Section: Pathology

Original Research Article

SERO-PREVALENCE OF DENGUE AMONG PATIENTS ATTENDING A DIAGNOSTIC LABORATORY

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ABSTRACT

Background: Dengue is a major mosquito-borne viral infection and a significant public health problem in India, with frequent outbreaks reported from urban regions. Early laboratory diagnosis using serological markers is essential for timely clinical management and surveillance. **Objectives:** To determine the seroprevalence of dengue infection and analyze the serological patterns among suspected dengue cases tested at a diagnostic laboratory in Hyderabad.

Materials and Methods: This laboratory-based cross-sectional study was conducted between August and October 2019. A total of 733 serum samples from clinically suspected dengue cases were tested for dengue NS1 antigen and dengue-specific IgM and IgG antibodies using ELISA (Panbio Diagnostics). Based on the combination of serological markers, cases were categorized into seven groups. Primary and secondary dengue infections were differentiated using the IgM:IgG index value ratio, with a ratio <1.78 indicating secondary infection.

Results: Out of 733 samples, 299 (40%) were confirmed as dengue positive. NS1 antigen alone was detected in 88 cases (29.4%), while IgM antibody alone was detected in 84 cases (28%). Combined IgM and IgG positivity was observed in 30 cases (10%). The highest number of dengue-positive cases was seen in the 21–30-year age group (35%), with a clear male predominance (70%). Secondary dengue infection was identified in 15 (50%) of the IgM- and IgG-positive cases.

Conclusion: The study demonstrates a high seroprevalence of dengue among suspected cases in Hyderabad, particularly among young adults and males. ELISA-based detection of NS1 antigen and dengue-specific antibodies remains a reliable and practical approach for early diagnosis and surveillance in routine laboratory practice.

Keywords: Dengue, Seroprevalence, NS1 antigen, IgM, IgG, ELISA, Hyderabad.

INTRODUCTION

Dengue is a rapidly emerging arboviral disease of major public health importance in tropical and subtropical regions, including India. Transmitted primarily by Aedes aegypti mosquitoes, dengue infection presents with a wide clinical spectrum ranging from asymptomatic illness and self-limiting febrile disease to severe dengue with plasma leakage, hemorrhage, and organ involvement. India contributes substantially to the global dengue burden, with frequent outbreaks reported from urban and semi-urban areas, particularly during the monsoon and post-monsoon seasons.[1,2]

Serological testing plays a pivotal role in the diagnosis and surveillance of dengue infection. Detection of dengue non-structural protein 1 (NS1) antigen allows early diagnosis during the acute phase, while dengue-specific immunoglobulin M (IgM) and immunoglobulin G (IgG) antibodies help identify recent and past infections, respectively. Laboratory-based seroprevalence studies provide valuable

insights into the magnitude of dengue transmission, temporal trends, and population groups at higher risk, thereby supporting clinical decision-making and public health planning.[3,4,5]

Hyderabad, a major metropolitan city in southern India, has witnessed recurrent dengue outbreaks over the past decade, driven by rapid urbanization, high population density, and favorable climatic conditions for vector breeding. Despite this, local laboratory-based data on dengue seroprevalence remain limited. Understanding the serological pattern of dengue among patients presenting for diagnostic testing can help identify seasonal trends, burden of acute infection, and the extent of prior exposure in the community.

Therefore, this study aimed to determine the seroprevalence of dengue among samples tested at a diagnostic laboratory in Hyderabad and to analyze the distribution of serological markers across different demographic and clinical characteristics. Such data may contribute to improved disease surveillance, early diagnosis, and targeted preventive strategies in dengue-endemic regions.

MATERIALS AND METHODS

Study period and sample collection

This laboratory-based descriptive study was conducted between **August and October 2019**. A total of **733 serum samples** were collected from patients with **clinically suspected dengue infection** who were referred for diagnostic testing during the study period.

Serological testing

Serological investigations for dengue were performed as requested by the treating physicians. All samples were tested for **dengue-specific NS1 antigen** and **dengue IgM and IgG antibodies** using **enzyme-linked immunosorbent assay (ELISA)** kits (Panbio Diagnostics, Australia), following the manufacturer's instructions.

Classification of serological results

Based on the combination of serological markers detected, samples were categorized as follows:

- **Category 1:** NS1 antigen only
- **Category 2:** IgM antibody only
- **Category 3:** NS1 antigen + IgM and IgG antibodies
- **Category 4:** IgM and IgG antibodies
- **Category 5:** NS1 antigen + IgM antibodies
- **Category 6:** NS1 antigen + IgG antibodies
- **Category 7:** IgG antibody only

Interpretation of primary and secondary dengue infection

Dengue infection was classified as **primary or secondary** based on the **IgM to IgG index value ratio**.

- A ratio ≥ **1.78** was considered indicative of **primary dengue infection**.
- A ratio < **1.78** was considered indicative of **secondary dengue infection**, as described previously.

RESULTS

Table 1: Seroprevalence of Dengue among Suspected Cases (n = 733)

Dengue status	Number of samples	Percentage (%)
Dengue positive	299	40.0
Dengue negative	437	60.0
Total	**733**	**100**

Out of a total of 733 serum samples received from clinically suspected dengue cases, 299 samples (40%) were confirmed positive for dengue infection by serological testing. The remaining 437 samples (60%) were negative for dengue markers.

Table 2: Serological Pattern among Dengue-Positive Cases (n = 299)

Category	Serological markers detected	Number of cases	Percentage (%)	Interpretation
1	NS1 antigen only	88	29.4	Early primary infection
2	IgM antibody only	84	28.0	Late primary infection
3	NS1 antigen + IgM + IgG	5	1.6	Late secondary infection
4	IgM + IgG antibodies	30	10.0	Late secondary infection
5	NS1 antigen + IgM	28	9.3	Late primary infection
6	NS1 antigen + IgG	5	1.6	Early secondary infection
7	IgG antibody only	59	19.7	Past dengue infection
Total	—	**299**	**100**	—

Analysis of serological markers among the 299 dengue-positive cases showed varied patterns of antigen and antibody detection. The most frequent finding was NS1 antigen positivity alone, observed in 88 cases (29.4%), indicating early primary dengue infection. This was followed by IgM antibody positivity alone in 84 cases (28%), suggestive of late primary infection.

Combined detection of IgM and IgG antibodies, representing late secondary infection, was noted in 30 cases (10%). NS1 antigen with IgM antibodies was detected in 28 cases (9.3%), while NS1 antigen with both IgM and IgG antibodies and NS1 antigen with IgG antibodies were each observed in 5 cases (1.6%). IgG antibody alone, indicating past dengue infection, was found in 59 cases (19.7%).

Table 3: Age-wise Distribution of Dengue Cases

Age group (years)	Total suspected cases	Dengue positive cases	Percentage among positives (%)
0–10	140	51	17.0
11–20	80	32	10.7
21–30	198	105	35.0
31–40	141	57	19.0
41–50	66	26	8.6
51–60	44	10	3.3
>60	64	18	6.0
Total	**733**	**299**	**100**

Dengue infection was detected across all age groups. The 21–30-year age group showed the highest number of dengue-positive cases, accounting for 105 cases (35%). This was followed by the 31–40-year age group with 57 cases (19%) and the 0–10-year age group with 51 cases (17%). A comparatively lower proportion of cases was observed in individuals aged above 50 years.

Table 4: Secondary Dengue Infection Based on IgM:IgG Ratio

Parameter	Number of cases	Percentage (%)
Total IgM + IgG positive cases	30	100
Secondary dengue (IgM:IgG < 1.78)	15	50
Primary dengue (IgM:IgG ≥ 1.78)	15	50

Among the cases positive for both IgM and IgG antibodies, secondary dengue infection, defined by an IgM:IgG ratio < 1.78, was identified in 15 out of 30 cases (50%), while the remaining cases were classified as primary dengue infection.

DISCUSSION

The present laboratory-based study documents a dengue seroprevalence of 40% among clinically suspected cases tested during the peak transmission period, confirming the continued public-health burden of dengue in urban India. Recent national and regional studies published after 2020 have similarly reported substantial dengue positivity rates during monsoon and post-monsoon seasons, reinforcing the endemic and seasonal nature of dengue transmission in metropolitan settings (WHO, 2021; NVBDCP, 2021).[2,3]

A notable finding of this study was the high proportion of NS1 antigen–positive cases, either alone or in combination with antibodies, suggesting that many patients presented during the early phase of infection. This observation is consistent with recent reports emphasizing the diagnostic value of NS1 antigen detection for early dengue diagnosis, particularly within the first week of illness (WHO, 2021; Wilder-Smith et al., 2020).[2,6] Contemporary studies from India have highlighted that combining NS1 antigen with IgM and IgG antibody testing significantly improves diagnostic sensitivity across different stages of infection (Kumar et al., 2022; Bhat et al., 2023).[7,8]

The predominance of dengue infection among male patients observed in the present study aligns with findings from several Indian studies published since 2020 (Sharma et al., 2021; Patel et al., 2023).[9,10] Male predominance has been consistently attributed to increased outdoor exposure, occupational activities, and behavioural factors that enhance contact with Aedes mosquito breeding environments. Recent urban epidemiological analyses have continued to support this gender-based difference in dengue risk (Shepard et al., 2021).[3]

Age-wise distribution revealed the highest dengue positivity in the 21–30-year age group, followed by individuals aged 31–40 years. Similar age-related trends have been reported in post-2020 studies, where young adults constituted the most affected group (Kaur et al., 2021; Roy et al., 2024).[11,12] This pattern is of concern as it affects the economically productive population and has implications for workforce productivity and healthcare utilization during outbreaks.

The detection of secondary dengue infection in a substantial proportion of IgM- and IgG-positive cases is clinically important. Recent immunological and clinical studies continue to demonstrate that secondary dengue infections are associated with an increased risk of severe disease due to antibody-dependent enhancement (Katzelnick et al., 2020; WHO, 2023).[13,2] The use of IgM:IgG ratio-based interpretation, as applied in the present study, remains a recommended and practical approach in routine diagnostic laboratories where molecular testing may not be universally available (WHO, 2021; Bhat et al., 2023).[8]

Overall, the findings of this study support recent literature emphasizing the role of ELISA-based serological assays as effective tools for dengue surveillance and diagnosis in routine laboratory practice (WHO, 2021; Kumar et al., 2022).[7] Laboratory-based seroprevalence data contribute valuable insights into local transmission dynamics and can assist public-health authorities in strengthening vector-control strategies, outbreak preparedness, and early clinical management.

Strengths and Limitations

The strengths of the study include a relatively large sample size and the use of standardized ELISA assays for dengue diagnosis. However, being a laboratory-based study, the findings may not reflect

true community-level prevalence. Additionally, molecular confirmation and serotype identification were not performed, which could have provided further epidemiological insights.

CONCLUSION

In conclusion, the study demonstrates a considerable burden of dengue infection in Hyderabad, with a predominance of early and primary infections among young adults and males, emphasizing the need for sustained surveillance and early diagnostic strategies.

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