Original Research Article

A Study on Seroprevalence of Dengue Virus in a Tertiary Care Hospital in North Karnataka

Md Hamed Altaf Mali[1], Mirza Hammad Ali Baig[2], Syeda Heena Kauser[3]

[1]Assistant Professor, Department of Pathology, ESIC Medical College and Hospital Kalaburagi
[2]Associate Professor, Department of General Medicine, ESIC Medical College and Hospital Kalaburagi
[3]Associate Professor, Department of Pathology, ESIC Medical College and Hospital Kalaburagi

Abstract:

Introduction: Dengue fever is an acute viral disease caused by Dengue virus of the Flaviviridae family and is transmitted by the bite of an infected female mosquito Aedes aegypti. The Dengue virus causes significant morbidity and mortality in many parts of the world, including India. Though, the cases of dengue fever are mild and self-resolving, there can be fatal complications like Dengue Haemorrhagic Fever (DHF) and Dengue Shock Syndrome (DSS). The aim of this study is to calculate the seroprevalence of Dengue fever referred to tertiary care hospital in North Karnataka.

Materials and Methods: This is a prospective type of cross-sectional study conducted in Department of Medicine for a period of two years from June 2021 to May 2023 at ESIC Medical College And Hospital, Kalaburagi, North Karnataka, India. The serum samples were collected from suspected dengue fever cases and tested by Immunoglobulin M (IgM) capture Enzyme Linked Immunosorbent Assay (ELISA) to detect IgM antibody against dengue virus and NS1 for dengue NS1 (Non-Structural Protein-1) antigen using Standard ELISA kits. The statistical analysis was done with SPSS 26.0 version.

Results: A total of 5940 serum samples were screened over a period of two years for Dengue IgM and IgG. Most affected age group was between 10-20 years and male to female ratio was 1.2:1. A total of 1040 (17.50%) cases were positive for dengue infection. Among which 812(80.3%) cases were positive for anti-dengue IgM antibodies, 96 (9.23%)cases were positive for NS1 antigen and 132 (12.70%)cases were positive for both, respectively.

Conclusion: Regular epidemiological studies are necessary to monitor the dengue situation in high risk areas. Seroprevalence of dengue infection being critical signifies the importance of detection of both IgM antibodies and NS1 antigen for diagnosis of dengue infection to prevent fatal complications like Dengue Haemorrhagic Fever and Dengue Shock Syndrome . The study identifies younger population being at higher risk and most cases were reported during the during monsoon period, which warrants coordinated action toward vector control measures.

Keywords: DSS, IgM, NS1.

Introduction

Dengue fever is a seasonal and emerging acute mosquito-borne arboviral illness affecting the subtropical countries like India. The World Health Organisation (WHO) has declared Dengue as a global threat as number of cases increased from <0.5 million in 2010 to over 3.34 million in 2016 The illness ranges from asymptomatic form to severe Dengue Hemorrhagic Fever(DHF) and Dengue Shock Syndrome (DSS) causing significant morbidity and mortality.

Dengue virus is a single-stranded positive-sense RNA virus belonging to the genus Flavivirus and family Flaviviridae. Dengue virus has five different serotypes including DENV-1, DENV-2, DENV-3, DENV-4 and DEN-5, indicating that immunity is serotype-specific. Majority of the cases are asymptomatic during the initial phase of infection, leading to spread of the disease. The clinical presentation of the patients suffering from Dengue fever includes high-grade fever, headache, muscle and joint pains, retro-orbital pain and skin rash. Further Plasma leakage, haemoconcentration, haemorrhagic shock and multiple organ failure can occurs causing high mortality in severe cases. The cases are confirmed by laboratory criterion.

For diagnosis of Dengue infection, the various laboratory test includes the Standard Serological Test, Hemagglutination Inhibition Test, Neutralization Test, Indirect Immunofluorescence Antibody Test, Enzyme-Linked Immunosorbent Assay (ELISA), Complement Fixation Test, Nucleic Acid Amplification Technology (NAATs) like

Reverse Transcriptase Polymerase Chain Reaction (RT-PCR)and Rapid Immunochromatography Test. Out of these tests, ELISA test is the most widely used method for routine diagnosis of dengue infection. It is simple, cost-effective and has high sensitivity and specificity and can be used for early detection of infection and hence early intervention.

Materials and Methods

This study was a prospective type of cross-sectional study conducted over a period of 2 years from June 2021 to May 2023 in the department of Medicine at ESIC Medical College And Hospital Kalaburagi, North Karnataka, India . The data were collected from medical records in the Department of Microbiology. The study included patients who were clinically suspected of dengue. The World Health Organization criteria was followed for the diagnosis of dengue and Universal safety precautions were followed while collecting and processing blood samples from patients. NS1Ag and IgM antibodies were detected using Dengue NS1Ag capture ELISA and IgM capture ELISA. The positive control and Negative Control from the test kit were put up. The ELISA microtiter plates were read with a Bio-rad ELISA reader. Optical density values were recorded and analyzed, and the results were read according to the manufacturer's instructions.

A total of 5940 non-repetitive blood samples were collected during the study period and sent to the microbiology laboratory to test for dengue virus infection. Hemolyzed and lipemic samples were excluded from the study. Blood samples were stored in the refrigerator at 4°C-8°C and processed for serum separation within 24 h. Serum was separated by centrifuging blood at 3000 rpm for 10 min. The separated serum samples were subjected to serological testing, depending on the duration of fever at the time of presentation of the patient to the hospital. Samples were respectively chosen to be processed for NS1 antigen detection and IgM antibody detection. Patients with previously diagnosed dengue infection and other proven aetiology of fever were excluded from the study.

Statistical Analysis

The statistical analysis was done with SPSS 26.0 version and it was presented in the form of tables and graphs

Results

A total of 5940 serum samples of suspected dengue patients were screened over the time period of two years. The age group of patients includes from 6 months to 70 years. Mean age was 34.5 years with 3240 male samples and 2700 females samples. Most affected age group was between 10-20 years and male to female ratio was 1.2:1. The maximum number of cases was seen during the monsoon period with highest seasonal peak. A total of 1040 (17.50%) cases were positive for dengue infection. Highest Dengue positive cases were seen in second year of the study i.e; 560 of 2986 (18.75%) of the cases.(TABLE/FIG-1). Among which 812(80.3%) cases were positive for anti-dengue IgM antibodies, 96(9.23%)cases were positive for NS1 antigen and 132 (12.70%)cases were positive for both respectively [Table/Fig-2]

Table 1: Spectrum of Dengue Cases Over Two Years

Dengue Cases	June/21- May/22	June/22- May/23	Total Cases
Probable	2954	2986	5940
Confirmed	480 (16.24%)	560 (18.75%)	1040 (17.50%)
Severe	62 (2.09%)	102 (3.41%)	164 (2.76%)

Table 2: Seropositivity of Dengue Cases.

Positivity	Number of Dengue Cases	Percentage
NS1 antigen	96	07.3%
Anti-Dengue IgM antibodies	812	80.0%
NS1 antigen & Anti-Dengue IgM antibodies	132	12.7%
TOTAL	1040	100%

Discussion

Dengue fever is an acute febrile viral infection, which has become a significant public health problem in tropical and subtropical regions of the world. After malaria, dengue fever is ranked the second most prevalent mosquito-borne infection in recent years. In India, the first epidemic of clinical dengue-like illness was recorded in Madras (Chennai) in 1780, and the first virologically proven epidemic of dengue fever occurred in Calcutta (Kolkata) in 1963-1964. The first major outbreak of dengue fever/DHF occurred in Delhi in 1996, where 10,252 cases were recorded, and 423 deaths were reported.

Dengue fever cases have reached 40 million and DHF cases are nearing an unsettling figure of several lakhs per year. India has been declared as hyper endemic for dengue by WHO and the frequency of cyclical dengue epidemics are found to be increasing here. The reported annual number of dengue cases

has been rising steadily Dengue is an urban disease, but it has changed character over time. Increased travel among people to neighbouring states for jobs and business might be responsible for the rapid spread of disease to new areas.

This study tested a total of 5940 serum samples from clinically suspected patients over a period of two years, of which 1040 of the samples were positive for dengue infection accounting for the overall seroprevalence of 17.50%. Similar prevalence was also seen in the studies conducted by Madkey MV et al., (12.37%). However, in various other studies conducted in India between 2013 and 2019 the seroprevalence ranges from as less as 6.8% (Umar N and Mir BA), 9.6% (Sahu SK et al.,) to as high as 58.98% (Islam A et al.,). [Table/Fig-3].

Table 3: Previous Trends in Seroprevalence of Dengue Infection

Sl.No.	Study	Duration of The Study	Place	Seroprevalence Of Dengue
01	Present study	2021 to 2023	North Karnataka	17.50%
02	Umar N and Mir BA	2013 to 2019	North Karnataka	6.8%
03	Madkey MV et al.,	2018 to 2020	Maharashtra	12.37%
04	Sahu SK et al.,	2013 to 2016	Southern Odisha	9.6%
05	Islam A et al.,	2011 to 2017	South Delhi	58.98%

The variation in the results observed in different studies can be attributed to the type of serum samples tested whether in acute or convalescent phase samples and the results of present study signify the importance of testing both IgM antibodies and NS1-Ag to diagnose Dengue infection. There was no mortality related to specific dengue infection but morbidity was high as the most affected population belonged to the teenage (11-20 years) and productive age group (21-30 years) followed by paediatric population (0-10 years) respectively. The elderly population was least affected. The low prevalence of dengue infection among the extremes of age groups may be because of restricted outdoor exposure and sheltered living. The lesser gender difference in the dengue cases could be due to equal outdoor activities performed by both the genders. Most of the studies conducted showed high seroprevalence of the dengue cases around the monsoon season peak in the month of August.

The present study was epidemiologically relevant as large number of cases have been tested compared to other studies from this region. Early detection and management was possible as both IgM antibody and NS1 antigen were detected by using ELISA test unlike rapid tests utilised in other studies. Study results were in good correlation with the other studies conducted across the country. The limitation of the study includes shorter duration of the study, other comorbiditys associated when diagnosed with dengue, various laboratories parameters like platelet counts, leucocyteic count and CRPs levels and history of transfusions would have been done.

Conclusion

Regular epidemiological studies are necessary to monitor the dengue situation in high risk areas. Seroprevalence of dengue infection being critical signifies the importance of detection of both IgM antibodies and NS1 antigen for diagnosis of dengue infection to prevent fatal complications like Dengue Haemorrhagic Fever and Dengue Shock Syndrome. The study identifies younger population being at higher risk and most cases were reported during the monsoon period, which warrants coordinated action toward vector control measures. Active participation from the public is an essential component to curb down the problem. There is also an urgent need to develop a vaccine that is effective against all five dengue virus serotypes.

References

1. World Health Organization, WHO (2002) Dengue and Dengue hemorrhagic fever. Fact sheet no117. WHOGeneva Available at: http://www. who. int/media Centre/facts heets/ f117/en/print.html.
2. Guha-sapir D, Shimmer B. Dengue fever: new paradigms for a changing epidemiology. Emerging themes in Epidemiology, 2005. Open access journal http://www.ete- online.com/content/2/1/1.
3. Gulber DJ. Dengue and Dengue hemorrhagic fever. Clin Microbiol Rev.1998 Jul; 11(3):480–96.
4. Dar L, Broor S, Sengupta S, Xess I, Seth P. The first major outbreak of DHF in Delhi, India. Emerg Infect Dis. 1999 Jul-Aug; 5 (4):589–90.
5. Dash PK, Saxena P, Abhyankar A, Bhargava R, Jana AM. Emergence of Dengue virus type-3 in northern India. Southeast Asian J Trop Med Public Health. 2005 Mar; 36(2): 370–77.
6. Umar N, Mir BA. A study on seroprevalence of dengue viral infection using IgM antibody capture ELISA for the early diagnosis in Kalaburagi district, North-Eastern part of Karnataka, India. Int J Med Microbiol Trop Dis. 2019; 5(3): 138-141.
7. Madkey MV, Gedam DS, Meshram VM, Gajbhiye SB. Seroprevalence of dengue in the tribal district of central India. Indian J Microbiol Res. 2021;8(1):45-48.
8. Sahu S K, Pasupalak S, Mohanty I, Narasimhan M V. Recent trends of seroprevalence of dengue

in a tertiary care hospital in Southern Odisha. J Clin Diagnostic Res. 2018;12(1):DC05-DC07.

9. Islam A, Abdullah M, Tazeen A, Naqvi IH, Kazim SN, Ahmed A, et al. Circulation of dengue virus serotypes in hyperendemic region of New Delhi, India during 2011-2017. J Infect Public Health. 2020;13(12):1912-19.

10. Prayitno A, Taurel AF, Nealon J, Satari HI. Dengue seroprevalence and force of primary infection in a representative population of urban dwelling Indonesian children. PLoS Negl Trop Dis. 2017;11(6):e0005621.

11. Ganeshkumar P, Murhekar MV, Poornima V, Saravanakumar V, Sukumaran K, Anandaselvasankar A, et al. Dengue infection in India: A systematic review and meta-analysis. PLoS Negl Trop Dis. 2018;12(7):e0006618.

12. Sood S. A hospital-based serosurveillance study of dengue infection in Jaipur (Rajasthan), India. J Clin Diagn Res. 2013;7(9):1917–20.

13. Ashshi AM. Sero-detection of dengue virus and its antibodies among blood donors in the western region of Saudi Arabia: A preliminary study. Blood Transfus. 2015;13(1):135–8.

14. Park K. Epidemiology of communicable diseases. In: Park's textbook of preventive and social medicine. Jabalpur: Bhanot; 2015. p. 246.

15. Ayukekbong JA, Oyero OG, Nnukwu SE, Mesumbe HN, Fobisong CN. Value of routine dengue diagnosis in endemic countries. World J Virol. 2017;6(1):9–16.