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Seroprevalence and changing trend of dengue in a tertiary care hospital

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Abstract

Introduction: Dengue fever is a seasonal acute febrile arbo-viral illness ranging from asymptomatic infection to dengue fever and the severe dengue haemorrhagic fever dengue shock syndrome. India is one of the seven identified countries in the South-East Asia region regularly reporting dengue fever dengue hemorrhagic fever outbreaks.

Objectives: To identify dengue seropositive patients by NS1 antigen testing and anti-dengue IgM antibody detection by ELISA and correlate the changes in epidemiology.

Materials and Method: Retrospective study done from January 2013 to December 2015 with blood samples tested from clinically suspected cases of dengue virus infection.

Results: A total of 3839 samples were tested. NS1 ELISA detected 196 (5.11%) cases and MAC ELISA registered 488 (12.71%) positives. Maximum number of cases was reported from June to September. Incidence was high in the paediatric age group with an overall male predominance. Mortality rate reported among dengue positive cases during 2013 was 9 (1.35%), 5 (3.12%) during 2014 and 1 (0.65%) during 2015.

Conclusion: Prevalence of dengue seropositive cases was 34.20% in 2013, 19.07% and 14.89% in 2014 and 2015 respectively indicating a relative decline in dengue infection which may be attributable to the increase in awareness and preventive measures taken among the people and health services.

Keywords: Dengue fever, Dengue haemorrhagic fever, NS1 Ag, IgM, ELISA

Introduction

Dengue virus is a positive-stranded RNA virus of the Flaviviridae family with 4 distinct serotypes (DV1-4) and is transmitted to humans by several species of the Aedes mosquito.(1) Dengue fever is a seasonal acute febrile arbo-viral illness with a spectrum of clinical manifestations ranging from asymptomatic infection to dengue fever (DF), the severe dengue hemorrhagic fever (DHF) or dengue shock syndrome (DSS) which is strongly influenced by rainfall and temperature.(2) Dengue is emerging as an important mosquito-borne arbo-viral disease in the world.(3) India is one of the seven identified countries in the South-East Asian region regularly reporting incidence of dengue.(4)

Dengue infection has been known to be endemic in India for over two centuries.(5,6) In spite of preventive measures by the respective governments since 1812, recurrent outbreaks have occurred.(7) Until mid-1990s, dengue was reported from only three of the four South Indian states namely, Andhra Pradesh (including the present day Telangana), Karnataka and Tamil Nadu. Several fatal forms of the disease have been reported in Indian cities of Kolkata, Delhi, and Chennai.(4) Treated DHF/DSS is associated with 3% mortality whereas untreated is associated with 20% mortality.(3)

The present study was undertaken to find out the seroprevalence of dengue in the North Karnataka area of Hubballi over the past 3 years and to analyze the changing trends of this infection – essential for planning necessary control and preventive measures in the forthcoming years.

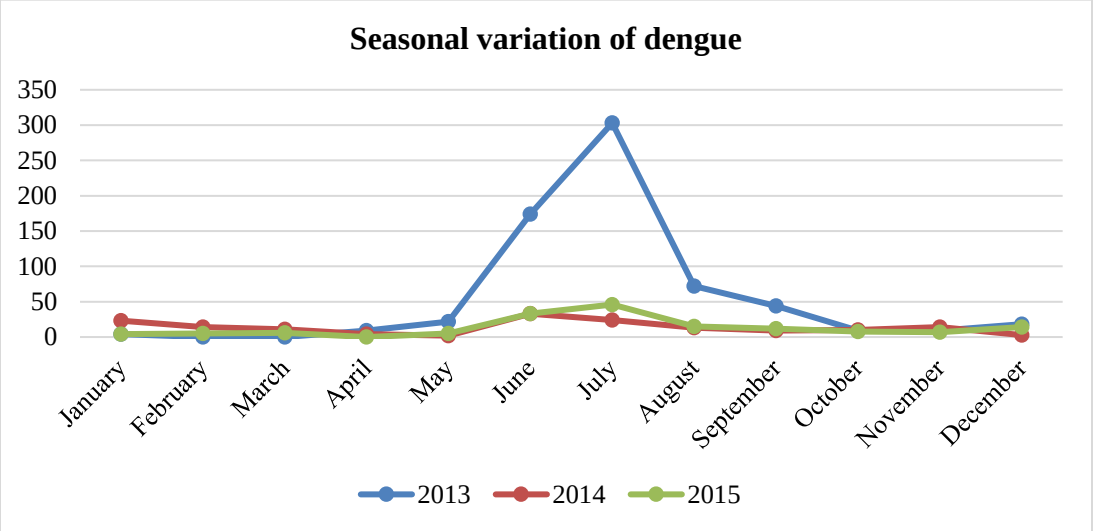
Materials and Method

A record based retrospective study was done from January 2013 to December 2015 at Karnataka Institute of Medical Sciences, a tertiary care teaching hospital in Hubballi, Karnataka where the Microbiology laboratory operates a sentinel surveillance unit for Dengue and Chikungunya under National Vector Borne Diseases Control Programme (NVBDCP) guidelines. Blood samples were tested from clinically suspected cases of dengue virus infection. Serum was separated from the blood samples by centrifugation. Depending on the duration of fever (less/more than 5 days) at the time of presentation of the patient to the hospital, the samples were respectively chosen to be processed for NS1 antigen detection or IgM antibody detection. They were subjected to NS1 antigen detection by ELISA using Dengue NS1 Ag Microlisa kit (J. Mitra & Co. Pvt. Ltd., New Delhi) and IgM detection by MAC ELISA using NIV DEN MAC ELISA Kit (National Institute of Virology, Pune). Procedure was followed as per manufacturer's instructions.

Results

A total of 3839 samples were tested over a period of 3 years from January 2013 to December 2015. Clustering of cases was reported during the monsoon periods of June to September of 2013 and during June and July months of 2014 and 2015 as seen in Graph 1.

Graph 1: Seasonal variation of dengue



As evidenced in Table 1, 1959 samples were tested in 2013 and 669 (34.15%) samples were seropositive for dengue; number of dengue cases detected by NS1 ELISA was 113 (5.77%) and by IgM ELISA were 556 (28.38%). 160 (19.07%) samples out of the 839 tested in 2014 were seropositive for dengue; 59 (7.03%) cases were detected as positive by NS1 ELISA and 101 (12.04%) by IgM ELISA. Of the 1041 samples tested during 2015, 155 (14.89%) turned out to be positive for dengue; NS1 ELISA detected 24 (2.31%) and IgM ELISA detected 131 (12.58%).

Table 1: Year wise distribution of positive dengue cases

Year	Total samples tested	NS1 positive	IgM positive	Total
2013	1959	113 (5.77%)	556 (28.38%)	669 (34.15%)
2014	839	59 (7.03%)	101 (12.04%)	160 (19.07%)
2015	1041	24 (2.31%)	131 (12.58%)	155 (14.89%)
Total	3839	196	488	984 (25.63%)

On looking at the age distribution of the seropositive cases (Table 2), we observed that in 2013, dengue was slightly more prevalent in patients less than 12 years of age whereas during 2014 and 2015, this trend saw a reversal in the proportion with more number of patients seen in age group of more than 12 years.

Table 2: Age wise distribution of dengue positive cases

Age	2013	2014	2015
<12 years	355 (18.12%)	73 (8.7%)	65 (6.24%)
>12 years	314 (16.03%)	87 (10.37%)	90 (8.65%)
Total	669 (34.15%)	160 (19.07%)	155 (14.89%)

Over the study period of 3 years, dengue was consistently more prevalent in males. 406 (20.72%), 95 (11.39%) and 80 (7.89%) samples were from male patients as compared to 263 (13.43%), 65 (7.74%) and 75 (7.39%) samples from female patients during 2013, 2014 and 2015 respectively (Table 3).

Table 3: Gender wise distribution of dengue positive cases

Gender	2013	2014	2015
Male	406 (20.72%)	95 (11.39%)	80 (7.89%)
Female	263 (13.43%)	65 (7.74%)	75 (7.39%)
Total	669 (34.15%)	160 (19.07%)	155 (14.89%)

The reported mortality rate among the dengue positive cases is shown in Table 4. Mortality rate during 2013 was 9 (1.35%), that during 2014 was 5 (3.12%) and during 2015 was 1 (0.65%).

Table 4: Mortality rates

Age	2013		2014		2015	
	Male	Female	Male	Female	Male	Female
<12 years	1	5	1	3	1	0
>12 years	3	0	0	1	0	0

Discussion

Dengue infection is amongst the most important emerging viral diseases transmitted by mosquitoes to humans, in terms of both illness and death. The world-wide large-scale reappearance of dengue for the past few decades has turned this disease into a serious public health problem, especially in the tropical and subtropical countries.[6] The dramatic increase in the global dengue burden has promoted social interest in improving dengue diagnosis.[8] The precise diagnosis is achieved either by isolating the virus, identifying viral RNA through RT-PCR or by serodiagnosis by detecting dengue-specific IgM and IgG antibodies. Both virus isolation and RT-PCR are time-consuming and costly laboratory methods. Thus, in a majority of cases, the only feasible diagnosis is based on the detection of dengue antigens or antibodies.[9]

Most of the vector-borne diseases exhibit a distinctive seasonal pattern and are influenced by climatic factors such as rainfall, temperature etc. because the vector and the pathogen they transmit are affected by these weather variables. Worldwide studies have proposed that ecological and climatic factors influence the seasonal prevalence of both *A. aegypti* mosquito and dengue virus.[6] To assess the seasonal variation of the disease, analysis of data was done on a monthly basis. Gradual increase was observed in the month of May, peaking in July and declining by September during 2013. Whereas, during 2014 and 2015, the maximum numbers of cases observed were in June and July months corresponding with the monsoon season in North Karnataka region. Clear correlation between monsoon season and dengue occurrence is supported by similar results seen in studies from other parts of Karnataka[2,4] and India[3,10] performed at different time lines from 2002 to 2014. Congruent findings were also observed in a study in the neighboring state of Tamil Nadu to assess the effect of climate on the incidence of dengue, indicating that rainfall and temperatures influence vector breeding and thereby dengue incidence.[11]

Seropositive dengue cases during the study period were 984 (25.63%). Year-wise distribution of the study population showed a steady decrease in the incidence of dengue; 68% were reported in 2013 and just 16% was noted in 2015. This may be partially attributed to alertness and maintenance and practice of good personal and environmental hygiene and protection following the upsurge of dengue cases in 2013.

Dengue positivity was observed mostly in the age group of <12 years during 2013 which is correlating with a study done in North India[3] and other studies from South India.[12] This affliction of the virus towards the younger population could be possibly due to the resurgence of an old serotype which was, until now, dormant. In the following couple of years, however, seropositive cases were higher in the adult (>12 years) age group as also evidenced in other studies.[4,10,12,13]

Our observation of male preponderance, with high to marginal difference between the prevalence in males and females over three years is in consort with the results of studies done in Udupi,[4] Surat,[13] and Jaipur.[14] Over the last 10 to 15 years, DF has been the major cause of hospitalization and mortality after acute respiratory and diarrheal infections among children.[7] The present study saw a total of 15 (1.52%) deaths in 3 years, mortality being highest in the paediatric age group. Concordant observations were made by other studies.[3,4]

The scope of the study was to highlight the changing trend of dengue in this particular region of North Karnataka where previously no such research has been performed. Although this work has its shortcomings in terms of correlating the patients' clinical histories and symptomatology with the occurrence of dengue seropositivity, further studies can be pursued on the lines of serotyping the prevalent strain/s of the virus in this particular geographical area.

An effective vaccine is the need of the hour in regard to dengue virus illness if the WHO goal of reducing dengue morbidity by at least 25% and mortality by at least 50% needs to be achieved by 2020.[15]

Conclusion

The prevalence of dengue seropositive cases saw a drastic decrease from 2013 to 2015 which may be attributed to the increase in awareness and preventive measures taken among the general population and steps taken by the health care services, notably the NVBDCP, for a swift diagnosis.

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