A CROSS-SECTIONAL STUDY OF THE CORRELATION BETWEEN DENGUE SEROLOGICAL MARKERS AND PLATELET COUNT IN THE NALGONDA REGION.

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ABSTRACT

Background:

Dengue virus infection has emerged as a significant public health concern in recent decades. Early diagnosis is vital for reducing morbidity and mortality. Laboratory evaluations, including dengue serological markers and platelet counts, play a crucial role in diagnosis and predicting disease progression. This study aims to evaluate the utility of dengue-specific serological markers and explore their correlation with platelet counts in dengue-positive cases.

Materials and Methods:

A cross-sectional prospective study was conducted at a tertiary healthcare center in Nalgonda from December 2022 to May 2023. Clinically suspected dengue cases from outpatient, emergency, and inpatient departments were included. Dengue-specific serological markers (NS1, IgM) were tested via ELISA and correlated with platelet counts using the Chi-square test. Data analysis was performed using Epi Info and MS Excel.

Results:

Out of 2180 clinically suspected cases, 183 (8.39%) were dengue-positive. Among them, 112 (61.2%) were male and 71 (38.8%) were female. Thrombocytopenia (platelet count <100,000/mm³) was observed in 98 cases (53.5%). Thrombocytopenia was most prevalent among IgM-positive individuals (32.65%) and those positive for NS1 antigen alone (28.57%). A statistically significant association was observed between the presence of dengue serological markers and low platelet counts ($p < 0.05$), indicating a positive correlation between serological positivity and thrombocytopenia.

Conclusion:

Thrombocytopenia is a common finding in dengue-positive cases, especially during the early and acute phases of infection indicated by NS1 and IgM positivity. The correlation between serological markers and platelet count supports their combined use for early diagnosis and prognosis, potentially improving clinical outcomes.

Recommendations:

Routine use of NS1, IgM, and platelet count assessments is advised for timely diagnosis and disease monitoring in dengue-endemic regions.

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Introduction

Dengue fever is a viral disease transmitted by mosquitoes and has emerged as a significant public health concern in tropical and subtropical areas, particularly in countries like India [1]. The disease presents with a wide spectrum of clinical manifestations, ranging from mild febrile illness to more severe forms such as dengue hemorrhagic fever and dengue shock syndrome, making timely diagnosis and management essential for reducing morbidity and mortality [2,3]. However, the early phase of dengue infection often mimics other febrile illnesses, which complicates clinical diagnosis and delays intervention [2].

Laboratory investigations have thus become indispensable in confirming dengue infection,

tracking disease progression, and aiding clinical decisions. Among the diagnostic tools available, dengue-specific serological markers such as Non-Structural Protein 1 (NS1) antigen and Immunoglobulin M (IgM) antibodies, along with hematological parameters like platelet count, are particularly valuable [4,5]. NS1 antigen is detectable early in the viremic phase of infection and is associated with disease severity, especially when present at high levels [4]. IgM antibodies typically appear a few days later and offer a complementary diagnostic window [6].

Thrombocytopenia, or a significant drop in platelet count, is another hallmark of dengue infection and frequently correlates with disease severity, often serving as a prognostic indicator [3,5]. While the diagnostic accuracy of NS1-based tests has been evaluated and proven useful for early detection [6,7], the relationship between specific serological profiles and the extent of thrombocytopenia remains underexplored, particularly in regional and resource-limited settings. This study aims to investigate these correlations to improve early diagnosis, risk stratification, and clinical management in dengue-endemic areas.

This study aims to investigate the correlation between dengue serological markers (NS1, IgM) and platelet count among clinically suspected dengue cases in the Nalgonda region. Understanding this correlation could aid in early disease identification, risk stratification, and improved clinical outcomes in affected populations.

Materials and Methods

Study Design and Setting

This was a cross-sectional prospective study conducted at Government Medical College and General Hospital, Nalgonda, Telangana, India. The hospital is a tertiary healthcare center serving a large population from rural and semi-urban areas of the Nalgonda district and surrounding regions. It offers comprehensive diagnostic, treatment, and laboratory services, including advanced microbiology and hematology testing, making it a suitable setting for this study. The study was conducted over a six-month period from December 2022 to May 2023.

Study Population and Sample Size

The study included all patients clinically suspected of having dengue fever and presenting with febrile illness of infectious origin. A total of 2180 blood samples were collected from such patients.

Inclusion Criteria

Patients presenting with clinical symptoms suggestive of dengue fever or other febrile illnesses of infectious etiology.

Exclusion Criteria

Patients with a confirmed diagnosis of other non-dengue febrile illnesses.

Sample Collection and Laboratory Analysis

Approximately 5 ml of venous blood was collected from each suspected case. Serum was separated and tested for dengue NS1 antigen and IgM antibodies using the ELISA method, and IgG antibodies were tested using a rapid diagnostic card test. Additionally, 2 ml of EDTA-anticoagulated blood was collected for platelet count, which was assessed using an automated hematology analyzer.

Dengue serological testing was performed using "Standard E" ELISA kits, which have a reported sensitivity of 99.04% and specificity of 99.06%. Results were interpreted within two hours of sample processing. Based on the manufacturer's guidelines, NS1 antigen results were categorized as:

Non-reactive: ratio < 9
Equivocal: ratio 9–11
Reactive: ratio > 11
Platelet counts were classified as:
Normal: 150,000–450,000 cells/mm³
Thrombocytopenia (DHF): <100,000 cells/mm³

Bias

To minimize selection bias, all clinically suspected dengue cases presenting during the study period were consecutively included regardless of age, gender, or socioeconomic status. Diagnostic bias was reduced by using standardized commercial ELISA kits (Standard E) with high sensitivity and specificity. Laboratory personnel were blinded to clinical history while processing serological and platelet count tests. Data entry was double-checked to prevent transcription errors and analytical bias.

Statistical Analysis

Data were entered in Microsoft Excel and analyzed using Epi Info statistical software. The Chi-square test was employed to evaluate the association between dengue serological markers and platelet count. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Ethics Committee of Government Medical College, Nalgonda, Telangana. Informed written consent was obtained from all participants or their legal guardians before sample collection. Confidentiality and anonymity of patient data were strictly maintained throughout the study in accordance with ethical research practices.

Results

A total of 2180 blood samples were collected from patients presenting with febrile illnesses. Of these, 183 samples (8.39%) tested positive for dengue infection based on serological marker analysis. Among the 183 confirmed dengue-positive cases, 92 patients (50.27%) exhibited thrombocytopenia, defined as a platelet count of less than 100,000 cells/mm³.

Participant Flow

A total of 2180 patients presenting with febrile illness were screened for suspected dengue infection during the study period. All met the inclusion criteria, and no cases were excluded. Blood samples were collected from all eligible individuals for dengue serological testing (NS1, IgM, IgG) and platelet count analysis. Of these, 183 samples (8.39%) tested positive for dengue serological markers and were included in the final analysis. Among the 183 confirmed dengue-positive cases, 92 patients (50.27%) exhibited thrombocytopenia, defined as a platelet count of less than 100,000 cells/mm³. As this was a cross-sectional study, there was no follow-up period, and complete data were available for all 183 confirmed cases.

Table 1. Platelet Count in Dengue-Positive Cases

Demographic Characteristics of Dengue-Positive Cases

Among the 183 dengue-positive patients, 112 (61.2%) were male and 71 (38.8%) were female, indicating a higher prevalence of infection in males.

Serological Marker Distribution

Based on the interpretation of serological markers (NS1 antigen, IgM, and IgG antibodies), the majority of dengue cases were in the mid-phase of active infection. Specifically, 66 patients (36%) were IgM-positive and NS1-negative, indicating the early recovery phase.

Thrombocytopenia in Dengue-Positive Patients

Platelet count distribution among dengue-positive cases is detailed in Table 1. Thrombocytopenia (platelet count < 100,000 cells/mm³) was observed in 98 cases (53.5%), whereas 85 cases (46.5%) had normal platelet counts. Further subgroup analysis revealed that thrombocytopenia was most commonly observed in the IgM-positive group (32.65%), followed by cases with NS1 antigen positivity alone (28.57%). In contrast, patients who were positive for IgG antibodies, indicative of past or late-phase infection, showed mostly normal platelet counts.

A Chi-square test was conducted to assess the association between dengue serological markers and thrombocytopenia. The analysis revealed a statistically significant association ($\chi^2 = 9.84$, df = 2, p = 0.0072), indicating that patients who tested positive for NS1 or IgM were significantly more likely to exhibit platelet counts below 100,000/mm³ compared to those with IgG positivity or other serological profiles.

Interpretation of Dengue Serological Markers

The serological profiles and their clinical interpretations are summarized in Table 2.

Platelet Count	No. of Cases	Percentage
< 100,000 / mm³	98	53.5%
> 100,000 / mm³	85	46.5%
Total	**183**	**100%**

Table 2. Interpretation of Dengue Serological Marker Combinations

S. No.	NS1 Ag	IgM Ab	IgG Ab	Interpretation
1	+	–	–	Early infection
2	+	+	–	Acute phase of infection
3	–	+	–	Mid-phase of active infection (early recovery)
4	–	+	+	Late phase of active infection
5	–	–	+	Past infection / recovered
6	+	+/–	+	Secondary or current active infection
7	–	–	–	No infection

Discussion

The current study investigated the relationship between dengue-specific serological markers and platelet counts among clinically suspected dengue cases in the Nalgonda region. Of the 2180 febrile cases, 183 (8.39%) were confirmed dengue-positive, with a higher prevalence among males (61.2%) than females (38.8%), which aligns with previous reports suggesting increased male vulnerability due to occupational and outdoor exposure.

Thrombocytopenia was present in 53.5% of dengue-positive cases, supporting findings by Jyothi and Metri , who demonstrated a significant association between dengue serological markers and platelet counts during acute infection phases [8]. Similarly, Gohel study emphasized the diagnostic value of combining platelet count analysis with serological methods, particularly NS1 and IgM detection, for accurate early diagnosis [9]. In this study, thrombocytopenia was more frequent in patients positive for either IgM (32.65%) or NS1 (28.57%), highlighting the active phase of infection. This observation corresponds with Kulkarni study, who reported that NS1 antigen is highly relevant in early-phase diagnosis and often linked with low platelet levels [10].

Furthermore, this data showed that IgG-positive individuals—indicative of late or past infection—mostly maintained normal platelet counts. This supports the findings of Sontakke study, who observed a lower severity of thrombocytopenia in

late-phase or convalescent dengue cases [11]. Vikhe study also noted that platelet counts at presentation are valuable in predicting dengue severity, aiding in clinical decision-making [12].

On a molecular level, the study by Hottz et al. revealed that dengue virus infection triggers platelet activation and disrupts mitochondrial function, ultimately causing cell death through pathways involving DC-SIGN receptors and caspase enzymes. This may explain the pronounced thrombocytopenia during the early viremic stages [13].

Generalizability

The findings of this study are primarily applicable to tertiary care settings in dengue-endemic regions like Nalgonda. While the results provide valuable insights, generalizability may be limited due to the single-center design. Multicentric studies across varied geographical and demographic populations are recommended to strengthen external validity and broader applicability of the results.

Conclusion

This study highlights the significant correlation between dengue serological markers and platelet count, reinforcing their combined utility in the early diagnosis and prognosis of dengue infection. Among the 183 dengue-positive cases, over half exhibited thrombocytopenia, particularly in those positive for IgM or NS1 antigens, indicating active or early phases of infection. In contrast, IgG-positive cases mostly maintained normal platelet counts, suggesting recovery or past infection. These

findings emphasize the diagnostic value of serological testing alongside platelet monitoring in managing dengue cases effectively. Early detection through this integrated approach can help guide timely clinical interventions, reduce complications, and improve patient outcomes, especially in endemic regions like Nalgonda.

Limitations

The study was limited by its single-center design, restricting generalizability. It did not include longitudinal follow-up to assess platelet trends over time. Additionally, other co-infections and clinical severity grading were not evaluated, which may influence interpretation.

Recommendations

Based on the study findings, it is recommended that all suspected dengue cases undergo early screening using NS1 antigen and IgM antibody tests along with routine platelet count monitoring. This combined approach facilitates timely diagnosis, risk stratification, and clinical decision-making. Health facilities, especially in endemic regions, should strengthen laboratory capabilities for serological testing and hematological assessments. Public health awareness campaigns should emphasize the importance of early testing and follow-up. Further multicentric and longitudinal studies are needed to validate the correlation between serological markers and disease severity. Integration of these markers into standard dengue management protocols can improve patient outcomes and reduce complications.

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List of Abbreviations

DENV – Dengue Virus
NS1 – Non-Structural Protein 1
IgM – Immunoglobulin M
IgG – Immunoglobulin G
DHF – Dengue Hemorrhagic Fever
ELISA – Enzyme-Linked Immunosorbent Assay
EDTA – Ethylenediaminetetraacetic Acid
OPD – Outpatient Department
Epi Info – Epidemiological Information Software
SD – Standard Deviation
WHO – World Health Organization

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Author declares no conflict of interest.

Data availability
Data Available

Author's contribution

BAR-Concept and design of the study, results interpretation, review of literature and preparing first draft of manuscript. Statistical analysis and interpretation, revision of manuscript.**DS**-Concept and design of the study, results interpretation, review of literature and preparing first draft of manuscript, revision of manuscript.**AS**-Review of literature and preparing first draft of manuscript. Statistical analysis and interpretation.

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