Dengue Infection - prevalence and seasonal variation among patients attending a tertiary care hospital at Chamarajanagar, Karnataka

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Abstract

Introduction: Dengue fever is an emerging acute febrile illness caused by arboviruses and presenting with wide spectrum of clinical manifestations ranging from self-limiting asymptomatic infection to severe fatal infection like Dengue hemorrhagic shock with unpredictable outcome. It is endemic in India and in recent years it is appearing in the form of epidemics especially during rainy season.

Objectives
1. To determine seroprevalence of dengue virus among clinically suspected cases.
2. To determine the seasonal variation of dengue infection in the study setting.
3. To study the demographic profile of dengue positive patients.

Materials and Methods: A cross sectional study was done at a tertiary care hospital, Chamarajanagar using secondary data which were maintained in the microbiology laboratory registers, for clinically suspected dengue patients reported to the hospital from January- December 2017. Prevalence was estimated by analyzing data for the results of both NS1antigen and IgM antibody by ELISA tests and any variations in disease reporting by gender, age and season were assessed. Statistical analysis was done using WHO Epi info software version 3.5.4.

Results: A total of 2213 serum samples were analyzed during the study period. Out of which 475 samples (21.46%) were found positive for dengue infection either by NS1 or IgM ELISA. The proportion of dengue cases was higher in monsoon season with maximum rate of positivity in August (55.37%). Paediatric population was the most common affected group (30.33%).

Conclusion: The present study confirms that dengue is mainly a disease of rainy season and also identifies certain vulnerable groups for effective planning of interventions.

Keywords: Dengue, IgM, NS1, Seasonal variation.

Introduction

Dengue is an acute arboviral infection with potential fatal complications. Dengue is an endemic disease worldwide. According to estimates of the World Health Organization (WHO), around two fifths of the world's population in tropical and subtropical countries are at constant risk of contracting this infection.[1] Dengue is endemic in many parts of India and recently in the last few years many places have even experienced epidemics.[2-4] The first evidence of occurrence of Dengue fever in the country was reported in1956 from Vellore district in Tamil Nadu followed by the first epidemic in Kolkata during 1963-64.[5] Unplanned urbanization, lifestyle changes and migration of the population from rural to urban areas leading to lack of proper sanitation facilities and improper water storage practices have resulted in an increased burden of dengue in recent times.[6]

Dengue fever is caused by dengue virus, a positive stranded RNA virus in the genus Flavivirus, belonging to family Flaviviridae.[7] Till now, dengue fever was believed to be caused by four different serotypes that share antigenic relationships (DENV-1, DENV-2, DENV-3 and DENV-4). The fifth variant DENV-5 has been isolated in October 2013 which follows the sylvatic cycle unlike the other four serotypes which follow the human cycle.[8]

Principle vectors of transmission for Dengue infection are arthropods of the Aedes genre, especially *Aedes aegypti* and *Aedes albopictus*. In tropical areas, maximum transmission of disease occurs in the months of rainfall[9] owing to increased breeding of vectors in various water collection sites like old tyres, coolers, old earthenware pots, coconut shells etc.[10] Density of mosquito population will be high (3-4 female mosquitoes per house) during the rainy season as compared the dry season (1-2 female mosquitoes per house).[11]

Diagnostic techniques like isolation of virus by cell culture and nucleic acid detection by reverse transcriptase polymerase chain reaction are time consuming and require costly laboratory setups. Hence in resource limited settings, detection of NS1 antigen and IgM/ IgG antibodies specific to virus remains as important diagnostic parameters.[12]

Since there is no specific treatment or vaccine for dengue till date, prevention and control of the disease mainly depend upon epidemiological surveillance that provides reliable estimates of the disease, thereby guiding in implementation of effective vector-control

measures. With this background, the present study was carried out to determine the epidemiological determinants and seasonal variation in dengue infection which could help in rendering adequate control measures.

Aims and Objectives

1. To determine seroprevalence of dengue virus among clinically suspected cases.
2. To determine the seasonal variation of dengue infection in the study setting.
3. To study the demographic profile of dengue positive patients.

Materials and Methods

The present cross-sectional study was conducted at a tertiary care hospital of Chamarajanagar Institute of Medical Sciences, Chamarajanagar using secondary data which was maintained in the microbiology laboratory registers, of clinically suspected dengue cases reported to various inpatient and out-patient departments of the hospital for a period of one year from January –December 2017 after obtaining prior permission from the head of the Institute. Prevalence was estimated by analyzing data for the results of both NS1antigen and IgM antibody by ELISA tests and any variations in disease reporting by gender, age and season were assessed.

Approximately 5 ml of blood samples were collected from all the suspects as a part of the routine laboratory work and the sera were separated and tested for the Dengue NS1 antigen and IgM antibody by ELISA methods. According to WHO criteria samples of patient < 5 days of fever were tested for NS1Ag by tulipqualisa and $\geq$ 5 days of fever were tested for the presence of dengue specific IgM antibodies by using MAC ELISA, developed and commercialized by NIV (National Institute of Virology), Pune, and recommended by National Vector Borne Disease control programme. Manufacturer's instructions were followed strictly while performing the ELISA. Values were calculated and results were interpreted as per manufacturer's guidelines.

Statistical analysis

Data was analysed using WHO Epi info software version 3.5.4. Observations were presented as frequency and percentage distribution. Relevant descriptive statistics like frequency and percentage were calculated for presentation of data.

Results

Fig. 1 illustrates seroprevalence of Dengue infection. Among 2213 clinically suspected cases, 475 (21.46%) were found to be positive for dengue infection either by NS1 or IgM ELISA in the present study.

Table 1 Department wise distribution of dengue suspects. Out of total samples in our study, majority i.e. 1495 (67.55%) were from out-patient department and the rest from in patient department as seen in table.

Table 2 and Fig. 2 Of the 475 total positive cases of dengue, the proportion of cases was almost equal in both < 15 years and 16 – 30 years age group whereas the rate of seropositivity was highest i.e. 30.33% in < 15 years age group followed by 16-30 years (20.4%) and the study found statistically significant association between rate of seropositivity and age group (p value < 0.05).

Table 3 Gender wise distribution of samples of Dengue suspects and positives. Out of 2213 samples tested, 1099 (49.66%) were males and the rest females. Out of the 475 total positive cases of dengue, both the proportion of cases i.e. 248 (52.21%) and the rate of seropositivity i.e. 22.26% was slightly higher in females as compared to males but there was no significant association between rate of seropositivity and gender (p value > 0.05).

Fig. 3 Seasonal trend showed that suspected cases of Dengue infection started increasing in number from the month of June and peaked in July, August and slowly tapered by September with maximum rate of positivity in August i.e. 170 (55.37%) followed by July i.e. 196 (27.72%). Serologically confirmed dengue cases were highest i.e. 429 (90.31%) during the monsoon period compared to other seasons of the year and it was found to be statistically significant (p value < 0.05).

Discussion

WHO has declared dengue to be hyper endemic in India and cyclical epidemics of dengue are becoming more frequent. There has been a steady rise in the number of dengue cases reported every year.[10,13] In the present study out of 2213 clinically suspected cases, 475 (21.46%) were found to be positive for dengue infection either by NS1 or IgM ELISA. The results were congruent with other studies[14-18] whereas few other studies have reported lower prevalence rate ranging 3-13%[19-22] and some studies have reported higher prevalence i.e. 40%.[23-25] This difference in seroprevalence could be due to differences in study settings, differences in study periods, differences in sampling techniques, data collection tools as well as differences in sample processing procedure/ techniques.

The present study found maximum positive cases 363 (76.41%) in the age group of <30 years similar to the findings of other studies.[26,27] However, rate of positivity was highest in age group < 15 years i.e. 30.33% followed by 16-30 years i.e. 20.4% similar to findings of several Indian[14-17] and international studies.[28,29] On the contrary few other Indian studies have reported 15 to 45 years as the most affected age group.[4,25,30] Comparatively lower immunity and intrinsically more permeable vascular endothelium in

children render them more susceptible to dengue infections.

A seasonal trend of dengue over one year period was assessed. According to intensity of rainfall, weather data was divided in three periods, namely; pre monsoon period: from February-May, monsoon period: from June-September and post monsoon period: from October-January. In the present study dengue cases were found to be maximum i.e. 429 (90.31%) during monsoon season. Similar pattern is reported by Kauser MM et al. in Central India,[31] Madhumati R et. al. at Bangalore,[32] Chakravarti A et. al. in Myanmar.[33] Certain studies showed highest number of cases during Aug-Nov (Maharashtra),[14] Sept- Oct (Bidar),[21] October (Delhi),[34] Oct-Nov (Northeast),[35] September (Lucknow, Udupi).[30,36] The reason for monsoon peak in our study may be due to prime occupation of the people being agriculture and increased breeding of vector mosquitoes owing to collection of rain water in domestic and peridomestic areas.

Table 1: Department wise distribution of Dengue samples

	Out patient	In patient	Total
Gender	No. (%)	No. (%)	No. (%)
Male	748 (50.03)	351 (48.88)	1099 (49.66)
Female	747 (49.96)	367 (51.11)	1114 (50.33)
Total	**1495 (67.55)**	**718 (32.44)**	**2213 (100)**

Table 2: Age wise distribution of samples of Dengue suspects and positives

Age in years	Suspects	Positives	Rate of positivity
	No. (%)	No. (%)	%
< 15	600 (27.11)	182 (38.31)	30.33
16-30	887 (40.08)	181 (38.1)	20.4
31-45	448 (20.24)	65 (13.68)	14.5
46-60	202 (9.12)	37 (7.78)	18.31
>60	76 (3.43)	10 (2.1)	13. 15
Total	2213 (100)	475 (100)	21.46
χ^2=45.74, p value= <0.00001			

Table 3: Gender wise distribution of Dengue suspects and positives

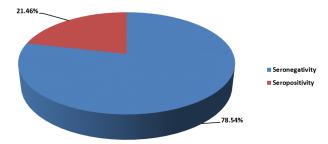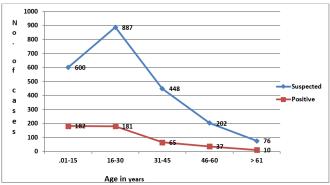| Gender	Suspects	Positive	Rate of positivity
	No. (%)	No. (%)	(%)
Male	1099 (49.66)	227 (47.78)	20.65
Female	1114 (50.33)	248 (52.21)	22.26
Total	2213 (100)	475 (100)	21.46
χ^2= 0.847, p value= 0.357			

Fig. 1: Seroprevalence of Dengue infection

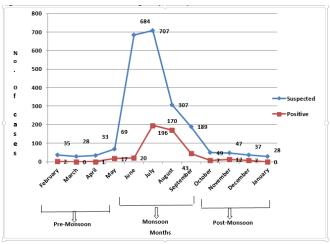**Fig. 2: Age wise distribution of Dengue suspects and positives**

Fig. 3: Seasonal/ month wise distribution of Dengue suspects and positives

Conclusion

The present study found seroprevalence of dengue infection to be critical in the study setting and identifies paediatric group being most vulnerable for infection and also identifies monsoon season as the most favourable season for transmission of disease. Need to strengthen integrated vector control measures during rainy season with special attention to personal protection measures among children.

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