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Original Research Article

Role of Platelet Parameters in Dengue Positive Cases - An Observational Study

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ABSTRACT

Background: Dengue is an endemic disease in subtropical and tropical regions of the world causing severe epidemic in India and is endemic in many parts of India, especially the metropolitan cities and towns. Each year an estimated 100 million cases of dengue fever (DF) occur and between 2.5 and 5 lakh cases of dengue hemorrhagic fever (DHF) are reported to WHO.
Aim and Objectives: To study the role of platelet parameters like platelet count (PLT), Mean platelet volume (MPV) and Platelet distribution width (PDW) in dengue positive infection and also to note their relationship with the severity of the disease.
Material and Methods: The study was done on 100 dengue positive cases during the outbreak of dengue infection over a period of 6 months between May 2015 to October 2015. The platelet parameter like Platelet count, Mean platelet volume, Platelet distribution width were noted using BC 3000 plus Mindray Automated Hematology Analyzer and was compared with severity of disease (DF/DHF/DSS).
Results: Relationship between platelet parameters like platelet count, MPV and PDW were made with severity of the disease (DF/DHF/DSS). Significant difference was observed between severity of the thrombocytopenia and severity of the disease (P value - 0.013). Dengue positive cases were associated with low MPV and high PDW values in 72% cases and 92% cases respectively.
Conclusion: Platelet count is thus a predictive parameter of DF/DHF/DSS. Low MPV (<9fl) and high PDW (>13fl) shows sensitivity for dengue fever thus reflecting a predictive marker for diagnosing dengue fever in endemic area.

Key words: Dengue, MPV, PDW.

INTRODUCTION

Dengue is the most important merging tropical viral disease in the world today. Dengue 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. [{1,2}] It produces two types of diseases- one mild self limiting illness that is dengue fever and the other is dengue hemorrhagic fever/ dengue shock syndrome which is fatal. [{3}] Detection of dengue specific IgM/IgG has been the mainstay of diagnosis of dengue infection (DI). 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. Apart from the dengue specific parameters,

platelet count is the only accessory laboratory test available in the peripheral areas that can support the diagnosis of DHF or DSS. Even in remote areas, platelet counts can be roughly estimated by microscopy. [4] The complex mechanism of thrombocytopenia remains unclear. Recently, novel platelet indices such as MPV and PDW have been investigated as prospective platelet activation markers. [5]

The aim of our study was to investigate the platelet parameters and to assess the role of it in dengue positive infection and also to note their relationship between the platelet count and the severity of the disease in the tertiary care setup.

Objective: To study the role of platelet parameters like platelet count, PDW and MPV in dengue positive infection and also to note their relationship with the severity of the disease.

MATERIALS AND METHODS

This was an observational study carried out in a tertiary care hospital on all dengue positive cases during the outbreak of dengue infection over a period of 6 months between May 2015 to October 2015, in the Department of Pathology and Microbiology K.V.G Medical college and hospital sullia, D.K.

The platelet parameters of 100 dengue positive patients like Platelet count, Mean platelet volume, Platelet distribution width were noted using BC 3000 plus Mindray Automated Hematology Analyzer and were compared with severity of the disease which included DF/DHF and DSS.

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 100 cases were studied, based on positive dengue test. Platelet parameters like platelet count, MPV and PDW of these patients were assessed by using BC Plus Mindray Automated hematology analyzer.

Table 1: Total no. of patients in age group

Serial No.	Age in Group	Male	Female	Total No. of Patients	Percentage
1	0 - 20	10	14	24	24%
2	21 - 40	22	18	40	40%
3	41 - 60	12	24	36	36%
	Total	**44**	**56**	**100**	**100%**

Of these 44 were males, 56 were females. Patients were mainly in age group of 21-40years (40%) followed by 41-60 years (36%), 0-20 years (24%). (Table 1)

Table 2: Dengue Positive cases

Dengue Parameters	No. of positive cases
NS1 positive	90
IgG positive	8
IgM positive	0
Both NS1 and IgG positive	0
Both IgG and IgM positive	0
Both NS1 and IgM positive	0
All positive	2
Total	**100**

Of all the positive samples tested by antigen - antibody reaction principle which is a rapid visual test for dengue. 90 patients were positive for NS-1, 8 patients were positive for IgG and none for IgM. Only two patients were positive for all NS-1, IgM and IgG.

Platelet counts results were grouped under 4 groups <20,000, 21-50,000, 50,000-1, 00,000 and >1 lakhs. Of the patients with thrombocytopenia (i.e. platelet count < 1 lakh) 8 patients had platelet count <20,000 (sever thrombocytopenia) 16 patients had platelet count between 21,000- 50,000 (moderate thrombocytopenia), 16 patients had platelet count between 51,000-1 lakh

(mild thrombocytopenia) while remaining cases in our study had platelet count > 1 lakhs (60 cases). 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.

Table 3: 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(7,1%)	3(21.4%)	4(28.5%)	6(42.8%)	14(100%)
21-40	2(8%)	6(24%)	4(16%)	13(52%)	25(100)
41-60	5(8.1%)	7(11.1%)	8(13.1%)	41(67.2%)	61(100%)
Total	**8(8%)**	**16(16%)**	**16(16%)**	**60(60%)**	**100(100%)**

Table 4: Platelet count with severity of disease

Platelet Count	DF	DHF	DSS	Total
<20,000	10(71.40%)	4(28.57%)	0(0%)	14(100%)
21,000 to 50,000	20(83.33%)	4(16.66%)	0(0%)	24(100%)
51000 to 1,00,000	40(95.2%)	2(4.76%)	0(0%)	42(100%)
>1 lakh	20(100%)	0(0%)	0(0%)	20(100%)
	90(90%)	10(10%)	0(0%)	100(100%)

The seropositive patients were followed clinically for the symptoms of DHF/DSS and they were correlated with the respective platelet counts. Dengue fever (DF) cases were noted in 90 cases and dengue hemorrhagic fever (DHF) cases were noted in 10 cases. Among the 90 cases of DF about 40 cases had mild thrombocytopenia followed by moderate thrombocytopenia in 20cases and severe thrombocytopenia in 10 cases while remaining 20 cases had platelet count > 1 lakh. Among 10 cases of DHF, 2 cases had mild thrombocytopenia, 4 cases had moderate thrombocytopenia and remaining 4 cases had severe thrombocytopenia. 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 5: Platelet indices with severity of disease in dengue positive cases

Diagnosis	Low MPV (<9fl)	High MPV (>9fl)	Total
DF	62(68.8%)	28(31.1)	90(100%)
DHF	10(100%)	0(0%)	10(100%)
Total	72(72%)	28(28%)	100(100)
	Low PDW (<13fl)	**High PDW (>13fl)**	**Total**
DF	6(6.66%)	84(93.33)	90(100%)
DHF	2(20%)	8(80%)	10(100%)
Total	8(8%)	92(92%)	100(100%)

Among 100 dengue positive cases, low MPV (<9fl) which indicates bone marrow suppression was seen in 72% of the cases, of which 68% were diagnosed as DF while 100% were of DHF remaining 28% cases showed high MPV (>9fl). A high PDW (>13fl) which indicates as useful marker for platelet activation was seen in 92% 0f cases, of which 84 cases were DF while 8 cases were DHF remaining 8% of cases showed low PDW (<13fl).

DISCUSSION

DF is a self limited febrile illness; DHF is characterized by prominent haemorrhagic manifestations associated with thrombocytopenia and an increased vascular permeability. The clinical diagnosis of DHF especially in the early phase of illness is not easy. Laboratory findings such as thrombocytopenia and a rising hematocrit in DHF cases are usually observed by day 3 or 4 of the illness. [{5}] The complex mechanism of thrombocytopenia remains unclear. 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. [{6}] Thrombocytopenia (TCP) can be due to increased peripheral destruction, inadequate production or abnormal pooling. [{7}] The release of high levels of platelet-activating factor may induce platelet consumption and augment adhesiveness of vascular endothelial cells resulting in thrombocytopenia. [{1}] Thrombocytopenia

leads to bleeding although the platelet count may not directly correlate with the bleeding manifestation recently, novel platelet indices such as MPV and PDW have been investigated as prospective platelet activation markers. Platelet volume, a marker of platelet function and activity is measured as mean platelet volume (MPV) by hematology analyzers. MPV can be used as independent predictors of bleeding. It is surrogate marker of bone marrow activity; a high MPV indicates increased megakaryocyte activity. A low MPV indicates marrow suppression and increased risk of bleeding. Correlation of platelet count and MPV with bleeding and severity of the disease can potentially predict outcome. {6} The present effort for finding simple and widely used platelet activation indices focused on the fact that platelet activation causes morphologic changes of platelets, including both the spherical shape and pseudopodia formation. Platelets with increased number and size of pseudopodia differ in size, possibly affecting platelet distribution width (PDW). {8,9}

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. {5}

Similar 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, {6} which is accordance with our study. Since our study was an observational study only dengue positive cases were taken and control group were not included.

CONCLUSION

The study focuses the importance of platelet parameters in dengue infection. Significant difference was observed between severity of the thrombocytopenia and severity of the disease (P value -0.013). Platelet count is thus a predictive parameter of DF/DHF/DSS. Low MPV (<9fl) and high PDW (>13fl) shows sensitivity for dengue fever thus reflecting a predictive marker for diagnosing dengue fever in endemic area.

Limitation: Small sample size and study restricted to small geographic area are considered as two important limitations of our study.

Recommendation: Further research studies in endemic areas are needed to support and asses the real benefits of our findings in wider population.

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