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Original Research Article

Trends in dengue virus infection with seasonal variation at a tertiary care centre, Mangaluru: A retrospective study

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ABSTRACT

Background: Dengue is currently the second most prevalent vector borne disease in the world. Dengue fever and its more serious forms, dengue hemorrhagic fever and dengue shock syndrome are becoming important public health problems. Since there is no immunoprophylaxis or specific antiviral therapy available, clinico-microbiological diagnosis plays a vital role in patient management and implementation of control measures.

Aim: To identify dengue seropositive patients by NS1 antigen and anti-dengue IgM antibody detection by ELISA and correlate the changes in epidemiology.

Materials and Methods: A retrospective study was performed for a period of 5 years from January 2017 to December 2021 in A.J Institute of Medical Sciences & Research Centre, Mangaluru. 1871 seropositive cases of all age groups admitted in the medical wards were included. Rapid immunochromatography test and ELISA was performed to detect NS1 antigen and IgM antibodies. Platelet count and total leucocyte count were also analysed.

Results: Out of 14656, 1871 samples (12.75%) were positive for dengue. Higher rate of cases were in males and the age group of 21 to 30 years were chiefly affected. 1158(61.89%) were positive for NS1 antigen and total positive cases for IgM antibody was 530(28.32%). About 183 (9.79%) cases were positive for both NS1 antigen and IgM antibody. An increase in the prevalence of dengue was recorded during the month of June to October.

Conclusion: The present study indicates a decline in dengue infection from 2020 which may be attributable to preventive and control measures provided by the health care workers besides having increased awareness among people. The decline may also may be due to the outbreak of SARS –Cov-2 in December 2019, which led to under diagnosis of dengue cases.

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1. Introduction

Dengue fever has developed into one of the world's major emerging infectious diseases. The infection is by now seen as global epidemic with recorded prevalence in more than 120 countries.[1] 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. In India; Dengue is a major public health problem and one of the leading cause for hospitalization. The number of dengue cases has increased over the last three to five years. Previously it was considered to be a disease of the urban and the semiurban areas, but now it has started affecting the affluent class as well, causing a major public health concern.[2] Dengue is an acute, life threatening viral infection transmitted through the bite of infected A*edes mosquitoes*, mainly *Ae. aegypti*. It belongs to the genus Flavivirus and family Flaviviridae

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and has four serotypes of dengue virus, namely DEN-1, DEN-2, DEN-3, DEN-4and newly identified fifth serotype DENV. Serious manifestations occur more frequently in reinfections.[3] It is one of the most swiftly increasing mosquito-borne viral diseases with a wide clinical spectrum and a wide variety of presentations, ranging from mild febrile illness to the more severe forms for instance Dengue Shock Syndrome (DSS) and Dengue hemorrhagic fever (DHF).Recovery from infection provides lifelong immunity against that serotype but confers only partial and transient protection against subsequent infection by other serotypes. Secondary infection with a serotype different from that causing primary infection may lead to DHF and DSS which can be fatal.[4] Detection of NS1 antigen and dengue specific IgM/IgG has been the mainstay of diagnosis of Dengue Infection. Apart from the dengue specific parameters, platelet count, leukocytes are the other accessory laboratory tests available that can support the diagnosis of DHF or DSS.[5] Therefore the present study is aimed to study the epidemiological trend of dengue virus infection by collecting the data from the records of all patients who were diagnosed as dengue by serological test and correlating it with hematological parameters like platelet count and total leukocytes count.

2. Materials and Methods

This is a retrospective study, performed in the department of Microbiology, A.J Institute of Medical Sciences and Research Centre, Mangaluru Karnataka from January 2017 to December 2021. The study was approved by the Institutional ethics committee (No AJEC/REV/62/2022). The study included all patients diagnosed with positive serology tests for dengue using standard NS1 antigen & IgM antibody immunochromatographic test and further subjected to ELISA from J. Mitra & Co. Pvt. Ltd., New Delhi. Approximately 5 ml of blood samples were collected from patients presented with dengue like illness and the sera were separated. Dengue serology was done for detection of NS1 antigen and IgM antibody by immunochromatography and confirmed by NS1 and IgM ELISA methods respectively. Manufacturer's instructions were followed strictly while performing the tests. According to WHO criteria samples of patient < 5 days of fever were tested for NS1Ag and ≥ 5 days of fever were tested for the presence of dengue specific IgM antibodies. Seasonal variation in dengue infection, platelet count, total leukocyte count were also assessed in all positive cases.

3. Results

Around 14,656 blood samples were received in Microbiology department for Dengue serology. Of these 1871 were positive for dengue infection either for NS1, Ig M or both.

Table 1: Sero-positivity for dengue viral infection

Serological marker	No. Positive (%)
NS1	1158(61.89)
Ig M	530(28.32)
NS1 +IgM	183(9.79)
Total	1871 (100)

Maximum positivity was seen in the year 2019 and there was a gradual decline in the following year (Figure 1)

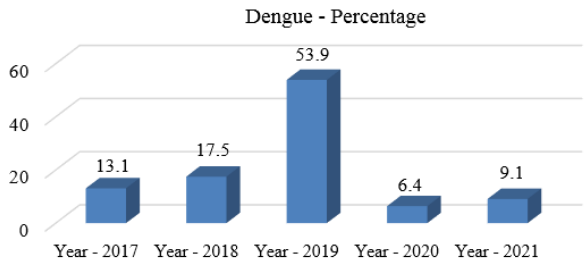

Fig. 1: Year-wise distribution of patients.

The incidence of Dengue was higher in males compared to females in the age group of 21-30years.(Figures 2, 3 and 4)

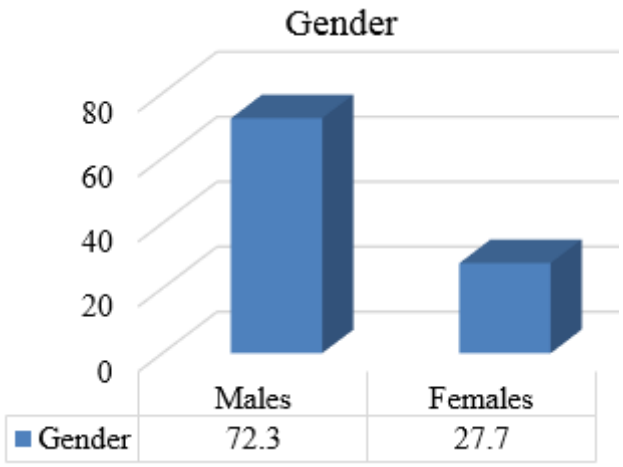

Fig. 2: Distribution of patients according to gender.

Dengue infection showed a seasonal trend of increasing cases during monsoons from the month of June to September.Figure 5

4. Discussion

Worldwide large scale reappearance of dengue in the past few decades has turned this into a serious public health problem, especially in tropical and subtropical countries. Even in India, dengue infection with rapidly changing epidemiology is evolving into an emerging viral

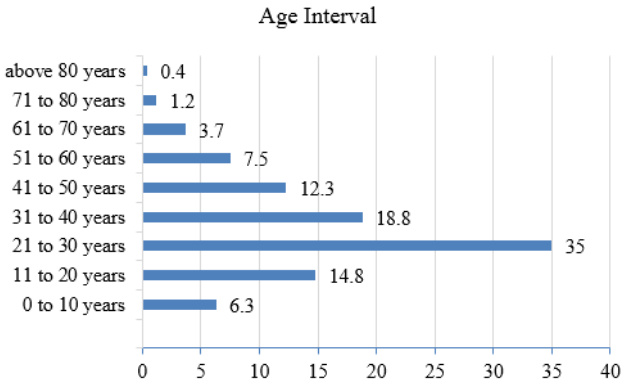

Fig. 3: Age wise distribution of dengue positive cases.

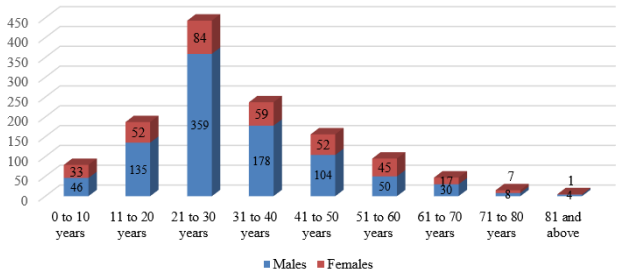

Fig. 4: Distribution of patients accordingto age and gender.

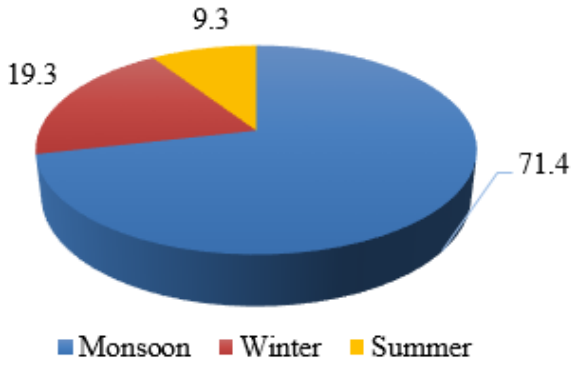

Fig. 5: Season-wise distribution of patients (%)

disease. Increase in the number of dengue cases over the past few years has been attributed to rapid unplanned urbanization with unchecked construction activities and poor sanitation facilities contributing to fertile breeding areas for mosquitoes. It is also seen that increase in alertness among medical personnel following the epidemics and availability of diagnostic tools in the hospitals have contributed to the increased detection of cases.[6] The rapid increase in the global dengue burden and inability of accurate clinical diagnosis because of its wide clinical

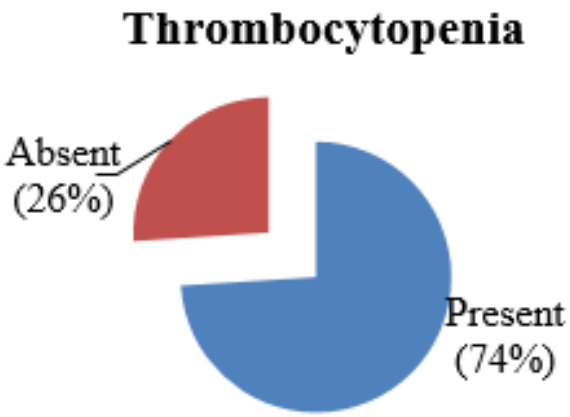

Fig. 6: Percentage of patients with thrombocytopenia

spectrum ranging from mild febrile illness to severe syndrome has promoted social interest in early laboratory diagnosis of dengue infection. As the initial symptoms of dengue mimic those of malaria, typhoid and leptospirosis which are endemic in coastal Karnataka, diagnosis gets delayed in the initial stages of illness. Diagnosis of dengue by viral culture and RT-PCR are time consuming, very costly and also it needs experienced laboratory personnel. Detecting antigen and antibody of dengue virus by serology, which is quick and relatively inexpensive and most feasible method can help in early detection and prevent further complications.[1,7]

In the present study, prevalence of dengue seropositive cases was 257 (9.8%) in 2017, 168 (5.54%) in 2018, 1143 (19%) in 2019, 122 (8.59%) in 2020 and 180 (11.32%) in 2021 indicating a decline in dengue infection from 2020-21. This declining trend from 2020 onwards could be due to preventive and control measures provided by the health care workers stringently besides having increased awareness among the people about the disease. It may also may be due to outbreak of SARS –CoV-2 in December 2019, causing disrupted healthcare services during lockdown resulting in under reporting of dengue cases in 2020 and 2021. Dengue prevalance of 20% till 2019 was found in similar study in Assam by Goswami L et al.[8]

Males were affected 1352 (72.3%) more than females 518 (27.7). Similar results were found in other study by Sumita Rajeevan et al in North Kerala in 2020.[3] Reasons behind male preponderance could be due to greater exposures of males to dengue-carrying mosquitoes during daytime either at the workplace or during travelling to and from work. Young people of 21-30 years age (35%) were affected maximum followed by 31- 40 years (18.8%) and 11-20 years (14.8). The result is concordant with earlier study by Priyadarshini et al conducted in Chennai.[9]

Our study showed thrombocytopenia as the most common haemotological abnormality in 74% of the diagnosed cases (Figure 6). It may be due to either immune mediated clearance of platelets or depressed platelet synthesis because of dengue virus induced bone marrow suppression. This correlates with study by Jyothi P et al.[10]

The highest number of cases were found during the monsoon and post monsoons (June to September) in our study. Increased prevalence of cases was reported in the month of July in 2018, July and August in 2019, August and September in 2019, June in 2020 and July in 2021. The presence of stagnating water after rainfall favors breeding of the mosquito vector resulting in an increased incidence of dengue. Most of the vector borne disease exhibit a distinctive seasonal pattern and climatic factors such as rainfall, temperature, humidity and other weather variables which in many ways influence the vectorand the pathogens they transmit. For assessing the seasonal variations of the disease, analysis of data was done on a monthly basis. Worldwide studies have proposed that ecological and climatic factors influence the seasonal prevalence of both *Ae. aegypti* mosquito and dengue virus.[11] During this study period, the peak of dengue cases from July to September was followed by successive decline in the number of cases by November. This corresponds with the monsoon trend in this part of the country, thus showing clear relationship between monsoon and dengue occurrence (outbreak). This is supported by studies conducted in Goa and other parts of India.[12,13] In monsoons, due to the rainfall followed by the creation of mosquito breeding habitats, the emergence of *Ae. aegypti* was aplenty. On the other hand, in the summer season, due to high temperature and negligible rainfall, very low density of dengue vectors were observed. Temperature can influence the adult and immature survival of *Aedes* population. It has been reported that temperature between 25°C and 30°C is optimal for *Aedes mosquito* survival and mortality is observed below15°C and above 35°C. It may be noted that rainfall is responsible for the creation of various secondary foci, less examined and not covered under the routine intervention measures. These habitats include discarded tyres, bottles, containers and any water-holding surface which provide conducive oviposition habitat for *Ae. aegypti*.[14]

The scope of the present study was to highlight the changing trends of dengue virus infection in Mangaluru. The present study has its shortcomings in terms of correlating the patient's clinical histories and symptomatology with occurrence of dengue seropositivity. Further serotyping of prevalent strains of virus was not done in the study that helps in differentiating primary and secondary infection in this particular geographical areas and to reduce the morbidity and mortality due to DHF/ DSS. However, no death from dengue virus infection has been reported in this study. Because of the scarcity of resources and facilities we could not perform molecular level study to counter check the serological test results of the present study. If the WHO's goal of reducing morbidity by about 25% and mortality by 50% is to be achieved, we need continuous sero-epidemiological surveillance for timely formulation and implementation of effective dengue control programme with delivery of effective vaccine before onset of monsoon season.

5. Conclusion

There are significant concerns with the arrival of Covid-19 which has overlapped with other viruses, particularly dengue in various geographical areas of Karnataka. The study concludes increase in the seroprevalence of dengue viral infection from 2017 to 2019 during monsoon and post monsoons, followed by rapid decline in the year 2020. SARS CoV-2 pandemic led to disrupted health care services amidst lockdown in many parts of India including Karnataka as collective health care efforts were diverted towards containment of COVID-19 infection. This must have led to under-reporting of dengue infection due to restriction in mobility of patients. Currently no specific antiviral therapy or vaccines are available. The challenge of the COVID-19 pandemic threatens to undermine, if not sink, actions to limit other dengue epidemics. Precise epidemiological and contact history-taking combined with due attention to false-positive dengue serology and the chance of co-infections are key devices for front line doctors to overcome this almost insurmountable challenge. Reliable, rapid point-of-care testing for dengue infection needs to be made accessible to screen patients with undifferentiated acute febrile illness to help segregate those who are covid positive, and those with dengue, despite their occasional deceptive clinical presentation.

6. Ethical Statement

This study was approved by Institutional Ethical committee by AJIMS & RC, Mangaluru.

7. Author's Contribution

All authors contributed to conception and design of the study and conducted the experiments, analyzed the data and also approved the final version of the manuscript and agree to be held accountable for the content.

8. Acknowledgement

None.

9. Conflicts of Interest

The authors declare that there are no conflicts of interest.

10. Source of Funding

None.

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