A study on the prevalence of Dengue fever in Kelambakkam in comparison to an earlier study

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Abstract

Introduction: Dengue is a mosquito borne viral fever, which is prevalent in India. A one year study was conducted from July 2014 to June 2015, to determine the prevalence of Dengue infection in patients with clinically suspected Dengue fever at Chettinad Hospital and Research institute, Kelambakkam, a suburb of Chennai.
Materials and Methods: The samples were tested for Dengue NS1antigen, IgM antibodies and IgG antibodies using the ELISA Methodology. 1231samples were tested during this period.
Results: Total positive cases were 474(38.5%). 299 samples were collected from adult males and 65 from pediatric males. 86 samples were collected from adult females and 25 from pediatric females. In males, dengue prevalence rate was higher (76.8%) than females (23.2%).Total positive cases for IgM was 215(45.6%) and for IgG was 203(43%). 284(76.8%) were positive for NS1 antigen. About 43(12%) cases were positive for both IgM and IgG antibodies and NS1 antigen. An increase in the prevalence of dengue was recorded during the months of June, July, August, September, and October. This increase in prevalence was due to the onset of the monsoon season in Tamil Nadu when the vector *Aedes aegypti* occurs in large numbers.50.6%of the positive cases had thrombocytopenia and 11.6% had leucopenia. Total IgM positivity has increased from 5.04% to 45.6% and total IgG positivity has increased from 14.2% to 43%, as when compared to our previous study.

Key words: pyrexia, dengue, prevalence, ELISA, Leucopenia, thrombocytopenia

Introduction

Dengue is the most rapidly spreading mosquito borne viral disease in the world[1]. Dengue fever is caused by any of the four serotypes of the virus belonging to the family Flavivirus. It is also called as break bone fever[2]. Incidence of dengue is steadily increasing with increasing geographic expansion to new countries[1]. This infection has become epidemic across the world recently as the virus and the vector are cosmopolitan in distribution. The prevalence is high in tropical countries where the vector Aedes aegypti and Aedes albopictus are found abundantly as the climatic conditions and the monsoons are favorable for them[2]. World Health Organization (WHO) has kept India under category A, based on the endemicity of the disease. Increasing prevalence of dengue is seen in recent years due to urbanization and poor water management. Dengue is a major public health problem and a leading cause of hospitalization and death among children.[3]

Dengue infection is a systemic and dynamic disease. It is an acute febrile illness causing significant mortality and morbidity[1]. It causes a wide spectrum of illness from mild asymptomatic illness to severe fatal dengue haemorrhagic fever/dengue shock syndrome (DHF/DSS)[2]. After the incubation period, the illness begins abruptly and is followed by three phases – febrile, critical and recovery[1]. Symptoms include sudden onset of fever, malaise, chills, headache, rashes and pain in joints, back, muscles and eyeball[2]. Neuromuscular complications are developed in about 4% dengue patients[4]. Leucopenia and thrombocytopenia are the common manifestations[2]. Based on their platelet count at the time of hospitalization patients can be categorized into the high, moderate, low and no risk patients[5]. Cytokines, complement and other factors may act on the endothelium thereby altering normal fluid barrier function[5]. Rarely haemorrhage and plasma leakage may occur which leads to hyper-permeability syndrome and shock. Metabolic acidosis and disseminated intravascular coagulation and multi organ failure are the further complications. Patients with dengue infection are coinfected with chikungunya which is increasing significantly[6].

Diagnosis of dengue infection relies on anti-Dengue viral antibody. In primary infection, immune response includes IgM antibodies which are developed within 3 to 5 days of the onset of the symptoms and persists for 1 to 2 months in circulation[7]. IgG appears on the 14th day of infection and persists for lifetime. In secondary infection IgG antibody levels rise within 1 to 2 days of infection and induce IgM response after 20

days infection. This immune response confers lifetime immunity against the infecting serotype but provides short duration of protection against the infection caused by different serotypes[7]. NS1 is a highly conserved glycoprotein that is needed for the viral replication. It is present at higher concentration in the patient sera during the early clinical phase of Dengue infection[8]. Dengue NS1 contributes to pathogenesis by inducing IL-10 production by monocytes[9]. NS1antigen is found from the day 1 to 9 after the onset of fever in primary and secondary Dengue infection[8]. Rapid detection of virus during the early viremic phase can be done by conventional and real time RT PCR, nested PCR, multiplex PCR and Nucleic acid sequence based amplification (NASBA)[10]. Rapid and reliable diagnostic tests are important for patient management[1]. Mortality rates in patients with dengue infection can be reduced by early diagnosis[11]. The differentiation between dengue and other acute febrile illnesses, is necessary for the appropriate diagnosis and prompt management of cases[12].

Many studies have been conducted on Dengue fever worldwide and in various parts of our country. This study was conducted to assess the present prevalence of Dengue fever in Kelambakkam and to compare the prevalence rate with the previous study as it would be beneficial in implementing the necessary preventive measures.

The study aimed to determine the prevalence of Dengue fever among patients with clinically suspected acute febrile illness at Chettinad Hospital and Research Institute, Kelambakkam and to compare the current prevalence rate with that of a previous study.

Materials and Methodology

Study Design: This prospective study was conducted for 1 year, from July 2014 to June 2015 at Chettinad Hospital and Research Institute, a tertiary care Hospital at Kelambakkam on the outskirts of Chennai. This hospital caters to the semi urban population belonging to villages around Kelambakkam, which include Kalavakkam, Kolapakkam, Kandigai, Mambakkam, Pudhupakkam, Padur, Navalur, Poonjeriandupto Sholinganallur. Blood samples were collected from patients with acute undifferentiated febrile illness, body

pain, headache, myalgia, arthralgia and or bleeding tendencies of 5 or more days. Both in-patients and out-patients belonging to all age groups were included in this study. 7 ml of whole blood was collected from patients. The samples were collected in both plain and EDTA containers. A total of 1231 samples were tested during this period. Informed consent was obtained from the patients prior to conducting the study.

Diagnosis of Dengue: Serum was separated from whole blood by centrifugation. The samples were tested for dengue antibodies using the J Mitra NSI Ag MicroLisa, Dengue IgM Microlisa and Dengue IgG Microlisa kit for the detection of NS1 Antigen, IgM and IgG antibodies respectively. NS1 Ag Microlisa is a solid phase ELISA based on the direct sandwich principle. The IgG and IgM ELISA were based on the capture Elisa technique. The tests were performed as per the kit manufacturer's instructions

For the determination of platelet count and leucocyte count, the EDTA samples were fed into the Beckman Coulter 5 part differential counter. The counts were also verified on peripheral smear examination

Results

During the study period 1231 samples were tested for dengue antibodies and NS1antigen. Total positive cases (NS1/IgM/IgG) were 474 (38.5%).The distribution of samples are given in Table 1.

**Table 1: Age wise distribution of the positive cases**

Subject	Adults	Pediatrics	Total
Male	299	64	363
Female	86	25	111
Total	385	89	474

Of the total 363 positive males, 82% were adults and 18% belonged to the pediatric age group. Of the 111 positive females, 77% were adults and 23% were children. Of the 385 positive samples among the aduts, 77.6% were male and 22.3% were female. Of the 89 positive pediatric patients, males constituted 71.9% and females 28.08%. The results of the NS1, IgM and IgG ELISA are given tabulated in Table 2.

Table 2: Study Results

S.N	Results	Total Samples Tested	Total Samples Positive
1.	IgM	472	215(45.6%)
2.	IgG	472	203(43%)
3.	IgM & IgG	472	107(22.7%)
4.	NS1	370	284(76.8%)
5.	IgM & NS1	367	108(29.4%)
6.	IgG & NS1	367	55(14.9%)
7.	IgG, IgM, NS1	359	43(12%)

Table 3: Month wise distribution of positive cases
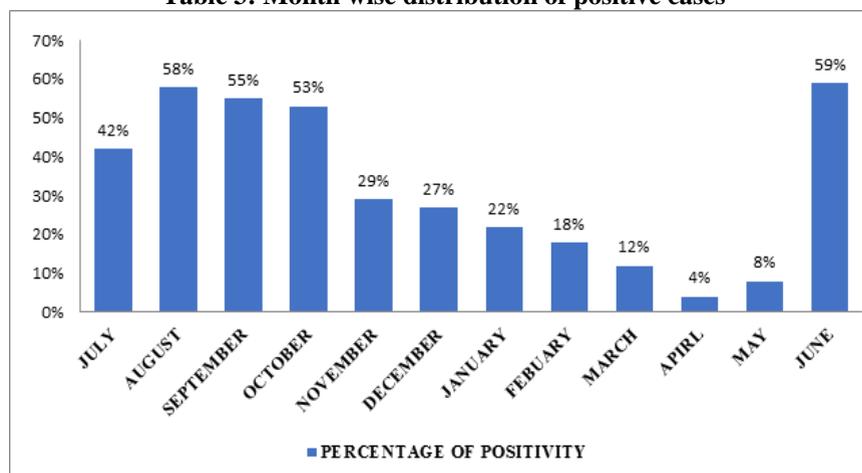
The overall positivity for dengue infection during the one year study period of one year was 38.5%. An increase in prevalence was recorded from June to October. This was related to the onset of monsoon in South India when the vectors are found in large numbers. Table 3 depicts the month wise distribution of the positive cases.

Table 4: Correlation with thrombocytopenia andleucopenia

Positive	Total	Thrombocytopenia	Leucopenia	Both
IgM only	215	138(64%)	32(15%)	45(21%)
IgG only	203	104(51%)	13(6.4%)	41(20%)
NS1 only	284	114(40%)	34(12%)	39(14%)
IgM, IgG and NS1	43	21(49%)	6(14%)	6(14%)
Total	744	377(50.6%)	85(11.4%)	131(17.6%)

50.6% of the positive cases had thrombocytopenia and 11.6% had leucopenia. The percentage of Thrombocytopenia was significantly higher in IgM positive samples (64%) than in IgG positive samples (51%). Thrombocytopenia occurring due to dengue fever can lead to further complications like hemorrhage and organ impairment. The correlation between Dengue positivity and Leucopenia and thrombocytopenia is shown in Table 4.

Discussion

The overall prevalence of dengue in Kelambakkam during the study period was 38.5%. The month wise prevalence of dengue varied from as low as 4% in the month of April 2014 to as high as 59% in the month of June 2015. There was a significant prevalence rate in the months of August, September and October (2014). This coincides with the rainy season in the state of Tamil Nadu. A study published by Nishat Hussein Ahmed et al[13] in Delhi showed a similar observation and increased prevalence in rainy season. The role of climatic factors in infectious diseases like dengue is well-known. In most tropical countries, dengue epidemics are reported to occur, during the rainy seasons, which favor abundant mosquito growth.

Our study also showed that the prevalence is higher in males when compared with females. Prevalence was higher in males in Nishat Hussian Ahmed's study[13]. Our study showed higher prevalence in adult age group which was in agreement with their study.

In a study done by Siraj A Khan etal[14], Female patients comprised 67.2% of the positive cases whereas in our study prevalence of infection in female patients was 23.2%[22]. A study performed by Capeding et al[15] showed the highest prevalence in 6- to 10-year-old age group (36.7%) which was in contrast to our study.

In our study total IgM positivity and IgG positivity was 45.6% and 43% respectively. In another study, Anita Chakravarti et al[16] have reported 22.28% and 35.05% positivity rate respectively for IgM and IgG antibodies alone which were lower than our study. Combined IgM and IgG positivity in our study was 22.7% whereas it was42.67% in their study. In our study primary dengue infection was significant which was in contrast to Anita Chakravarti's[16] study in which secondary dengue is more significant.

In a 7 year study conducted by Pandey et al[17] in Nepal the overall prevalence of Dengue cases was found to range from 26.1 to 55.4%. Infection was found to be more common among adults and males. Seasonal trends revealed that cases peaked in October and November which was similar to our study[18]. Another study by Jhansi Charles et al in Madurai[19] also showed that out of 167 Dengue positives, 93 were males (55.6%) and 74 were females (44.4%) proving that the Dengue infection was predominant in males than in females.

Thrombocytopenia was seen in 23.1% of dengue IgM-positive patients in NH Ahmed's study whereas Thrombocytopenia was 64% in IgM positive patients in our study. Platelet count of < 100,000/cumm was detected in 84.88% of patients in R.N. Makroo et al's[6] study which was significantly higher than our study (50.6%). Another study by Nandhini Chatterjee et al[20] also showed thrombocytopenia and gross leucopenia.

When compared to a previous study conducted at Chettinad Hospital and Research Institute, by Priyadarshini et al in 2010[21], the overall positivity had increased to 38.5% as when compared to the earlier study which reported a positivity of 30.9%. The percentage positivity was higher in the adults (79.5%) as when compared to the previous study where the percentage positivity was higher in the pediatric age group (48%). In the present study, the prevalence was higher among the adult males than the adult females whereas the prevalence was the same in both sexes in the previous study. In the pediatric age group, the prevalence was higher in the males in both the studies. This shows that the IgM positivity has increased as when compared to the previous study. The overall IgM positivity was 45.6% and the IgG positivity was 43% which were also higher than the previous rates of 5.04% and 14.2% respectively. Both IgM and IgG positivity was seen in 23% of the cases, whereas the earlier prevalence was 11.69%. The rates of thrombocytopenia and leucopenia were also higher than the previous study findings.

Conclusion

This study shows that the dengue is prevalent in and around Kelambakkam with the annual prevalence rate of 38.5%. Prevalence is significantly higher in males. Positivity rate is higher in adult age group. In this study we identified more cases of primary dengue than secondary dengue. Increase in the prevalence was seen during the rainy seasons when the vectors are present abundantly. 50.6% of the positive cases had thrombocytopenia. Our study on epidemiological trends and incidence of dengue infection can be useful in prevention and geographical surveillance of the disease as it has become a major public health problem.

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