



A 5-Year Retrospective Study of Seroprevalence and Changing Trends of Dengue in a Tertiary Care Hospital in Western Uttar Pradesh

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Abstract: Background: Dengue fever, a viral illness transmitted primarily by *Aedes aegypti* and *Aedes albopictus* mosquitoes, has become a major public health concern in tropical and subtropical regions worldwide. **Aim:** This Study was conducted to know the Seroprevalence and Changing Trends of Dengue in a Tertiary Care teaching hospital Western Uttar Pradesh. **Material and methods:** A retrospective, observational study was conducted in Department of Microbiology. A total of 4073 non-repetitive blood samples were subjected to detection of NS1Ag, IgM and IgG by ELISA. Other demographic details were also noted. **Result:** A total of 4073 blood samples were analyzed. Out of which 1621(39.8%) samples were found to be positive for serological markers NS1Ag, IgM Ab, & both NS1Ag & IgM Ab. The seroprevalence of dengue rose from 40% in 2020 to 44.2 in 2021 and to 45.1% in 2022. In 2023, the positivity rate reached a record high of 53.6%. However, in 2024, despite a total of 1,156 cases, the positivity rate dropped significantly to 12.1%. Also, it was noted that post monsoon season is the peak reason for dengue every year. **Conclusion:** Acute dengue infections can also be detected with great efficacy and economy by utilizing both the NS1 antigen and IgM antibody tests. To control and prevent dengue from spreading, & emphasized the necessity of better vector control strategies and effective diagnostic methods.

Keywords: Dengue, NS1Ag, IgM ELISA, DHF, DSS



INTRODUCTION

Dengue fever, a viral illness is transmitted primarily by *Aedes aegypti* and *Aedes albopictus* mosquitoes, has become a major public health concern in tropical and subtropical regions worldwide. The global burden of dengue is increasing steadily, ranging from 58.4 to 96 million cases per year, with serious morbidity and mortality associated with severe manifestations, including dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS) [1].

The dengue virus has five distinct serotypes, meaning immunity to one serotype does not protect against the others. All five serotypes circulate in India, leading to periodic dengue outbreaks. [2]. Each dengue virus serotype provides lifelong immunity specific to that serotype, but only temporary immunity against the other serotypes. [3]

The disease has an estimated case fatality rate of 2.5% and is currently endemic in 128 countries, primarily within tropical and subtropical regions. Seasonal epidemic outbreaks are most prevalent during the rainy season, a period associated with increased breeding and activity of the primary vectors, such as *Aedes* mosquitoes. This seasonal rise in vector density significantly enhances the risk of transmission and contributes to the observed spike in infection rates during these periods.[4] Early diagnosis of dengue is essential to manage the disease properly and to prevent severe problems such as Dengue haemorrhagic fever (DHF) and Dengue shock syndrome (DSS). Early detection of the disease helps doctors to provide the right treatment and reduces the risk of serious illness or death.[5]

Several blood tests can detect viral infections, including hemagglutination inhibition, neutralization, indirect immunofluorescence, ELISA, complement fixation, and rapid immunochromatography tests. Among these, ELISA is the most commonly used for diagnosing dengue because it is accurate, easy to perform, and affordable.[6]

This study aims to investigate the seroprevalence and changing trends of dengue in a tertiary care hospital in Western Uttar Pradesh, over a five-year period. A retrospective analysis of data collected from 2020 to 2024 was conducted to evaluate the frequency of dengue cases, identify seasonal trends, and assess the demographic factors associated with the disease.

The study also aims to examine the evolution of dengue severity and the role of serological testing in diagnosing and managing the disease.

Materials and Methods

This was a retrospective, observational study conducted in the department of Microbiology over a five-year period (from January 2020 to December 2024). A total of 4073 non-repetitive blood samples were collected during the study period and sent to the microbiology laboratory to test for dengue virus infection by ELISA.

Inclusion Criteria:

- All patients presenting with clinically suspected dengue fever (fever, headache, retro-orbital pain, muscle and joint pain, rash, etc.) at the tertiary care hospital during the study period.
- Patients aged 1 year and above.

Exclusion Criteria:

- Patients with incomplete clinical or laboratory records.
- Cases diagnosed with other viral or bacterial infections showing similar symptoms.
- Patients who were not tested for dengue due to clinical or logistical reasons.
- Hemolyzed and lipemic samples were excluded from the study.

Venous blood samples collected from each patient, typically within the first few days of symptom onset for NS1 antigen and IgM testing, and during later stages (5-7 days post-symptom onset) for IgG testing. The blood was collected into sterile vacutainer tubes and submitted to the Microbiology Department. Blood samples were processed and stored at -20°C in the hospital laboratory as per standard operating procedures. The serum was separated from whole blood by centrifugation at 3000 rpm for 5 min. The separated serum samples were subjected to serological test. Dengue diagnosis was confirmed through serological tests conducted in the hospital's diagnostic laboratory. The following tests were used:

1. NS1 Antigen Test: To detect the presence of the dengue virus early in the infection (within the first 5 days).
2. IgM and IgG ELISA (Enzyme-Linked Immunosorbent Assay): To detect recent (IgM) and past (IgG) dengue virus infections. IgM antibodies typically indicate a recent infection, while IgG antibodies suggest previous exposure.

Ethical Considerations: The study was approved by the institutional ethics committee. All patient data were anonymized to ensure confidentiality and privacy. Consent for data use was waived due to the retrospective nature of the study.

Result

A total of 4073 blood samples were analyzed over a five-year period (2020-2024). The samples included both inpatients and outpatients who presented with clinically suspected dengue and underwent diagnostic testing for dengue infection. Out of which 1621(39.8%) samples were found to be positive by different serological markers like NS1Ag, IgM Ab, & both NS1Ag & IgM Ab. The seroprevalence of dengue rose from 40% in 2020 to 44.2 in 2021 and to 45.1% in 2022. In 2023, the positivity rate reached a record high of 53.6%. However, in 2024, despite a total of 1,156 cases, the positivity rate dropped to 12.1%. Table 1

Table 1: - Year-wise distribution of dengue seroprevalence rate

YEAR	TOTAL	NS1 ANTIGEN	IgM Ab	NS1Ag+IgMAB	Positivity (%)
2020	40	11	4	1	16(40)
2021	421	129	47	10	186(44.2)
2022	443	146	44	10	200(45.1)
2023	2013	897	57	125	1079(53.6)
2024	1156	98	32	10	140(12.1)
Grand Total	4073	1281	184	156	1621(39.8)

Table 2: - Seasonal variation of dengue month wise distribution of clinical diagnosed and serologically positive case from 2020 -2024

Month	Year				
	2020	2021	2022	2023	2024
January	0	3	2	10	2
February	0	4	3	15	3
March	0	2	1	12	1
April	0	6	5	14	4
May	0	8	9	41	6
June	0	9	11	55	7
July	0	7	8	80	5
August	3	41	48	243	34
September	8	9	11	144	38
October	2	49	51	255	8
November	2	43	45	180	31
December	1	5	6	30	11
Total	16	186	200	1079	150

The trends of dengue infection over a five-year period is presented in Table 2. After June and July, there is noticeable rise in dengue cases, with the peak occurring after the rainy season (September-November). There is a reduction in reported cases between January and May.

Table 3: - Gender wise distribution of dengue cases from 2020-2024

YEAR	MALE	FEMALE
2020	10(0.9%)	6(1.2%)
2021	120(10.5%)	66(13.5%)
2022	127(11.1%)	73(14.9%)
2023	780(68.3%)	298(60.9)
2024	105(9.2%)	46(9.4%)
TOTAL	1142(70%)	489(30%)

There were 489(30%) females and 1142(30%) males among the 1621 dengue-positive cases. According to Table 3,

men are therefore more impacted than women. The p -value is .040689. The result is significant at $p < .05$

DISCUSSION

Giant congenital melanocytic nevi (GCMN) represent a Dengue fever is an acute viral illness that has become a significant public health concern in tropical and subtropical areas worldwide. In India, the earliest recorded case of a dengue-like illness was in Madras (Chennai) in 1780. The first confirmed outbreak of dengue fever occurred in Calcutta (Kolkata) in 1963-1964, leading to 200 deaths.[7,8] A major epidemic of dengue fever and dengue hemorrhagic fever (DHF) took place in Delhi in 1996, with over 10,000 cases and 423 fatalities.[9] Dengue is primarily considered an urban disease, but its nature has evolved over time. The rise in travel between neighboring states for work and business could be a key factor contributing to the rapid spread of the disease to new regions. A laboratory diagnosis of dengue infection is essential because the disease's varied presentation can make an accurate clinical diagnosis challenging. Additionally, unplanned urbanization and inadequate sanitation facilities provide mosquitoes with breeding grounds. In the majority of laboratories, assays based on the detection of NS1Ag or IgM antibody are frequently employed.

As of right now, dengue infection has no known cure. Early diagnosis is important for managing the disease and applying control measures. The first dengue vaccine, Dengvaxia (CYD-TDV) by Sanofi Pasteur, was approved in Mexico in December 2015 and is available in some countries. Other prevention methods focus on reducing mosquito breeding sites and minimizing contact with mosquito bites.

It may not be safe for those who have never had dengue, so it is only advised for those who have had the illness before. Reducing standing water and other mosquito breeding grounds is crucial to preventing dengue. Additionally, people can prevent mosquito bites by sleeping under mosquito nets, wearing long sleeves, and applying insect repellent.

In the current study, A total of 4073 blood samples were analyzed over a five-year period (2020-2025), out of which 1621(39.8%) samples were found to be positive by different serological markers like NS1Ag, IgM Ab, & both NS1Ag & IgM Ab. The seroprevalence of dengue rose 40% in 2020 to 44.2 in 2021 and 45.1% in 2022. In 2023, the positivity rate reached a record high of 53.6%. However, in 2024, despite a total of 1156 cases, the positivity rate dropped significantly to 12.1%. A study by TK Raj et al showed that of the 1194 samples tested, 258 (21.6%) were serologically positive for NS1 Ag, 142 (11.89%) and IgM Ab 116 (9.71%), indicating that the infection was primary. The overall prevalence of dengue was 21.6 % during the period of study. In a study by

Ashwini et al, the highest positive detection rates were found for NS1 and IgM (97.8 %). In this study, a total of 94 cases were confirmed from 112 clinically suspected cases, with a positivity rate of 80.9% and IgM of 47.9 %.[10]

In the present study, out of total positive cases of dengue infection 1621(39.8%) samples, 184(11.4%) were IgM positive which indicated recent dengue infection. Thirty-three (30%) of the 108 cases in a study by Sailaja et al. in Andhra Pradesh tested positive for IgM antibody between the fifth and tenth day of fever. [11] Out of 1637 samples tested for dengue infections in a study by Neralwar A et al. in Raipur, 161 (29 percent) tested positive for NS1, 83, 1471 (15 percent) tested positive for both NS1 and IgM Ab, and 294 (54 percent) tested positive for IgM Ab.[12]

In the present study, out of positive cases of dengue infection 1621(39.8%) samples, 1281() were NS1Ag positive. In a study by Fauziah Md Kassim et al, out of the 208 sera tested, 69.2% (144/208) were positive for dengue virus infection. Of these (32.2%) samples (67/208) were found positive for dengue NS1 antigen only. [13] Datta et. al had reported NS1Ag positivity which varied from 71.42% to 28.4% in acute and early convalescent sera, conversely IgM detection rate was 93.61% and 6.38% in early convalescent and acute phase sere.[14] In a study conducted in Angul district of Odisha by Dharitri Mahapatra et al out of the 1020 blood samples screened, 513 (50.2%) were positive for dengue NS1 Ag.[15]

To implement public health control programmers, it is nice to understand the male female difference in dengue infection rate and the complications of the disease. We found that men were more affected women, constituting nearly two-thirds of the total cases. In this study done by TK Raji et al showed higher prevalence of dengue infection was noted among males (57.36%) than females (42.64%).[10] In another study by Hari. P Nepal et al the highest number of dengue cases was observed in the 21-30 years age group with greater predilection in males than in females. In this study 62% of positive cases were males and 38% were females. This finding indirectly indicates the importance of workplace and travel on dengue incidence, which needs further exploration.[16]

The present study showed that the post-monsoon season (August-November) is peak season for dengue cases to occur. A study done by Neralwar et al also showed similar finding.[10] This should be considered

to create a prevalence strategy to minimize dengue infection. Testing for NS1Ag and IgM could significantly improve diagnostic sensitivity, which helps in the timely management of dengue infections. Further studies should be done to determine the prevalence of serotypes and genotypes in this area to prevent impending outbreaks due to dengue hemorrhagic fever. This indicates an increase in the breeding places for the vectors during the post-monsoon period.

CONCLUSION

Dengue fever primarily affects active adult males. The rapid urbanization of impacted areas and the surge in mosquito vectors during the monsoon and post-monsoon seasons are possibly responsible for the increase in cases. Acute dengue infections can also be detected with great efficacy and economy by utilizing both the NS1 antigen and IgM antibody tests. To control and prevent dengue from spreading, & emphasized the necessity of better vector control strategies and effective diagnostic methods.

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