



STUDY ON MEAN PLATELET VOLUME AND ITS CORRELATION WITH PLATELET COUNT AND BLEEDING MANIFESTATIONS IN DENGUE FEVER AT TERTIARY CARE HOSPITAL, TELANGANA STATE

General Medicine

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ABSTRACT

Aim of the Study: Role of mean platelet volume on the outcome of the dengue patients and Decision on platelet transfusion based on mean platelet volume. **Methods:** Study on mean platelet volume and its correlation with platelet count and bleeding manifestation in Dengue Fever was conducted at a Tertiary Care Hospital, Telangana State from October 2018 to October 2020. **Results:** The distribution of age among the study subjects were 36% belonged to the age between 35 to 40 years, 24% were between 15 to 24 years. 22% were between 35 to 44 years, 12 were between 44 to 54 years. 6% were above 55 years. The mean age in the present study was 33.33 ± 12.58 years. **Conclusion:** Mean platelet volume on day 1 has no correlation with platelet count and bleeding manifestations. Patients with low MPV also improved.

KEYWORDS

Thrombocytopenia (TCP) ; Mean Platelet Volume (MPV)

INTRODUCTION

Dengue is the most common mosquito borne, endemo-epidemic arbo viral infection in many tropical and subtropical regions of the world. In the past 50 years, the prevalence of dengue fever has increased 30 fold with increasing geographic expansion to new countries and in the present decade, from urban to rural setting.

An estimated 50-100 million dengue infections occur annually and approximately 2.5 billion live in dengue endemic countries. Case fatality rates vary from 1 to 5% but can be <1% with appropriate treatment.^{1,2}

Haemorrhagic manifestations in dengue infection seen clinically are petechiae, echymosis, purpurae, hematuria, hemoptysis, subconjunctival hemorrhages, epistaxis, hematemesis, skin bleeds, malena, gum bleeds, Intracranial bleed.³

Bleeding in dengue fever is multifactorial in etiology. Several factors like, thrombocytopenia, prolonged shock with capillary leak, derangement of coagulation profile, are known causes of bleeding.

Although there are many explanations for the mechanisms of thrombocytopenia in various diseases, many a times the cause for thrombocytopenia is difficult to establish.

Mean platelet volume is a more reliable marker than thrombocytopenia, because it not only shows platelet size but also it denotes the activity of bone marrow. And indirectly shows the platelet function.

As dengue can progress to more severe conditions like dengue hemorrhagic fever and dengue shock syndrome, early intervention with appropriate measures can decrease the complications.

Aim of the Study

- 1) Correlation of Mean platelet volume with platelet count and bleeding manifestations in a patient of dengue.
- 2) Day 1 mean platelet volume at the time of admission and its correlation with the platelet counts on following days and improvement in bleeding manifestations in dengue.
- 3) Role of mean platelet volume on the outcome of the dengue patients.
- 4) Decision on platelet transfusion based on mean platelet volume.

MATERIAL & METHODS

Present study was conducted at a Tertiary Care Hospital Telangana

State from October 2018 to October 2020. There has been increasing incidence of dengue fever in this area with thrombocytopenia associated with bleeding manifestations in recent years. Requirement for platelet transfusion increased. Many patients with the same platelet levels few are developing bleeding manifestations and few are not. To access the bleeding manifestation instead of platelet count alone, with mean platelet volume with platelet count is a more reliable marker. Hence the following cross sectional observational study in 100 patients with dengue fever for correlation between mean platelet volume with platelet count with bleeding manifestation.

Inclusion criteria

Serologically confirmed Immunoglobulin (IgM) antibody positive and NS 1 antigen positive dengue patients with dengue symptoms with bleeding manifestations admitted in medicine department.

Exclusion criteria

- 1) IgM and NS1 negative patients with dengue like illness.
- 2) Only Immunoglobulin G (IgG) positive cases.
- 3) IgM positive and NS1 positive cases without bleed manifestations.
- 4) Patients with bleeding disorders.
- 5) Patients with thrombocytopenia secondary to other causes.
- 6) Patients with known cases of platelet functional disorders, immune thrombocytopenic purpura, Bernard soulier disease and glanzman thrombasthenia and other disorders which affect platelet size.

RESULTS

Table 1: Distribution of subjects according to sex (n=100)

Sex	Frequency	Percent
Males	66	66
Females	34	34
Total	100	100%

M:F = 1.94:1

Table 2: Overall distribution of subject according to bleeding tendencies (n=100)

Bleeding tendencies	Frequency
Purpura	45/100
Malena	36/100
Epistaxis	28/100
Bleeding gums	26/100
Hematuria	21/100
Hematemesis	06/100

Table 3: Distribution of subjects according to platelet count on day 1 (n=100)

Platelet count day 1	
Minimum	4000/mm3
Maximum	45,000/ mm3
Mean day 1 platelet count	13,780/ mm3
SD	6816.49/ mm3

Table 4: Distribution of subjects according to platelet count at discharge (n=100)

Platelet count at discharge	
Minimum	98,000/mm3
Maximum	4,32,000/ mm3
Mean day 5 platelet count	2,45900/ mm3
SD	86055.36/ mm3

Table 5: Correlation between day 1 and at discharge platelet count

Correlations		Pcday1	Pc@ discharge
Pc day 1	Pearson Correlation	1	0.217
	Sig. (2-tailed)		0.03*
	N	100	100
Pc day 5	Pearson Correlation	0.217	1
	Sig. (2-tailed)	0.03*	
	N	100	100

*. Correlation is significant at the 0.05 level (2-tailed).

DISCUSSION

In our study we took patients of age more than 13 years. Distribution of age among the study subjects were 36% belonged to the age between 35 to 40 years, 24% were between 15 to 24 years. 22% were between 35 to 44 years. Present study consisted of 66 males and 34 females. 45 subjects had purpura. 36 subjects had Malena. 28 subjects had epistaxis. 26 subjects had bleeding gums. 21 subjects had hematuria. 6 subjects had hematemesis.

Distribution of platelet count on the first day were the counts ranged with minimum count of 4000/mm3 and maximum was 45,000/mm3. With the detailed history of fever onset and duration associated with bleeding manifestations. Few cases presented with bleeding manifestations, others developed manifestations after admission to the hospital. We followed subjects daily with the improvement in the bleeding manifestations and any new manifestations. We did smear for platelet count daily and we correlated with the mean platelet volume. We observed that with the mean platelet volume when correlated with the platelet count, improvement in the platelet count improved bleeding manifestations in the subjects.

Few cases showed decreasing platelet count after admission without significant change in the mean platelet volume. Few cases increased manifestations with decreasing platelet count but without change in the mean platelet volume. In our study Sysmex 5 part Hematology analyser used for the mean platelet volume. Compared the mean platelet volume on day 1 with the platelet count and bleeding manifestations in our study. With a single value of mean platelet volume on day one it is difficult to tell the patient improves next day or not. And also it was difficult to take a decision on platelet transfusion solely on mean platelet volume.

In our study we observed patients presented with bleeding manifestations have good mpv but still have a low platelet count and it took few days to improve the platelet count and also bleeding manifestations.

Raise in the mean platelet volume when monitoring daily increased platelet count associated with decreased bleeding manifestation and no fresh bleeding episodes.

In our study there is a correlation with the platelet count and bleeding manifestations. In this study no correlation with mpv on day 1 with platelet count and bleeding manifestations. There is a high significance of association ($p < 0.001$) when MPV increased the bleeding tendencies among the subject decreased/ recovered owing to increase in platelet count.

Reports also show that the activation of complement factor C3

followed by binding of C5b-9 complex to platelet surface is significantly linked with platelet destruction and thrombocytopenia in the studies.

A low MPV implies marrow suppression as a cause of thrombocytopenia and a rising MPV heralds the improvement in platelet count. A low MPV in Indian subset of patients has been reported in more than two third of the Navya et al, study group of DF patients.

Serially observing the MPV and platelets may guide a clinician in an important subset of patients in DF and severe dengue where the mechanism of thrombocytopenia is largely marrow suppression-initial MPV significantly low and the thrombocytopenia recovery following the MPV. Increased MPV indicates increased platelet diameter, which can be used as a marker of production rate and platelet activation.

Navya et al, studied the relationship between platelet parameters like platelet count, MPV and PDW and 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. They found Low MPV shows sensitivity for dengue fever thus reflecting a predictive marker for diagnosing dengue fever in endemic area.

Sharma K et al, studied 200 Dengue fever cases. Out of which, 68% cases were of DF, 23% DHF and 9% DSS i.e. Classical dengue fever was most common presentation. 98% cases of dengue had thrombocytopenia. MPV showed no significant correlation with severity, serology and treatment outcome, thus excluding its role in dengue cases. No significant difference was observed in Mean between MPV at the time of minimal platelet counts and at discharge in dengue cases except in dengue⁴

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, $p = 0.761$)⁵

According to study by Kritika Sharma and Ajay Yadav "MPV showed no significant correlation with severity, serology & treatment outcome, thus excluding its role in dengue cases. Mean platelet volume has not found to be an important prognostic parameter in dengue fever cases".

Wiwanitkit et al⁶, found that MPV for patients with DHF is not decreased and appears to be similar to that for the general healthy population⁷.

In study by Mukker P et al. Int J Res Med Sci. 2018 Jun;6(6):2054-2059 studied the ratios of the platelet indices in the three platelet groups ($< 20,000$, $20,000$ to $100,000$ and $> 100,000$)⁸

The Platelet index (MPV $\times$ PDW/PLC $\times$ PCT) was 3 in the 20,000 group as compared to a value of 1.7 in the 100,000 group (p value < 0.001). Study revealed a low MPV and high PDW in patients with platelet counts below 20,000 compared to higher platelet count groups. Similar result was seen in a case control study by Bashir AB et al⁹. They found MPV was decreased in dengue positive cases and was normal in control group. The changes in platelet ratios also reflect the bone marrow involvement of dengue virus.

Golwala et al study in Pediatric age group showed "The MPV/PCT, PDW/Platelet count and MPV/Platelet count, in the first sample after admission in this case control study were predictors of mortality and could predict 65% to 67% of deaths accurately"¹⁰

The pathogenesis of thrombocytopenia in dengue is not fully known, with two major hypotheses: first, decreased production resultant to bone marrow depression by dengue virus, second, immune (anti-dengue antibodies/immune complex) mediated destruction of platelets, 11 of 61 patients studied by Mitrakul et al., had destruction as a main cause for TCP as revealed by platelet kinetic study.¹¹

A study from a tertiary care hospital in Rajasthan, also demonstrated low platelet count, low MPV, low PCT and high PDW in dengue cases by Nehra hr et al.¹² A study by Shraddha Khatri et al showed Majority of the patients in the study had normal platelet count and were classified as dengue fever. All dengue fever cases with thrombo-cytopenia and

made an attempt to evaluate the changes in platelet parameters. Observed that all the patients did not have any bleeding episodes and had an uneventful recovery with no variation in platelet parameters, thrombocytopenia in dengue patients was not associated with alteration of platelet indices.

A study by Wiwikanti and Sharma K Yadav showed normal mean platelet volume in thrombocytopenic patients. Study by Jayashree et al showed Platelet counts were found to be predictive as well as recovery parameter of DF/DHF/DSS¹³

Study by Kurata et al to assess reticulated platelet using RNA-binding dyes and flow cytometric analysers, as these reticulated platelets are newly released from the bone marrow which can help in determining the aetiology of thrombocytopenia¹⁴ Study conducted by Hardeva RN et al recorded significant association between platelet counts and severity of the disease. Low platelet count, low MPV, low PCT, high PDW and high P-LCR shows considerable sensitivity and specificity for dengue fever and can be used as a predictor of severity of dengue infection.¹⁵

Study by Nidish Kumar et al differences were observed in the MPV, PDW, PCT and PLT. They showed that MPV level increased as the platelet count decreased, but PDW has no correlation with the decrease in platelet count. Low platelet count, low PCT and high PDW may be used as predictor of severity of Dengue infection. Shah et al and Borkataky et al, found a higher PDW in hyper destructive thrombocytopenia when compared to hypo productive thrombocytopenia.

studies didn't find consistent correlation with MPV and Dengue severity, that might be partly due to different pathogenesis or lack of a similar design to observe the MPV and Platelets serially till recover.

In our study with comparing mean platelet volume with platelet count and bleeding manifestations there is a statistical significance of association but it is difficult to take a decision on further treatment and timing of raise of platelet count.

CONCLUSION

- 1) Mean platelet volume on day 1 has no correlation with platelet count and bleeding manifestations.
- 2) Increasing MPV not showed increased platelet counts.
- 3) Patients with low MPV also improved.
- 4) MPV is not useful for prognosis and final outcome of a patient.
- 5) Single reading of an MPV cannot predict platelet count.
- 6) We cannot decide platelet transfusion based on MPV.

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