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Pattern of Dengue Virus Infection in Tertiary Care: A Seasonal Perspective

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ABSTRACT

In India and other tropical and subtropical countries, dengue is a serious public health issue, associated with substantial mortality and morbidity. A wide range of symptoms from minor clinical illnesses to severe infections can be caused by dengue fever, like dengue shock syndrome and dengue hemorrhagic fever. The need for early diagnosis to minimise mortality and for effective management of this illness. To study the serological profile of Dengue cases with association of platelet count and pattern of seasonal fluctuation in DENV infection, a hospital based prospective study was conducted in year 2022 from January to December in Department of Microbiology MSD ASMC and MBH Bahraich. Serum samples were collected from 3118 suspected dengue patients attended Indoor and Out-patient department of the hospital. Rapid immunochromatography test was performed to detect NS1 antigen IgM and IgG antibodies. Patient who tested positive, their platelet counts were recorded. In the course of the study, a total of 3118 samples were processed and 207 (6.63%) samples came out to be positive for dengue virus infection. The majority of those affected were men between the ages of 16-30. The best times of year to transmit dengue are during the monsoon and post-monsoon. Thrombocytopenia was noted in 119 (57.48%) of the 207 positive cases overall. In comparison to NS1 detection, thrombocytopenia was more frequently linked to the presence of IgM. Early identification and diagnosis are crucial for a successful outcome. A high degree of clinical suspicion combined with laboratory evidence, such as dengue serological testing and platelet counts aids in the timely identification of dengue.

INTRODUCTION

Dengue is a *Flavivirus* infection spread by mosquitoes, mainly by the *Aedes aegypti* mosquito, which is then followed by the *Aedes albopictus* mosquito and other *Aedes* species[1]. Dengue fever cases have sharply grown during the past several decades on a global scale. Around 40,000 people die each year from dengue virus (DENV) infections, which affect roughly 390 million people annually in more than 128 countries[2]. Four different DENV-1, DENV-2, DENV-3 and DENV-4 dengue virus serotypes are responsible for infection[3]. In Malaysia's Sarawak state, a fifth serotype (DENV-5) was discovered in October 2013 by isolation and gene sequence analysis[1]. The first clinical case report of dengue was reported from Philadelphia by Berjanin Rush, who coined the term "Break Bone fever" due to the symptoms of arthralgia and myalgia[4].

Dengue cases have increased as a result of increasing population, unchecked urbanisation, changes in the climate, and inadequate vector control. Dengue virus seasonal transmission is more prevalent during the monsoon and post-monsoon seasons of the year[5]. Since the genetic makeup of these serotypes varies, there is no protection against other serotypes after contracting one serotype[4]. High fever, headache, joint and muscle aches, retro-orbital discomfort and a rash resembling the measles are among the symptoms of dengue fever. Anorexia, nausea and vomiting, as well as pronounced cutaneous hypersensitivity, are other typical symptoms. Plasma leakage, hemoconcentration, hemorrhagic shock and multiple organ failure are symptoms of severe dengue, which can be fatal[6]. As of right now, there isn't a vaccination or very safe and effective antiviral medication to treat DENV infection. The mainstay of treatment for dengue infection remained fluid replacement therapy the administration of the antipyretic medication and other symptomatic therapies in the absence of approved therapy[7]. Rapid immunochromatographic approaches, qualitative and quantitative techniques like CAPTURE ELISA and Polymerase chain reaction are used in the laboratory to identify dengue specific IgM, IgG and Dengue NS1 Antigen. Dengue NS1 antigen detected in serum from the first day of infection. It is well established that a prompt and accurate diagnosis of DHF or DSS, followed by supportive care, lowers morbidity and mortality. The health care system in a developing nation like ours has to rely on quick and easy laboratory testing for diagnosis. In this context, the present study aimed to investigate the serological markers, platelets count of patients with dengue fever and seasonal variables that influenced dengue virus infection in our region.

MATERIALS AND METHODS

The present study was conducted at Department of Microbiology, Government Medical College and Hospital, Bahraich Uttar Pradesh during a period of one year from January 2022 to December 2022. The study was approved by the Institutional Ethics Committee. A total of 3118 serum samples from clinically suspected dengue cases attending our tertiary care hospital, were included in the study. Blood samples were collected in plain vacutainer and serum was separated by standard protocol. All samples were tested for Dengue IgM, IgG and NS1 antigen by rapid immunochromatographic method. The J.MITRA (dengue day 1 test) immunochromatographic card kit was used in this investigation. The antigen-antibody reaction is the basic principle of this immunochromatographic card test. The NS1 antigen and differential IgM and IgG antibodies in the serum sample were qualitatively detected using the immunochromatographic card test. The "C" (Control line) and "T" (Dengue NS1 antigen test line) are the two lines on the Dengue NS1 antigen device. Anti-dengue NS1 Ag was coated to the test line. The antigen-antibody complex was formed when the sample's Dengue NS1 antigen interacted with the anti-dengue NS1 gold colloid conjugate. As an antigen-antibody gold conjugate complex, this complex moved across the membrane to the test area, where it generated the noticeable pink coloured line at "T".

The three lines on the dengue IgM/IgG test device were "C" for the control line, "M" for the IgM test line, and "G" for the IgG test line. Anti-human IgM and IgG monoclonal antibodies are coated on the IgM and IgG test lines, respectively. The anti-human IgM and IgG antibodies coated on the membrane interacted with the sample's IgM and IgG antibodies, when the sample was introduced to the apparatus. A pale to dark red coloured band formed in the IgG or IgM area of the test device window as a result of the bound anti-dengue IgM or IgG capturing colloidal gold complexes containing dengue 1-4 antigen obtained from DENV culture. Platelet count was taken into consideration in the current study. If the platelet count is lesser than 100,000 per microliter of blood, it was considered thrombocytopenia. Platelets count was done in automated cell counter, Medonic M20.

RESULTS

Out of 3118 samples tested, 207 (6.63%) cases were positive for dengue by RICT and 2911 (93.36%) cases were negative. Out of 207 positive cases, 159 (76.81%) positive cases were of male and 48 (23.19%) positive cases were of female patients (Fig. 1).

Table 1 shows the age and gender wise distribution of dengue-positive patients. Young people
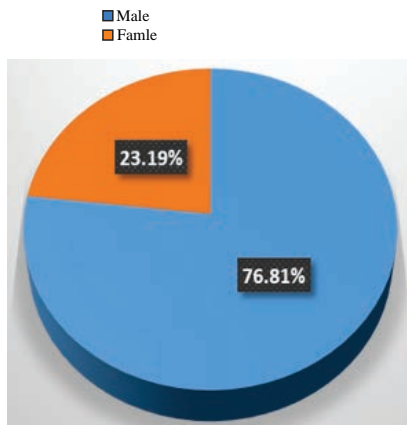
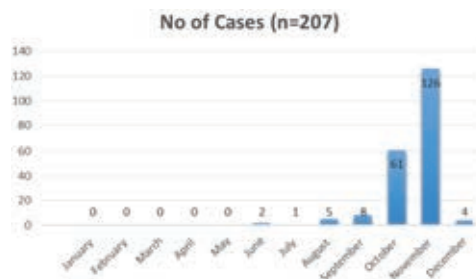Fig. 1: Dengue positive cases distributed with respect to gender (n=207)

Fig. 2: Month-wise distribution of Dengue positive cases (n=207)

Table 1: Age and sex wise distribution of dengue patients (n = 207)

Age group (yrs)	Male (%)	Female (%)	Total (%)
0-15	16	4	20
16-30	84	23	107
31-45	36	10	46
46-60	15	8	23
>60	8	3	11
Total	159	48	207

Table 2: Month wise distribution of dengue positive cases (n = 207)

Months	No of cases (n = 207)
January	0
February	0
March	0
April	0
May	0
June	2
July	1
August	5
September	8
October	61
November	126
December	4
Total	207

Table 3: Various serological marker's seropositivity for diagnosing of dengue infection

Parameter	No. of positive cases	Percentage
NS1 Ag	118	57
IgM	26	12.56
IgG	49	23.67
NS1 Ag, IgM, IgG	5	2.42
IgM and IgG	4	1.93
NS1 Ag and IgM	5	2.42
Total	207	100

Table 4: Comparing dengue serological markers with platelet counts <1,000,000

Parameters	Total	<1,00,000 platelet	Percentage
NS1 only	118	60	50.84
IgM only	26	22	84.61
IgG Only	49	30	61.22
NS1, IgM and IgG	5	2	40
IgM and IgG only	4	2	50
NS1 and IgM Only	5	3	60
Total	207	119	

in the age group of 16-30 years were affected maximum followed by the age group of 31-45. Month wise distribution of Dengue positive cases as shown in Table 2 and Fig. 2 revealed maximum positive cases were found in post monsoon seasons during the month of November (60.86%) followed by October (29.46%). Of the 207 positive cases by RICT, 118 cases (57%) were positive for NS1 Ag, 49 (23.67%) were positive for IGG Ab, 26 (12.56%) were positive for IgM Ab, all three NS1 Ag, IgM, IgG were detected in 5 (2.41%) cases (Table 3). Out of the 207 positive cases, 119 (57.48%) individuals had a platelet count of less than one lakh. As seen in Table 3, dengue IgM positive subjects had lower platelet counts than NS1 positive ones. Out of the 26 IgM positive cases in total, 22 (84.61%) individuals had thrombocytopenia.

DISCUSSIONS

Currently there is not a specific antiviral medication available to treat DENV infection, consequently, prompt diagnosis is still essential for treating dengue fever in order to minimise consequences and illness severity[8]. The seasonal fluctuation in DENV infection is examined in this study.

Out of the 3118 samples that were included in the current investigation, 207 samples were found to be positive for one or more serological parameters of dengue Infection. Thus, overall seroprevalence of dengue in our study is 6.63%. In contrast to our finding a higher prevalence (35.38%) was reported by Jadhav *et al*.[9] As shown in Fig. 1, gender wise distribution in our study shows that male is most commonly 159 (76.81%) affected than female 48 (23.18%). Male to female ratio among the seropositive cases was 3.3:1. According to a study done in Uttar Pradesh, India, in 2020 by Kumar *et al*. the proportion of men is higher than that of females which is consistent with our findings[10].

Nerawar *et al*.[11] and Atul *et al*.[12] revealed similar results, stating that males are more frequently affected than females in their studies. Males were more likely than females to be infected, which may have been brought on by more outdoor or occupational exposure. The age group between 16 and 30 years old in our study was most affected (51.69%), followed by 31-45

(22.22%). In the 16-30 age range, Patel *et al.*[3] also found the highest level of positivity (48.60%), which is strongly correlates to our finding. A retrospective study conducted in China in 2020 revealed that dengue was very prevalent in the 31-45 and 15-30 age groups, while it was less common in the <14 and >60 year age groups[13]. Graph 2 shows seasonal distribution of all dengue-positive cases. The graph clearly indicates that the monsoon and post-monsoon are the most favourable seasons for dengue transmission, as the number of cases starts rising from the month of July, and reaches its peak in the month of October to November. A study conducted by Soumya *et al.*[14] revealed the same finding. The majority of serologically positive cases in Northern India have been reported during the post-monsoon season. One possible explanation for this might be that the majority of people work in agriculture and *Aedes aegypti* breeds more during the pre-and post-monsoon seasons[15].

Out of the total 207 dengue seropositive cases, NS1 was positive in 118 (57%) cases, 49 (23.67%) cases were IGG positive, only 26 (12.56%) cases were positive for IGM and 5 (2.41%) cases were positive for combination of NS1, IgM and IgG. Similar findings are found in a study by Biradar *et al.*[16] from Karnataka, where 46.55% of cases tested positive for NS1, 6.89% for IgM, 24.13% for IgG antibody. According to a Study conducted by Trivedi *et al.*[17] the proportion of patients that tested positive for both antigen and antibody, both antibodies, or a combination of serological criteria was 24.13-22.43%, respectively.

Table 4 displays the comparison between the platelet count and a dengue-specific parameter. According to our finding thrombocytopenia was found in 57.48% (119/207) patients. Kalyanappa and Surekha in their study reported out of 262 dengue positive cases platelets count <100000 was found in 140 (53.43%) patients, which is comparable to our finding[18]. Out of 26 patients positive for Dengue IGM, 22 (84.61%) of them had platelet count less than one lacs. Thrombocytopenia was more common in IgM positive in comparision to NS1Ag positive. Patel *et al.*[3] also reported, when IgM antibodies are detected there is more consistent association with thrombocytopenia compaired to the detection of NS1 Ag. This may be caused by the duration of the illness; the longer the illness, the greater the affection of platelet count as a result of disease progression.

Public health strategies and vector control measures should be put into place as they are currently the only ways to reduce the disease because there is no known therapy for it. RICT provide the useful aids in early diagnosis of dengue, helps in lowering the inappropriate administration of antibiotics and antimalarials to patients suffering from febrile illnesses.

Limitation: The limitation of the present study was that ELISA and PCR test was not performed. The results of an immunochromatographic test, which identify Dengue NS1 antigen and DENV-specific IgM and IgG antibodies in the samples, must not be the only factor considered for diagnosing DENV infection.

CONCLUSION

Males in their youth have the highest prevalence of dengue in this geographic area after the rainy season. The NS 1 antigen detection test is very useful in the early diagnosis of dengue since it may diagnose the disease from the very first day. In addition, IgM and IgG serve as diagnostic markers in the latter stages of infection.

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