Original Article

Haematological Parameters as Associate Marker of Disease Activity in Rheumatoid Arthritis: A Cross-Sectional Study from West Bengal Region of India

Ritasman Baisya[1], Vikas Dagar[2,*], Juwain Nehil[2], Sudhanshu Shekhar[2], Indranil Chakrabarti[2], T Santosh[2]

[1]Department of Rheumatology, All India Institute of Medical Sciences Kalyani, Kalyani, West Bengal, India
[2]Department of Pathology, All India Institute of Medical Sciences Kalyani, Kalyani, West Bengal, India

*Correspondence: vikas.patho@aiimskalyani.edu.in

DOI
10.21276/apalm.3827

Article History
Received: 24-01-2026
Revised: 06-04-2026
Accepted: 13-04-2026
Published: 01-05-2026

How to cite this article
Baisya R, Dagar V, Nehil J, et al. Haematological Parameters as Associate Marker of Disease Activity in Rheumatoid Arthritis: A Cross-Sectional Study from West Bengal Region of India. Ann Pathol Lab Med. 2026;13(5):A224-A230.

Abstract

Background: Rheumatoid arthritis (RA) is a chronic autoimmune disorder that affects synovial joints. Monitoring the disease activity is essential for effective treatment and remission. While the Disease Activity Score 28 (DAS28) is commonly used, recent studies have suggested that haematological parameters from a complete blood count (CBC) may also indicate disease activity. This study evaluated parameters such as haemoglobin (Hb), red and white blood cell counts, platelets, and ratios (NLR, PLR, and MPV) across different levels of RA activity and assessed their predictive accuracy using ROC analysis.

Methods: A cross-sectional study was conducted from January to April 2024 in patients with RA meeting the ACR/EULAR 2010 criteria. Patients with coexisting autoimmune diseases, infections, or hematologic disorders were excluded from the study. The CBC and DAS28 scores were reviewed. The patients were classified into four groups: remission, low, moderate, and high disease activity. Statistical analyses involved Kruskal-Wallis tests and multivariate logistic regression analyses. Receiver operating characteristic (ROC) curves were used to determine diagnostic performance.

Result: Multivariate analysis identified Hb level, NLR, and MPV as independent predictors of RA activity. ROC analysis showed AUCs of 0.717 for Hb, 0.608 for NLR, and 0.679 for MPV, indicating moderate diagnostic value. CBC-derived parameters, particularly Hb level, MPV, and NLR, are correlated with RA disease activity. Their integration into routine assessment can enhance disease monitoring, cost-effectiveness, and wide accessibility.

Conclusion: CBC-derived markers low haemoglobin with elevated NLR and MPV reflect increased inflammatory burden in RA. As these tests are inexpensive and widely available, they can complement DAS28 to improve accessible and cost-effective RA disease monitoring.

Keywords: rheumatoid arthritis; disease activity score 28 (DAS28); neutrophil to lymphocyte ratio (NLR); mean platelet volume (MPV); haemoglobin (Hb)

Introduction

Rheumatoid arthritis (RA) is a systemic autoimmune disorder characterised by synovial inflammation, joint damage, and extra-articular manifestations. The main objective of RA treatment is to achieve remission or low disease activity by consistent monitoring. Traditionally, disease activity is measured using the Disease Activity Score in 28 joints (DAS28), which involves erythrocyte sedimentation rate (ESR) or C-reactive protein (CRP). However, both ESR and CRP levels can be

inaccurately elevated in various conditions, often resulting in an additional financial burden during routine practice. Regular monitoring of adverse drug reactions necessitates a complete blood count (CBC) at every appointment. This standard, cheaper test can indicate inflammatory changes through fluctuations in haemoglobin (Hb) levels, white blood cell (WBC) counts, neutrophil-to-lymphocyte ratio (NLR), platelet indices, and mean platelet volume (MPV). These factors are regulated by cytokines, such as TNF-α, IL-1, IL-6, and IFN-γ, which play a role in the pathogenesis of RA. As a result, growing evidence has emphasized the relevance of haematological markers as additional indicators of systemic inflammation in RA.[1]

This study sought to investigate whether haematological indices could independently predict RA disease activity and aid in clinical decision-making. We also sought to assess their predictive accuracy as composite scores to determine whether CBC-derived indices can be reliably integrated into routine clinical practice in this resource-constrained setting.

Materials and Methods

A cross-sectional study was conducted at the rheumatology outpatient clinic from January to April 2024, following ethical approval (EC no-IEC/AIIMS/Kalyani/certificate/2024/182). The study included adult patients aged 18 years or older who were diagnosed with RA according to the ACR/EULAR 2010 criteria[2]. For this study, we included patients with early disease (duration of less than 5 years). Patients were excluded if they had overlap with other autoimmune diseases, such as systemic lupus erythematosus (SLE), vasculitis, scleroderma, or seronegative spondyloarthropathy; hematologic disorders, including thalassemia or immune thrombocytopenic purpura (ITP) or an active infection. Patients who were pregnant or lactating during the study were also excluded.

Study variables

Data collected included demographic details, disease duration, anti-cyclic citrullinated peptide (anti-CCP), and rheumatoid factor (RF) status. Disease activity was measured using DAS28 scores, which were calculated based on the number of tender joints, swollen joints, physician global assessment score (0–10), and ESR/CRP at the time of data collection.[3] Patients were categorized into remission (<2.6), low (2.6–3.2), moderate (3.2–5.1), and high (>5.1) disease activity groups based on DAS28-ESR/CRP scores.[4] Complete hemogram parameters included Hb, red blood cell (RBC) count, WBC count with differential, platelet count, MPV, NLR, RDW, and platelet-to-lymphocyte ratio (PLR). DAS28 scoring was double verified by two investigators to prevent any bias in the global assessment calculation. Study size was calculated from the previously conducted studies with adjustment of the power of the study and effect size in the previous result.

Statistical analysis was performed using SPSS version 22.0. Categorical variables were expressed as frequencies and percentages, while continuous variables were summarized as medians with interquartile ranges (IQR). Kruskal-Wallis and Chi-square tests were used to compare differences across the disease activity groups. Multivariate analysis was conducted using logistic regression, and receiver operating characteristic (ROC) curves were generated to assess the predictive value of the haematological markers. Statistical significance was set at $P < 0.05$.

Results

100 patients with RA were screened, and 90 patients with RA were included in the final analysis. They were categorized into four disease activity groups based on the DAS28 ESR/CRP scores: remission (n = 20), low activity (n = 4), moderate activity (n = 21), and high activity (n = 45). The mean age of the study population was 42.95 $\pm$ 9.79 years, with 33 $\pm$ 2.9 years in the remission groups and 44.13 $\pm$ 9.42 years in the severe disease activity group (p = 0.360). Among the 90 patients, 78 were female and 12 were male, with no statistically significant sex distribution among the groups (p = 0.211). Anti-CCP antibody positivity was observed in 54 patients and rheumatoid factor positivity was observed in 40 patients, with no significant difference across disease activity categories (p = 0.610 and 0.321, respectively). (Table 1)

Extra-articular manifestations were reported in 43 patients with no significant variation across the groups (p = 0.654). The duration of RA significantly differed among groups, with the highest duration in the low disease activity group (52 $\pm$ 15.4 months) and the lowest in the remission group (25.75 $\pm$ 31.3 months) ($p < 0.001$). DAS28 scores were significantly different across the groups ($p < 0.001$), with mean values increasing from 1.77 in remission to 6.61 in the high disease activity group. (Table 1)

Haemoglobin levels decreased with increasing disease activity, from 12.0 $\pm$ 1.1 g/dL in remission to 10.6 $\pm$ 1.54 g/dL in high disease activity ($p < 0.001$). Total leukocyte counts showed an increasing trend, from 7.45 $\pm$ 1.5 $\times$ 10^9/L in remission to 9.11 $\pm$ 2.5 $\times$ 10^9/L in high disease activity ($p < 0.001$). NLR rose from 1.8 $\pm$ 0.52 in remission to 3.0 $\pm$ 1.13 in high disease activity ($p < 0.001$). Platelet counts also increased from 2.70 $\pm$ 0.70 to 3.3 $\pm$ 1.10 $\times 10^5$/µL across the groups ($p < 0.001$). MPV increased from 10.68 $\pm$ 1.53 fL in remission to 12.77 $\pm$ 1.43 fL in high disease activity ($p < 0.001$). The

Table 1: Demographic characteristics of study population with status of disease activity.

Characteristics	Total	Remission	Low disease activity	Moderate disease activity	Severe disease activity p value
Number of patients	90	20	4	21	45
Age in years (mean)	42.95 ± 9.79	33 ± 2.94	33 ± 14.31	43.6 ± 10.63	44.13 ± 9.42 0.360
Male / Female	12 /78	3 /17	0 /4	5 /16	4 /41 0.211
Anti-CCP antibody	54	13	2	12	27 0.610
RA factor	40	9	1	11	24 0.321
Extra-articular manifestation	43	9	2	10	24 0.654
Duration of RA (in months)	30.63 ± 21.68	25.75 ± 31.30	52 ± 15.40	31.14 ± 18.32	29.6 ± 21.65 <0.001
DAS28 score	4.85 ± 2.10	1.77 ± 0.54	2.71 ± 0.50	4.40 ± 0.51	6.61 ± 0.93 <0.001

mean RDW was 15.16 ± 1.79, which did not differ significantly across the groups. Although numerically more prevalent in the high disease group (Table 2).

Table 2: Haematological parameters in different groups of RA.

Characteristics	Total	Remission	Low disease activity	Moderate disease activity	Severe disease activity P value
No. of patients	90	20	4	21	45
Haemoglobin	11.8 ± 1.32	12.0 ± 1.1	12.5 ± 1.21	11.7 ± 1.42	10.6 ± 1.54 <0.001
TLC	8.00 ± 1.94	7.45 ± 1.5	7.2 ± 1.4	8.21 ± 2.34	9.11 ± 2.5 <0.001
NLR	2.4 ± 0.81	1.8 ± 0.52	1.6 ± 0.75	2.42 ± 0.83	3.0 ± 1.13 <0.001
Platelets	2.6 ± 0.74	2.70 ± 0.70	2.73 ± 0.51	3.0 ± 0.63	3.3 ± 1.10 <0.001
MPV (fL)	11.4 ± 1.42	10.68 ± 1.53	10.21 ± 1.23	11.66 ± 1.51	12.77 ± 1.43 <0.001
RDW cv	15.16 ± 1.79	13.7 ± 0.54	14.7 ± 0.25	14.7 ± 1.24	15.5 ± 2.0 >0.05

Association with disease activity

Multivariate logistic regression analysis revealed that haemoglobin (OR: 0.52, $p < 0.001$), NLR (OR: 1.23, $p < 0.010$), and MPV (OR: 0.62, $p < 0.001$) were significantly associated with disease activity. Rest all parameters were not significantly associated (Table 3).

Table 3: Multivariate analysis to determine significant haematological parameters associated with RA disease severity.

Parameter	Adjusted OR	p value
Hb (g/dl)	0.52	<0.001
WBC count (cells/ul)	0.88	0.213
Neutrophils	1.12	0.651
Lymphocytes	0.99	0.185
NLR ratio	1.23	<0.010
Platelet count (10/ul)	1.17	<0.071
MPV	0.62	<0.001

ROC analysis showed AUCs of 0.717 for Hb, 0.608 for NLR, and 0.679 for MPV, indicating moderate diagnostic value (Figure 1).

ROC curve analysis indicated that haemoglobin had a sensitivity of 88%, specificity of 22.22%, positive predictive value (PPV) of 53.3%, negative predictive value (NPV) of 66.67%, and positive likelihood ratio of 1.14. The NLR exhibited a sensitivity of 89.13%, specificity of 77.78%, PPV of 80.39%, NPV of 87.50%, and positive likelihood ratio of 4.01. MPV demonstrated a sensitivity of 93.48%, specificity of 51.43%, PPV of 71.67%, NPV of 85.71%, and positive likelihood ratio of 1.92.

The combination of Hb <12.05 g/dL, NLR >2.63, and MPV >11.80 fL yielded a sensitivity of 97.83%, specificity of 91.11%, PPV of 91.84%, NPV of 97.62%, and a positive likelihood ratio of 11.01 (Table 4).

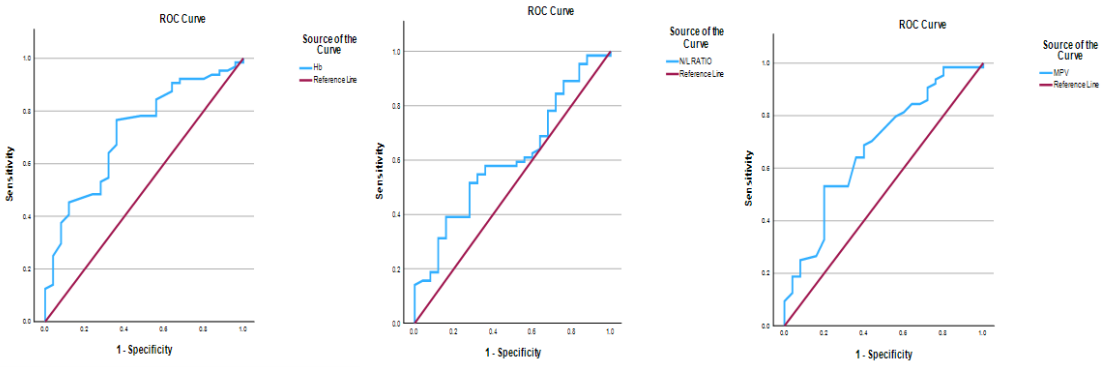

Figure 1: ROC analysis showing AUCs of 0.717 for Hb, 0.608 for NLR, and 0.679 for MPV, indicating moderate diagnostic value.

Table 4: Specificity, sensitivity of combined haematological parameters for disease severity for severe DAS28 activity.

Haematology parameter	Sensitivity (%)	Specificity (%)	PPV	NPV	Positive likelihood ratio (%)
Haemoglobin	88 (75.95 to 96.29)	22.22 (11.20 to 37.09)	53.3 (48.66 to 57.95)	66.67 (42.61–84.34)	1.14 (0.95 to 1.38)
NLR	89.13 (76.43 to 96.38)	77.78 (62.91 to 88.80)	80.39 (70.16 to 87.73)	87.50 (75.10 to 94.20)	4.01 (2.30 to 6.99)
MPV	93.48 (82.10 to 98.63)	51.43 (33.99 to 68.62)	71.67 (64.08 to 78.20)	85.71 (65.73 to 94.94)	1.92 (1.36 to 2.73)
HB+NLR+MPV	97.83 (88.47 to 99.94)	91.11 (78.78 to 97.52)	91.84 (81.52 to 96.63)	97.62 (85.48 to 99.65)	11.01 (4.31 to 28.07)

Hb <12.05 gm%, NLR >2.63 and MPV > 11.80 fL
PPV – positive predictive value, NPV – Negative predictive value

The ROC analysis reinforced the role of Hb and MPV as relatively strong and statistically significant predictors of RA disease activity, while NLR suggested a trend that may gain importance in larger or more diverse populations.

Discussion

This study highlights the importance of haematological parameters, specifically haemoglobin level, MPV, and NLR, as readily available and cost-effective indicators for assessing disease activity in RA. Haemoglobin had the strongest predictive value for disease activity, followed by MPV. These markers indicate that inflammatory processes are influenced by cytokine-mediated changes in haematopoiesis. By integrating these haematological metrics into routine assessments, we can enhance early identification of disease flares, track treatment effectiveness, and guide timely therapeutic strategies, particularly in resource-limited environments.

We have conducted a narrative review of various studies examined thus far regarding the correlation between disease activity and haematological parameters in RA, as presented in Table 5.[1, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14] In acute or high-grade inflammation (e.g., flares of rheumatoid arthritis), MPV tends to decrease. This is thought to occur due to rapid consumption and migration of large, reactive platelets to the sites of inflammation, reducing their numbers in circulation.[15] The cause of low haemoglobin in inflammation is a complex interplay of immune-mediated marrow suppression and iron-restricted erythropoiesis driven by inflammatory cytokines and hepcidin dysregulation.[16] Neutrophils are primed and activated in active RA, secreting pro-inflammatory mediators like proteases, reactive oxygen species, and cytokines that worsen joint inflammation. Lymphopenia in RA is associated with lymphocyte migration into the inflamed synovium and increased lymphocyte apoptosis, which correlates with disease severity. The imbalance of elevated neutrophils and reduced lymphocytes results in increased NLR, which correlates with RA disease activity.[17]

Mercan et al.[8] reported a positive correlation between NLR and RA disease activity, suggesting its usefulness in evaluating treatment response. A recent meta-analysis by Lee et al.[18] established positive associations between NLR, PLR, and RA activity, as measured by DAS28. Findings by Chandrashekara et al.[5] revealed a lower area under the curve (AUC) for NLR (0.584) in an Indian population, emphasising the need to account for population-specific variations. Similarly, recent studies[19, 20] noted that while the NLR had moderate diagnostic value in predicting disease flares, its accuracy improved when assessed in conjunction with other haematological markers.

Table 5: Comparative analysis of different studies on the correlation of haematological parameters with RA disease activity.

Study	Population with outcome variable	Haematological parameters	Result
Chandrashekara S et al[5] India 2015	124 RA based on relapse and remission (based on DAS 28 CRP)	NLR	The ROC analysis indicated that NLR was consistent in predicting remission.
Uslu AU et al[6] 2015 Turkey	104 RA – group 1 & 2 based on DAS28	NLR, PLR	A correlation was observed between NLR and PLR by DAS-28
Peng Y F et al[7] 2015 China	104 RA, compared with healthy control irrespective of disease activity	PLR, NLR	PLR is associated with RA, and PLR may be an underlying indicator indicating the chronic subclinical inflammation in patients with RA.
Mercan et al[8] 2015, Turkey	136 RA-DAS28 CRP	NLR	NLR strong association with disease activity
Tekeoglu et al[9] Turkey 2016	102 patients with RA based on DAS28	NLR & MPV	High NLR with high disease while low MPV with high disease
Talukdar et al[10] India 2017	RA (80) – two group (low to moderate disease, DAS28 < 5.1 versus high disease, DAS28 > 5.1)	Hb, Platelet count, MPV	High disease active group had higher MPV, platelet count & low HB ($p < 0.01$, for all)
Abd-Elazeem, et al[11] 2018 Egypt	50 RA – Active and Remission group	NLR, PLR	The NLR and PLR significantly correlated with the patients age (p = .02 and p = .006) and with the DAS-28 (p = .001 and p = .03 respectively)
Remalante PPM et al[12] 2020 Philippines	134 RA – based on DAS28 ESR	NLR & RDW	Weak positive correlation between NLR & disease activity, no correlation between RDW & disease activity
Dechanuwong P et al[1] Thailand 2021	325 patients - 4 groups according to disease activity: disease remission or low, moderate or high disease activity.	Hb, MPV, NLR	Hb, NLR, MPV - independent factors associated with disease activity. Combination – sensitivity 95%, specificity 24%, PPV 37% NPV 91% in predicting remission
Lijuan, W et al[13] 2021 China	547 RA patients – remission & disease activity based on DAS28	NLR, PLR, LMR	Statistically significant difference in the NLR (4.2 ± 3.2 vs 3.4 ± 2.4, P=.034) and PLR (222.3 ± 136.4 vs 176.9 ± 89.8, P=.006) between the two groups
Masoumi, M et al[14] Iran 2024	305 RA patients – remission, LDA, moderate disease, active disease	PLR, NLR, LMR	ROC analysis showed ESR, CRP, NLR, and PLR distinguish active from remission RA AUC – NLR 0.66, PLR – 0.64

Abbreviation – DAS28 – Disease activity score 28, ESR – erythrocyte sedimentation rate, CRP – C reactive protein, Hb – Hemoglobin, MPV – mean platelet volume, NLR – neutrophil-lymphocyte ratio, PLR – platelet-lymphocyte ratio, LMR – lymphocyte-monocyte ratio, RDW – red cell distribution width, ROC – Receiver operator statistics

Our results are consistent with those of Khaled et al.[21] and Dechanuwong et al.,[1] who found significantly elevated MPV in RA patients with active disease, as well as by Uslu et al.[6] who advocated the use of both NLR and MPV as inflammatory indicators in RA and additional autoimmune disorders.

ROC analysis in the current study indicated that Hb is the most dependable haematological predictor of disease activity, followed by MPV. This finding is supported by many recent studies,[22, 23, 24] which show that lower Hb levels are strongly linked to active RA and unfavourable functional outcomes. Furthermore, several studies have highlighted the effectiveness of MPV and RDW as early indicators of systemic inflammation and treatment response among patients with RA taking disease-modifying anti-rheumatic drugs (DMARDs).

Our study demonstrated that the combination of Hb, MPV, and NLR significantly enhanced the diagnostic performance, with high sensitivity and specificity in identifying high disease activity. This aligns with recent conclusions that argue that composite haematological scores offer superior clinical benefits for monitoring RA progression and facilitating timely therapeutic adjustments. Integrating these parameters into standard RA monitoring protocols could enhance the early detection of disease flare-ups or treatment failures, particularly in resource-limited clinical settings.

The limitations of this study include the small sample size and the absence of follow-up data. The low disease activity group contains only four patients, which poses a restriction for subgroup analysis. Including additional RA activity measures, such as CDAI and SDAI, would strengthen the study. Further multicentre and longitudinal research is required to confirm the prognostic value of these findings across different populations. Incorporating more haematological parameters will improve the study's results. A comparative analysis of various serum biomarkers alongside haematological parameters will assist in identifying more specific multiparameter predictors for the treatment of difficult-to-treat RA.

Conclusion

This study highlights the importance of haematological parameters, specifically haemoglobin, MPV, and NLR, as readily available and cost-effective associate variables for assessing disease activity in RA. Further longitudinal studies are needed to use them as predictive markers in RA disease activity assessment.

Acknowledgements: Thanks to lab technician Mr Shahid for assisting in data collection.

Funding: Nil

Competing Interests: Nil

References

1. Dechanuwong P, Phuan-Udom R. Hematological parameters as a predictor of disease remission in patients with rheumatoid arthritis. Ann Med Surg (Lond). 2021;72:103085.
2. Aletaha D, Neogi T, Silman AJ, et al. Rheumatoid arthritis classification criteria: an American College of Rheumatology/European League Against Rheumatism collaborative initiative. Ann Rheum Dis. 2010;69:1580–1588.
3. Wells G, Becker C, Teng J, et al. Validation of the 28-joint Disease Activity Score (DAS28) and European League Against Rheumatism response criteria based on C-reactive protein against disease progression in patients with rheumatoid arthritis, and comparison with the DAS28 based on erythrocyte sedimentation rate. Ann Rheum Dis. 2008;68(6):954.
4. Fransen J, Creemers MC, Van Riel PL. Remission in rheumatoid arthritis: Agreement of the disease activity score (DAS28) with the ARA preliminary remission criteria. Rheumatology. 2004;43(10):1252–1255.
5. Chandrashekara S, Rajendran A, Jaganath AB, et al. NLR, pain perception and disease activity in RA. Reumatismo. 2015;67(3):109–115.
6. Uslu AU, Küçük A, Şahin A, et al. Two new inflammatory markers associated with Disease Activity Score-28 in patients with rheumatoid arthritis: neutrophil-lymphocyte ratio and platelet-lymphocyte ratio. Int J Rheum Dis. 2015;18(7):731–735.
7. Peng F, Cao L, Zeng H, et al. Platelet to lymphocyte ratio and neutrophil to lymphocyte ratio in patients with rheumatoid arthritis. Open Medicine. 2015;10(1):249.
8. Mercan R, Bitik B, Tufan A, et al. The Association Between Neutrophil/Lymphocyte Ratio and Disease Activity in Rheumatoid Arthritis and Ankylosing Spondylitis. J Clin Lab Anal. 2016;30(5):597–601.
9. Tekeoğlu G, Gürol G, Harman H, et al. Overlooked hematological markers in RA. Int J Rheum Dis. 2016;19(11):1078–1082.
10. Talukdar M, Barui G, Adhikari A, et al. A study on association between common hematological parameters and disease activity in RA. J Clin Diagn Res. 2017;11(1):EC01–EC04.
11. Abd-Elazeem MI, Mohamed RA. Neutrophil-lymphocyte and platelet-lymphocyte ratios in rheumatoid arthritis patients: Relation to disease activity. The Egyptian Rheumatologist. 2018;40(4):227–231.
12. Remalante PPM, Salido EO, Penserga EG, et al. Red cell distribution width and neutrophil-lymphocyte ratio in rheumatoid arthritis. Rheumatol Int. 2020;40(10):1631–1637.
13. Lijuan W, Yuting Z, Chaoyang L, Ju Y. Neutrophil-lymphocyte, platelet-lymphocyte and lymphocyte-monocyte ratios may not be useful markers to assess disease activity in rheumatoid arthritis: A STROBE-compliant article. Medicine. 2021;100(45):e27631.
14. Masoumi M, Bozorgi M, Nourmohammadi Z, et al. Evaluation of hematological markers as prognostic tools in rheumatoid arthritis. BMC Rheumatol. 2024;8:75.
15. Korniluk A, Koper-Lenkiewicz OM, Kamińska J, Kemona H, Dymicka-Piekarska V. Mean Platelet Volume (MPV): New Perspectives for an Old Marker in the Course and Prognosis of Inflammatory Conditions. Mediators of Inflammation. 2019:9213074.

16. Weiss G, Ganz T, Goodnough LT. Anemia of inflammation. Blood. 2018;133(1):40.
17. Kondo N, Kuroda T, Kobayashi D. Cytokine Networks in the Pathogenesis of Rheumatoid Arthritis. Int J Mol Sci. 2021;22(20):10922.
18. Lee YH. Association between the Neutrophil-to-lymphocyte Ratio, and Platelet-to-lymphocyte Ratio and Rheumatoid Arthritis and their Correlations with the Disease Activity: A Meta-analysis. J Rheum Dis. 2018;25:169–178.
19. Kong W, He Y, Bao H, et al. Diagnostic Value of Neutrophil-Lymphocyte Ratio for Predicting the Severity of Acute Pancreatitis: A Meta-Analysis. Disease Markers. 2020:9731854.
20. Li Y, Liu J, Hu Y, Cong C, Chen Y, Fang Y. The neutrophil-to-lymphocyte ratio in rheumatoid arthritis: The dual perspectives from literature and clinic. Medicine (Baltimore). 2025 Sep 19;104(38):e44554.
21. Khaled SAA, Mahmoud HFF. Platelet indices parameters in the new disease activity score of rheumatoid arthritis with ankle involvement: A comparative analytic study. PLoS One. 2021 Sep 16;16(9):e0257200.
22. Ravichandran S, Petchiappan V, Rajangam T, et al. Low Haemoglobin is Inversely Associated with Disease Activity in Rheumatoid Arthritis: A Cross-Sectional Study from a Tertiary Care Hospital. Mediterr J Rheumatol. 2024 Jan 25;35(3):432–437.
23. Furst DE, Chang H, Greenberg JD, et al. Low haemoglobin and disease parameters in RA. Clin Exp Rheumatol. 2009;27(4):560–566.
24. Chen YF, Xu SQ, Xu YC, et al. Inflammatory anemia as a predictor in Chinese RA patients. Clin Rheumatol. 2020;39(6):1737–1745.