Original Article

Can we Predict the Clinical Course of Immune Thrombocytopenia in Children by The Mean Platelet Volume? A Preliminary Study

Yoon Kyung Lee¹, Hoi Soo Yoon¹, Eun Hye Lee¹, Sun Young Cho²

¹Department of Pediatrics, College of Medicine, Kyung Hee University, Seoul, Korea
²Department of Laboratory Medicine, College of Medicine, Kyung Hee University, Seoul, Korea

SUMMARY

Background: Mean platelet volume (MPV) is considered a marker of platelet function and is known to increase in immune thrombocytopenia (ITP). We aimed to investigate the predictive value of MPV for predicting the clinical course of ITP in children.

Methods: We retrospectively analyzed children aged < 18 years with ITP (n = 36) and healthy controls (n = 36) from June 2010 to November 2018. The subjects were stratified into: (i) Healthy controls [group I, n = 36]; (ii) Newly diagnosed ITP (nITP) and persistent ITP (pITP) [group II, n = 24]; and (iii) Chronic ITP (cITP) [group III, n = 12]. Hematological indices including MPV were measured and compared between the three groups.

Results: The median MPV values at diagnosis in group I, II, and III were 7.20, 8.15, and 8.65 fl, respectively (p = 0.0004). Cutoff value of MPV at diagnosis differentiating group I from group II + III was 7.6 fl, and group II from group III was 8.7 fl. MPV change (ΔMPV after three months minus MPV at diagnosis) in children with nITP and pITP (n = 22) was greater than in those with cITP (n = 6) (-2.18 fl vs. 0.66 fl, p = 0.0059).

Conclusions: This study revealed that group III had a higher MPV than group II at diagnosis. Therefore, an initial MPV value more than 8.7 fl may be used as a predictive factor for chronicity in children with ITP. The change in MPV over time as well as MPV at diagnosis, may be regarded as a prognostic marker to predict the course of ITP in children.


KEY WORDS
mean platelet volume (MPV), immune thrombocytopenia (ITP), children

INTRODUCTION

Immune thrombocytopenia (ITP) is an acquired immune disorder characterized by an isolated thrombocytopenia [1,2]. ITP is caused by autoantibodies that bind to platelets resulting in an increased peripheral destruction of platelets by phagocytic cells of the reticuloendothelial system. ITP is a common cause of thrombocytopenia and usually has a favorable prognosis in children. Although only a small number of children develop chronic ITP, it is difficult to predict the course of the disease at the time of diagnosis [3]. Several factors such as an insidious onset and older age at diagnosis (> 10 years)
have been reported to be predictive factors for chronicity in children with ITP [4,5]. However, laboratory variables that can serve as prognostic markers in these patients are still unknown. Platelets are classically known as the cellular mediators of hemostasis and thrombosis, but have been receiving growing attention for their inflammatory role. Currently, platelets are regarded as significant elements in the pathogenesis of inflammatory diseases ranging from atherosclerosis to infectious diseases [6,7]. Mean platelet volume (MPV) describes the average size of platelets in a blood sample. In several recent studies, MPV has been considered to be a marker of platelet function and is known to be increased in disorders involving the peripheral destruction of platelets such as ITP [3,6,8-10]. An inverse relationship between the platelet count and MPV value has been well described in previous studies [11,12]. A number of studies have demonstrated an increase in MPV values in ITP patients, and have suggested the possibility of MPV as a diagnostic and prognostic marker [3,6,8,9]. However, the clinical implications of MPV in children with ITP have not been well investigated.

In this study, we analyzed the MPV values at diagnosis and changes in MPV over time in healthy controls and children with ITP in order to determine whether MPV can predict the clinical course of ITP in children.

MATERIALS AND METHODS

Study design and participants

We reviewed the medical records of children less than 18 years of age with thrombocytopenia from June 2010 to November 2018 at Kyung Hee University Medical Center. Patients were excluded from this study if they had primary hematological disorders and secondary ITP. Furthermore, patients who had no MPV value recorded at the time of diagnosis and those who were lost to follow up were also excluded. ITP patients were clinically classified into three groups by definition of ITP: newly diagnosed ITP (nITP), persistent ITP (pITP), and chronic ITP (cITP) [1,2]. The subjects were stratified into healthy controls (Group I, n = 36), nITP and pITP (Group II, n = 24), and cITP (Group III, n = 12) (Figure 1).

Data collection

The demographic and clinical data of the study participants were obtained from their medical records. This included age at diagnosis, gender, laboratory values, and treatment options used such as intravenous immunoglobulin (IVIG), Rho(D) immune globulin (RhiG), and supportive care. All EDTA blood specimens were analyzed within two hours of venipuncture. Platelet index and complete blood count (CBC) were analyzed on an Advia 2120 (Siemens Healthcare Diagnostics Inc., Tarrytown, NY, USA). In the instrument used at our institution, normal MPV values ranged from 7.2 to 11.1 fl.

Definitions

Thrombocytopenia was defined as a platelet count below 150,000/µL [6]. nITP was defined as the first phase encompassing the first three months after diagnosis, pITP refers to symptoms occurring between three to 12 months after diagnosis, and cITP was defined as when the symptoms persisted beyond 12 months, as has been previously described [1,2]. Healthy controls were defined as individuals whose CBC results were within the reference range and who did not have any underlying diseases [8]. We selected healthy controls from among preoperative consultation patients referred to the pediatric department, with matching of age and gender. In this study, we analyzed time-dependent MPV changes as well as MPV value at diagnosis. Pre-MPV, post-MPV, post1-MPV, and post3-MPV were defined as MPV value at diagnosis, after treatment, after one month, and after three months, respectively. The differences between pre-MPV and the values at each of the three time points were stated as △MPV, △1_MPV, and △3_MPV, respectively.

Statistical analysis

Continuous variables were expressed as median values and the interquartile ranges (IQRs, three quartile - one quartile). Independent two or three group comparisons were performed based on the Fisher’s exact test or the Chi-square test for categorical variables. The Wilcoxon rank sum test was used to compare CBC parameters between group I and group II + III, and the Kruskal-Wallis test was used to compare the three groups. Multivariable generalized linear model (GLM) with adjustments for age and gender was applied to analyze whether the initial MPV values and platelet counts (PLTs) correlated with the groups. The cutoff value was selected as the maximum accuracy under the condition that the sensitivity and specificity is higher than 0.5 for predicting MPV were determined from the receiver operating characteristic (ROC) analysis. Changes in the MPV value after three months were compared between treated group II and group III using repeated measures analysis of variance (RM-ANOVA). We performed all statistical analyses using SAS 9.4 (SAS Institute Inc., Cary, NC, USA) and R 3.5.1 (https://cran.r-project.org). p-values less than 0.05 were considered statistically significant.

Ethics statement

This study was reviewed and approved by the institutional review board of Kyung Hee University (IRB No. 2019-09-048). The requirement for informed consent was waived due to the retrospective nature of the study.

RESULTS

Baseline demographic and laboratory data

Of the 116 patients who presented with thrombocytopenia from June 2010 to November 2018, 36 patients with ITP were enrolled in this study (Figure 1). The distribu-
Predictive Potential of MPV in ITP Children

Table 1. Demographic and laboratory data comparison between group I and group II + III at diagnosis.

<table>
<thead>
<tr>
<th></th>
<th>Group I</th>
<th>Group II + III</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 36)</td>
<td>(n = 36)</td>
<td></td>
</tr>
<tr>
<td>Median age (yr) *</td>
<td>3.50 [1.75 - 11.50]</td>
<td>3.00 [0.85 - 11.00]</td>
<td>0.7690</td>
</tr>
<tr>
<td>Gender (m/f) b</td>
<td>22/14</td>
<td>15/21</td>
<td>0.0988</td>
</tr>
<tr>
<td>ANC (10^3/μL) a</td>
<td>3.28 [2.60 - 4.17]</td>
<td>2.87 [1.71 - 3.74]</td>
<td>0.3609</td>
</tr>
<tr>
<td>ALC (10^3/μL) a</td>
<td>2.91 [1.90 - 4.35]</td>
<td>3.97 [2.53 - 5.99]</td>
<td>0.0211*</td>
</tr>
<tr>
<td>MPV (fL) a</td>
<td>7.20 [6.70-7.55]</td>
<td>8.20 [7.60-9.15]</td>
<td>0.0001*</td>
</tr>
<tr>
<td>PLT (10^3/μL) a (PLT/1,000)</td>
<td>319.50 [272.50 - 371.50]</td>
<td>11.00 [6.00 - 20.50]</td>
<td>&lt; 0.0001*</td>
</tr>
</tbody>
</table>

Values are given as medians [range].
WBC - white blood cell, ANC - absolute neutrophil count, ALC - absolute lymphocyte count, MPV - mean platelet volume, PLTs - platelets.
* by analysis of variance; b by chi-square test.
* Indicates statistically significant p < 0.05.

Table 2. Demographic and laboratory data comparison between the three groups at diagnosis.

<table>
<thead>
<tr>
<th></th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 36)</td>
<td>(n = 24)</td>
<td>(n = 12)</td>
<td></td>
</tr>
<tr>
<td>Median age (yr) *</td>
<td>3.50 [1.75 - 11.50]</td>
<td>1.10 [0.30 - 3.00]</td>
<td>14.00 [9.50 - 15.50]</td>
<td>&lt; 0.0001*</td>
</tr>
<tr>
<td>Gender (m/f) b</td>
<td>22/14</td>
<td>10/14</td>
<td>5/7</td>
<td>0.2561</td>
</tr>
<tr>
<td>ANC (10^3/μL) a</td>
<td>3.28 [2.60 - 4.17]</td>
<td>2.21 [1.37 - 3.45]</td>
<td>3.53 [2.92 - 5.36]</td>
<td>0.0132*</td>
</tr>
<tr>
<td>ALC (10^3/μL) a</td>
<td>2.91 [1.90 - 4.35]</td>
<td>5.17 [2.91 - 6.80]</td>
<td>2.53 [1.94 - 2.84]</td>
<td>&lt; 0.0001*</td>
</tr>
<tr>
<td>MPV (fL) a</td>
<td>7.20 [6.70 - 7.55]</td>
<td>8.15 [7.40 - 8.95]</td>
<td>8.65 [7.85 - 10.00]</td>
<td>0.0004*</td>
</tr>
<tr>
<td>PLT (10^3/μL) a (PLT/1,000)</td>
<td>319.50 [272.50 - 371.50]</td>
<td>8.00 [5.00 - 14.50]</td>
<td>21.50 [9.00 - 73.00]</td>
<td>&lt; 0.0001*</td>
</tr>
</tbody>
</table>

Values are given as medians [range].
WBC - white blood cell, ANC - absolute neutrophil count, ALC - absolute lymphocyte count, MPV - mean platelet volume, PLTs - platelets.
* by analysis of variance; b by chi-square test.
* Indicates statistically significant p < 0.05.

Table 3. Generalized linear model of laboratory parameters in the three groups at diagnosis.

<table>
<thead>
<tr>
<th></th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 36)</td>
<td>(n = 24)</td>
<td>(n = 12)</td>
<td></td>
</tr>
<tr>
<td>Estimate</td>
<td>Estimate</td>
<td>95% CI</td>
<td>p-value</td>
<td>Estimate</td>
</tr>
<tr>
<td>WBC (10^3/μL)</td>
<td>0.00</td>
<td>0.45</td>
<td>-0.75</td>
<td>1.65</td>
</tr>
<tr>
<td>ANC (10^3/μL)</td>
<td>0.00</td>
<td>-0.78</td>
<td>-1.70</td>
<td>0.15</td>
</tr>
<tr>
<td>ALC (10^3/μL)</td>
<td>0.00</td>
<td>1.09</td>
<td>0.29</td>
<td>1.89</td>
</tr>
<tr>
<td>MPV (fL)</td>
<td>0.00</td>
<td>1.92</td>
<td>0.89</td>
<td>2.94</td>
</tr>
<tr>
<td>PLT (10^3/μL) (PLT/1,000)</td>
<td>0.00</td>
<td>-336.83</td>
<td>-371.44</td>
<td>-302.23</td>
</tr>
</tbody>
</table>

Data adjusted by age (year), gender.
WBC - white blood cell, ANC - absolute neutrophil count, ALC - absolute lymphocyte count, MPV - mean platelet volume, PLTs - platelets.
* Indicates statistically significant p < 0.05.
Figure 1. Study design and participants.

ITP - Immune thrombocytopenia, nITP - newly diagnosed ITP, pITP - persistent ITP, cITP - chronic ITP, ALL - Acute lymphoblastic leukemia, MPV - Mean platelet volume.

tion of age, gender, and measured CBC parameters, including white blood cells (WBCs), absolute neutrophil count (ANC), absolute lymphocyte count (ALC), MPV, and PLTs among the study subjects is summarized in Tables 1 and 2. The median patient’s age in group I and group II + III was 3.5 and 3.0 years (p = 0.7690), respectively, but separately in the three groups was 3.50, 1.10, and 14.00 years, respectively, which was statistically different (p < 0.0001). The median MPV at diagnosis in group I and II + III was 7.20 and 8.20 fL (p = 0.0001), respectively, and separately in groups I, II, and III was 7.20, 8.15, and 8.65 fL, respectively (p = 0.0004). The initial MPV of group II + III was higher than that of group I. On comparing the initial MPV of group II and III, the median MPV of group III was relatively higher than that of group II. The median PLTs at diagnosis in group I and II + III were 319.50 and 11.00 x 10^3/µL (p < 0.0001), respectively, and separately in the three groups were 319.50, 8.00, and 21.50 x 10^3/µL, respectively (p < 0.0001). The median WBCs showed no statistical significance among the groups. Even though the median ANC was found to be lower in group II than in group I and group III (p = 0.0132), there was no significant difference in ANC between group I and group II + III (p = 0.3609). The median ALC was significantly higher in group II + III than in group I (p = 0.0211), and group II had the highest median ALC among three groups (p < 0.0001).

Generalized linear model of laboratory parameters
To adjust for age differences among the three groups, we conducted generalized linear model (GLM) analysis (Table 3). Compared to group I, adjusted MPV value was elevated by 1.92 fL in group II (p = 0.0004) and by 1.51 fL in group III (p = 0.0313). Adjusted initial MPV values of group II and group III were significantly higher than that of group I after adjusting for age and gender. Although it appears that MPV of group II was higher than that of group III, it is impossible to compare the values between the two groups directly, and therefore, it is difficult to generalize the findings because of the limited size of the study population.

Cutoff value analysis of MPV at diagnosis
Cutoff value of MPV at diagnosis that can differentiate between group I and group II + III was 7.6 fL with sensitivity of 72.2% and specificity of 83.3%. Area under curve was 0.831, p-value was less than 0.001 (Figure 2). Similarly, the cutoff value of MPV that can differentiate between group II and III was 8.7 fL with sensitivity of 50.0% and specificity of 70.8%. Area under curve was 0.606, p-value was 0.306 which was not statistically significant (Figure 3). Although the MPV cutoff value to differentiate between group II and III was found to be statistically insignificant, 17 (70.8%) out of 24 patients in group II showed initial MPV of 8.7 fL or below, and six (50.0%) out of 12 patients in group III showed initial MPV above 8.7 fL.
Figure 2. ROC curve analysis of initial MPV between group I and group II + III.

(A) ROC curve and cutoff value of MPV at diagnosis for differentiating group I and group II + III. (B) Comparison of MPV at diagnosis between group I and group II + III.

* *p*-value by Wilcoxon rank sum test.
* * Indicates statistically significant *p* < 0.05.

AUC - Area under the curve, MPV - Mean platelet volume, Pre MPV - Mean platelet volume at diagnosis.

Comparison of time-dependent MPV changes

All 28 patients received treatment for ITP with a single agent during their admission. Intravenous immunoglobulin (IVIG) was given to 27 patients and Rho(D) immune globulin (RhIG) was given to only one patient. We analyzed MPV changes over time: (i) at diagnosis, (ii) after treatment, (iii) after one month, and (iv) after three months in treated group II (n = 22) and treated group III (n = 6). Trends in MPV change during the first three months after diagnosis are shown in Figure 4. The MPV values decreased after treatment in both treated group II and III. However, RM-ANOVA revealed significantly higher MPV values after one month and three months in treated group III than treated group II patients (p = 0.0364 and p = 0.0080, respectively). In addition, the mean value of △3_MPV for treated group II (-2.18
Figure 3. ROC curve analysis of initial MPV among three groups.

(A) ROC curve and cutoff value of MPV at diagnosis for differentiating group I and group II. (B) ROC curve and cutoff value of MPV at diagnosis for differentiating group II and group III. (C) Comparison of MPV at diagnosis among three groups.

* *p*-value by Bonferroni of post hoc, *p*-value of Kruskal Wallis test < 0.0001, * Indicates statistically significant *p* < 0.05.

AUC - Area under the curve, MPV - Mean platelet volume, Pre MPV - Mean platelet volume at diagnosis.
Predictive Potential of MPV in ITP Children

Figure 4. Comparison of time-dependent MPV changes between treated group II and group III.

* p-value by Wilcoxon rank sum test for Bonferroni of post hoc.

Values are given as means.

MPV - Mean platelet volume, Pre - MPV value at diagnosis, Post - MPV value after treatment, Post1 - MPV value after 1 month, Post3 - MPV value after 3 months, Δ3_MPV - The differences between MPV at diagnosis and after three months.

fl) was significantly greater than that for treated group III (0.66 fl) (p = 0.0059). In treated group II, MPV demonstrated a steady decline and finally returned to a value within the normal range. However, in treated group III, MPV showed only a small decrease and even increased again after three months.

DISCUSSION

This was a pilot study to investigate MPV and its changes in children with ITP. In our study, increased initial MPV values were observed in ITP patients concurrent with the findings of previous studies [6,8,13]. We also observed that children with cITP showed a tendency to have higher initial MPV values than children with nITP and pITP. In addition, our study has yielded preliminary data showing that time-dependent MPV change may be used as a predictor of the disease course in children with ITP.

ITP is a disorder that involves the peripheral destruction of platelets, along with a mechanism to compensate for the platelet destruction, leading to an increase in the immature forms of platelets. Since the size of an immature platelet is larger than the mature form, MPV in patients with ITP is higher than in healthy controls [8,9,13]. Some previous studies have shown that MPV is higher in patients with ITP than in those with thrombocytopenia of different pathologies, such as hypoproliferative thrombocytopenia [6,9,14-16]. This is because of compensatory thrombopoiesis in the bone marrow in response to antibody-mediated peripheral destruction, which is a discriminatory process in ITP. However, these studies compared MPV values only between diseases with different mechanisms of thrombocytopenia. Several studies have investigated MPV as a prognostic variable in ITP patients. Ahmed et al. reported that the initial MPV value was an independent prognostic factor for predicting a durable complete remission (CR) in childhood ITP [3]. In this study, 92% patients with an initial MPV < 8 fl achieved a durable complete remission compared to 42% patients with an initial MPV of 8 fl or above (p < 0.0001). However, their results did not show a comparison of initial MPV values between ITP patients and healthy controls. Moreover, their data was not adjusted for important potential confounders such as age and gender; therefore, individual differences in the baseline platelets were not taken into account. In contrast, our study included healthy controls with matching of age and gender. Additionally, we conducted GLM analysis to adjust for the confounders that may affect the prognosis of ITP as reported in a previous paper [17]. In another study concerning MPV in children with ITP, Yildirmak et al. showed that there was no correla-
tion of the disease course with gender and age in childhood ITP and observed significantly higher initial MPV values in chronic ITP (9.24 ± 2.26 fL) compared to acute ITP (8.1 ± 2.25 fL) patients (p < 0.05) [13]. Although they focused more on the antiplatelet antibodies rather than on MPV in terms of disease prognosis, they showed the potential value of MPV as a prognostic factor and this concurs with our results. In another study on MPV, Chen et al. concluded that there was a non-linear relationship between MPV and the risk of ITP relapse [10]. Furthermore, they found a linear increase in MPV and relapse risk in nITP patients only when MPV was less than 21 fL. Their results suggest that a higher MPV could be associated with chronicity in ITP patients. Our study results did not yield a MPV more than 21 fL and showed statistically higher initial MPV in cITP than in nITP and pITP children even after adjusting for age and gender.

We also performed cutoff value analysis for MPV between the study groups. Cutoff value of initial MPV differentiating healthy controls and children with ITP was 7.6 fL with sensitivity 72.2% and specificity 83.3% (p < 0.0001). Similarly, cutoff value of initial MPV differentiating group II from group III was 8.7 fL with sensitivity 50.0% and specificity 70.8% (p = 0.3060). Our result may not be sufficiently conclusive, and a future study with a larger number of subjects may be helpful to validate our findings.

Recently, there has been increased interest in MPV changes rather than absolute MPV value in various diseases. Vardon-Boues et al. showed that septic patients with an increase in MPV value without returning to initial values are most likely to have an unfavorable prognosis [18]. They suggested tracking MPV changes in sepsis patients in order to improve their management. In another study of critically ill patients admitted to intensive care unit (ICU), Zampieri et al. reported that despite having similar MPV values on ICU admission, higher ΔMPV24h (%) was observed in non-survivors (2.04%) than in survivors (-0.81%) [19]. In pneumonia patients, Gorelik et al. demonstrated that rising MPV was the most powerful predictor of in-hospital mortality and suggested that repeated assessment of MPV during hospitalization may provide additional prognostic information about pneumonia patients [20]. Lee et al. additionally stated that an increasing MPV after ICU admission was significantly associated with poor outcomes in pneumonia patients, and therefore, ΔMPV values were strong predictors of the disease course [21]. We demonstrated the prognostic significance of time-dependent MPV changes in both treated group II and group III. From the time of diagnosis, the MPV showed a significant decrease in treated group II and continued to decrease until three months later (Δ3_MPV = -2.18 fL). In contrast, in treated group III, the MPV showed only a small decrease after treatment, and increased again exceeding the initial value (Δ3_MPV = 0.66 fL) (p = 0.0059). Consequently, no recovery of MPV after treatment shows a high risk of a chronic course in children with ITP. In summary, changes in MPV have been regarded as more reliable markers of poor prognosis than the corresponding absolute values, which is consistent with our findings.

In the context of ALC, we found that group III had lower initial ALC (2.53 x 10^3/μL) than group II (5.17 x 10^3/μL) (Table 2). In a study by Ahmed et al., a similar tendency of ALC was observed in ITP children [22]. Their results showed significantly lower initial mean ALC in persistent ITP (≥ 6 months) than in recovered ITP (< 6 months) (p < 0.0001). They concluded that the cutoff value of ALC ≤ 3,050/mm^3 was associated with a significant risk of developing persistent ITP beyond 6 months. In another pediatric study, Akbayram et al. determined the cutoff value of ALC ≤ 2,050/mm^3 and demonstrated that ALC at the time of diagnosis was a predictive variable for the development of chronic ITP in children [23]. Further prospective studies may explain the association of low ALC at diagnosis and chronic ITP.

This study has some limitations. Firstly, the retrospective design of this study may have distorted the results due to selection bias or missing data. Secondly, since all subjects included in this study were enrolled in a single medical center, it may be difficult to generalize the results. Nevertheless, it can be a strong advantage that all the blood samples were tested using the same equipment. Thirdly, the small sample size is a major limitation of this study. A future large-scale prospective study is required to confirm our findings. Finally, various alternative platelet indices such as platelet distribution width (PDW) and plateletcrit (PCT) were not included in our analysis. In a recent study which compared platelet indices in ITP and essential thrombocytopenia (ET) patients, Lee et al. analyzed both MPV and PDW in the context of understanding platelet biology [8]. They explained that these parameters reflect the overall features of immature and mature circulating platelets. In another study, Kaito et al. conducted cutoff value analysis using MPV, PDW, and platelet large cell ratio (P-LCR) for diagnosing ITP [16]. Among the three indices, P-LCR and PDW displayed favorable sensitivity and specificity for ITP.

Despite these limitations, our study suggested the potential value of MPV in predicting the clinical course of ITP. To our knowledge, the MPV changes through 3-month follow-up has never been taken into consideration as a predictor of prognosis in ITP children. Based on our results, a smaller Δ3_MPV, in other words, the tendency of MPV to not normalize and even increase again after three months, may suggest a chronic clinical course in children with ITP. Therefore, MPV at diagnosis and MPV change in the next three months could be helpful factors to differentiate children with cITP among patients who still have thrombocytopenia within one year after diagnosis. Future large prospective studies that include various platelet indices might be helpful to predict the prognosis of ITP.
Predictive Potential of MPV in ITP Children

Source of Funds:
The authors received no financial support for the research, authorship, and/or publication of this article.

Declaration of Interest:
The authors have no potential conflicts of interest to disclose.

References: