Original Article

Prevalence of Dengue Fever in Kanyakumari District: A Cross-sectional Study

V Kalaivani[1], K Ajay Gopal[2], Srinivasa Kannan[3], Heber Anandan[4]

[1]Associate Professor, Department of Microbiology, Thoothukudi Government Medical College, Thoothukudi, Tamil Nadu, India, [2]MBBS Student, Department of Microbiology, Thoothukudi Government Medical College, Thoothukudi, Tamil Nadu, India, [3]Director, Department of Microbiology, Vivek Institute of Paramedical Sciences, Nagercoil, Tamil Nadu, India, [4]Senior Clinical Scientist, Department of Clinical Research, Dr. Agarwal's Healthcare Limited, Tirunelveli, Tamil Nadu, India

Abstract

Introduction: The global prevalence of dengue has grown dramatically in recent decades. Therefore, a study regarding the prevalence of dengue fever in Kanyakumari district will provide the necessary data to tackle the disease and prevent future outbreaks.

Aim: To determine the prevalence of dengue fever in Kanyakumari District, southern coastal district of Tamil Nadu during the period from June to July 2013 and early detection of secondary dengue cases.

Methods: A cross-sectional study was conducted in Nagercoil in patients with fever suspicious of dengue referred from various hospitals in Kanyakumari district during June and July 2013. Patients with fever and other associated symptoms such as headache, joint pains, purpuric rashes, and reduction in platelet count were noted. 3 ml of blood is collected aseptically by venipuncture. The serum is subjected to serological tests for dengue immunoglobulin M enzyme-linked immunosorbent assay (ELISA) and immunoglobulin G ELISA (PanBio diagnostics).

Results: Among 226 cases suspected for dengue fever, 140 (62%) were positive for dengue and 86 (38%) were negative. Out of 140 positive cases, 61 were primary dengue and 79 cases were secondary dengue. Among the age group, positivity was significantly high (46%) in 0-10 years age group. By clinical evaluation, 35% cases had hemorrhagic manifestations including petechiae, gum bleeding, and epistaxis.

Conclusion: The present study has shown the prevalence of dengue fever in Kanyakumari District, southern coastal district of Tamil Nadu. The study has also showed the early diagnosis of secondary dengue to reduce morbidity and mortality.

Key words: Dengue, Immunoglobulin G and immunoglobulin M enzyme-linked immunosorbent assay, Kanyakumari, Secondary dengue

INTRODUCTION

Dengue virus is a mosquito-borne *Flavivirus* and the most prevalent arbovirus in tropical and subtropical regions of the world.[1] Dengue virus is a positive-stranded encapsulated RNA virus. There are four distinct serotypes: Serotypes 1-4. Infection induces a lifelong protective immunity to the homologous serotype but confers only partial and transient protection against subsequent infections by the other three serotypes. Instead, it has generally been accepted that secondary infection or infection with secondary or multiple infections with various dengue virus serotypes is a major risk factor for dengue hemorrhagic fever-dengue shock syndrome (DHF-DSS) due to antibody-dependent enhancement.[2-4] Dengue is an endemic viral disease affecting predominantly in urban and semi-urban areas. The global prevalence of dengue has grown dramatically in recent decades. The disease is now endemic in more than 100 countries in Africa, America, the eastern Mediterranean, Southeast Asia, and the Western Pacific, threatening more than 2.5 billion people.[5] The World Health Organization estimates that there may be 50 million to 100 million cases of dengue virus infections worldwide every year, which result in 250,000-500,000 cases of DHF and 24,000 deaths each year.[6,7] Dengue virus causes a broad spectrum of illnesses, ranging from inapparent infection, flu-like mild undifferentiated fever, and classical DF to the more severe form, DHF-DSS, from which rates of morbidity and mortality are high.[5,7-9] Dengue virus serotype analysis is

Corresponding Author: Heber Anandan, No. 10, South By-pass Road, Vannarpettai, Tirunelveli - 627 003, Tamil Nadu, India.
Phone: +91-9894067910. E-mail: clinicalresearch@dragarwal.com

important in epidemiological and pathological studies. Among the available methods, virus isolation followed by type-specific monoclonal antibody immunofluorescence staining, the neutralization test, and reverse transcription-polymerase chain reaction are widely used by many laboratories studying dengue virus.[7,10] Two patterns of serological response can be observed in patients with dengue virus infection: Primary and secondary antibody responses depending on the immunological status of the infected individuals. A primary antibody response is seen in individuals who are not immune to *Flaviviruses*. A secondary antibody response is seen in individuals who have had a previous *Flavivirus* infection. For acute- and convalescent-phase sera, serological detection of antibodies based on capture immunoglobulin M (IgM) and immunoglobulin G (IgG) enzyme-linked immunosorbent assay (ELISA) has become the new standard for the detection and differentiation of primary and secondary dengue virus infections.[7,11,12] The management of dengue virus infection is essentially supportive and symptomatic. No specific treatment is available. However, there are Indian studies which have contributed in terms of better management of DHF/DSS. A rapid response to platelet and fresh frozen plasma transfusion is reported in a study.[13]

Dengue is one of the major public health problems which can be controlled with active participation of the community. Need is to organize health education programs about dengue disease to increase community knowledge and sensitize the community to participate in integrated vector control programs.[14,15] As attempts to eradicate *Aedes aegypti*, the most efficient mosquito vector of dengue virus, are not successful in countries where dengue is endemic, the control of dengue will be possible only after an efficient vaccine has been developed. At present, no dengue vaccine has been licensed. The development of an efficient dengue vaccine is difficult because the vaccine must be tetravalent so that it includes all four serotypes. The global prevalence of dengue has grown dramatically in recent decades. Therefore, a study regarding the prevalence of dengue fever in Kanyakumari district will provide the necessary data to tackle the disease and prevent future outbreaks.

Aim

To determine the prevalence of dengue fever in Kanyakumari, southern coastal district of Tamil Nadu, during the period June and July 2013 and early detection of secondary dengue cases.

MATERIALS AND METHODS

A cross-sectional study was conducted in Nagercoil in patients with fever suspicious of dengue referred from various hospitals in Kanyakumari district during June and July 2013. Patients with fever and other associated symptoms such as headache, joint pains, purpuric rashes, and reduction in platelet count were noted. 3 ml of blood is collected aseptically by venipuncture. The serum is subjected to serological tests for dengue IgM ELISA and IgG ELISA (PanBio diagnostics).

RESULTS

Among 226 cases suspected for dengue fever, 140 (62%) were positive for dengue and 86 (38%) were negative. Among the cases tested for dengue by IgM and IgG Capture ELISA, 61 (44%) positive for IgM antibodies only, 18 (12%) were positive for only IgG antibodies and 61 (44%) were positive for both IgM and IgG antibodies. (Table 2). Of 140 positive cases, 61 were primary dengue and 79 cases were secondary dengue. Among the age group, positivity was significantly high (46%) in 0-10 years age group (Table 3). By clinical evaluation, 35% cases had hemorrhagic manifestations including petechiae, gum bleeding, and epistaxis (Figure 1).

DISCUSSION

As our study was conducted during an outbreak in Kanyakumari district during monsoon period, an unusually high prevalence is seen indicating about 62% positivity. According to Gupta *et al*., of 1820 serum samples received from suspected cases in all 3 years, 811 (44.56%) were confirmed as dengue infection serologically. There was an increase in the number of samples received in the postmonsoon period (September to November) with a peak in the 2nd and 3rd week of October.[16]

Table 1: Sex distribution of clinical cases

Dengue	Total	Male	Female
Number of patients tested	226	120	106
Number of positive cases	140	70	70

Table 2: Dengue positive cases

Test	Dengue positive		
	IgM (%)	IgG (%)	IgM+IgG (%)
Total	61 (44)	18 (12)	61 (44)

Table 3: Age group of dengue cases

Age group	IgM ELISA positive	IgG ELISA positive	IgM and IgG ELISA positive	Total
0-10	36	7	22	65
11-20	4	2	9	15
21-30	6	1	9	16
31-40	4	1	6	11
41-50	4	4	3	11
Above 50	7	3	12	22
Total	61	18	61	140

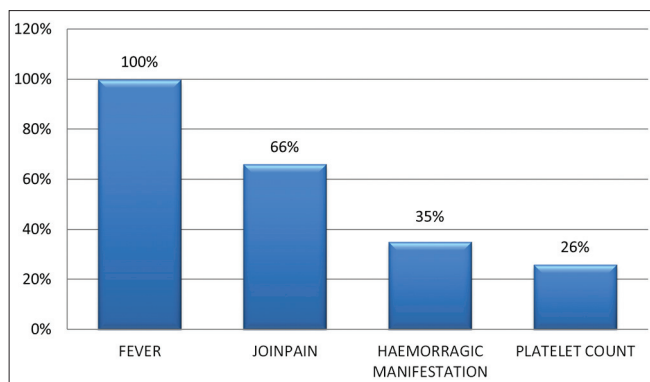IgM: Immunoglobulin M, IgG: Immunoglobulin G, ELISA: Enzyme-linked immunosorbent assay

Figure 1: Signs and symptoms observed in dengue cases

According to the WHO publication 1997, secondary dengue infection was characterized by high IgG which may be accompanied by elevated IgM levels, and the cases with only IgM positive were considered as primary dengue.[17] Of 140 positive cases, 61 were primary dengue and 79 cases were secondary dengue in our study.

Serological studies, for primary infection, the dominant immunoglobulin isotype is IgM, IgM may appear during febrile phase (50% of cases), the other half, it appears within 2-3 days of defervescence. Once detectable, IgM levels rise quickly and appear to peak about 2 weeks after the onset of symptoms, and then, they decline to undetectable level over 2-3 months. IgG appears shortly afterward with very low level. The physiological definition of a primary infection is, therefore, characterized by a high molar fraction of IgM and low molar fraction of IgG. Secondary dengue infections are characterized by a rapid increase in IgG antibodies, IgM appears in the most instances, the level is dramatically lower.[18]

In our study, positivity was significantly high (46%) in 0-10 years age group. However, in the study by Gupta *et al.* among the confirmed dengue cases, maximum cases were seen in the age group 21-30 years.[16]

In a study by Ali *et al.*, overall male population was mostly infected as compared to females and people in the age group between 15 and 45 was the highest infected group.[17] In our study, among the positive patients, male and female have equal distribution. By clinical evaluation, among the 140 positive cases, 66% patients had joint pain, 35% cases had hemorrhagic manifestations including petechiae, gum bleeding, and epistaxis, and 26% patients had thrombocytopenia in our study.

CONCLUSION

The present study has shown the prevalence of dengue fever in Kanyakumari District, southern coastal district of Tamil Nadu. The study has also shown the early diagnosis of secondary dengue to reduce morbidity and mortality because patients with secondary infection are more likely to have severe forms of dengue such as DHF-DSS.

REFERENCES

1. Gubler DJ, Clark GG. Dengue/dengue hemorrhagic fever: The emergence of a global health problem. Emerg Infect Dis 1995;1:55-7.
2. Guzmán MG, Kouri GP, Bravo J, Soler M, Vazquez S, Morier L. Dengue hemorrhagic fever in Cuba, 1981: A retrospective seroepidemiologic study. Am J Trop Med Hyg 1990;42:179-84.
3. Halstead SB, Shotwell H, Casals J. Studies on the pathogenesis of dengue infection in monkeys. II. Clinical laboratory responses to heterologous infection. J Infect Dis 1973;128:15-22.
4. Halstead SB. Pathogenesis of dengue: Challenges to molecular biology. Science 1988;239:476-81.
5. Gubler D. Dengue and dengue hemorrhagic fever. Semin Pediatr Infect Dis 1997;8:3-9.
6. Gibbons RV, Vaughn DW. Dengue: An escalating problem. BMJ 2002;324:1563-6.
7. WHO. Dengue Haemorrhagic Fever: Diagnosis, Treatment, Prevention and Control. 2nd ed. Geneva: World Health Organization; 1997.
8. Guzmán MG, Kourí G. Dengue: An update. Lancet Infect Dis 2002;2:33-42.
9. Nimmannitya S. Clinical spectrum and management of dengue haemorrhagic fever. Southeast Asian J Trop Med Public Health 1987;18:392-7.
10. Lanciotti RS, Calisher CH, Gubler DJ, Chang GJ, Vorndam AV. Rapid detection and typing of dengue viruses from clinical samples by using reverse transcriptase-polymerase chain reaction. J Clin Microbiol 1992;30:545-51.
11. Gubler DJ. Serologic diagnosis of dengue/dengue haemorrhagic fever. Dengue Bull 1996;20:20-3.
12. Innis BL, Nisalak A, Nimmannitya S, Kusalerdchariya S, Chongswasdi V, Suntayakorn S, *et al.* An enzyme-linked immunosorbent assay to characterize dengue infections where dengue and Japanese encephalitis co-circulate. Am J Trop Med Hyg 1989;40:418-27.
13. Chaudhary R, Khetan D, Sinha S, Sinha P, Sonker A, Pandey P, *et al.* Transfusion support to Dengue patients in a hospital based blood transfusion service in north India. Transfus Apher Sci 2006;35:239-44.
14. Shriram AN, Sugunan AP, Manimunda SP, Vijayachari P. Community-centred approach for the control of *Aedes* spp. In a peri-urban zone in the Andaman and Nicobar Islands using temephos. Natl Med J India 2009;22:116-20.
15. Ashok Kumar V, Rajendran R, Manavalan R, Tewari SC, Arunachalam N, Ayanar K, *et al.* Studies on community knowledge and behavior following a dengue epidemic in Chennai city, Tamil Nadu, India. Trop Biomed 2010;27:330-6.
16. Gupta E, Dar L, Kapoor G, Broor S. The changing epidemiology of dengue in Delhi, India. Virol J 2006;3:92.
17. Ali A, Ahmad H, Idrees M, Zahir F, Ali I. Circulating serotypes of dengue virus and their incursion into non-endemic areas of Pakistan; A serious threat. Virol J 2016;13:144.
18. Nisalak A. Laboratory diagnosis of dengue virus infections. Southeast Asian J Trop Med Public Health 2015;46 Suppl 1:55-76.