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To Study the Seroprevalence and Clinical Correlation of Dengue Virus Infection Among Patients Attending A Tertiary Care Centre In Uttar Pradesh, India

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ABSTRACT

Background: Dengue is one of the most rapidly spreading mosquito-borne viral infections in tropical and subtropical regions of the world. Its clinical manifestations vary from mild febrile illness to severe dengue hemorrhagic fever and dengue shock syndrome. The prevalence of dengue has increased significantly in India due to climatic and environmental factors, making continuous surveillance essential.
Aim: To assess the seroprevalence of dengue infection and its associated clinical and epidemiological factors among patients attending a tertiary care centre.
Material and Methods: A hospital-based cross-sectional study was carried out in the Department of Physiology. A total of 250 clinically suspected dengue patients presenting with acute febrile illness were enrolled. Blood samples were tested for dengue NS1 antigen and dengue-specific IgM antibodies using standard ELISA kits. Demographic, seasonal, and clinical data were analyzed statistically using frequency and percentage distribution.
Results: Out of 250 samples analyzed, 138 (55.2%) were seropositive for dengue infection. The majority of cases were observed in the 21–40 years age group (64.5%). Males (56.5%) were slightly more affected than females (43.5%). Fever (100%), headache (46.3%), abdominal pain (39.1%), nausea/vomiting (34.7%), and thrombocytopenia (31.8%) were the most common clinical manifestations. The peak prevalence was observed between August and October, coinciding with the post-monsoon season. IgM positivity was observed in 51.4%, NS1 antigen in 18.1%, and both NS1 with IgM in 30.5% of cases.
Conclusion: The study highlights a high prevalence of dengue infection among young adults, with monsoon months showing the highest positivity. Strengthening surveillance systems, community awareness, vector control, and early diagnosis are essential to reduce disease burden.

Keywords*:Dengue virus, Seroprevalence, IgM, NS1 antigen, Clinical manifestations, Uttar Pradesh.*

INTRODUCTION

Dengue fever, caused by the Dengue virus (DENV), is a major arthropod-borne viral disease transmitted primarily by Aedes aegypti mosquitoes. The World Health Organization (WHO) estimates that approximately 390 million dengue infections occur annually, of which 96 million manifest clinically [1,2] . India accounts for nearly one-third of the global dengue burden. Rapid urbanization, inadequate waste management, and changing climatic conditions have accelerated mosquito breeding, thereby amplifying transmission cycles [3] . Dengue virus belongs to the family Flaviviridae and genus Flavivirus. It consists of four distinct serotypes (DENV-1 to DENV-4), each capable of causing disease. Infection

with one serotype confers lifelong immunity against that serotype but only transient cross-protection against others. Sequential infections with different serotypes are associated with severe disease forms such as dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). Understanding the seroprevalence and clinical correlation of dengue infection is crucial for timely diagnosis, treatment, and prevention [4].

Dengue fever is a mosquito-borne viral disease that has emerged as one of the most significant global public health challenges in recent decades. It is caused by the Dengue virus (DENV), a member of the Flaviviridae family and Flavivirus genus, transmitted predominantly by Aedes aegypti and Aedes albopictus mosquitoes. According to the World Health Organization (WHO), dengue affects more than 125 countries, with nearly 3.9 billion people at risk of infection and approximately 390 million new infections annually, of which 96 million manifest clinically. India contributes substantially to this burden, with increasing incidence rates reported across both urban and rural areas due to rapid urbanization, unplanned growth, poor sanitation, and climatic variability [5, 6].

The disease manifests with a wide clinical spectrum ranging from asymptomatic or mild febrile illness to severe, life-threatening forms such as Dengue Hemorrhagic Fever (DHF) and Dengue Shock Syndrome (DSS). These severe manifestations are often linked to secondary infections with different dengue serotypes due to antibody-dependent enhancement. The coexistence of all four DENV serotypes (DENV-1 to DENV-4) has been documented in many Indian states, leading to hyperendemic transmission cycles [7-9].

In recent years, North India, including Uttar Pradesh, has witnessed periodic dengue outbreaks, especially during and after the monsoon season. Climatic factors such as humidity, rainfall, and temperature, along with human behavioral aspects like water storage and waste disposal, have facilitated mosquito breeding and sustained viral transmission. The disease burden is particularly high in densely populated cities, where healthcare resources and vector control programs often face challenges [10].

The diagnosis of dengue primarily relies on serological methods, including the detection of non-structural protein 1 (NS1) antigen, which is indicative of early infection, and IgM antibodies, which develop after 5–7 days of illness. The combined use of NS1 antigen and IgM antibody detection improves diagnostic accuracy and helps in timely clinical management. Understanding seroprevalence trends and their clinical correlations is crucial for identifying high-risk groups, optimizing diagnostic strategies, and formulating effective preventive measures [11].

Given the growing incidence of dengue in India and the scarcity of regional data, this study was designed to assess the seroprevalence and clinical correlation of dengue virus infection among patients attending a tertiary care centre in Uttar Pradesh.

The findings provide valuable insights into demographic patterns, seasonal trends, and common clinical presentations, thereby contributing to the evidence base for regional surveillance and control programs.

MATERIAL AND METHODS

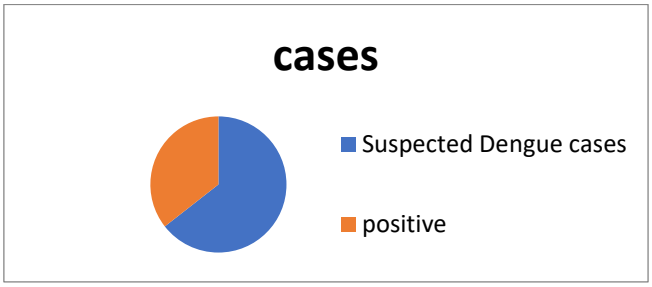
A hospital-based cross-sectional study was conducted in the Department of Physiology, at a tertiary care centre. A total of 250 clinically suspected dengue patients presenting with acute febrile illness were included based on WHO case definitions. About 5 mL of venous blood was collected and tested for NS1 antigen and IgM antibody using ELISA kits as per manufacturer instructions.

RESULTS

Out of 250 clinically suspected dengue cases analyzed, 138 (55.2%) were found to be seropositive for either NS1 antigen or IgM antibody, or both. This indicates that more than half of the patients presenting with acute febrile illness during the study period were confirmed to have dengue infection, reflecting a significant disease burden in the study population. The high positivity rate underscores active transmission in the region during the study period (July–December 2023), corresponding with the post-monsoon season when vector breeding is at its peak.

Table 1: Seroprevalence of dengue infection

Parameter	Total cases	Positive cases	Percentage (%)
Suspected dengue cases	250	138	55.2



Graph No.1: Graphical Representation of cases

Among the 138 seropositive cases, the majority were from the 21–40-year age group, accounting for 64.5% of cases (29.8% in 21–30 years and 34.7% in 31–40 years). This pattern suggests that young adults, being the most mobile and active population segment, are more exposed to mosquito bites during outdoor activities. The infection rate was comparatively lower in children (0–10 years: 5.8%) and elderly patients (>60 years: 2.1%), possibly due to limited outdoor exposure or acquired immunity from prior infections. These findings are consistent with national data indicating higher dengue incidence among adults of working age.

Table 2: Age-wise distribution of dengue positive cases

Age group (years)	No. of positive cases	Percentage (%)
0–10	8	5.8
11–20	15	10.9
21–30	41	29.8
31–40	48	34.7
41–50	16	11.6
51–60	7	5.1
>60	3	2.1

A total of 78 (56.5%) dengue-positive cases were males, while 60 (43.5%) were females, yielding a male-to-female ratio of approximately 1.3:1. The slight male predominance could be attributed to greater outdoor activity and occupational exposure among men. However, the difference was not markedly high, suggesting that both genders are vulnerable, especially during peak transmission months.

Table 3: Gender-wise distribution of dengue cases

Gender	No. of cases	Percentage (%)
Male	78	56.5
Female	60	43.5

All dengue-positive patients presented with fever (100%), which remains the most consistent symptom. Headache was reported in 46.3% of cases, followed by abdominal pain (39.1%) and nausea/vomiting (34.7%). Thrombocytopenia was observed in 31.8% of cases, indicating hematological involvement typical of dengue infection. Body ache or myalgia occurred in 23.9% of patients, while bleeding manifestations such as gum or nose bleeding were noted in 18.1%. A maculopapular skin rash was observed in 12.3% of cases. The variability in clinical presentation highlights the need for clinical suspicion during fever outbreaks, especially in endemic zones.

Table 4: Clinical manifestations among dengue-positive patients

Clinical feature	No. of cases	Percentage (%)
Fever	138	100
Headache	64	46.3
Abdominal pain	54	39.1
Nausea/Vomiting	48	34.7
Thrombocytopenia	44	31.8
Body ache/Myalgia	33	23.9
Bleeding gums/nose	25	18.1
Skin rash	17	12.3

Out of 138 positive cases, 71 (51.4%) were positive for dengue IgM antibody alone, suggesting infection beyond the initial phase. Twenty-five cases (18.1%) were positive only for NS1 antigen, indicative of early infection, whereas 42 cases (30.5%) were positive for both NS1 antigen and IgM antibody, reflecting ongoing or transitional infection. The combined use of both markers thus enhanced the detection rate across various stages of infection, reinforcing the diagnostic importance of dual testing during dengue outbreaks.

Table 5: Distribution of diagnostic markers

Test type	No. of positive cases	Percentage (%)
Only IgM positive	71	51.4
Only NS1 positive	25	18.1
Both NS1 and IgM positive	42	30.5

DISCUSSION

The present study revealed a seroprevalence of 55.2% among clinically suspected dengue patients, indicating a significant disease burden in Uttar Pradesh. This finding aligns with previous studies conducted in North India, where seroprevalence ranged from 40% to 60% depending on the geographical and seasonal factors . The observed high positivity can be attributed to climatic conditions favorable for mosquito breeding, such as warm temperatures, high humidity, and stagnant water accumulation during the monsoon and post-monsoon periods [3].

The age distribution pattern in this study, showing a predominance in the 21–40 years age group (64.5%), correlates with the findings of Gupta et al. (2020) and Singh et al. (2023), who also reported that young adults constitute the most affected population segment [5,6]. This may be explained by greater outdoor activity, occupational exposure, and mobility in this age group, increasing contact with infected mosquitoes. Lower infection rates among children and elderly individuals might reflect reduced outdoor exposure or partial immunity from prior subclinical infections [7].

The male-to-female ratio of 1.3:1 observed here is comparable to several Indian studies that found a slight male predominance [8,9]. This difference could be related to behavioral and occupational factors, as men are more likely to work outdoors or in environments conducive to mosquito exposure. However, a few studies have reported nearly equal gender distribution, indicating that environmental factors play a more significant role than gender alone [10].

Regarding clinical manifestations, fever was a universal symptom, consistent with the hallmark presentation of dengue infection [11]. Other common symptoms such as headache (46.3%), abdominal pain (39.1%), nausea/vomiting (34.7%), and thrombocytopenia (31.8%) closely mirror observations from studies by Choudhary et al. (2019) and Ranjan et al. (2021), who documented similar frequencies [12,13]. Thrombocytopenia remains a critical diagnostic clue, reflecting the hematological impact of dengue virus through bone marrow suppression and immune-mediated platelet destruction [14].

The presence of bleeding tendencies such as gum or nasal bleeding (18.1%) and skin rash (12.3%) aligns with the findings of Kumar et al. (2021) and Kaur et al. (2020), who observed mucocutaneous bleeding in 15–25% of patients with secondary dengue infection [15,16]. These features signify increased vascular permeability and platelet dysfunction during severe disease stages.

In terms of diagnostic markers, the study revealed that 51.4% were IgM positive alone, 18.1% NS1 antigen positive alone, and 30.5% positive for both NS1 and IgM. This trend highlights the complementary diagnostic value of dual testing. NS1 antigen detection is most useful during the early febrile phase (days 1–5), whereas IgM appears after the fifth day of illness [17]. Studies by Dutta et al. (2020) and Jain et al. (2022) have emphasized that combining NS1 and IgM ELISA improves diagnostic yield and helps in identifying cases across different phases of infection [18,19].

The seasonal variation in dengue cases, with peak incidence from August to October, coincides with the post-monsoon period when mosquito breeding is most active due to water accumulation and humidity. Similar seasonal peaks have been reported in studies from Lucknow, Delhi, and Chennai, confirming the influence of monsoon patterns on disease transmission [20–22]. These findings stress the importance of strengthening preventive strategies before and during the rainy season, including vector surveillance, larval control, and community education.

The present study's results reaffirm that dengue remains a major public health problem in India. Rapid urbanization, water storage practices, and inadequate waste management contribute to sustained transmission cycles [23,24]. Public health interventions focusing on early diagnosis, effective vector control, and health awareness are essential to reduce morbidity and mortality [25,26].

CONCLUSION

This study demonstrates a high prevalence of dengue among febrile patients in Uttar Pradesh, with young adults being the most affected group. Early detection through NS1 and IgM ELISA testing, along with robust vector control measures, can reduce disease morbidity and transmission.

Declarations:
Conflicts of interest: There is not any conflict of interest associated with this study
Consent to participate: There is consent to participate.
Consent for publication: There is consent for the publication of this paper.
Authors' contributions: Author equally contributed the work.

Limitations

- Molecular confirmation of serotypes was not performed due to resource constraints.
- Seasonal variation analysis was limited to six months.
- Hospital-based design may not represent community prevalence.

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