

STUDY OF PLATELET INDICES IN CHILDREN SUFFERING FROM DENGUE IN A TERTIARY CARE HOSPITAL

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Received : 06/01/2024
Received in revised form : 23/02/2024
Accepted : 09/03/2024

Keywords:
Platelet Indices in Children Suffering From Dengue.

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DOI: 10.47009/jamp.2024.6.2.29

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (2); 144-146



Abstract

Background: The aim of our study was to investigate the platelet parameters and to assess their relationship between the platelet count and the severity of the dengue disease in children. **Materials and Methods:** This was a prospective observational study carried out in a tertiary care hospital on all dengue infected children during the outbreak of dengue infection over a period of 3 months from June 2023 to September 2023 in the Department of Paediatrics, NMCH, Patna, Bihar. The platelet parameters of 60 dengue infected children like PLT, MPV, PDW, PCT were noted. Subjects were divided into Three groups according to their platelet count on day 3 of illness (<20,000 cells/cumm, 20,000 to 50,000 cells/cumm, 50,000 to 100,000 cells/cumm and >100,000 cells/cumm). Data was entered in Microsoft Office Excel 2007 and analysis done using SPSS (version 16) windows. Categorical data was calculated as mean \pm standard deviation (SD). Platelet parameters were compared with severity of illness and platelet count on Day 3 and Day 7 by student t test and anova 1 test. P value <0.05 was taken as significant. **Result:** Male: female ratio was 33:27. Mean age of presentation was 7.8 ± 2.2 years. Thirty-four patients belonged to Group A, 24 to group B and 2 belonged to group C. On day 3 of illness, 6 (10%) had PLT below 20,000 cells/cumm, 12 (20%) patients had PLT between 20,000 to 50,000 cells/cumm, 15 (25%) had PLT between 50,000 to 1,00,000 cells/cumm and 27 (45%) patients had PLT above 100,000 cells/cumm. On day 7 of illness, none of them had PLT below 20,000 cells/cumm, 1 (2%) had PLT between 20,000 to 50,000 cells/cumm, 12 (20%) had PLT between 50,000 to 1,00,000 cells/cumm and 54 (90%) had PLT above 1,00,000 cells/cumm. **Conclusion:** Lower platelet count and low PCT are seen with severe dengue, increasing platelet count and PCT suggest recovery phase of dengue. MPV had no correlation with severity of dengue or level of thrombocytopenia suggestive that there is no role to predict severity of dengue. PDW does not fluctuate with severity of dengue or level of thrombocytopenia.

INTRODUCTION

Dengue fever (DF) is an acute febrile disease characterized by sudden onset of fever of 3-5 days, intense headache, myalgia, joint pain, retro-orbital pain, anorexia, gastrointestinal disturbances and rash.^[1] Dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS) are life threatening reversible vascular complications of DF and are associated with severe thrombocytopenia, bleeding and increased vascular permeability.^[2] Decreasing platelet counts have found to predict the severity of the disease.^[3] Platelet indices like mean platelet volume (MPV), platelet distribution width (PDW) have been investigated as prospective platelet activation indicators.^[4] The combined interpretation

of platelet (PLT) count, plateletcrit (PCT), MPV, PDW can be very useful in various inflammatory disorders.^[5] MPV is average size of the platelets in blood. Normal range of MPV is 7.5-11.5 fl.^[6] Usually MPV >13 occurs in hyper destruction & MPV <8 in hypo production of platelet.^[7] Correlation of parameters like platelet count and MPV with bleeding and severity of the disease can be a predictor of disease outcome.^[8] Plateletcrit is a measure of total platelet mass. The cut off value in thrombocytopenia is 0.2-0.36%.^[9] Plateletcrit is an effective screening tool for detecting platelet quantitative abnormalities. PCT is the volume occupied by platelets in the blood as a percentage and calculated by the formula $PCT = \text{platelet count} \times MPV/10,000$.^[9] PDW is a marker of volume

variability in platelet size and is elevated in the presence of platelet anisocytosis. The PDW reported varies with reference intervals ranging from 8.3 to 56.6%.^[10] PDW directly measures variability in platelet size, changes occurring with platelet activation, and suggests the heterogeneity in platelet morphology.^[10]

The aim of our study was to investigate the platelet parameters and to assess their relationship between the platelet count and the severity of the dengue disease in children.

MATERIALS AND METHODS

This was a prospective observational study carried out in a tertiary care hospital on all dengue infected children during the outbreak of dengue infection over a period of 3 months from June 2023 to September 2023 in the Department of Paediatrics, NMCH, Patna, Bihar. The platelet parameters of 60 dengue infected children like PLT, MPV, PDW,

PCT were noted. Subjects were divided into Three groups according to their platelet count on day 3 of illness (<20,000 cells/cumm, 20,000 to 50,000 cells/cumm, 50,000 to 100,000 cells/cumm and >100,000 cells/cumm). Platelet indices were studied among these groups and also the indices were evaluated with respect to the severity of disease as group A (dengue without warning signs), group B (dengue with warning signs and group C (severe dengue) based on WHO 2009 guidelines on dengue.^[11] Dengue was diagnosed on the basis of clinical features and positive dengue serology (NS1 antigen, IgM/IgG antibody to the dengue virus).

Statistical Analysis

Data was entered in Microsoft Office Excel 2007 and analysis done using SPSS (version 16) windows. Categorical data was calculated as mean \pm standard deviation (SD). Platelet parameters were compared with severity of illness and platelet count on Day 3 and Day 7 by student t test and anova 1 test. P value <0.05 was taken as significant.

RESULTS

Table 1: Comparison of severity of thrombocytopenia with platelet parameters on day 3 and day 7 of illness

PLT (cells/cumm) (N)	PLT (cells/cumm) Day 3	PLT (cells/cumm) Day 7	P value	PCT (%) Day3	PCT (%) Day7	P value	MPV (FL) Day3	MPV (FL) Day7	P value	PDW (FL) Day3	PDW (FL) Day7	P value
<20,000 (n=6)	14,500 \pm 3,109	78,250 \pm 28,535	0.0051	0.02 \pm 0.01	0.08 \pm 0.03	0.0096	9.57 \pm 0.5	10.6 \pm 0.5	0.023	14.67 \pm 1.02	13.9 \pm 0.58	0.238
20,000-50,000 (n=12)	35,222 \pm 9,614	123,888 \pm 38,653	<0.0001	0.03 \pm 0.01	0.13 \pm 0.04	<0.0001	11.43 \pm 1.10	12.16 \pm 0.72	0.12	16.47 \pm 0.73	14.4 \pm 1.02	0.0001
50,000-100,000 (n=15)	75,750 \pm 11,810	130,833 \pm 38,819	<0.0001	0.09 \pm 0.02	0.12 \pm 0.04	0.0007	12.22 \pm 1.2	12.64 \pm 1.21	0.41	15.78 \pm 1.46	13.8 \pm 1.09	0.0011
>100,000 (n=27)	10,7120 \pm 12,336	247,360 \pm 42,960	<0.0001	0.12 \pm 0.03	0.21 \pm 0.04	<0.0001	11.67 \pm 0.9	12.21 \pm 1.01	0.05	15.16 \pm 1.31	14.28 \pm 1.02	0.0107

Note: PLT – platelet counts, PCT- Plateletcrit, MPV - mean platelet volume, PDW - platelet distribution width.

Table 2: Comparison of platelet parameters with severity of dengue on day 3 and day 7 of illness

Severity of Dengue	PLT (cells/cumm) Day 3	PLT (cells/cumm) Day 7	P value	PCT (%) Day3	PCT (%) Day7	P value	MPV (FL) Day3	MPV (FL) Day7	P value	PDW (FL) Day3	PDW (FL) Day7	P value
GRO UP A (34)	92,828 \pm 33,532	96,371 \pm 70,586	<0.0001	0.1 \pm 0.04	0.19 \pm 0.06	<0.0001	11.73 \pm 1.07	12.34 \pm 1.09	0.0212	15.46 \pm 1.35	14.22 \pm 1.1	0.0001
GRO UP B (24)	70,076 \pm 45,904	164,230 \pm 85,053	0.0018	0.07 \pm 0.04	0.16 \pm 0.07	0.0009	11.41 \pm 1.39	11.87 \pm 0.99	0.3389	15.61 \pm 1.36	14.0 \pm 0.76	0.0011
GRO UP C (2)	39,500 \pm 38,890	87,000 \pm 28,284	0.29	0.04 \pm 0.04	0.09 \pm 0.028	0.84	10.35 \pm 1.62	10.3 \pm 1.4	0.59	15.5 \pm 1.84	14.5 \pm 0.71	0.54

Note: PLT – platelet counts, PCT- Plateletcrit, MPV - mean platelet volume, PDW - platelet distribution width.

Male: female ratio was 33:27. Mean age of presentation was 7.8 \pm 2.2 years. Thirty-four patients belonged to Group A, 24 to group B and 2 belonged to group C. On day 3 of illness, 6 (10%) had PLT below 20,000 cells/cumm, 12 (20%) patients had PLT between 20,000 to 50,000 cells/cumm, 15 (25%) had PLT between 50,000 to 1,00,000 cells/cumm and 27 (45%) patients had PLT above 100,000 cells/cumm. On day 7 of illness, none of them had PLT below 20,000 cells/cumm, 1 (2%) had PLT between 20,000 to 50,000 cells/cumm, 12 (20%) had PLT between 50,000 to 1,

00,000 cells/cumm and 54 (90%) had PLT above 1,00,000 cells/cumm. The mean PLT on day 3 was 83,000 \pm 39,000 cells/cumm and on day 7 was 1,83,000 \pm 77,000 cells/cumm. The mean PCT on day 3 was 0.07 \pm 0.04 % and on day 7 was 0.16 \pm 0.07 %. Mean MPV on day 3 was 10.6 \pm 1.2 fl and on day 7 was 11.18 \pm 1.1 fl. Mean PDW on day 3 was 15.5 \pm 1.3 fl and on day 7 was 13.2 \pm 1 fl. The average hospital stay in these patients was 9 \pm 5.6 days. [Table 1] shows comparison of platelet indices among the four groups based on platelet count on day 3 and day 7 of illness. [Table 2] shows

comparison of platelet parameters with severity of dengue on day 3 and day 7 of illness. Though MPV was lower in patients with platelet count <20,000 cells/cumm (8.57 ± 0.5 fl) as compared to those with higher platelet count on Day 3, it was not statistically significant ($p=0.325$). Similarly, on recovery, MPV did not vary with the platelet counts on Day 7 ($p=0.07$). PCT increases with increase in platelet count on Day 3 and Day 7 ($p=0.000$). Though PDW was lower on Day 3 in patients with platelet count <20,000 cells/cumm as compared to the other 3 groups, it was not statistically significant ($p=0.0740$).

DISCUSSION

Low platelet count in dengue is either due to decreased production of platelets in the bone marrow or increased destruction and clearance of platelets from peripheral blood.^[12] Low PCT and low platelet count could be used as a significant predictor of severity of dengue illness,^[8] which was also seen in our study. Shah et al and Borkataky et al, found a higher PDW in hyper destructive thrombocytopenia when compared to hypoproductive thrombocytopenia.^[12,13] In our study, the severity of dengue did not correlate with PDW nor did the PDW fluctuate with recovery suggestive that thrombocytopenia in dengue could be multifactorial and not due to isolated hyperdestruction or hypoproduction though PDW was lower in patients with platelet count <20,000 cells/cumm suggestive of bone marrow involvement with lower platelet counts. A low MPV implies marrow suppression as a cause of thrombocytopenia and a rising MPV heralds the improvement in platelet count.^[8] Our study revealed a low MPV in patients with platelet counts below 20,000 compared to higher platelet count groups. However, it was not statistically significant. Similar result was seen in a case control study by Bashir et al. They found MPV was decreased in dengue positive cases and was normal in control group.^[14] Sharma et al studied 200 dengue fever cases. MPV showed no significant correlation with severity, serology, and treatment outcome, thus excluding its role in dengue cases.^[15] Similarly, in our study MPV had no correlation with severity of dengue suggestive that there is no role to predict severity of dengue. In the study, done by Dewi et al, there was no significant difference in MPV between DF, DHF and DSS (9.18 ± 1.5 fL vs. 8.94 ± 1.94 fL vs. 8.57 ± 1.03 fL, $p=0.761$).^[16] Wiwanitkit et al, found that MPV for patients with DHF is not decreased and appears to be similar to that for the general healthy population.^[17]

CONCLUSION

Lower platelet count and low PCT are seen with severe dengue, increasing platelet count and PCT

suggest recovery phase of dengue. MPV had no correlation with severity of dengue or level of thrombocytopenia suggestive that there is no role to predict severity of dengue. PDW does not fluctuate with severity of dengue or level of thrombocytopenia.

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