

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

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ABSTRACT

Background: Rheumatoid arthritis (RA) is a chronic inflammatory disorder characterized by the presence of joint inflammation, joint pain, and the progressive deterioration of synovial joints. As a consequence, individuals have physical impairment and an increased susceptibility to premature death. **Objective:** In order to determine the correlation between mean platelet volume and disease activity score in individuals diagnosed with rheumatoid arthritis. **Study Design:** Cross sectional study design. **Settings:** Department of Rheumatology Sheikh Zayed Hospital, Lahore Pakistan. **Duration:** 6th October 2021 to 5th April 2022. **Methods:** In this research, 140 participants of varying genders, aged between 20 and 70 years, were included, all of whom were diagnosed with rheumatoid arthritis. To evaluate disease activity, the researchers utilized the Disease Activity Score (DAS-28), and the mean platelet volume (MPV) was measured through routine complete blood examination. **Results:** The patient cohort spanned from 20 to 70 years old, with an average age of 45.85 ± 12.24 years. Among them, 33 (23.6%) were male, and 107 (76.4%) were female, resulting in a female-to-male ratio of 3.2:1. The duration of rheumatoid arthritis varied from 6 to 72 months, averaging 38.36 ± 16.93 months. Patients' DAS-28 scores ranged from 2.6 to 10.0, with a mean of 5.52 ± 2.10 , while their mean platelet volume (MPV) ranged from 6.5 fl to 13.5 fl, with an average of 9.99 ± 1.98 fl. **Conclusion:** There was significantly strong negative correlation between disease activity score and mean platelet volume in patients suffering from rheumatoid arthritis across all age and gender groups.

Keywords: Rheumatoid arthritis, Disease activity, Mean platelet volume, DAS-28, Disease activity score.

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 megakaryocytopoiesis, 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.⁴ Platelet size and other inflammatory and prothrombotic markers are thought to reflect the severity of Rheumatoid Arthritis.⁵ Treatment efficacy may be gauged in part by measuring MPV.⁶ It has been tested as a negative acute phase reactant in patients with active Rheumatoid arthritis (Disease Activity Score -28 over 2.6).⁷ One study reported a weak but significant correlation ($r=0.27$, $n=97$, $p=0.007$) between Mean Platelet Volume and DAS-28 score.⁸ Another study showed that both MPV and PDW were lower during active inflammation, with statistically significant results ($p<0.05$).⁷

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 ± 0.9 fL at baseline, 7.8 ± 1.1 fL at 2 weeks, and 8.4 ± 1.1 fL at 12 weeks; $P = 0.001$), while Das-28 reduced dramatically from 4.2 ± 25.099 to 2.8 ± 07.145 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.^{9,10}

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 ± 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 ± 16.93 months. DAS-28 scores for the patients varied from 2.6 to 10.0, with a mean of 5.52 ± 2.10 . Meanwhile, mean platelet volume (MPV) ranged from 6.5 fl to 13.5 fl, with an average of 9.99 ± 1.98 fl, as depicted in Table 1.

Table 1: Baseline Characteristics of Study Sample

Variables	Characteristics	Participants
Age (years)	Mean \pm SD	45.85 \pm 12.24
	20-44 years	63 (45.0%)
	45-70 years	77 (55.0%)
Gender	Male	33 (23.6%)
	Female	107 (76.4%)
Duration (months)	Mean \pm SD	38.36 \pm 16.93
	6-24 months	36 (25.7%)
	25-48 months	60 (42.9%)
	49-72 months	44 (31.4%)
DAS-28	Mean \pm SD	5.52 \pm 2.10
MPV (fl.)	Mean \pm SD	9.99 \pm 1.98

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

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

* 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.¹¹

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 Zammurad *et al.* in 2013 for rheumatoid arthritis patients at Pakistan Institute of Medical Sciences in Islamabad.¹² In contrast, Alam *et al.* (2011) observed a somewhat lower mean age of 38.5 ± 12.4 years at Liaquat National Hospital in Karachi.¹³ Yildirim *et al.* (2015) reported a mean age of 47.08 ± 11.05 years among Turkish rheumatoid arthritis patients,¹⁴ while

Yazici *et al.* (2010) noted a higher mean age of 51 ± 12 years in a Turkish population.⁸

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).^{14,15} However, Alam *et al.* (2011) reported an even higher female predominance with a female-to-male ratio of 11.7:1.¹³

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)¹³ and 5.96 ± 0.95 by Yazici *et al.* (2010) in previous studies.¹⁴ Gasparian *et al.* (2010) found a relatively lower mean DAS-28 score of 4.23 ± 0.99 among British patients.⁹

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.⁸

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.* ($r=-0.231$, $p=0.029$).^{8,14}

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.

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