

Utility Of Platelet Indices In Dengue Seropositive Patients: An Observational Study At A Tertiary Care Hospital

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Abstract

Dengue, also known as breakbone fever, is an emerging mosquito borne viral illness of tropical and subtropical areas of the world today. It is caused by one of the four serotypes of the dengue virus (DEN-1, DEN-2, DEN-3, DEN-4) also referred to as an arbovirus (arthropod-borne viruses) that belongs to the genus flavivirus of the family flaviviridae. It is transmitted by mosquitoes of the genus *Aedes aegypti*.^[1]

Introduction:

It is estimated that annually 390 million dengue infections occurs worldwide, of which 25% manifest clinically.^[2] According to National center for vector borne diseases control, India has reported on average of 1.93 lakh cases in 2021. Though the reported cases have increased, the case fatality rate has declined to less than 0.5 %.^[3]

In most of the individuals, it presents as self-limiting condition. However, in few of them it can become complicated by dengue shock syndrome or dengue hemorrhagic fever which warrants prompt management.

Severe forms of dengue virus infections are associated with major hematological complications such as bleeding tendency, thrombocytopenia, and plasma leakage.^[4] And many studies and literature have proven the importance of decrease in platelet count and rise in hematocrit as a predictive and recovery parameter of DHF/DSS.^[5] Hence complete blood count analysis and peripheral smear study forms the integral part of diagnostic work up and are widely utilized for making clinical decisions.

The mechanism for thrombocytopenia is complex and still unclear. Recently, novel platelet indices such as Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), and Platelet to Large Cell Ratio (PLCR) have been investigated as prospective platelet activation markers.^[6,7]

The aim of our study was to evaluate the role of platelet indices in dengue seropositive patients along with other hematological parameters like hematocrit, total leucocyte count, atypical lymphocyte and monocytes. As hematological complications are the prime reason for mortality, these parameters will aid the physicians in better management.

Materials and methods

It was hospital based observational study conducted during the epidemic outbreak of dengue infection over a period of 6 months from July 2021 to December 2021 in the Department of Pathology, Sri Muthukumaran medical college and Hospital, Mangadu.

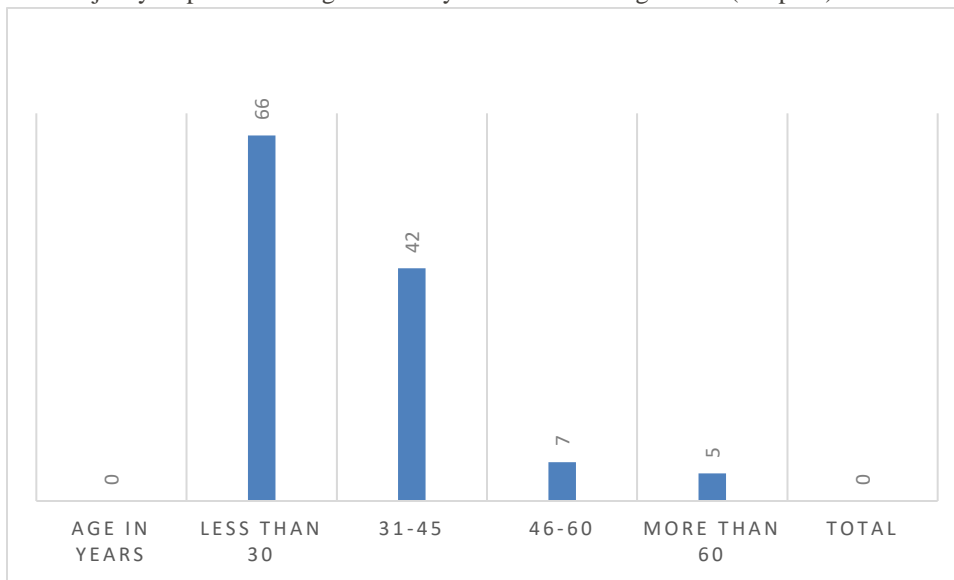
All the patients of both gender with clinical features and serological positivity for IgM/NS1 antigen were included in the study. All patients with negative serology were excluded from the study. The hematological analysis was done in automated hemoanalyzer ERBA H650 five part analyzer. Peripheral smears were stained by Leishman stain. The demographic and clinical data of each patient were collected from medical records.

Statistical Analysis:

All the collected data were entered in Microsoft Excel and analysis was done in SPSS software.

Results:

In the present study a total of 120 dengue seropositive cases were evaluated. Age ranged from 18 months to 81 years with majority of patients being under 30 years with mean age of 25.(Graph 1)



Graph 1: Age distribution of the study population.

Of these males were 72, females were 48.(Chart 1)

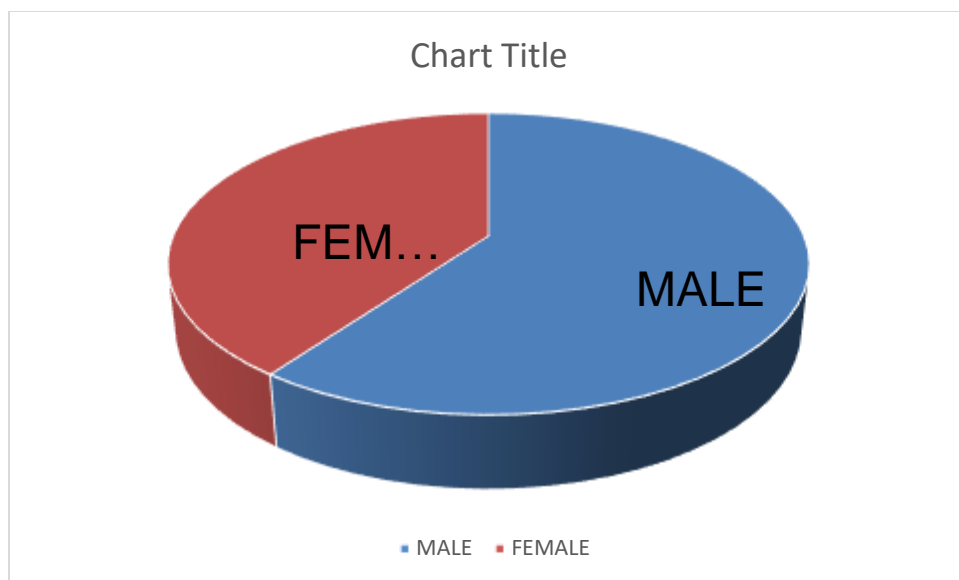


Chart 1: Sex distribution of the study population.

Cases were majorly seen during monsoon season. Fever was most common clinical symptom being seen in all cases followed by myalgia and headache.

In our study, mean hemoglobin was 12.6 with 18.3% cases with Hb <10 and 15.8% having > 15.

Mean total WBC count was 4563 with majority of cases having normal range. In this study 26.6% cases having below 4000/cu mm and 16.6% having more than 11,000/cu mm. And Lymphocytosis was seen in 64.3% of cases and monocytosis was seen in 64 % of cases.

The most common peripheral smear finding were presence of atypical lymphocytes seen in 77.5% of cases. Other findings were, shift to left with presence of toxic granules in granulocytes, reactive change in monocytes and presence of giant platelets.

Hematocrit (HCT) of above 48% was seen only in 9 cases (7.5%).

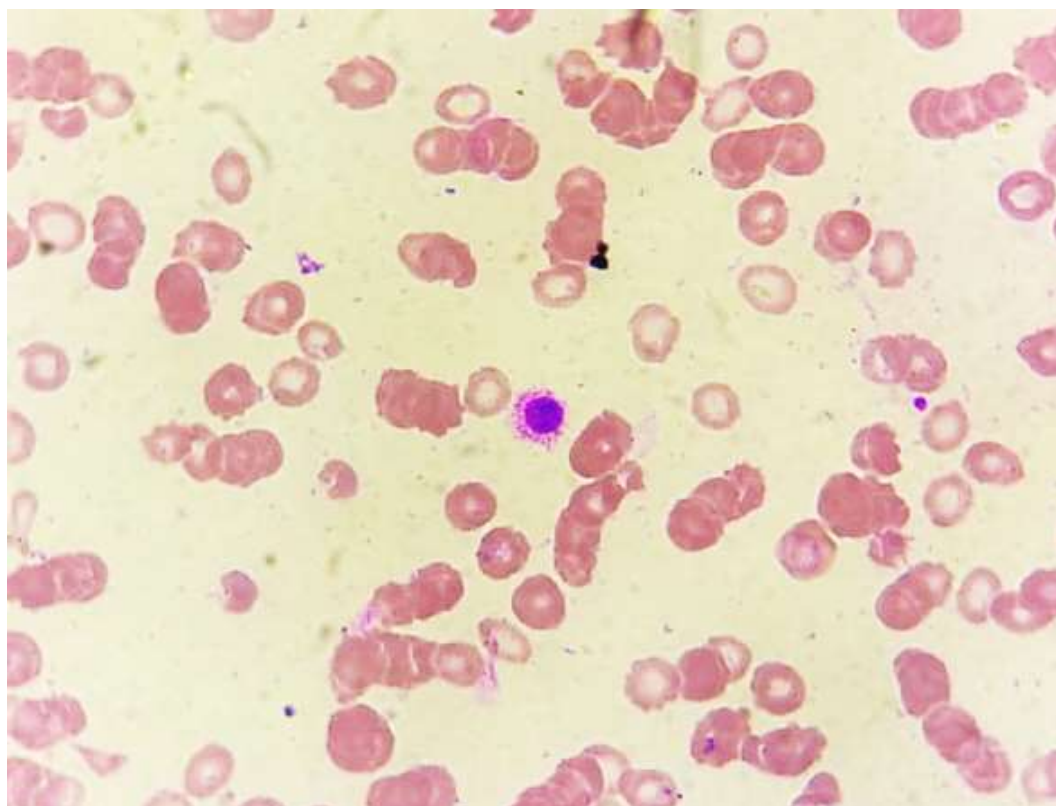
Platelet count results were tabulated under 4 groups. (Table1)

Of the cases, 42 cases (35%) had platelet count < 50,000/cumm and remaining 78 cases(65%) had >50000/cumm.

<u>PLATELET COUNT</u>	<u>NO OF PATIENTS</u>	<u>PERCENTAGE</u>
< 20,000	18	15
20000 - 50,000	24	20
50,000-1,00,000	63	53
>1,00,000	15	12
Total	120	100 %

Table 1: Distribution of Platelet count in study population.

The platelet activity and regenerative capacity can be assessed in terms of Mean platelet volume (MPV) , Plateletcrit (PCT) and Platelet distribution width (PDW).



Picture 1: Photomicrograph showing Giant platelet in a Dengue seropositive Thrombocytopenic patient. (Leishman, oil immersion)

In our study, we divided the platelets counts into 4 groups and Mean MPV, PDW, L-PCR and PCT values were taken for the different classes of platelet count.

<u>Platelet Count</u>	<u><20000</u>	<u>20000-50000</u>	<u>50000-100000</u>	<u>>100000</u>
MPV (fl)	10.75±0.65	11.12±0.78	11.67±1.01	11.81±1.22
PDW %	17.52±0.89	17.21±0.65	16.78±0.54	16.21±0.44
PCT %	0.04±0.02	0.05±0.01	0.06±0.01	0.07±0.02

Table 2: Mean platelet indices in the study population

Discussion:

Dengue fever is a self limiting illness with a wide range of findings in peripheral blood.

In our study, the majority of patients being affected were below 30 years and males outnumbered the cases which was in concordance with the studies done by Neeraja et al^[8] and Patil PJ et al^[9]

Environment being more favorable for breeding of the vector during monsoon and post-monsoon season, it explains the increase in number of cases during rainy season.^[9]

Hematocrit forms an integral indicator in recognizing complications of dengue. In our study, the raised hematocrit was seen in 34 cases (28.3%) and decrease in hematocrit was seen in 37 cases(30.8%) which was in concordance with studies done by Madhuri K et al.^[10]

Increase in HCT over the baseline suggests haemoconcentration and possibly impending shock. This is caused by fluid leakage from capillaries that are seen in dengue. Such patients are more likely to develop DSS and need aggressive management with IV fluids.

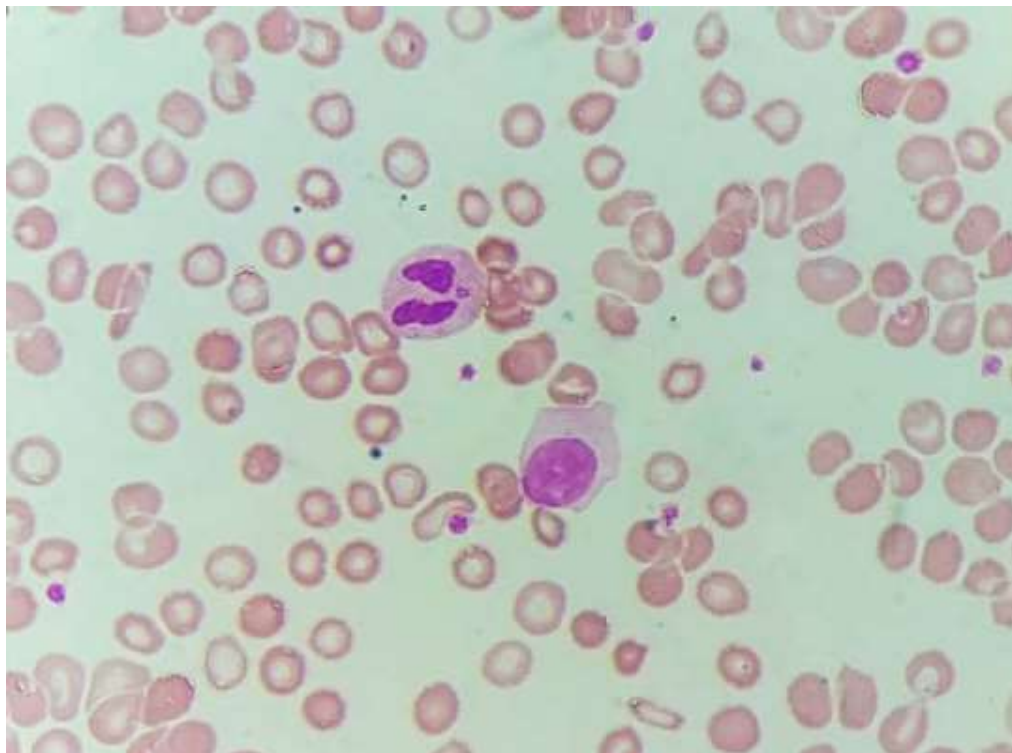
Decrease in HCT in an unstable patient is suggestive of hemorrhage and may indicate internal bleeding secondary to DHF, whereas a decrease in HCT in a stable patient suggests recovery from disease. patients with viral fevers.^[11]

Decrease in Total WBC count is mainly attributed due to decrease in number of granulocytes. In our study leukopenia was seen in 26.6% of cases which was in concordance with Patil PJ et al^[9] & Madhuri K et a.^[10] And leukocytosis was seen in 16.6% of cases. The probable reason is that in few patients leukocytosis is usually observed in very early course of dengue infection followed by leucopenia and other common reason being co existing infection.

A study on peripheral smear was done and most common finding were the morphological changes exhibited by lymphocytes seen as basophilic cytoplasm with plasmacytoid and monocytoid appearance.

A number of studies have shown that early in the course of illness, patients with either primary or secondary dengue infections exhibit a fall in the leukocyte count associated with rise in the percentage of lymphocytes and this finding is in parallel to marrow suppression during acute phase.

In our study atypical lymphocytes were seen in 77.5% was cases which was in concordance with studies done by Patil PJ et al^[9] & the study conducted by Madhuri K et al showed larger proportion of patients with atypical lymphocytes.^[10]



Picture 2 : Photomicrograph showing a Reactive Lymphocyte with Neutrophil in a Dengue seropositive patient.(Leishman, Oil immersion)

Thrombocytopenia ($< 1,00,000/\text{cumm}$), which is WHO defining criteria for Dengue viral infection was the most common laboratory finding in our study as seen in other studies. The probable cause could be due to direct bone-marrow suppression of thrombopoiesis modulation of endothelial cell by dengue virus destruction of platelets by Anti-NS1 antibodies directed against the virus cross-reacting with the platelets.^[11]

Nearly 90% of cases had total platelet count less 1,00,000/cumm and 100% cases had less than 1,50,000/cumm, which was in concordance with the studies done by Subhaschandra Kadavar S^[13] & Patil PJ et al.^[9]

Haemorrhagic complications are quite common with severe thrombocytopenia and severity of bleeding tendency directly correlates with total platelet count, there by playing a vital role in management.

In our study we had evaluated the role of platelet indices in dengue seropositive patients.

In the present study, we could see that Mean MPV increases with platelet count which was found to be in concordance with Wayez A et al,^[7] Bashir et al,^[14] Navya, et al,^[15] and Mukker, et al.^[16]

A mean MPV of < 9 fl indicates bone marrow suppression. Thus postulating transient bone marrow suppression by dengue virus as one of the mechanisms of thrombocytopenia in patients of dengue fever.^[15]

Increase in MPV together with a stable platelet count possibly indicates recovery whereas a persistently elevated MPV together with ongoing thrombocytopenia is suggestive of active disease causing platelet destruction with possible need to prepare for platelet transfusions.

Decreased MPV with severe thrombocytopenia (<20,000 platelets/UL) could be an ominous sign in dengue and could indicate need for red cell transfusion. [11,17]

Thus MPV is surrogate marker of bone marrow activity with positive correlation with platelet count. There by correlating the platelet count and MPV with bleeding manifestations and severity of the disease, it can potentially help us in predicting outcome.

PDW is a useful marker for platelet activation. In the present study, we found that PDW was inversely related with platelet count. Thus, in we can see that low platelet count was associated with high PDW which was in concordance with studies done by Wayez A et al^[7], Bashir et al^[14], Navya, et al^[15], and Mukker, et al^[16]

PCT is directly related to platelet counts, whereas P-LCR is inversely related to platelet count and an increased P-LCR is seen in destructive thrombocytopenia (more likely in dengue). In our study, we can see that low platelet count is associated with low PCT which is in concordance with studies done by Wayez A et al^[7] and Mukker et al.^[16]

Studies have shown that a high PDW >13 Fl is associated with dengue fever, whereas a PDW >15 Fl, a high P-LCR (>42%), and low PCT (<0.15%) are more sensitive for DHF. Thus, low platelet count, low PCT, and high PDW may be used as predictors of severity of dengue infection. [11,18]

Hence, we can conclude from our study that, Low platelet count, low MPV, low PCT, high PDW and high P-LCR in combination may be used as probable indicators for dengue in endemic area especially in peripheral centres with minimal facilities.

Conclusion:

Dengue is one of the major preventable & treatable cause of mortality and morbidity in tropical and subtropical regions. Our study highlights the utility of platelet indices along with peripheral smear findings in early detection of dengue infection and its potential complications. Increased HCT with low MPV, low PCT, high PDW and high P-LCR can be used as a predictor of severity of dengue infection. Hence, timely assessment of the above indices, can aid in prevention of complication and mortality in dengue seropositive patients in endemic areas.

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