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Original Article

Microbiology Section

Recent Trends of Seroprevalence of Dengue in a Tertiary Care Hospital in Southern Odisha

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ABSTRACT

Introduction: Dengue is a most common arthropod borne viral infection. It is endemic in several parts of India. It can lead to life threatening severe complications such as Dengue Haemorrhagic Fever (DHF)/Dengue Shock Syndrome (DSS).

Aim: This study was conducted to know the seroprevalence of Dengue virus in a tertiary care hospital, Berhampur, Southern Odisha, India.

Materials and Methods: Over a period of four years from January 2013 to December 2016, a total of 7345 blood samples from clinically suspected dengue patients were received in department of Microbiology laboratory. Serum was separated and subjected to enzyme immunoassay for detection of both Non Structural (NS1) antigen and IgM antibody.

Results: Out of 7345 serum samples positive infection detected in 712 (9.6%) cases. Maximum number of cases were detected in the year 2016 and less number of cases were detected in 2013. Majority numbers of cases were detected in the month of September. Combination of NS1Ag ELISA and IgM antibody ELISA were used for early detection of dengue infection.

Conclusion: Regular epidemiological studies are necessary to monitor the dengue situation in an area which helps in early detection of an outbreak and to initiate effective control measures.

Keywords: Arbovirus, Dengue haemorrhagic fever, Serum NS1Ag/IgM antibody

INTRODUCTION

Dengue virus infection is an important mosquito borne Arboviral infection of human. The global incidence of Dengue Fever (DF) and DHF has increased dramatically in recent decades [1]. It is a very rapidly growing public health problem currently faced by people living in tropical and sub tropical countries. It is transmitted by *Aedes aegyptii* and *Aedes albopticus* which are day biting mosquitoes. It affects more than 2.5 billion people annually and 975 million people who resides in tropical and sub tropical countries in south east Asia, the Pacific and the America with Africa bearing the major burden of the disease accounting to 900 million cases annually [2].

It is a flu like illness that affects all age groups. Epidemics are more frequently occur during monsoon and post monsoon period. It is maintained in nature through a biological transmission between susceptible vertebrate hosts by haematophagous arthropods [3].

The Dengue virus has four serotypes which are DEN-1, DEN-2, DEN-3, DEN-4. Each serotype produce specific antibodies for life time, but only short term cross immunity [4]. Recently, a fifth serotype has been identified [5]. The largest Dengue outbreak in India which occurred in 1996 was due to DEN-2 [6]. This was later replaced by DEN-3 as the dominant serotype in 2003 [7]. Throughout the world millions of cases appear every year and nearly half a million people develop DHF/DSS with a 2.5% of fatality rate cases [8]. Vaccine development is a major challenge due to the fact that DHF/DSS is associated with secondary infection and that the ideal vaccine should induce immune response against all four serotypes [9].

All four dengue virus serotypes have been isolated from different parts of the country [10]. This wide prevalence of infectious disease may be attributed to the number of cases are better reported and increased awareness among public and also bringing the dengue infection under the notification category. In India, the disease reflects cyclical pattern which over the years increased in frequency and geographical extent. Meteorological factors such as temperature, humidity and rainfall have considerable impact on dengue transmission [11].

Early diagnosis plays an important role in detecting an epidemic or outbreak and in undertaking effective vector control measures. Several diagnostic methods are available like antigen detection tests (Non structural NS1Ag), antibody detection tests like (Dengue IgM, IgG), virus isolation in cell culture, immunofluorescence or by detection of viral RNA by Nucleic Acid Amplification Tests (NAATs) [12].

Cell culture and NAATs require sophisticated laboratory and expensive equipments. In resource limit setting Dengue NS1Ag, IgM and IgG antibody detection are possible which are cheap and they can detect infection in the early stages so that prompt intervention can be done.

NS1 antigen is a non structural protein considered as a marker during initial phase of dengue infection. It can be detected in the sample from one to nine days after onset of DF. IgM antibody starts raising in the body from 5-7 days of infection and persist for 2-3 months and IgG appear by 2-4 weeks after the onset of fever and persist for life [13,14]. Antigen capture ELISA should be considered as the test of choice for patients suspected of acute dengue illness with fever less than five days. For patients with history of fever for more than six days and are suspected to have acute dengue infection. The NS1Ag capture ELISA could be considered along with IgM capture ELISA.

The present study was a four year hospital based serosurveillance study conducted to assess the prevalence of dengue infection in southern Odisha. We did both types of immune assays NS1Ag and IgM Ab in patients with suspected DF like illness, and the results of combined tests have been compared individually with each test separately.

MATERIALS AND METHODS

The present serosurveillance study was conducted in the department of Microbiology, Maha Raja Krishna Chandra Gajapati Medical College, Berhampur, Odisha, India from January 2013 to December 2016. The present study was approved by Institutional Ethical Committee. Patients presenting with fever for more than three days

with two or more of the following manifestations: headache, retro-orbital pain, myalgia, arthralgia, rash, haemorrhagic manifestations, and leucopenia were included in the study group. A total number of 7345 blood samples from clinically suspected cases of DF according to WHO criteria were obtained from both the outdoor and indoor hospitalised patients.

Sample Collection and Processing

Serum was separated by centrifuging blood at 3000 rpm for five minutes and processed immediately. Detection of NS1Ag and IgM antibody done by the ELISA test using Dengue NS1Ag capture ELISA (Pan Bio Dengue diagnostics) and IgM antibody detection by IgM capture ELISA test (NIV Pune). The Positive Control (PC) and Negative Control (NC) from the test kit were put up and results were read according to manufacturer's literature provided. Available data were analysed and the trend of Dengue infection was observed during the study period.

RESULTS

During the study period (January 2013 to December 2016), a total of 7345 serum samples were processed among which 712 (9.6%) cases were serologically proved to have dengue infection [Table/Fig-1].

A month wise distribution of dengue infection revealed that cases increased gradually from July to September and decreased gradually from there onwards, and not even a single case was detected in the month of May [Table/Fig-2].

Out of 712 positive dengue cases 339 (47.6%) samples were NS1Ag positive, 172 (24.1%) were both NS1Ag and IgM Ab positive and 201 (28.2%) were only IgM Ab positive [Table/Fig-3,4].

Year	Total number of suspected dengue cases (n=7345)	Number of dengue positive cases (n=712)
2013	1085	101 (9.3%)
2014	1465	99 (6.7%)
2015	1117	93 (8.3%)
2016	3678	419 (11.3%)

[Table/Fig-1]: Year wise distribution of suspected dengue fever cases and dengue positive cases.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013	5	2	3	1	-	1	5	10	26	22	17	9
2014	4	4	1	-	-	-	6	20	32	15	13	2
2015	2	1	-	-	-	-	5	5	38	29	11	2
2016	1	2	-	-	-	3	85	99	144	58	25	4

[Table/Fig-2]: Month wise distribution of cases from 2013-2016.

NS1Ag	Number of patients (n=712)
NS1Ag positve	339 (47.6%)
NS1Ag+IgM	172 (24.1%)
NS1Ag Negative	201 (28.2%)

[Table/Fig-3]: NS1 Ag positive in Dengue patients.

IgM antibody	Number of patients
Only IgM Ab positive	201 (28.2%)
IgM+ NS1Ag	172 (24.1%)
IgM Ab Negative	339 (47.6%)

[Table/Fig-4]: IgMAb positive in Dengue patients.

Days of onset of illness	NS1Ag	IgM
1-7 days (early cases)	332/712 (46.6%)	120/712 (16.8%)
8-14 days (late)	7/712 (0.9%)	81/712 (11.3%)

[Table/Fig-5]: Positivity of NS1Ag and IgM according to days of illness.

NS1Ag positivity from day 1-7 post onset of illness detected in 332 (46.2%) cases. For IgM most of the positive cases (16.8%) were seen between 8-14 days post onset of illness [Table/Fig-5].

DISCUSSION

Dengue fever is an acute febrile viral infection which has become a major public health problem in tropical and subtropical region of the world. In India, the first epidemic of clinical dengue-like illness was recorded in Madras (Chennai) in 1780 and the first virologically proved epidemic of DF occurred in Calcutta (Kolkata) in 1963-1964 where 200 people died of it [15,16]. The first major outbreak of DF/DHF occurred in Delhi in 1996 where 10,252 cases detected and 423 deaths were reported [6]. It is essentially an urban disease but it has changed its character in course of time. Increased travel among people to neighboring states for the purpose of jobs and business might be responsible for rapid spread of disease to new areas. Also unplanned urbanisation and poor sanitation facilities contribute to fertile breeding grounds for the mosquitoes.

Laboratory diagnosis of dengue infection is crucial as the varied presentation of the disease can make accurate clinical diagnosis difficult. Assays based on detection of NS1Ag or IgM Ab are two most commonly used tests in most of the laboratories.

In present study, 9.6% of patients had serologically confirmed dengue infection. A similar surveillance study done by Sood S, reported to be 18.99% [18]. Garg A et al., reported the seroprevalence of dengue infection in their area to be 19.7% [19]. Highest number of cases was seen in the year 2016 whereas, lowest number of cases was detected in the year 2013. In our area year wise distribution of dengue cases showed steady decrease in the number of cases from 2013, 2014, 2015. However, in 2016 there has been rise in the number of cases. A study by Padhi S et al., in this region showed steady rise of cases from 2010 to 2012 with peak number in 2012 [20]. Dengue infection established seasonal and cyclical epidemic patterns with outbreaks occurring at 2-3 year intervals. Increased number of cases in 2016 after previous outbreak in 2012 might be due to immunity or herd immunity of the population increased after an outbreak, subsequently the transmission may cease for some time and immunity obtained from previous outbreak gives some cross protection to other serological dengue strains after infection with one for shorter intervals [21]. A cyclical pattern of increased transmission coinciding with the monsoon and post monsoon period has been observed. The maximum number of dengue cases seen from August to November, less number cases reported from January to March, a single positive case in april month and not even a single positive was reported in May month. The interaction between temperature and rainfall are important determinants of dengue transmission as cooler temperatures affect adult mosquitoes influencing transmission rates. The presence of stagnant water after rainfall favours breeding of the vector resulting in an increase in dengue cases. Temperature and rainfall also affect patterns of feeding and reproduction and hence, the population density of vector mosquitoes [22]. In our laboratory for early diagnosis NS1Ag and IgM Abs detection by ELISA method was used. The combination of these two methods would increase the rate of detection of DF at an early stage. These tests are simple, cheap and high sensitivity and specificity. A study done by Neralwar A et al., also showed similar findings [23]. From results of present study, it is found that post monsoon season (August to November)

is the peak season for dengue cases to occur. This should be taken into consideration to plan a preventive strategy to fight the life threatening condition during that season. Also, it is found that combined use of NS1Ag with dengue IgM test could significantly improve diagnostic sensitivity of dengue infection which helps in timely management. Further studies should be done to know the prevalence of serotypes and genotypes in this area to prevent impending outbreaks due to DHF.

LIMITATION

Limitation of present study was that we were unable to do serotyping to know the prevalent serotypes due to economical restraints and resource limited setup.

CONCLUSION

Seroprevalence studies are required to monitor the situation in an area regularly. Many of the cases were reported in monsoon and post monsoon period indicating a need for effective vector control programs before arrival of monsoon.

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