dengue virus entirely depends on the control of the mosquito vectors or interrupting the human-vector contacts [10,11]. The WHO ascertained that integrated vector management is the best strategic approach to control vectors in all vector borne diseases including dengue [12]. It is a proven fact that dengue control is possible only through advocacy, social mobilization, legislation, collaboration with health sectors and capacity building [13]. Above all, promoting the source reduction of Aedes species through the AL works along with the community participation yielded good results and control of A. aegypti was mainly achieved by eliminating water filled containers that are favorable oviposition sites, which permit the development of the aquatic stages. In unavoidable situations, insecticides and bio-control agents were used which kill the mosquitoes [14]. The importance of using Aedes indices has been proven as an effective tool as there was a rapid reduction in the number of dengue cases after the AL work. For monitoring the entomological surveillance an appraising mechanism was used which is also novel method or a milestone to evaluate day-to-day control activities of dengue and to assess the quality of AL work, the incubation period of dengue (4-14 days) was considered during the appraising phase. These observations have the merits to be incorporated

as a modes operandi in the preventing and control of dengue in any corner of the world.

This study also estimated the real magnitude of leptospirosis outbreak and control measures in the affected village. Eleven affected individuals were interviewed; some of them became infected from wet land agriculture practice, some others by walking bare foot during a monsoon, some by association with pet animals and very few were associated with drinking water contamination. Social control measures in the affected village and awareness and health education are necessary [15]. Further, it has been recommended that especially in India, the rodent control is a vital consideration in the prevention of diseases transmission. Rodents and domestic mammals such as cattle, pigs and dogs serve as major reservoir hosts [16, 17]. Infected animals may excrete leptospirosis intermittently or regularly for their life time. Vaccinated animals may still shed infectious organisms in the urine [18]. Human infection results from direct or indirect exposure to the urine of certain animals. These findings support the view of leading researchers of leptospirosis who have mentioned that 20% cases fatality rate in leptospirosis is due to under reporting and misdiagnosis due to a wide spectrum of symptoms, which may mimic the clinical signs of many others fever such as dengue, hanta virus, west Nile and malaria [19]. Mixed infection associated with high case fatality during seasonal periods of rainfall in poor urban areas that lack of basic sanitation infrastructure [20].

Table 1: Distribution of age-wise cases in Kirungakottai village, Tamil Nadu, India.

Age	Dengue Cases	Leptospirosis cases	Mixed Infection
1-6 years	1	0	0
7-14 years	3	0	0
>15 years	11	7	4

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6. Conflicts of interest

All authors declare no conflicts of interest.

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