ORIGINAL ARTICLE

A Cross Sectional Study on Thrombocytopenia with Mean Platelet Volume and Platelet Distribution Width in Patient with Febrile Illness

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Abstract
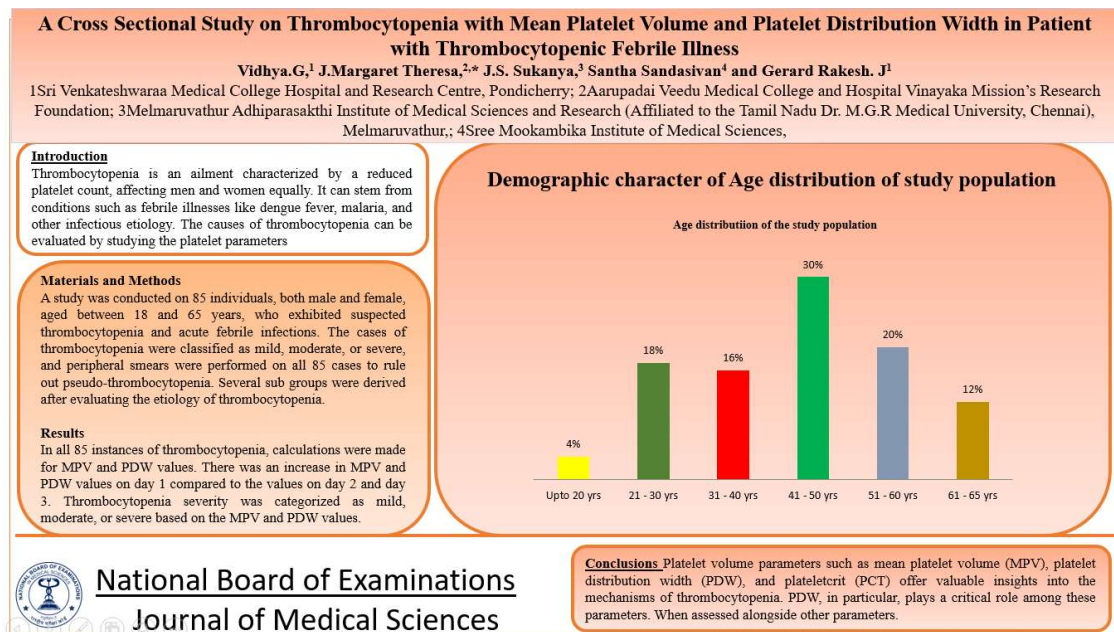**Introduction:** Thrombocytopenia is characterized by reduced platelet count, affecting men and women equally. It is usually associated with conditions such as febrile illnesses like dengue fever, malaria, and other infectious etiology. The causes of thrombocytopenia can be evaluated by studying the platelet parameters. **Aim:** Investigating the clinical and pathological characteristics of Acute Febrile Illness and Assessing Thrombocytopenia Using Mean Platelet Volume and Platelet Distribution Width. **Materials and Methods:** Study was conducted on 85 individuals, both male and female, aged between 18 and 65 years, who presented with thrombocytopenia and acute febrile infections. The cases of thrombocytopenia were classified as mild, moderate, or severe, and peripheral smears were performed on all 85 cases to rule out pseudo-thrombocytopenia. Several subgroups were also derived after evaluating the etiology of thrombocytopenia. **Results:** In all 85 individuals who presented with thrombocytopenia, MPV and PDW values were calculated. There was an increase in MPV and PDW values on day 1 compared to the values on day 2 and day 3. Thrombocytopenia severity was categorized as mild, moderate, or severe based on the MPV and PDW values. **Conclusion:** Platelet volume parameters such as mean platelet volume (MPV) and platelet distribution width (PDW) offer valuable insights into the mechanisms of thrombocytopenia. PDW, in particular, plays a critical role among these parameters. When assessed alongside other parameters, PDW can provide important information about the mechanisms behind platelet destruction.

Keywords: Thrombocytopenia, acute febrile illnesses, mean platelet volume and platelet distribution width

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Graphical Abstract

A Cross Sectional Study on Thrombocytopenia with Mean Platelet Volume and Platelet Distribution Width in Patient with Thrombocytopenic Febrile Illness

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Introduction
Thrombocytopenia is an ailment characterized by a reduced platelet count, affecting men and women equally. It can stem from conditions such as febrile illnesses like dengue fever, malaria, and other infectious etiology. The causes of thrombocytopenia can be evaluated by studying the platelet parameters

Materials and Methods
A study was conducted on 85 individuals, both male and female, aged between 18 and 65 years, who exhibited suspected thrombocytopenia and acute febrile infections. The cases of thrombocytopenia were classified as mild, moderate, or severe, and peripheral smears were performed on all 85 cases to rule out pseudo-thrombocytopenia. Several sub groups were derived after evaluating the etiology of thrombocytopenia.

Results
In all 85 instances of thrombocytopenia, calculations were made for MPV and PDW values. There was an increase in MPV and PDW values on day 1 compared to the values on day 2 and day 3. Thrombocytopenia severity was categorized as mild, moderate, or severe based on the MPV and PDW values.

Demographic character of Age distribution of study population

Age distributiion of the study population

Conclusions Platelet volume parameters such as mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit (PCT) offer valuable insights into the mechanisms of thrombocytopenia. PDW, in particular, plays a critical role among these parameters. When assessed alongside other parameters.

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Introduction

Thrombocytopenia is one of the most common problem among the clinicians in the routine clinical practice. Thrombocytopenia defined as platelet count decreased less than <1,50,000/μL [1].

Thrombocytopenia is considered to be a medical emergency which needs to be managed immediately. Thrombocytopenia can be graded as Grade I (75,000-<1,50,000/μL), Grade II (50,000-75,000/μL), Grade III (25,000-50,000/ μL) and Grade IV (<25,000/ μL).

Most common cause for thrombocytopenia is acute febrile illness. Some of the infections associated with febrile thrombocytopenia are dengue, malaria, leptospirosis, chikungunya, enteric fever, rickettsia and Japanese encephalitis [2]. Patient with moderate and severe thrombocytopenia needs continuous monitoring, because they have a high propensity to bleed from mucous membrane, skin and various organs.

Thrombocytopenia can be classified based on their aetiology like decreased production, increased destruction and pseudothrombocytopenia.

Pseudothrombocytopenia occurs due to Ethylenediamine tetraacetic acid (EDTA) anticoagulant used in the blood sample collection tube [3,4]. It is a in-vitro phenomenon caused by clumping of platelet, which give us false low value of platelet. Destruction of platelet can be mediated by immunological cause or non-immunological aetiology.

The mean platelet volume (MPV) reflects platelet size and the rate of platelet production in the bone marrow. Mean platelet volume used as indicator of platelet activation and severity of inflammation [5,6]. Platelet distribution width (PDW) represents the heterogenecity in platelet morphology due to the presence of large platelets along with normal-sized platelets. However, the mean platelet volume (MPV) and PDW are less often analysed and are poorly

understood. The main aim of the present study is to understand the role of mean platelet volume and platelet distribution width in patients presenting with thrombocytopenia associated with acute febrile illness.

Materials and Methods

This cross-sectional study was conducted in the Department of Pathology over a period of two years. Sample size was calculated using the formula $4pq/d^2$, with analysis of a total of 85 samples. The study included adult males and females aged between 18-65 years with suspected thrombocytopenia, as well as patients with a platelet count < 1.5 lakh/mm^3 (with or without clinical bleeding). Patients on anticoagulant therapy, those with malignancy and patients on chemotherapy were excluded from the study. Informed consent was obtained from all participating patients, and the study was approved by the Institutional Ethics Committee.

A structured survey was created to gather personal and medical details from the study group, including age, gender, medical history, existing conditions, and medication usage. 5ml of blood was aseptically extracted from the superficial vein in the anticubital fossa of the study population. The complete blood count (CBC) was studied using the Sysmex Automated Hematology Analyzer, and peripheral smears were prepared, examined and recorded. The gathered data was documented into a Microsoft Excel spreadsheet. Analysis was performed using SPSS software, with a P-value of <0.05 being deemed statistically significant.

Results and Observations

The study involved 85 samples of individuals with low platelet counts associated with acute febrile illness received in the hematology laboratory.
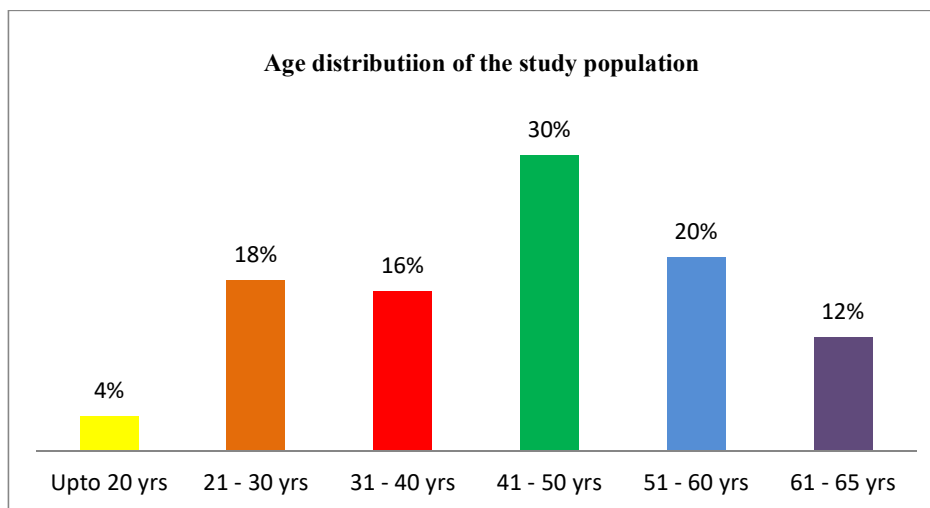

Figure 1. Demographic character of Age distribution of study population

In this study, we analyzed the demographic features of patients presenting with thrombocytopenia and acute febrile illness. The highest incidence of thrombocytopenia was observed in the age group of 41-50 years (30%) (Figure1).
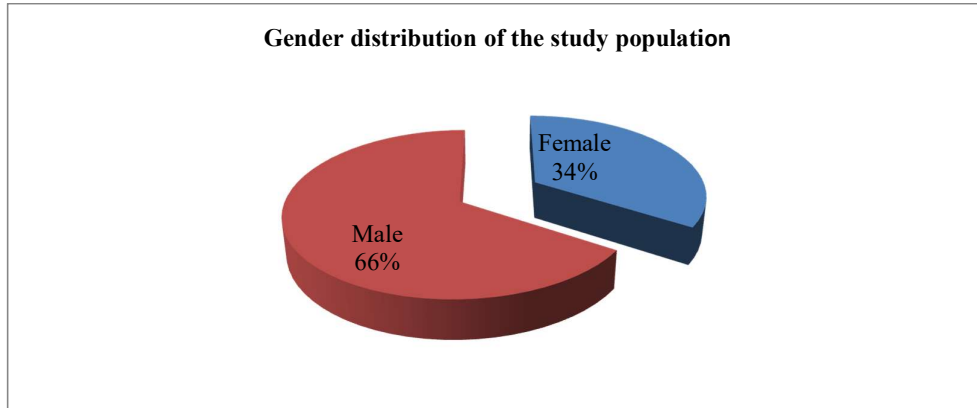
Figure 2. Gender distribution of the study population

In this study, among 85 cases, male patients (66%) showed high incidence of thrombocytopenia with acute febrile illness when compared to the female population (34%) (Figure 2).

Table 1. Distribution of various infectious diseases among the study population

S.No	Disease	Frequency	Percentage
1	Dengue	22	25.88
2	Malaria	6	7.06
3	Leptospira	5	5.88
4	Fever of unknown origin	52	61.18

In this study, out of 85 cases of thrombocytopenia with acute febrile illness, 22 cases were due to dengue, 6 cases were due to malaria, and 52 cases were attributed to fever of unknown origin (Table 1).
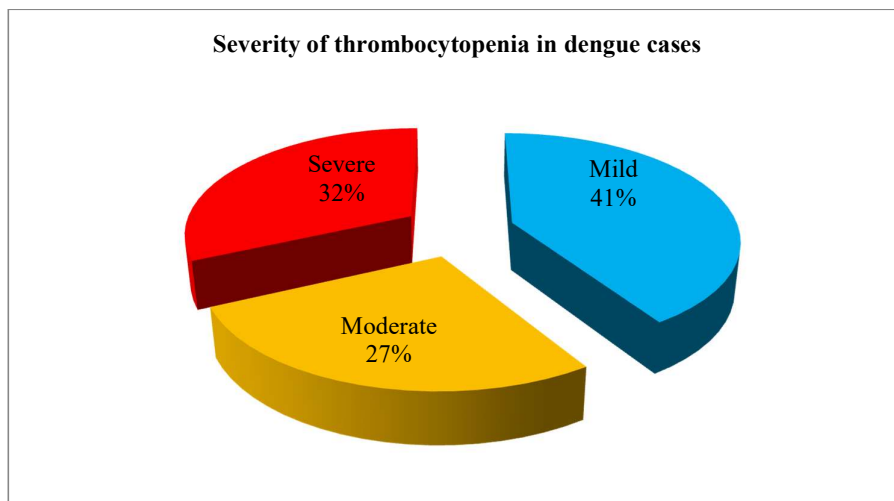
Figure 3. Severity of thrombocytopenia in dengue cases

Figure 3, Out of 22 Dengue cases of thrombocytopenia with acute febrile illness, 7 cases had severe thrombocytopenia, 6 cases had moderate thrombocytopenia and 9 cases had mild thrombocytopenia.
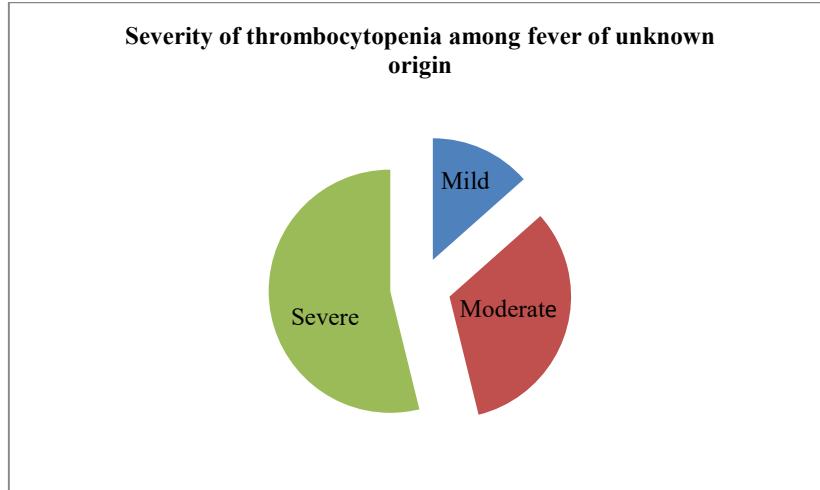

Figure 4. Severity of thrombocytopenia in fever of unknown origin

Figure 4, In a group of 52 fever of unknown origin cases, 26 cases had severe thrombocytopenia, 18cases had moderate thrombocytopenia, and 8 cases had mild thrombocytopenia.

Table 2. Severity of thrombocytopenia in leptospirosis cases

S.No	Leptospirosis	No of Cases
1	Mild	2
2	Moderate	1
3	Severe	2

Out of 5 cases of leptospirosis, 2 cases had severe thrombocytopenia, 1 case had moderate thrombocytopenia and 2 cases had mild thrombocytopenia (Table 2).

Table 3. Comparison of MPV by repeated measure of ANOVA

Days	Mean	SD	N	F-Value	p- Value
Day 1	8.62	1.33	85		
Day 2	8.44	1.03	85	11.062	0.0005**
Day 3	7.98	1.15	85		

** Highly Significant at P < 0.01 level

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A comparison of mean platelet volume (MPV) values on day 1, day 2, and day 3 revealed statistical significance (p = 0.0005). The standard deviations (SD) of MPV were 1.33 on day 1 with a mean value of 8.62, 1.03 on day 2 with a mean value of 8.44, and 1.15 on day 3 with a mean value of 7.98. MPV value was higher on day 1 compared to day 2 and day 3 (Table 3).

Table 4: Comparison of PDW by repeated measure of ANOVA

Days	Mean	SD	N	F-Value	p- Value
Day 1	16.68	2.16	85	5.172	0.007**
Day 2	15.84	2.35	85		
Day 3	16.19	2.56	85		

** Highly Significant at P < 0.01 level

A comparison of platelet distribution width (PDW) from day 1 to day 3 also showed statistical significance (p < 0.01). PDW value was higher on day 1 compared to day 2 and day 3 (Table 4).
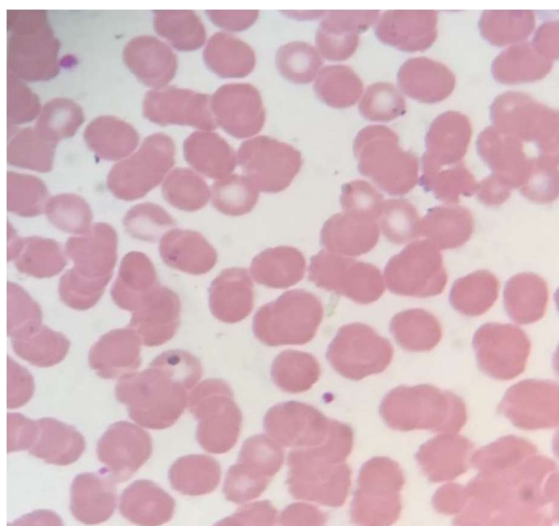

Figure 5. Peripheral Smear

Figure 5 Peripheral smear picture show features of thrombocytopenia win a patient suffering from acute febrile illness.

Discussion

In the present study, it was found that, prevalence of thrombocytopenia was notably high between the age group of 41 and 50, affecting around 30.5% of individuals. Research study conducted by Manoj Kumar Choudhary et al. [7] observed thrombocytopenia was commonly observed between age group of 21 and 40 associated with acute febrile

illness. Study conducted by Chris I. Jones et al. [8] observed decrease in the occurrence of thrombocytopenia with increasing age. In the present study, out of 85 cases, prevalence of thrombocytopenia in males (66%) were observed more, than in females (34%). Suresh et al [9] studied on evaluation of the cause of fever with thrombocytopenia cases, also observed male preponderance (54%) than females (46%) which is concordant with the present study.

In the current study, most fever-associated thrombocytopenia patients do not exhibit any bleeding manifestation. Only a small number of patients presented with minor bleeding manifestations like petechiae, purpura, and minor mucosal bleeding. Bichile et al. [10] also observed, fever-related thrombocytopenia patients occasionally experienced features of bleeding. The present study witnessed, both hereditary and acquired causes of thrombocytopenia, with acquired causes being more prevalent. The majority of acquired cases were due to infections such as dengue (22 cases, 25.88%), malaria (6 cases, 7.06%), leptospirosis (5 cases, 5.88%), and viral infections

Sekhon et al. [11] studied the thrombocytopenia in adults and a practical approach to evaluation and management of thrombocytopenia. He categorized platelet counts into Grade I, II, III, and IV. Platelet count of 75,000 to < 1, 50,000/μL as grade I thrombocytopenia, 50,000 to<75,000/μL as grade II, 25,000 to <50,000/μL as grade III thrombocytopenia and below 25,000 as grade IV thrombocytopenia. In the present study also grading was done and observed 18 cases of grade I, 34 cases of grade II and 24 cases of grade III and 9 cases of grade IV.

In the present study Platelet distribution width (PDW) was analyzed on day 1 to day 3. PDW values was increased on day 1 but day 2 and day 3 had no significant change in PDW values. Study conducted by Xiude Fan et al [12] also studied the PDW on day 1, day 2 and day 3 and observed PDW value on first day of hospitalization is a valuable parameter for evaluating the severity of Hemorrhagic fever. In the present study MPV was also studied along with PDW on day 1 to day 3 and observed, these parameters were highly sensitive and specific indicator to detect and understand the mechanism of thrombocytopenia. Kaito et al. [13] study also stated, the role of MPV and PDW play a significant role in detecting the thrombocytopenia in patient presenting with acute febrile illness. The present study also revealed, individual with thrombocytopenia tend to have elevated mean platelet volume (MPV) and platelet distribution width (PDW), which were studied as parameters to determine the cause of thrombocytopenia.

Conclusion

The leading cause of thrombocytopenia is infectious disease caused by various organisms. Among these, Dengue fever was found to be the primary cause of thrombocytopenia in patients with acute febrile illness, followed by malaria and leptospirosis. Platelet volume parameters like Mean Platelet Volume (MPV), Platelet Distribution Width (PDW) play a vital role in understanding the mechanism behind thrombocytopenia. Platelet Distribution Width and Mean Platelet volume also offer important insights into platelet destruction. An increased PDW indicates higher levels of platelet destruction and splenic pooling,

while Platelet Distribution Width varies in an inverse relationship with platelet count. Meanwhile, Mean Platelet Width serves as a useful screening test for distinguishing the cause of thrombocytopenia through the assessment of patient blood samples. Both MPV and PDW have the potential to detect the thrombocytopenia effectively with continuous assessment of blood samples of the patients.

Statements and Declarations
Conflicts of interest

The authors declare that they do not have conflict of interest.

Funding

No funding was received for conducting this study.

Informed Consent

Informed consent was obtained from all participating patients, and the study was approved by the institutional Ethics Committee

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