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Correlation study between platelet count, leukocyte count, and duration of hospital stay in dengue fever with thrombocytopenia

Mr. Shivam Kumar[1], Dr Richa Sharma[2], Dr Mansi[2]

[1]Department of Pathology, Santosh deemed to be University, Ghaziabad, Uttar Pradesh, India.

[2]Assistant Professor, Department of Pathology, Santosh deemed to be University, Uttar Pradesh, Ghaziabad, India.

Corresponding Author:

Mr. Shivam Kumar

shivamkumarmahur@gmail.com

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Abstract

Dengue fever, a mosquito-borne arboviral infection, remains a critical public health concern in tropical and subtropical regions worldwide. This cross-sectional study, conducted at Santosh Hospital—a tertiary care center—aims to investigate the relationship between platelet count, leukocyte count, and the duration of hospitalization among dengue patients presenting with thrombocytopenia. A total of 200 laboratory-confirmed dengue cases admitted between September 2022 and October 2023 were analyzed. Clinical profiles and hematological parameters, including platelet and total leukocyte counts, were systematically assessed to evaluate their prognostic significance. Statistical analysis revealed a strong inverse correlation between platelet count and length of hospital stay ($r = –0.65$, $p < 0.01$), indicating that lower platelet levels are significantly associated with prolonged hospitalization. Additionally, leukopenia was observed in 62.5% of patients and demonstrated a moderate positive correlation with increased hospital stay ($r = 0.52$, $p < 0.01$). Multivariate regression analysis further identified both thrombocytopenia and leukopenia as independent predictors of extended inpatient care, with platelet depletion showing a more pronounced effect.

Moreover, severe clinical manifestations—including dengue hemorrhagic fever, dengue shock syndrome, and major bleeding events—were more prevalent among patients requiring extended hospitalization. These findings underscore the critical role of hematological indices in predicting disease severity and duration of hospitalization in dengue infection. Early identification and close monitoring of these parameters are essential for timely clinical intervention, improved patient outcomes, and optimal utilization of healthcare resources.

Keywords:

Dengue fever, thrombocytopenia, leukopenia, platelet count, hospital stay, hematological parameters, disease severity, clinical management.

Introduction

Dengue fever, a mosquito-borne viral disease, has become a significant global public health concern. Caused by the dengue virus (DENV), a single-stranded RNA virus belonging to the *Flaviviridae* family, dengue is transmitted primarily by female *Aedes* mosquitoes, particularly *Aedes aegypti*.[1] This vector is also responsible for spreading other arboviral diseases such as chikungunya, Zika, and yellow fever. Secondary vectors, such as *Aedes albopictus*, also play a role in the transmission of dengue, particularly in rural and semi-urban areas.[2] The capacity of these mosquitoes to breed in peri-domestic and domestic habitats, utilizing stagnant water in containers like tires, flower pots, and tanks, contributes significantly to the rapid spread of the disease.[3]

Dengue presents as a clinical spectrum, ranging from asymptomatic infections to severe, life-threatening manifestations.[4] Classical dengue fever (DF) is characterized by acute febrile illness accompanied by symptoms such as severe headache, retro-orbital pain, myalgia, arthralgia, rash, and hemorrhagic tendencies. Severe dengue, previously known as dengue hemorrhagic fever (DHF) or dengue shock syndrome (DSS), involves plasma leakage, severe bleeding, and organ impairment.[5] These complications arise due to endothelial dysfunction, coagulopathy, and profound thrombocytopenia. The critical phase of the disease, occurring around the third to seventh day of illness, often determines the clinical outcome, emphasizing the importance of timely diagnosis and management.[6]

Thrombocytopenia, defined as a significant reduction in platelet count, is one of the hallmark laboratory findings in dengue. This condition arises from several mechanisms, including direct infection of hematopoietic cells, inhibition of megakaryocytopoiesis, increased peripheral platelet destruction, and immune-mediated mechanisms. The interplay between endothelial dysfunction, cytokine storms, and activation of the complement system exacerbates thrombocytopenia and leads to further complications such as bleeding and disseminated intravascular coagulation (DIC).[7] Concurrently, leucopenia, or a reduction in white blood cell count, is often observed, reflecting bone marrow suppression and immune dysregulation during the acute phase of the disease.[8]

The global burden of dengue is staggering, with approximately 3.9 billion people in 128 countries at risk of infection. The disease is hyperendemic in many tropical and subtropical regions, particularly in Southeast Asia, the Western Pacific, and the Americas.[9] In India, dengue

outbreaks occur annually, particularly during and after the monsoon season, placing immense strain on healthcare resources. Increasing urbanization, inadequate mosquito control, and climatic factors have contributed to the rise in cases over recent decades.[10,11,12]

The clinical management of dengue is primarily supportive, with a focus on fluid management, monitoring for warning signs, and symptomatic treatment. While most cases resolve without complications, severe dengue often necessitates hospitalization. Platelet transfusions are generally reserved for patients with significant bleeding or extremely low platelet counts, as routine prophylactic transfusions have not consistently demonstrated a reduction in morbidity or mortality. The duration of hospitalization is a critical metric for assessing disease severity and the effectiveness of interventions.[13, 14, 15]

This study investigates the correlation between platelet count, leukocyte count, and the duration of hospital stay in patients with dengue fever complicated by thrombocytopenia. These parameters are pivotal indicators of disease severity and clinical outcomes. Previous research has suggested that lower platelet counts and leukocyte levels are associated with prolonged hospitalization and increased morbidity. Understanding these relationships can provide insights into disease progression, help refine prognostic models, and guide clinical decision-making. By exploring the interplay between hematological parameters and hospital stay, this research aims to contribute to the optimization of patient management strategies and the allocation of healthcare resources in the fight against dengue.

Aims and objectives

1) To study the correlation between platelet, count and nonhemorrhagic complication rate.
2) To study the effect of leukopenia in patients with thrombocytopenia on complications.
3) To study the correlation between platelet count and duration of hospital stay.

Material and Methods

This cross-sectional study was conducted in the Department of Pathology at Santosh Hospital, a tertiary care center, from September 2022 to October 2023. The research aimed to evaluate the correlation between platelet count, leukocyte count, and the duration of hospital stay in patients diagnosed with dengue fever accompanied by thrombocytopenia. A total of 200 patients meeting the inclusion criteria were included, with the sample size determined based on the regional prevalence of dengue fever and hospital admission rates during the study period. Patients aged 18 years and above with a confirmed diagnosis of

dengue fever (serological confirmation via NS1 antigen or IgM/IgG antibodies) and thrombocytopenia (platelet count <150,000/μL) were eligible. Exclusion criteria included pre-existing hematological disorders, medications affecting platelet or leukocyte counts, co-infections, and other chronic illnesses.

Data were collected from medical records and included demographic information (age and gender), clinical data (duration of hospital stay, and initial and subsequent platelet and leukocyte counts), and laboratory findings (complete blood count, liver and renal function tests, and serological tests for dengue). The data were recorded in Microsoft Excel and analyzed using SPSS version 25.0. Descriptive statistics summarized the demographic and clinical characteristics, while the Pearson correlation coefficient assessed relationships between platelet count, leukocyte count, and hospital stay duration. A p-value of <0.05 was considered statistically significant.

Ethical approval was obtained from the Institutional Ethics Committee of Santosh Hospital, and informed consent was secured from all patients or their legal guardians. Patient confidentiality was rigorously maintained throughout the study, which sought to enhance understanding of the clinical trajectory and management of dengue fever with thrombocytopenia to improve patient outcomes.

Observation and results

The study evaluated 200 patients diagnosed with dengue fever and thrombocytopenia, analyzing their demographic data, clinical presentations, laboratory findings, and factors influencing the duration of hospital stay.

Patient Demographics

The study population comprised 114 males (57%) and 86 females (43%) (Figure 1). The mean age of the patients was 32 years, with a significant proportion (60%) residing in urban areas, while 40% were from rural regions (Figures 5).

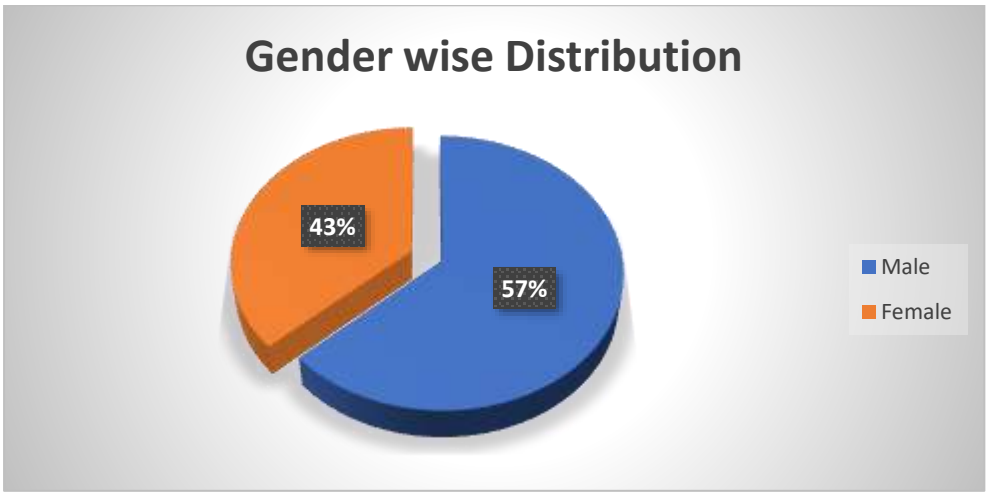

Figure 1: Gender wise distribution.

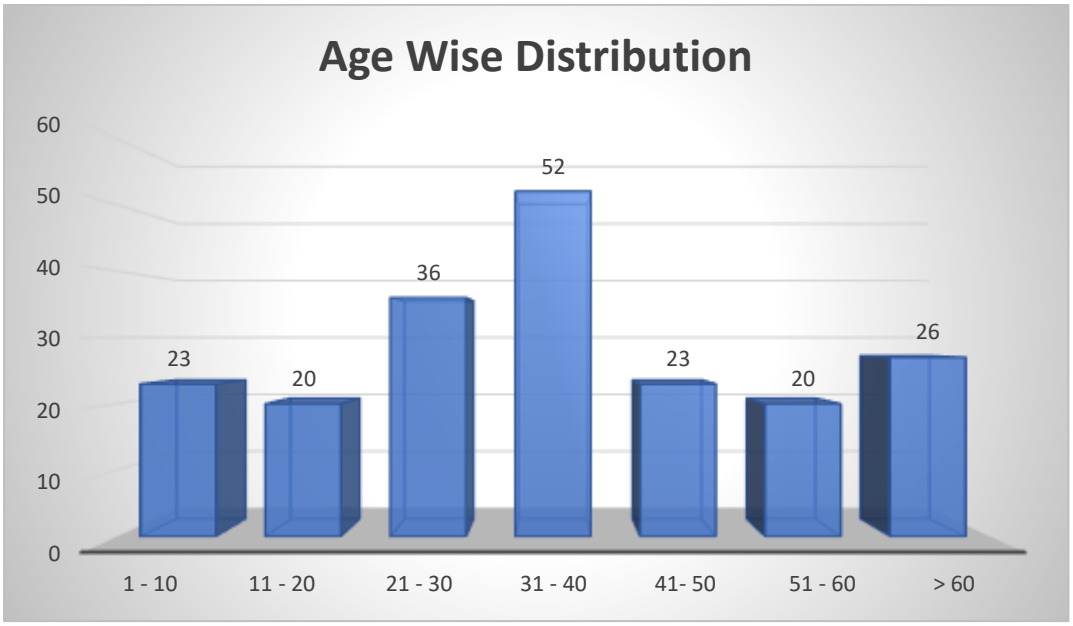

Figure 2: Age wise distribution

Clinical Presentation

All patients presented with high-grade fever (100%), accompanied by symptoms such as severe headache and myalgia in 73%, retro-orbital pain in 60%, arthralgia in 50%, and rash in 30%. Bleeding manifestations included petechiae (17%), gum bleeding (12%), epistaxis (8%), and gastrointestinal bleeding (3%). Gastrointestinal symptoms like nausea/vomiting (43%) and abdominal pain (27%) were common. Fatigue/weakness (47%), dizziness (23.3%), and conjunctival injection (13%) were also observed.

Laboratory Findings

Key laboratory parameters highlighted hematological, hepatic, and coagulation abnormalities:

- **Platelet Count**: Mean count was 85,000/µL (range: 20,000–150,000/µL). Thrombocytopenia (<150,000/µL) was present in all patients, with varying severity.
- **Leukopenia**: Observed in 62.5% of patients (leukocyte count <4,000 cells/µL), significantly correlating with longer hospital stays ($r = -0.45$, $p < 0.01$).
- **Hemoglobin and Hematocrit**: Mean hemoglobin was 13.5 g/dL, with hemoconcentration (hematocrit >45%) seen in 6.7%.
- **Liver Function Tests**: Elevated AST (mean: 80 U/L) and ALT (mean: 70 U/L) indicated mild-to-moderate hepatic involvement.
- **Renal Function**: Mean BUN and creatinine levels were within normal ranges, indicating no significant renal impairment.
- **Coagulation Profile**: Prolonged PT and aPTT were noted in 16.7%, suggesting coagulopathy.
- **Serological Tests**: NS1 antigen was positive in 80% of patients, with 87% showing IgM positivity and 47% IgG positivity.

Duration of Hospital Stay

The mean hospital stay was 7 days, ranging from 3 to 14 days.

- **Short Stay (3–5 days)**: 46% of patients.
- **Moderate Stay (6–8 days)**: 30% of patients.
- **Long Stay (9–14 days)**: 24% of patients. Factors influencing hospital stay included the severity of thrombocytopenia, bleeding manifestations, liver dysfunction, and coagulopathy. Patients with severe thrombocytopenia (<50,000/µL) and bleeding complications had significantly prolonged stays.

Correlation and Regression Analysis

A negative correlation was observed between platelet count and hospital stay duration ($r = -0.65$, $p < 0.01$), while leukocyte count showed a positive correlation ($r = 0.52$, $p < 0.01$). Regression analysis revealed platelet count and leukocyte count as significant predictors of hospital stay ($R^2 = 0.55$, $p < 0.01$), with platelet count demonstrating a stronger impact ($\beta = -0.48$).

Complications

Complications included dengue hemorrhagic fever (46%), dengue shock syndrome (30%), and severe bleeding manifestations (24%). These were associated with extended hospital stays, emphasizing the need for vigilant monitoring and timely intervention.

The findings highlight the multifactorial determinants of disease severity and hospital stay in dengue patients with thrombocytopenia, offering critical insights for clinical management.

CONCLUSION

In conclusion, this study highlights the significant role of hematological parameters—particularly platelet and leukocyte counts—in understanding and managing dengue fever with thrombocytopenia. The observed negative correlation between platelet count at admission and hospital stay duration underscores the impact of severe thrombocytopenia on disease severity and healthcare resource utilization. Conversely, the positive correlation between leukocyte count and hospital stay duration suggests that leukocytosis may be a marker of more severe or complicated disease courses. These findings emphasize the predictive value of these parameters in stratifying risk, guiding early interventions, and optimizing resource allocation in clinical settings.

The study's comprehensive approach, large sample size, and focus on practical clinical relevance contribute to a deeper understanding of dengue pathophysiology and its management. By integrating these insights into routine practice, healthcare providers can prioritize monitoring and interventions for high-risk patients, thereby improving patient outcomes and streamlining hospital operations. However, further research is warranted to refine these findings and explore their application in diverse clinical settings. Overall, this study provides a foundation for evidence-based strategies to enhance the care of patients with dengue fever and thrombocytopenia, addressing both clinical and operational challenges in healthcare.

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