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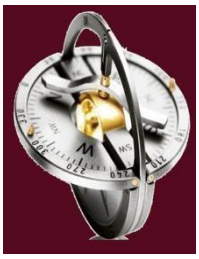

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Original Research

A Study of Platelet Indices as Prognostic Markers In Children With Dengue Fever

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Abstract

BACKGROUND: Dengue is an arbo-viral disease which is transmitted by a female mosquito called Aedes aegypti. Dengue is widespread and endemic throughout the world due to change in epidemiology which is influenced by rainfall, temperature and rapid urbanization. Dengue has varied spectrum of presentation with rapid increase in severe dengue cases in high risk population including children resulti ng in increased hospitalization of children.

AIMS and OBJECTIVES: To study the prognostic role of platelet indices in assessing the severity of dengue infection in children.

MATERIALS AND METHODS: this prospective observational study was conducted in Indira Gandhi institute of child heath, Bangalore over a period of 18 months. All the children who were suspected and diagnosed as dengue fever by NS1, IgM, IgG positive serology were included in the study. Study group were classified clinically as DF, DWS, DHF, DSS, EDS and further grouped based on the WHO grading system into dengue± warning signs which included DF, DWS and severe dengue which include DHF, DSS, EDS. After obtained demographic and clinical data, platelet count and platelet indices were studied over a period 48hours and results were obtained.

RESULTS: A fall in platelet count, MPV, PCT and rise in PDW, PLCR was seen in severe dengue cases.

CONCLUSION: platelet indices along with platelet count should be monitored in children with dengue fever for early recognition of severe dengue cases and there by early intervention and prompt referral can done

Keywords: *dengue fever, severe dengue, MPV, PDW, PCT, PLCR*

Introduction

Dengue fever is the fastest-spreading mosquito-borne viral disease globally, with an estimated 50 million infections annually across more than 100 countries (1). The incidence of dengue has surged 30-fold in recent decades, accompanied by a significant geographic expansion (1).

Dengue hemorrhagic fever (DHF) has a prevalence of approximately 11.4% (2). The primary vector, Aedes aegypti, is widely distributed worldwide (3). The severity of dengue illness is influenced by various risk factors, including age, pre-existing illnesses, the infecting serotype, and secondary infections (4). Among the laboratory findings in dengue, thrombocytopenia is one of the most common. However, the complex mechanisms underlying thrombocytopenia in dengue fever remain poorly understood (5).

Novel platelet indices such as mean platelet volume (MPV), platelet distribution width (PDW), plateletcrit (PCT), and platelet large cell ratio (P-LCR) have emerged as valuable tools for assessing the severity of dengue fever, in addition to the traditional platelet count (6).

Despite advancements in diagnostic and therapeutic approaches, there is limited data on dengue fever in the pediatric population, particularly regarding its pathogenesis (7). This study aims to explore the role of platelet indices in evaluating disease severity and predicting short-term outcomes in dengue infection.

By identifying cases at risk of progression to DHF or Dengue Shock Syndrome (DSS), this study seeks to enable close monitoring and timely interventions to mitigate complications (8). Ultimately, these efforts may contribute to reducing the morbidity and mortality associated with dengue infection.

The primary aim of the study is to evaluate the prognostic role of platelet indices in determining the severity of dengue infection in children.

Materials and Methods

The study was conducted on children diagnosed with confirmed dengue fever (NS1 and/or IgM positive) admitted to the Indira Gandhi Institute of Child Health (IGICH), Bangalore, over a period of two years, from November 2019 to October 2021. The study included all children aged 0-18 years with confirmed dengue fever, identified through rapid card tests or enzyme -linked immunosorbent assay (ELISA) for NS1, IgM, and IgG antibodies. Based on the published literature, the prevalence of dengue hemorrhagic fever (DHF) was estimated at 11.4%. U sing 90% power, a 5% level of significance, and an absolute precision of 5%, the calculated sample size was 155 children.

The study design was a prospective cross-sectional study. Informed consent was obtained from parents or guardians before including their children in the study. A pre-structured proforma was used to record demographic details (age, gender, residential address), clinical history, and examination findings. Routine laboratory investigations, including a complete blood count with mean platelet volume (MPV), platelet

distribution width (PDW), platecrit (PCT), and platelet large cell ratio (P-LCR), were performed using MINDRAY 5100 and UBM F-19 plus differential cell counters, which also provided platelet histograms. Additional tests, including liver function tests and coagulation profiles, were conducted as required.

The study group was classified based on the WHO dengue grading system into five grades to assess the severity of dengue infection. Patients were further categorized into groups with or without warning signs of severe dengue, including dengue fever (DF), dengue with warning signs (DWS), dengue hemorrhagic fever (DHF), dengue shock syndrome (DSS), and extended dengue syndrome (EDS). Platelet indices were analyzed to assess the severity of the infection and predict short-term outcomes.

Inclusion criteria comprised all children under 18 years with confirmed dengue fever (NS1 and/or IgM positive) with or without IgG positivity (indicative of secondary dengue infection) by rapid card test or ELISA, provided parental or guardian consent was obtained. Children were excluded if they tested negative for NS1 and IgM or if other causes of thrombocytopenia, such as septic shock, bone marrow suppression, leukemia, or autoimmune conditions, were identified.

Data was entered into an Excel spreadsheet and analyzed using SPSS version 20 (IBM Corp, Armonk, NY, USA). Descriptive statis tics, including mean and standard deviation for quantitative variables and frequency and proportions for qualitative variables, were calculated. The Chi-square test was used to examine associations between qualitative variables, while paired t-tests assessed mean differences in quantitative variables at 0 and 48 hours. A p-value of <0.05 was considered statistically significant.

Results and Observations

A total of 180 children diagnosed with dengue fever were studied over a two-year period (November 2019 to October 2021). The results are summarized as follows

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Table 1: Demographics and Symptom Distribution

Parameter	Dengue Fever (%)	Severe Dengue Fever (%)	Total (%)	p-value
Age Distribution				
<1 year	17 (17.5%)	19 (22.9%)	36 (20.0%)	0.714
1-5 years	32 (33.0%)	24 (28.9%)	56 (31.1%)	
6-10 years	14 (14.4%)	16 (19.3%)	30 (16.7%)	
11-15 years	2 (2.1%)	1 (1.2%)	3 (1.7%)	
15-18 years	32 (33.0%)	23 (27.7%)	55 (30.6%)	
Sex Distribution				
Male	54 (55.7%)	39 (47.0%)	93 (51.7%)	0.245
Female	43 (44.3%)	44 (53.0%)	87 (48.3%)	
Symptoms				
Headache	45 (45.9%)	33 (40.2%)	78 (43.3%)	0.245
Myalgia	40 (41.2%)	31 (37.3%)	71 (39.4%)	0.245
Arthralgia	38 (39.1%)	30 (36.1%)	68 (37.7%)	0.245
Rash	17 (17.5%)	21 (25.3%)	38 (21.1%)	0.203
Bleeding Manifestations	0 (0%)	18 (21.6%)	18 (10.0%)	0.001

The majority of cases (31.1%) occurred in the 1-5 years age group, followed by the 15-18 years group (30.6%). Dengue fever was more common in males (55.7%), while severe dengue fever was slightly more prevalent in females (53%). Symptoms such as rash, bleeding manifestations, and pain abdomen were more frequent in severe dengue fever cases (Table 1)

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Table 2: Laboratory Findings

Parameter	Dengue Fever (%)	Severe Dengue Fever (%)	Total (%)	p-value
Platelet Count				
Decreased	32 (33.0%)	32 (38.6%)	64 (35.6%)	0.437
Increased	65 (67.0%)	51 (61.4%)	116 (64.4%)	
MPV				
Decreased	33 (34.0%)	31 (37.3%)	64 (35.6%)	0.642
Increased	64 (66.0%)	52 (62.7%)	116 (64.4%)	
PDW				
Decreased	54 (55.7%)	40 (48.2%)	94 (52.2%)	0.317
Increased	43 (44.3%)	43 (51.8%)	86 (47.8%)	
PCT				
Decreased	33 (34.0%)	37 (44.6%)	70 (38.9%)	0.176
Increased	64 (66.0%)	45 (54.2%)	109 (60.6%)	

Decreased platelet count (35.6%) was seen in both groups, while increased mean platelet volume (MPV) and plateletcrit (PCT) were observed in the majority of cases, highlighting their potential as markers of disease progression (Table 2).

Table 3: Liver Function and Coagulation Parameters

Parameter	Dengue Fever (%)	Severe Dengue Fever (%)	Total (%)	p-value
SGOT				
Elevated	29 (29.8%)	61 (73.4%)	90 (50.0%)	0.245
Normal	68 (70.2%)	22 (26.6%)	90 (50.0%)	
SGPT				
Elevated	8 (8.0%)	39 (46.9%)	47 (26.1%)	0.001
Normal	89 (92.0%)	44 (53.1%)	133 (73.9%)	
Prothrombin Time (PT)				
Increased	11 (11.3%)	23 (27.7%)	34 (18.9%)	0.005
Normal	86 (88.7%)	60 (72.3%)	146 (81.1%)	

Elevated SGPT (46.9%) and prolonged PT (27.7%) were more common in severe dengue fever, indicating significant hepatic involvement and coagulation abnormalities (Table 3).

Table 4: Serological and NS1 Status

Parameter	Dengue Fever (%)	Severe Dengue Fever (%)	Total (%)	p-value
NS1				
Positive	56 (57.8%)	60 (72.3%)	116 (64.4%)	0.042
Negative	41 (42.2%)	23 (27.7%)	64 (35.6%)	
IgM				
Positive	45 (46.4%)	41 (49.4%)	86 (47.8%)	0.687
Negative	52 (53.6%)	42 (50.6%)	94 (52.2%)	
IgG				
Positive	17 (17.6%)	34 (41.0%)	51 (28.3%)	0.005
Negative	80 (82.4%)	49 (59.0%)	129 (71.7%)	

Positive NS1 was detected in 64.4% of cases, more commonly in severe dengue fever (72.3%). IgG positivity was significantly associated with severe dengue fever (p=0.005), suggesting secondary dengue infection in these cases (Table 4).

Discussion

Dengue fever is one of the fastest-growing arthropod-borne diseases worldwide, particularly affecting tropical and subtropical regions. Although its typical course is benign, severe forms of the disease, such as dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS), are associated with significant morbidity and mortality, particularly in pediatric populations (1,2). These complications, including dengue hepatitis, encephalitis, myocarditis, and disseminated intravascular coagulation (DIC), result from immune-mediated mechanisms such as cytokine storms and thrombocytopenia (3). Early recognition and intervention remain critical in managing these complications and reducing mortality.

Platelet indices, including mean platelet volume (MPV), platelet distribution width (PDW), plateletcrit (PCT), and platelet large cell ratio (PLCR), have emerged as valuable markers in evaluating hyperdestructive states such as immune thrombocytopenia (ITP) a nd hypoproductive states like bone marrow suppression (4,5). While several studies have investigated the role of platelet indices in adults with dengue, their utility in the pediatric population remains underexplored. This prospective observational study was designed to evaluate the prognostic role of platelet indices in pediatric dengue and their correlation with disease severity and outcomes.

The study included 180 children aged 0-18 years with confirmed dengue fever based on positive serology (NS1, IgM, or IgG). Among these, 53.9% were classified as dengue with warning signs, while 46.1% had severe dengue, including DHF, DSS, and extended dengue sy ndrome (EDS). The demographic findings revealed that males (51.7%) were slightly more affected than females, consistent with previous studies (6,7). The most affected age group was 1-5 years, highlighting the vulnerability of younger children to severe manifestations of dengue, in agreement with earlier research (8).

Symptomatically, fever was the most common presentation in both groups. Symptoms such as headache, myalgia, and arthralgia were more prevalent in dengue with warning signs, whereas severe dengue cases exhibited a higher prevalence of rash, bleeding manifesta tions, abdominal pain, decreased urine output, and vomiting (9). Additionally, clinical parameters such as prolonged capillary refill time (>3 seconds), poor pulse pressure, and hypotension were significantly more common in severe dengue, reflecting the critical hemodynamic cha nges associated with the disease (10).

Platelet indices have been studied as markers of disease progression in dengue. In this study, severe dengue cases were assoc iated with lower MPV and PCT values and higher PDW and PLCR values, findings consistent with previous studies (11,12). The dynamic changes in platelet indices observed over 48 hours demonstrated a strong correlation with disease progression. For instance, decreasing platelet counts were associated with falling MPV and PCT and rising PDW and PLCR, indicating worsening disease. Conversely, increasing platelet counts correlated with improving platelet indices, suggesting recovery (13,14).

Liver dysfunction, reflected by elevated SGOT and SGPT levels, was significantly more common in severe dengue cases, consistent with the hepatic involvement reported in dengue fever (15). Additionally, coagulation abnormalities such as prolonged prothrombin time (PT) and activated partial thromboplastin time (aPTT) were observed more frequently in severe cases, indicative of coagulopathy secondary to endothelial damage and cytokine release (16).

This study's findings align with existing literature but also highlight differences due to the pediatric focus and the longit udinal assessment of platelet indices. Unlike previous studies conducted on adult populations or comparing dengue cases with healthy controls, this study exclusively examined pediatric cases and compared dengue with warning signs to severe dengue cases. This approach provides unique insights into the progression of dengue within the pediatric population and emphasizes the value of platelet indices as prognostic markers (17). The study, however, has limitations, including the random enrollment of patients at different disease phases, limited monitoring frequency of platelet indices, and inclusion of children with comorbidities, which may influence results. Future studies with larger sample sizes, stratified by age and comorbidities, and with more frequent monitoring of platelet indices, are warranted to validate these findings (18-20).

Conclusion

In conclusion, platelet indices, alongside traditional markers such as platelet count, liver enzymes, and coagulation parameters, provide a comprehensive tool for assessing dengue severity. The integration of these indices into routine clinical practice could facilitate early identification of high-risk pediatric cases, enabling timely intervention and potentially improving outcomes.

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