

Trends in Dengue Virus Infection in and Around Miraj

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Abstract

Background- In tropical countries especially in developing countries, an estimated 50 million Dengue infections occur annually. The incidence has increased 30 fold over the last 50 years due to urbanization and poor sanitation facilities. The diagnosis of Dengue is important for research into host, virus-vector characteristics, and for preparation of vaccine. With this background present study was conducted to know seroprevalence of dengue virus infection.

Material and Methods- Total 4541 serum samples from dengue suspected patients were included in study from Jan 2016 – Dec 2020. These serum samples were subjected for detection of Dengue IgM Mac ELISA.

Results and Discussion- Out of 4541 suspected cases 31.03% found positive for dengue virus infection. Dengue cases were found from start of the year showing no seasonal or month wise variation. Male and female both are equally affected by dengue infection.

Conclusion- Dengue cases are no more related to particular month or any climatic season. Preventive measures for Dengue infection should be taken throughout the year.

Keyword- Dengue, IgM, Elisa, Virus

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I. Introduction

Dengue virus is categorized under the genus Flavivirus, which is transmitted by *Aedes aegypti* mosquito. The Dengue virus is a small (50 nm size) single stranded RNA virus. There are five distinct serotypes DEN-1, DEN-2, DEN-3, DEN-4, DEN-5. The DEN-5 is discovered recently.¹

These serotypes may circulate either singly or more than one serotype may circulate in any area at the same time. Infection with one serotype confers the lifelong immunity to that serotype only. These serotypes are antigenically similar but they are different to produce cross protection for few months after the infection by any one of them.² The antibody response varies from individual to individual. Individual risk factors determine the severity of the disease which includes age of patient, ethnicity, and other chronic diseases. The antibody response depends upon the pre-existing heterotypic flavivirus antibodies. This is the basis of pathogenesis of Dengue virus infection. The pre-existing heterotypic flavivirus antibodies enhance the antibody response to infection by DENV serotype.³

The dengue virus genome is composed of three structural protein genes, membrane associated protein (M), an envelope protein (E), seven non-structural NS proteins NS1, NS2A B, NS3, NS4 A B, and NS5. NS1 protein is essential for virus replication.³ This NS1 protein is also responsible for T cell response. The detection of NS1 antigen is one of the diagnostic marker of the infection as it is present in the measurable amount.⁴

The host immune response plays a major role in the pathogenesis of Dengue fever. The exact mechanisms are not clearly understood. The most common mechanism is virus strains enhance the antibodies and memory T cells in the secondary infection which result in the cytokine tsunami.⁵ The targets are vascular endothelium, platelets and various organs which cause vasculopathy and coagulopathy. And it is responsible for hemorrhage and shock. During the last decade more frequent and severe epidemics of Dengue are noted in India leading to significant mortality and morbidity.⁶ Now a days infection is also extending to rural areas.³

In India Dengue was first reported in Tamilnadu in 1965 and Dengue Hemorrhagic Fever (DHF) first occurred in Calcutta in 1963. There is variation in the epidemiology and clinical presentation of Dengue infection in different geographical areas of India. So it is necessary to collect the data from various regions and to study the nature and course of infection.⁵

The clinical spectrum of Dengue infection is from asymptomatic to an undifferentiated from other viral fever. Classic Dengue fever patients present with high grade fever, rash, bodyache, severe headache, bone pains, bleeding manifestations may occur. In DHF when previously infected with different serotype, patient present with high grade fever, hemorrhagic manifestations and circulatory disturbances. Young children are less likely to compensate the capillary leakage and are at greater risk of Dengue shock than adults.⁵

Intravenous rehydration is the choice of treatment. This intervention reduces the case fatality rate to less than 1%. So the early diagnosis is always necessary for the management. The diagnosis can be done by demonstration of presence of DENV by i) isolation of DENV in cell culture, ii) detection of viral RNA by RT-PCR, iii) serological tests detection of NS1 antigen and detection of IgM, IgG antibodies which are specific to virus envelope protein E5. Each of these tests have some disadvantages or drawbacks.⁷

In acute stage of illness, virus isolation using cell culture, or detection by immunofluorescence assay or viral RNA detection are very useful but not economical, and very time consuming, require expertise and need of special laboratory infrastructure. So it cannot be used as a routine diagnostic assay.⁸ NS1 antigen detection test by ELISA is a simple and cost effective method but useful during acute stage of illness. Dengue specific IgM antibody detection tests are simple and cost effective. In primary infection IgM is detected by the 5th day of illness and is detectable for up to 90 days. IgG becomes detected by day 10 -15 of illness and rises slowly. In secondary dengue infection IgM levels are low and High levels of IgG are detectable even in the acute phase and IgG rise dramatically over the next two weeks⁷. IgM capture Enzyme linked immunosorbant assay, MAC – ELISA format is most commonly employed in diagnostic laboratories. The assay is based on capturing IgM antibodies on a microtitre plate using anti human IgM antibody followed by the addition of dengue virus specific antigen (DENV 1-4). It has a sensitivity and specificity of 90% and 98% respectively when used 5 or more days after the onset of illness⁷. Elisa based IgM is also an invaluable tool for surveillance of dengue infection.⁹ According to National Vector Borne Disease Control Programme(NVBDCP) MAC–ELISA should be considered as the diagnostic test for dengue infection. This study was conducted in a tertiary care hospital to know the rate of Dengue infection in and around the hospital.

II. Material and Methods

Study Type- Retrospective cross sectional study

Study Duration- Jan 2016- Dec 2020

Place of study- Department of Microbiology Govt. Medical College & Hospital Miraj

Total 4541 serum samples from dengue suspected cases received during Jan 2016 to Dec 2020 are included. The samples were referred from civil hospitals as well as from the peripheral health centers. These serum samples were subjected for detection of Dengue IgM Mac ELISA. The test was performed according to manufactures' instruction. Positive and negative controls were run and cut off value was calculated. The samples were reported as positive, negative and equivocal. The second sample for equivocal results could not be collected because of technical difficulties and not included in this study. Statistical analysis was done by SPSS info.

III. Results

Table No 1: Serological results of Dengue IgM test

Year	Positive	Negative	Total
2016	167 (22.75%)	567	734
2017	62 (15.73%)	332	394
2018	91 (14.84%)	522	613
2019	961 (45.54%)	1149	2110
2020	128 (18.55%)	562	690
Total	1409 (31.03%)	3132	4541

The positivity for dengue cases ranges between 14.84%- 45.54%. Lowest in 2018 while highest in 2019. In 2019 there were flood in Sangli District leading to post flood rise in cases of dengue infection.

Table No 2: Sex wise distribution of samples during 2016-2019.

	Male	Female	Total	M:F ratio
2016	378	356	734	1.06:1
2017	325	69	394	4.71:1
2018	253	360	613	0.7:1
2019	1112	998	2110	1.11:1
2020	359	331	690	1.08:1
TOTAL	2427	2114	4541	1.14:1

Male patients were slightly more than female patients except in year 2017.

Table 3: Geographical distribution of Patients.

Year	Urban	Rural	Total
2016	540 (73.56%)	194 (26.44%)	734
2017	283 (71.82%)	111 (28.18%)	394
2018	338 (55.13%)	275 (44.87%)	613
2019	1395 (66.1%)	715 (33.89%)	2110
2020	344 (49.85%)	346 (50.15%)	690
Total	2900 (63.86%)	1641 (36.14%)	4541

Majority of patients were from Urban area. It may be because of easy availability of diagnostic facilities in urban area.

Table No.4 Month wise distribution of positivity

Months % Years	Jan (winter)	Feb (summer)	Mar (summer)	Apr (summer)	May (summer)	June (rainy)	July (rainy)	Aug (rainy)	Sep (rainy)	Oct (rainy)	Nov (winter)	Dec (winter)
2016	3.33	16.39	37.93	30	42.85	27.63	14.06	30.70	17.77	21.87	19.60	13.33
2017	50	0	25	11.11	20	4.54	0	23.07	23.80	20.93	9.90	6.97
2018	3.70	22.22	5.71	35.48	45.45	21.21	25	12.90	5.8	13.84	9.90	20.63
2019	0.73	0	0.10	0.42	1.15	2.29	1.66	9.46	35.27	18.21	19.66	11.03
2020	30.46	11.72	12.5	6.25	3.13	8.59	8.59	6.25	10.16	0.78	1.56	0

Above table shows that the dengue positivity rate is not related to any particular month, it varies from month to month and throughout year over a period of 5 year (2016-2020) Seasonal variation demolished from 2016-2020.

IV. Discussion

The causes of acute febrile illness are infections due to bacterial agents like leptospira, *Salmonella typhi*, rickettsial group, influenza viral agents including Dengue, Chikungunya, other arboviruses and parasitic infections like malaria. The most common etiological agents are viruses. Antibiotics are useful to treat only bacterial infections. By diagnosing the viral etiological agent one can avoid the unnecessary use of antibiotics.¹⁰

Dengue patients present with vague symptoms like fever, myalgia, and headache. Patients progressing from non severe to severe disease is difficult to define, so the appropriate rehydration therapy may prevent these patients from developing more severe clinical conditions like plasma leakage, coagulopathy, bleeding manifestations, organ impairment etc. In concern of such patients, especially rehydration before vascular leakage, it is important to diagnose as early as possible.¹¹

In conjunction with clinical and epidemiological surveillance, the detection of Dengue virus circulation in community will help the health care authorities to get useful information on time, location, and virus serotype as well as disease severity. This will also help to take preventive steps like mosquito control measures. Since 2007 diagnosis and data assimilation for Dengue and Chikungunya has been facilitated by NVBDCP. Though the diagnosis of Dengue infection can be done by rapid tests, it cannot be used as a stand alone test. Every Positive sample by rapid test is again tested by Mc ELISA test for confirmation.¹²

During 2016-2020 total 4541 serum samples of the patients suspected of having dengue infection were tested by dengue IgM Elisa & 31.03% were laboratory confirmed as dengue. It is similar to by study done by Manoj Murhekar et al over a period of 2014-2017(28%).¹³ Smita Sood et al in their study period of 2008-2011 found 18.99% of prevalence of dengue cases. It shows that the cases are rising.¹⁴

Among the cases, dengue positivity was slightly higher in male initially (2016-2017) but later on there is not significant difference in occurrence of dengue infection among male & females. Many studies have observed higher prevalence of dengue infection among males than females.^{13,14,15,16}

In current study we found sudden spike of cases in year 2019. It is mainly due to post flood rise in dengue infection. The Sangli Miraj Kupwad Corporation and whole district was hit by severe flood in August 2019. So from September onwards so many cases of acute febrile illness got admitted, among them many of patients confirmed as having dengue infection. These findings are in correlation with the study done by Philip et al in Kerala, after 2018 flood in Ernakulam district.¹⁷

The present study has shown that over a period of time the dengue positive cases have started increasing from start of the year. There is on change in no. of cases detected with respect to the seasonality of infection. Similar finding was repeated by Kulkarni SK et al in their study conducted at Nanded.¹⁶ The pre monsoon rise in no. of cases from January, may be due to stagnation of water after a few bouts of intermittent rainfall. This Facilitate vector breeding. These finding highlight the effect of global warming over seasonality. It also remind us that the preventive measures against dengue infection should be taken throughout the year. Though among medical services alertness has increased following previous dengue epidemics, and increased

availability of diagnostic tools for dengue ,may have contributed to detection of dengue positive cases through out the year.¹⁶ ,

Globally there may be several reasons for increase in dengue infection cases, but most important is, climate change leading to inappropriate & unpredictable rainfall in whole year. At the same time globalisation, ease of travelling, world wide trade relations might have spread the disease across the countries & continents.²

V. Conclusion

Present study highlight that the burden of disease has been consistently rising through out the year. It is recommended that the disease suspicion should be high for the dengue cases even in the seasons not traditionally associated with the disease.

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