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Epidemiological Trend Analysis of Dengue Virus Infection in Western Part of Gujarat

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ABSTRACT

Objective: Epidemiology of dengue fever in the Indian subcontinent has been very complex and has substantially changed over past decade due to increased prevalence. So, the present study was conducted to detect recent epidemiological and seasonal trend of dengue positive cases tested by the IgM CAPTURE ELISA in Jamnagar district of western Gujarat, India. Materials and Methods: The study was conducted in microbiology department of government hospital from August-2011 to August-2013 during which samples were tested for Dengue IgM antibody from suspected Dengue cases. RESULTS: 178 out of total 516 samples were positive for Dengue IgM antibody. The dengue case positivity rate were rising year by year (13.54% in 2011, 37.5% in 2012 and 42.86% in 2013). 51.69% of dengue positive cases were reported in the age group of 16-30 years. Male-to-female ratio is 2.42:1 with higher positive cases from urban areas (62.36%). 88.20% dengue cases were recorded between July to December with seasonal peak 4-6 weeks after arrival of rain. Conclusion: Epidemiological trend may be of help to local health authorities for early diagnosis and implementation of measures targeting the risk population.

KEYWORDS Dengue, Epidemiology, Seasonal trend, India, IgM Capture ELISA

INTRODUCTION

During the 19th century, dengue was considered as a sporadic disease, causing epidemics at long intervals. However, there is an upsurge in reported cases of dengue in a number of Southeast Asian countries including Bangladesh, India, Sri Lanka and Thailand[1]. The epidemiology of dengue fevers in the Indian subcontinent has been very complex and has substantially changed over almost past six decades in terms of prevalent strains, affected geographical locations and severity of disease. Dengue virus is an arthropod-borne flavivirus that comprises four distinct serotypes (DEN-1, DEN-2, DEN-3 and DEN-4) of the family flaviviridae. Infection by one serotype induces life-long immunity against reinfection by the same serotype, but only transient and partial protection against infection with the other serotypes[2,3]. Dengue virus infections can result in a range of clinical manifestations from asymptomatic infection to dengue fever (DF) and the severe disease dengue haemorrhagic fever/dengue shock syndrome (DHF/DSS), which can result in death if it is not managed appropriately. Dengue virus specific IgM antibody tends to appear early during the course of disease and allows for a provisional diagnosis of dengue to be made from a single serum sample[1]. Various studies had demonstrated trend of dengue virus by using IgM Capture ELISA test at different time points in different regions[1,4,5,6]. Some of the studies also noted recent epidemiological change of trend in dengue virus because of change in serotype of dengue virus periodically[1]. So, the present study was conducted to detect recent epidemiological and seasonal trend of dengue positive cases tested by the DENGUE IgM CAPTURE ELISA which is essential to plan necessary measures in upcoming years to control and prevent dengue infection in Jamnagar district of western Gujarat, India.

MATERIALS AND METHODS

The study was conducted in microbiology department of GG government hospital, Jamnagar, Gujarat from August-2011 to August-2013. The test kit was supplied by National Institute of Virology (NIV) Pune to detect dengue positive cases[7]. 5 ml of venous blood was collected in a plain sterile test tube from clinically suspected dengue cases from GG hospital, other government hospitals and private institutions all over and around Jamnagar district of Gujarat. Patients with acute onset of illness; high grade fever of more than five days; severe headache; backache; musculoskeletal pain or retro-bulbar pain; with or without rashes were considered as clinically suspected case of dengue virus infection. Serum from the collected samples was separated by centrifugation and then DENGUE IgM CAPTURE ELISA TEST is performed. Results were recorded in a case report form. Data were analysed using statistical package for social science (SPSS) version 21.0; P value < 0.05 considered as 'statistical significance'

RESULTS

Total 516 samples were screened for Dengue virus infection during the study period of 2 years and 1 month from August 2011 to August 2013.

Out of total 516 samples screened, 178 samples were found positive for Dengue IgM antibody with case positivity rate of 34.5 % over the whole study period.

Age wise distribution of Dengue positive cases

Table-1 shows year wise distribution of positive Dengue cases in each age group. Maximum number of dengue positive cases i.e. 92 out of 178 (51.69%) were reported in the age group of 16- 30 years.

Table-1 Age group wise distribution of positive cases

Age group (yrs)	Year of testing			Total
	2011	2012	2013	
<1	0	1	0	1
1-15	2	15	14	31
16-30	3	57	32	92
31-45	2	23	11	36
46-60	6	8	3	17
> 75	0	1	0	1
Total	13	105	60	178

Figure-1 below depicts mean age of dengue reactive cases in each year from Aug 2011 to Aug 2013.

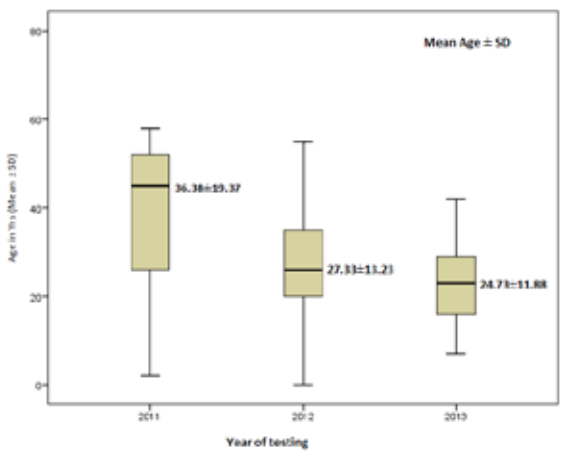


Figure-1 Mean age of Dengue positive cases in each year
(Central line denotes mean age; Box denotes 95% standard deviation; Horizontal line at extreme denotes Range)

Gender wise distribution
Majority of the patients i.e. 126 out of 178 positive cases (70.79%) were found to be males compared to 52 positive cases (29.21%) of females. Male to female ratio of dengue positive cases were found to be increased with each passing year. [0.85:1 (in year 2011); 2.5:1 (in year 2012); 3:1 (in year 2013)]

Figure 2 shows gender wise distribution of Dengue positive cases among male and female.

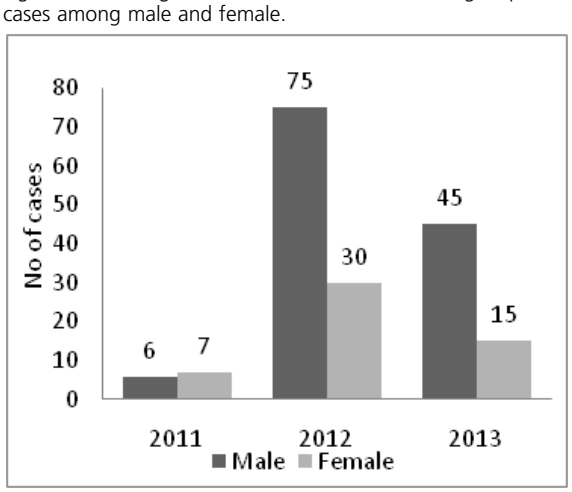


Figure-2 Gender wise distribution of positive cases

Locality wise distribution
Majority of the positive cases were found from urban areas i.e. 111 out of 178 (62.36%) compared to 67 patients (37.64%) in rural areas.

Table-2 Locality wise distribution of positive cases

Year	Urban	Rural	Total
2011	4	9	13
2012	72	33	105
2013	35	25	60
Total	111	67	178

Seasonal trend of Dengue cases
Maximum number of Dengue positive cases 157 out of 178 (88.20%) were seen between July to December which is probably monsoon-post monsoon season. Cases of dengue fever started increasing in the month of October in year 2011 and 2012. However, in 2013, rising trend of dengue positive cases was seen in the month of July. (Fig: 3) Figure 4 shows relation between number of Dengue positive cases and trend of rainfall in that area. A seasonal peak of dengue virus infection was recorded around 4-6 weeks after arrival of rain every year.

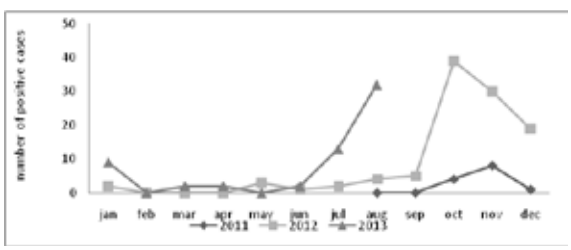


Figure-3 month wise distribution of positive cases

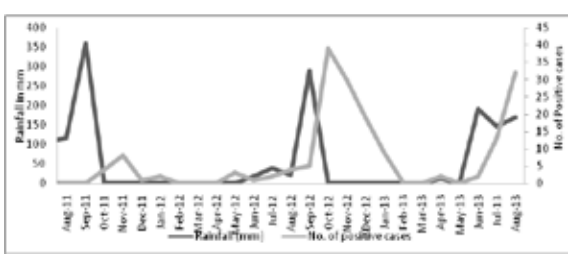


Figure-4 Relation between rainfall and positive cases

DISCUSSION
With the help of IgM Capture ELISA, total 178 cases out of 516 samples from clinically suspected dengue patients found positive for Dengue IgM with the positivity rate of 34.5% which is similar to other studies like Rashmi et al.[6] (34.5%), Arun et al[5] (35.0%), A.K.Hati et al[8] (36.2%), done in other districts of Gujarat as well as other states of India.

In our study, 51.69% (92/178) of dengue positive cases were reported in the age group of 16- 30 years with gradual decrease in mean age of dengue affected patients from 2011 to 2013. The trend for the increased incidence of dengue infection among young adults has been observed in previous Indian studies. Some of the Indian studies done before 2010 showed higher dengue positive cases in younger age group(<18 years). However, Nidhi et al[9] study had demonstrated epidemiological shift of dengue in 2010 toward older age group (15-45 year). Our study supports this epidemiological shift as around 77.5% of dengue positive cases were reported in age ≥ 18 years. In Asian countries where dengue has been epidemic for several years, this age shift is clearly observed, indicating an epidemiological change in dengue infection.[9]

In our study majority of positive cases were found in male (126 out of 178) which is similar to other studies like Nidhi et al[9] and Rashmi et al[6]. The lower infection rates in females of Asian community might be attributed to lower reporting rate and the fact that they remained stationed at home and are less exposed to this vector born infection.[6] Our study also reported significantly higher case positivity rate amongst male patients (39.13%) compared to that of female patients (26.80%) (P = 0.017). This suggests that chances of positive

dengue are higher in clinically suspected cases amongst males which have critical implication in prevention and control of the infection.

In this study, majority of the dengue-positive patients were from the urban areas of 62.36% (111/178) followed by rural areas 37.64% (67/178)[10,11]. This suggests that dengue infection is no more an urban area infection but it is extending its arms to rural areas also, which may become a cause for concern to health authorities. This study calls for a careful vigil to prevent the possible transportation of the vector between different areas.

The seasonal disparities of dengue occurrence with monsoon and post monsoon seasons 88.20% (157/178) are analogous to the findings of other studies (Rashmi et al[6], A.K.Hati et al.[8] Arun et al[5]) which showed rise in incidence of dengue infection in monsoon and Post monsoon season. On analysing relation of dengue positive cases with the rainfall in our area, a seasonal peak of dengue virus infection was recorded around 4-6 weeks after arrival of rain every year. This could be because of mosquitoes breed much more in the rainy season leading to spread of dengue in the area. This seasonal outbreak of disease transmission emphasizes the importance for appropriate vector control measures to be implemented into full swing during water stagnation periods after the initial bouts of rainfall, at the end of monsoon and post monsoon months to reduce the case incidence.

On analyzing the year-wise distribution of dengue cases, the dengue case positivity rate in our study were clearly rising year by year (13.54 % in 2011, 37.5 % in 2012 and 42.86% in 2013). There is statically significantly increase case positivity rate from 2011 to 2013 ($P<0.001$). This may be partially attributed to the rapid unplanned urbanization with unchecked construction activities and poor sanitation facilities contributing fertile breeding grounds for mosquitoes. This rising trend of case positivity rates warns local health authorities that if appropriate steps are not taken in the area, it may further worsen the situation in coming years to come.

CONCLUSION

The study draws attention towards the young adult age group which represents the endemicity observed in this part of India, where dengue has emerged in more recent years with large outbreaks occurring in monsoon and post monsoon seasons. This finding may be of help to the epidemiologists, clinician, and dengue prevention and control measure authorities for early diagnosis and to plan and implement various measures targeting the risk population. A high percentage of dengue positive cases among suspected patients demands early careful investigation and management.

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