Relationship between Mean Platelet Volume and Disease Activity Score in Patients Presenting with Rheumatoid Arthritis

Shujaat Hassan¹, Umair Shakir², Adil Khan³, Maryam Rajput⁴, Hina Tariq⁵, Fouzia Tabasam⁶, Ali Raja⁷

INTRODUCTION

Rheumatoid arthritis (RA) is a persistent inflammatory condition characterized by symptoms such as joint swelling, joint tenderness, and the deterioration of synovial joints. This condition not only results in physical disability but can also lead to premature mortality.¹ In the field of Rheumatology, several methods have been proposed to gauge the severity of RA disease activity.²

Platelet structure and function may be affected by RA-related variables. Reactive megakaryocytopenia, a feature of the dynamic inflammatory process, is intimately associated with platelet activation in RA. In the presence of active Rheumatoid Arthritis, a decreased mean platelet volume (MPV) may be indicative of hastened platelet maturation and a shortened platelet lifespan. In recent years, MPV has emerged as a potential marker of platelet reactivity. Platelet activity may be lowered by disease-modifying anti-rheumatic medications (DMARDs), according to the available evidence.³

In the pathophysiology of disorders prone to thrombosis and inflammation, platelet activation plays a crucial role. The relationship between thrombosis and inflammation...
has been studied using numerous platelet indicators. Platelet size and other inflammatory and prothrombotic markers are thought to reflect the severity of Rheumatoid Arthritis. Treatment efficacy may be gauged in part by measuring MPV. It has been tested as a negative acute phase reactant in patients with active Rheumatoid arthritis (Disease Activity Score-28 over 2.6). One study reported a weak but significant correlation \( r=0.27, n=97, p=0.007 \) between Mean Platelet Volume and DAS-28 score. Another study showed that both MPV and PDW were lower during active inflammation, with statistically significant results \( p<0.05 \).

Twenty-one individuals with RA were given anti-inflammatory medication and then assessed before treatment, after 2 weeks, and after 12 weeks. Overall, the data showed that MPV increased significantly during the course of the trial \( 7.7 \pm 0.9 \text{ fl at baseline}, 7.8 \pm 1.1 \text{ fl at 2 weeks}, \) and \( 8.4 \pm 1.1 \text{ fl at 12 weeks}; P = 0.001 \), while DAS-28 reduced dramatically from 4.2 \( \pm 25 \text{ 0.99 to 2.8 \pm 07 \text{ 1.45 fl at baseline}} \). These results indicate that MPV may be useful for tracking the effects of anti-inflammatory therapy in high-grade inflammation disorders, such as RA.

Peripheral physicians can also monitor MPV in their patients, gaining indirect insights into disease severity and making informed decisions about referrals to specialists or implementing appropriate measures. Given its widespread availability and cost-effectiveness for screening, detecting lower-than-expected mean platelet volume levels should prompt physicians to investigate these patients more thoroughly.

**METHODS**

This cross-sectional study was done in the Department of Rheumatology at Sheikh Zayed Hospital in Lahore between October 6, 2021, and April 5, 2022, with approval from the hospital’s ethical review board (ERB). In order to draw reliable conclusions on the relationship between the DAS-28 and MPV in RA patients, a sample size of 140 was determined by assuming a type I error of 5%, a type II error of 10%, and a correlation coefficient of \( r=0.27 \). Non-Probabilistic Consecutive Sampling was used to pick the patients. Patients with RA might be of either sex and any age between 20 and 70. Excluded from the trial were those having a history of cardiovascular illness, chronic renal disease (GFR60 ml/min/1.73m2), autoimmune disease, anemia (Hb 10), or who were currently receiving anti platelet drugs. The study involved 140 patients (both sexes) who met the inclusion criteria. Additionally, demographic data (such as name, age, gender, and RA diagnosis duration) was collected. Through the use of exclusion criteria, potential confounding variables were removed. All patients were given a DAS-28 score. Standardized blood collection procedures were followed, and the samples were transported to the hospital laboratory where they were analyzed for ESR and mean platelet volume. All patients had their reports analyzed. Every patient was treated in accordance with established hospital policy. A custom-made proforma was used to compile all of the data.

SPSS version 20 was used for data entry and analysis. Age, duration of RA, DAS-28 score, and MPV are some of the numerical variables that have been given as means SD. Identifiable categories The gender breakdown has been shown as a frequency and percentage distribution. The DAS-28 score and MPV have been correlated using Pearson’s coefficient, with a \( p \) value of 0.05 indicating a statistically significant relationship. To account for potential moderators, the data have been separated by age, gender, and RA length. Post-stratification The significance level for the Pearson correlation coefficient was set at 0.05.

**RESULTS**

Patient ages spanned from 20 to 70 years, with a mean age of 45.85 \( \pm \) 12.24 years. The cohort consisted of 33 (23.6%) males and 107 (76.4%) females, yielding a female-to-male ratio of 3.2:1. The duration of rheumatoid arthritis ranged from 6 to 72 months, averaging 38.36 \( \pm \) 16.93 months. DAS-28 scores for the patients varied from 2.6 to 10.0, with a mean of 5.52 \( \pm \) 2.10. Meanwhile, mean platelet volume (MPV) ranged from 6.5 fl to 13.5 fl, with an average of 9.99 \( \pm \) 1.98 fl, as depicted in Table 1.

**Table 1: Baseline Characteristics of Study Sample**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Characteristics</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>Mean ± SD</td>
<td>45.85 ± 12.24</td>
</tr>
<tr>
<td></td>
<td>20-44 years</td>
<td>63 (45.0%)</td>
</tr>
<tr>
<td></td>
<td>45-70 years</td>
<td>77 (55.0%)</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>33 (23.6%)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>107 (76.4%)</td>
</tr>
<tr>
<td>Duration (months)</td>
<td>Mean ± SD</td>
<td>38.36±16.93</td>
</tr>
<tr>
<td></td>
<td>6-24 months</td>
<td>36 (25.7%)</td>
</tr>
<tr>
<td></td>
<td>25-48 months</td>
<td>60 (42.9%)</td>
</tr>
<tr>
<td></td>
<td>49-72 months</td>
<td>44 (31.4%)</td>
</tr>
<tr>
<td>DAS-28</td>
<td>Mean ± SD</td>
<td>5.52 ± 2.10</td>
</tr>
<tr>
<td>MPV (fl)</td>
<td>Mean ± SD</td>
<td>9.99 ± 1.98</td>
</tr>
</tbody>
</table>

A statistically significant and strong negative correlation was observed between DAS-28 and MPV \( (r=-0.433, p=0.000) \) across all age and gender groups. This correlation was notably more robust in cases with a
shorter disease duration and gradually decreased over time: 6-24 months (r=-0.603; p=0.000), 25-48 months (r=-0.429; p=0.001), and 49-72 months (r=-0.323, p=0.033). A summary of these findings can be found in Table 2.

**Table 2: Correlation between DAS-28 and MPV**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>DAS-28 Mean ± SD</th>
<th>MPV Mean ± SD</th>
<th>Pearson correlation coefficient (r)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>5.52 ± 2.10</td>
<td>9.99 ± 1.98</td>
<td>-0.433</td>
<td>0.000*</td>
</tr>
<tr>
<td>20-44 years</td>
<td>5.46 ± 1.86</td>
<td>10.68 ± 1.89</td>
<td>-0.447</td>
<td>0.000*</td>
</tr>
<tr>
<td>45-70 years</td>
<td>5.57 ± 2.30</td>
<td>9.43 ± 1.88</td>
<td>-0.453</td>
<td>0.000*</td>
</tr>
<tr>
<td>Male</td>
<td>5.36 ± 2.31</td>
<td>10.29 ± 2.28</td>
<td>-0.442</td>
<td>0.010*</td>
</tr>
<tr>
<td>Female</td>
<td>5.58 ± 2.05</td>
<td>9.90 ± 1.88</td>
<td>-0.428</td>
<td>0.000*</td>
</tr>
<tr>
<td>6-24 months</td>
<td>5.60 ± 2.24</td>
<td>9.96 ± 2.10</td>
<td>-0.603</td>
<td>0.000*</td>
</tr>
<tr>
<td>25-48 months</td>
<td>5.39 ± 2.10</td>
<td>9.69 ± 1.95</td>
<td>-0.429</td>
<td>0.001*</td>
</tr>
<tr>
<td>49-72 months</td>
<td>5.65 ± 2.03</td>
<td>10.43 ± 1.88</td>
<td>-0.323</td>
<td>0.033*</td>
</tr>
</tbody>
</table>

*observed correlation was statistically significant

**DISCUSSION**

Several authoritative bodies, including the World Health Organization (WHO) and the World Alliance for Patient Safety, have emphasized the importance of hand hygiene as a critical indicator of safety, quality, and excellence in healthcare. There is substantial evidence supporting the link between effective hand hygiene practices and reduced rates of healthcare-associated infections (HCAIs). Therefore, mean platelet volume (MPV) has emerged as a potential tool to assess disease activity in RA. Despite the absence of local research in this area, our study was undertaken with the hope of uncovering a significant and robust correlation between these parameters. If such a correlation were found, it could offer a cost-effective means of evaluating disease activity in rheumatoid arthritis patients, given that MPV is routinely measured as part of a complete blood examination.

In our study, patient ages ranged from 20 to 70 years, with a mean age of 45.85 ± 12.24 years. A similar mean age of 45.4 ± 10.7 years was reported by Zamurad et al. in 2013 for rheumatoid arthritis patients at Pakistan Institute of Medical Sciences in Islamabad. In contrast, Alam et al. (2011) observed a somewhat lower mean age of 38.5 ± 12.4 years at Liaquat National Hospital in Karachi. Yildirim et al. (2015) reported a mean age of 47.08 ± 11.05 years among Turkish rheumatoid arthritis patients, while Yazici et al. (2010) noted a higher mean age of 51 ± 12 years in a Turkish population.

Out of the participants, 33 (23.6%) were male, and 107 (76.4%) were female, resulting in a female-to-male ratio of 3.2:1. This female predominance aligns with findings from numerous previous studies, including those by Yazici et al. (4.1:1), Yildirim et al. (3.3:1), and Isik et al. (2.1:1). However, Alam et al. (2011) reported an even higher female predominance with a female-to-male ratio of 11.7:1.

Disease Activity Score (DAS-28) in our study ranged from 2.6 to 10.0, with a mean score of 5.52 ± 2.10. This is consistent with similar mean DAS-28 scores of 5.6 ± 6.2 reported by Alam et al. (2011) and 5.96 ± 0.95 by Yazici et al. (2010) in previous studies. Gasparyan et al. (2010) found a relatively lower mean DAS-28 score of 4.23 ± 0.99 among British patients.

Mean platelet volume (MPV) ranged from 6.5 fl. to 13.5 fl., with a mean value of 9.99 ± 1.98 fl. A comparable mean MPV of 9.5 ± 1.3 fl. was reported by Yazici et al. (2010) for Turkish rheumatoid arthritis patients.

Our study revealed a significantly strong negative correlation between DAS-28 and MPV (r=-0.433, p=0.000) across all age and gender groups. This correlation was most pronounced during the early stages of the disease and gradually weakened over time, with correlations of -0.603 (p=0.000) for disease durations of 6-24 months, -0.429 (p=0.001) for 25-48 months, and -0.323 (p=0.033) for 49-72 months. Similar correlations between DAS-28 and MPV have been previously reported by Yazici et al. (r=-0.27, p=0.007) and Yildirim et al. (r=-0.231, p=0.029).

Our study represents a pioneering effort in the local population, demonstrating a significant and robust negative correlation between disease activity scores and mean platelet volume (r=-0.433, p=0.000) in rheumatoid arthritis patients across all age and gender categories. This suggests that MPV could serve as a cost-effective tool for monitoring disease severity and treatment response. MPV is a parameter routinely measured as part of a standard complete blood examination, requiring no specialized equipment, skills, or additional costs. Moreover, our findings indicate that MPV may be a particularly effective marker for assessing disease activity during the acute inflammatory phase. Therefore, we strongly recommend that future research address this aspect to further establish the role of MPV in monitoring treatment response.

**CONCLUSION**

There was significantly strong negative correlation between disease activity score (DAS-28) and mean platelet volume (r=-0.433, p=0.000) in patients suffering
from rheumatoid arthritis across all age and gender groups. The correlation was more strong with shorter duration of disease and decreased gradually over time; 6-24 months \(r=-0.603; p=0.000\), 25-48 months \(r=-0.429, p=0.001\) and 49-72 months \(r=-0.323, p=0.033\).

**LIMITATIONS**

However, it's important to note a significant limitation of our study: we did not assess changes in MPV in response to treatment and changes in disease activity.

**SUGGESTIONS / RECOMMENDATIONS**

It is crucial to encourage future studies on this topic.

**CONFLICT OF INTEREST / DISCLOSURE**

None.

**ACKNOWLEDGEMENTS**

None.

**REFERENCES**