Research Article

ROLE OF PLATELET PARAMETERS IN PATIENTS WITH DENGUE INFECTION

Neha Singh., Sweta* and Uma Sharma

Department of Pathology, SGT Medical College & Hospital, Gurugram, Haryana

A R T I C L E   I N F O

A B S T R A C T

Background: Dengue is one of the arthropod borne viral diseases transmitted by female mosquito Aedes aegypti. Dengue fever has a wide spectrum of clinical presentation ranging from flu-like illness to severe complicated stage of dengue hemorrhagic fever leading to mortality.

Aims & Objectives: To study platelet parameters like MPV, PDW & PLCR in dengue positive infection and to correlate their relationship with the severity of the disease.

Material & Methods: Study was done on 80 consecutive dengue positive cases during the outbreak of dengue infection from July 2017 to October 2017 in Department of Pathology at FMHS, SGT University, Gurugram. The platelet parameters like platelet count, MPV, PDW & PLCR were noted using SYSMEX XN 550 analyser and was compared with severity of disease(DF/DHF/DSS).

Results: Relationship between platelet parameters like platelet count, MPV, PDW and P-LCR along with thrombocytopenia was made with the severity of the disease.

Conclusion: Platelet count is thus a predictive parameter of DF/DHF/DSS. Decrease platelet count, MPV, PDW & PLCR may be used as a probable indicator for dengue. Decrease MPV (<9fl) and increase PDW (>13fl) showed considerable sensitivity for dengue fever.

INTRODUCTION

Dengue fever is the most rapidly spreading mosquito-borne viral disease in the world.[1] The World Health Organization (WHO) has estimated 50 million cases of dengue fever and several hundred thousand cases of dengue hemorrhagic fever occur each year, depending on the epidemic activity.[2] The WHO classified the clinical presentations of Dengue hemorrhagic fever (DHF) into four severity grades based on laboratory data: Grade I: fever with positive tourniquet test; In grade II: grade 1 findings plus mild spontaneous bleeding; Grade III: presence of weak and rapid pulse; and Grade IV: profound shock with undetectable pulse. The last two are considered Dengue shock syndrome (DSS).[3]

Prompt diagnosis during the febrile stage is essential for adjusting appropriate management. Clinical features in dengue can range from a nonspecific febrile illness to severe disease i.e. dengue hemorrhagic fever and dengue shock syndrome in which patients develop hematological complications.[4]

One of the most common laboratory findings in dengue is thrombocytopenia. The complex mechanism of thrombocytopenia remains unclear.

Corresponding author: **Sweta**
Department of Pathology, SGT Medical College & Hospital, Gurugram, Haryana

Possible mechanisms of thrombocytopenia could be, direct bone marrow suppression by the virus; anti dengue antibody-mediated platelet destruction, peripheral consumption of platelets and isolated viral replication in the platelet.

Thrombocytopenia leads to bleeding although the platelet count may not directly correlate with the bleeding manifestation.[5]

The aim of our study was to analyze platelet parameters like platelet count, Mean platelet volume (MPV), Platelet distribution width (PDW) and Platelet large cell ratio (P-LCR) along with thrombocytopenia to assess their role in severity of dengue infection.

MATERIALS AND METHODS

This study was an observational study carried out in a tertiary care hospital on all dengue positive cases over a period of 4 months prospectively from July 2017 to October 2017 during the outbreak of dengue.

The platelet parameters like platelet count, MPV, PDW & P-LCR were noted using SYSMEX XN 550 analyser and was compared with severity of disease. The dengue NS1 antigen was detected by antigen-antibody reaction principle, which is a rapid visual test for dengue.

Inclusion Criteria

All patients with clinical features and serologically positive dengue infection were included.

Exclusion Criteria

Patients serologically negative for dengue infection and if routine laboratory testing suggested a bacterial, parasitic or any viral infection other than dengue infection or any other disease were excluded from the study.

Statistical Analysis

Data was entered in Microsoft Office Excel 2007 and analysis done using SPSS (version 16) windows.

RESULTS

A total of 80 cases were studied, based on positive dengue test. Platelet parameters like platelet count, MPV, PDW & P-LCR of these patients were assessed by using SYSMEX XN 550 analyser.

Out of the 80 patients, 50 were male and 30 were female. The age group ranged from 1 to 60 years. Patients were mainly in age group of 21- 40years (36%) followed by 41-60 years (31%), 1-20 years (33%).(Graph -1)
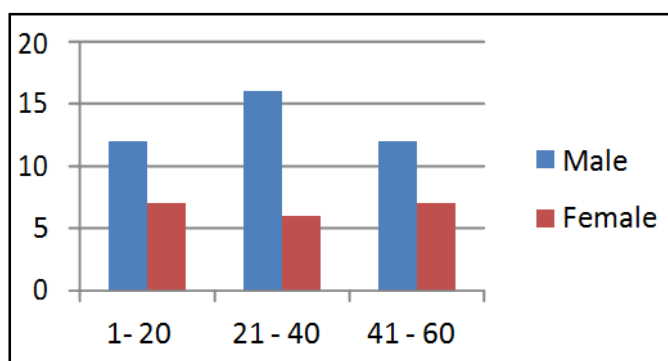
Graph 1 Total no. of patients in age group

Of all the positive samples tested by antigen - antibody reaction principle which is a rapid visual test for dengue. 64 patients were positive for NS-1, 15 patients were positive for IgG and none for IgM. Only 1 patient was positive for all NS-1, IgM and IgG.(Table-1)

Table 1 Dengue positive cases

Dengue Parameters	No. of positive cases
NS1 positive	64
IgG positive	15
IgM positive	0
Both NS1 and IgG positive	0
Both IgG and IgM positive	0
Both NS1 and IgM positive	0
All positive	1
Total	80

Platelet counts results were grouped under 4 groups. Of the patients with thrombocytopenia (i.e. platelet count < 1 lakh) 11.25% patients had platelet count < 20,000 (severe thrombocytopenia), 33.75% patients had platelet count between 21,000-50,000 (moderate thrombocytopenia), 37.5% patients had platelet count between 51,000- 1 lakh (mild thrombocytopenia) while remaining cases in our study had platelet count > 1 lakhs (17.5%). There was no significant difference in severe thrombocytopenia among different age group. Chi square was done and p value was found to be 0.991 which signifies that, it is not statistically significant.The seropositive patients were followed clinically for the symptoms

of DHF/DSS and they were correlated with the respective platelet counts.(Table-2)

Table 2 Platelet count with age wise distribution

Age Group	Platelet counts				
	<20,000	21,000-50,000	51,000- 1 lakh	>1 lakh	Total
0-20	1 (6.2%)	4(25%)	8(50)	3(18.7%)	16(100%)
21-40	2(6.06%)	12(36.3%)	13(39.3%)	6(18.1%)	33(100%)
41-60	6(19.3%)	11(35.4%)	9(29.03%)	5(16.1%)	31(100%)
Total	9(11.25%)	27(33.75%)	30(37.5%)	14(17.5%)	80(100%)

Dengue fever (DF) cases were noted in 72.5% patients and dengue hemorrhagic fever (DHF) cases were noted in 27.5% patient. Among the 72.5% patients of DF about 76% patients had mild thrombocytopenia, moderate thrombocytopenia also seen in 65.5% patients and severe thrombocytopenia in 77.7% patients while remaining 76.4% patients had platelet count > 1 lakh. Among 27.5% patients of DHF, 24% patients had mild thrombocytopenia, 34.4% patients had moderate thrombocytopenia, 2.2% patients had severe thrombocytopenia and in remaining 23.5% patients had platelet count > 1 lakh. In our study, no case of DSS was seen. Significant difference was observed between severity of the thrombocytopenia and severity of the disease, (P value -0.013).(Table-3)

Table 3 Platelet count with severity of disease

Platelet Count	DF	DHF	DSS	Total
<20,000	7(77.7%)	2(22.2%)	0(0%)	9(100%)
21,000 to 50,000	19(65.5%)	10(34.4%)	0(0%)	29(100%)
51000 to 1,00,000	19(76%)	6(24%)	0(0%)	25(100%)
>1 lakh	13(76.4%)	4(23.5%)	0(0%)	17(100%)
Total	58(72.5%)	22(27.5%)	0(0%)	80(100%)

Low MPV which indicates bone marrow suppression were noted in 70% patients, of which 61.01% patients were diagnosed as DF while 95.2% patients were of DHF. 30% patients showed high MPV (>9fl), of which 38.9% patients were diagnosed as DF and 4.7% patients diagnosed as DHF. A high PDW (>13fl) which indicates as useful marker for platelet activation was seen in 68.7% patients, of which 69.4% patients were DF while 66.6% patients were DHF remaining 31.2% patients of cases showed low PDW (<13fl).(Table-4)

Table 4 Platelet indices with severity of disease in dengue positive cases

Diagnosis	Low MPV (<9fl)	High MPV (>9fl)	Total
DF	36(61.01%)	23(38.9%)	59(100%)
DHF	20(95.2%)	1(4.7%)	21(100%)
TOTAL	56(70%)	24(30%)	80(100%)
	Low PDW (<13fl)	High PDW (>13fl)	TOTAL
DF	18(30.5%)	41(69.4%)	59(100%)
DHF	7(33.3%)	14(66.6%)	21(100%)
TOTAL	25(31.2%)	55(68.7%)	80(100%)

Table 5 PLCR with severity of disease in dengue positive cases

Diagnosis	Low PLCR	High PLCR	Total
DF	20(29.4%)	48(70.5%)	68(100%)
DHF	4(33.3%)	8(66.6%)	12(100%)
Total	24(30%)	56(70%)	80(100%)

70% patients with high PLCR of which 70.5% patients are of DF while 66.6% patients are of DHF whereas only 30% patients shows low PLCR out of which 29.4% patients are of DF and 33.3% are of DHF.(Table-5)

DISCUSSION

Dengue fever is a self-limiting febrile illness, whereas DHF is characterized by prominent hemorrhagic manifestations associated with thrombocytopenia and an increased vascular permeability.[6] Detection of dengue specific IgM/IgG has been the mainstay of diagnosis of dengue infection. Antibody detection is an indirect method of diagnosis and, therefore, is prone to false positive as well as false negative results. Of late, non structural protein 1(NS1) detection is available for diagnosis of DF. NS1Ag detection is reported to be sensitive as well as highly specific.[7]

Platelet indices such as MPV, PDW and P-LCR has been found as prospective platelet activation marker.[6] MPV can predict bleeding and is considered as surrogate marker of bone marrow activity. A high MPV indicates a increased megakaryocytic activity whereas low MPV indicates marrow suppression and increased risk of bleeding.[8] Platelet with increased number and size of pseudopodia differ in size affecting platelet distribution width which increases during platelet activation. P-LCR is found to decrease in patient with thrombocytosis and increase in patient with thrombocytopenia.[9]

MPV has been evaluated as a diagnostic tool in different conditions with thrombocytopenia with contradictory results. It has been demonstrated that MPV has sufficient sensitivity and specificity to discriminate aplastic anemia, bone marrow disease, hypoproductive thrombocytopenia, and bone marrow metastasis of solid tumor.[10-12] Correlation of platelet count and MPV with bleeding and severity of the disease can potentially predict outcome.[10]

Defect in DF/DHF are multifactorial that include thrombopathy coagulopathy and vasculopathy. The depression in the bone marrow along with direct infection of the megakaryocytes by dengue virus lead to increased destruction of platelet. Platelet are natural sources of growth factors like platelet-derived growth factor, vascular endothelial growth factor or insulin-like growth factor-I, they play important role in inflammation, angiogenesis, repair and regeneration of tissue.[13,14] In our study we found that MPV and Platelet count were lower whereas PDW and P-LCR were higher in dengue positive patients as compared to studies done by Wiwanikit V, Bahir AB *et al*, Hardeva RN *et al*.[10,8,15]

According to the study conducted by Jayashree K *et al* there was a significant association between platelet counts and severity of the disease which is similar to our study, thus concluding that platelet count can be used as predictive parameters for diagnosing DF/DHF/DSS.[6]

The platelet parameters were also studied by Navya BN *et al*. They observed platelet count as a predictive parameter of DF/DHF/DSS and also showed that low MPV and high PDW sensitivity for dengue fever.[16]

A study was done by Bashir AB *et al* on control and study group and found that the MPV was decreased in cases of study group that is dengue positive cases and was normal in cases of control. PDW was normal in control group while it was increased in dengue infection, which is accordance with our study.[8] Since our study was an observational study only dengue positive cases were taken and control group were not included.

CONCLUSION

In conclusion, low platelet count, low MPV, high PDW and P-LCR may be used as probable indicator for dengue infection. Platelet count, MPV and PDW may be used as a probable indicator for dengue. Decrease MPV (<9fl) and increase PDW (>13fl) showed considerable sensitivity for dengue fever. Further research studies are needed to assess the real benefit of these parameters as our study size was small and limited to a particular geographical area.

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